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The study found that current systems disproportionately burden low-income, unbanked, and disabled users through high complexity and lack of cash-equivalent options. To mitigate this, the report recommends designing and deploying a California Mobility Card (CMC). The CMC would be a reloadable, prepaid transportation card operating on an existing, widespread payment network, offering cash-equivalent anonymity, seamless crosssystem travel, and automatic access to discounts like fare capping.

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UCLA Institute of Transportation Studies

Equity in Transportation Payments:

A study for the California Department of Transportation

October 31, 2025

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Final Recommendations Report

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About the UCLA Institute of Transportation Studies

The UCLA Institute of Transportation Studies supports and advances cutting-edge research, the highest-quality education, and meaningful and influential civic engagement on the many pressing transportation issues facing our cities, state, nation and world today. The institute is part of the University of California Institute of Transportation Studies, a four-campus consortium that includes UC Berkeley, UC Davis and UC Irvine. UCLA ITS is also a proud partner of the Pacific Southwest Region 9 University of Transportation Center, a federally funded research network with seven other universities.

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Disclaimer

The California Department of Transportation funded this project. The contents may not necessarily reflect the official views or policies of the State of California.

Project Advisory Group

We are grateful to the members of the project advisory group, who helped the research team with problem definition and scoping decisions, reviewed materials and provided feedback, and attended up to four meetings as the research team developed the equity assessment framework and recommendations.

We offered advisory group members the opportunity to express their assent, dissent, or participation with the project and report.

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Gillian Gillett	Caltrans	Participant
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1.0 Introduction

The UCLA Institute of Transportation Studies undertook a study of equity in transportation payments under the direction and with the financial support of the California Department of Transportation (Caltrans). The purpose of this study was to a) identify existing transportation payment processes and the equity implications of these existing systems, b) outline emerging trends and the equity implications of technological solutions for future and cross-modal payment solutions, c) make recommendations concerning the implementation of a framework that will allow California's transportation providers to choose payment solutions that meet local goals of operational efficiency as well as state goals for interoperability while at the same time ensuring equitable access, especially for persons with no smartphone and/or bank access.

Payment technologies and processes are evolving quickly, and both retailers and consumers increasingly expect easy and seamless payments to be part of the payment experience. Retail point-of-sale systems have, for years, moved toward increasingly simple transactions. Magnetic stripe transactions are all but eliminated; signature verification has been largely replaced by chip-and-pin, near-field communication (NFC), and even biometric payment methods, such as pay-by-palm. In the transportation context, a similarly speedy transition has been hampered by 1) the unique constraints of the sector— the need for extremely rapid transactions of typically small amounts, the ability to process payments without a stable internet connection—and 2) the contracting complexities that arise from the small scale of small operators and municipalities and the fragmentation of the industry that limits scale and the size of market that attracts vendors to develop solutions that meet the unique constraints.

The transportation payment options currently available to users vary by mode. Toll operators have, for years, used technology to process payments quickly and electronically, aided by the fixed infrastructure required at relatively few locations. On-street parking has fixed infrastructure in many places; electronic payments were slower to roll out and now include mobile app payments. Bike and scooter share systems were mostly installed without applicable regulations (regarding parking and transit fares) and typically rely on apps. Transit payments run the gamut from ticket vending machines or fixed-payment terminals to faregates at subway, LRT, and BRT stations, to fareboxes on buses, to ticket- or app-based proof-of-payment with little or no physical payment infrastructure. The complexity and unique requirements of transit, in particular, mean that payment types and methods vary widely across the state. This means travelers face a complex array of options when choosing trips outside their region or across modes, especially on transit. Navigating payment options is even more challenging for persons with disabilities and/or people eligible for low-income transportation.

What transportation users increasingly face is cashless options of one type or another. The move to cashless is advantageous to transportation operators, as cash is expensive and labor-intensive to move and manage. Cashless payment methods also offer greater opportunities to expand payment options, such as transit fare capping and integrating payment systems so that, for example, one "transportation wallet" or ticket is all a user needs to pay for any transportation mode across the state. Payment options such as these arguably improve equity outcomes, as in the case of fare capping, they allow low-income transit users to benefit from weekly or monthly transit passes without the need for an upfront lump payment. Similarly, integrated transportation payments can make it easier for low-income users to access multiple transportation services at single and/or reduced fare; integrated payment options can make it easier for transportation or social service agencies to provide transportation dollars or benefits to low-income users.

On the other hand, cashless payment forgoes the simplicity, privacy, and universal access of cash, and typically requires a bank account and/or smartphone. When cashless is the only option, users without bank accounts or smartphone app access are unable to pay for or use transportation services. This group of people includes, but is not limited to, low-income persons who depend most on the transportation services offered. Other persons potentially included in this “left out” group include young people, visitors from another country, and undocumented residents. The number of people in this group is significant: a 2021 City of Santa Monica “cashless” pilot found that nearly 11% of riders had neither a smartphone nor a bank account. Their Big Blue Bus service resumed accepting cash fares.

To understand how the quickly evolving needs of the transportation industry, expectations of users, and developments in payment technologies fit together, UCLA ITS researchers undertook a multi-part investigation that included literature reviews, an inventory of existing transit payment systems around the world and parking systems, interviews, advisory committee stakeholder meetings, a look at six case studies, and an evaluation of existing payment solutions and outside of the transportation sector.

This report does the following: 1) describes the current status quo of the transportation payment landscape, with a focus on transit and parking, 2) outlines the equity considerations of the current status quo, 3) summarizes the findings from payment systems outside of transportation, 4) presents recommendations for advancing cashless options without leaving users behind, and 5) discusses the equity considerations for these recommendations.

The report is organized into the following sections: Methodology, which describes the research steps undertaken and the rationale for each; Results, which discusses what we found in our inventory, case studies, literature reviews, and interviews; Findings, which synthesizes the information found in Results; and Recommendations, which uses the Findings to make recommendations for advancing the efficiency and equity of transportation payments across modes in California.

2.0 Methodology

This section describes the steps we took in researching transportation payments as a basis for developing equity criteria. Our research included: 1) Literature reviews, 2) An Inventory of transportation payment systems, 3) Selected case studies of seven notable examples, 4) Expert interviews, and 5) Advisory committee meetings. The details of our research approach for each initiative are described in the sections below.

2.1 Literature Reviews

To understand the scope of prior research and place our findings in the context of previous work, we undertook a review of academic and industry literature on transportation payments, the equity of the status quo, and usage-based fees.

To analyze equity issues in transportation payments, we synthesized transit payment history from reports by institutions such as the RAND Corporation, the US Department of Transportation, and the Journal of the Transportation Research Board. Specifically, the transition from closed-loop to open-loop payments required research into financial and banking policy for contactless payments and an understanding of under- and unbanked individuals through the Federal Deposit Insurance Corporation (FDIC). A review of academic evaluations of Californian banking networks was used to contextualize the institutional structure for un- and under-banked individuals. Surveys involving cash users and transportation modes, along with demographic surveys, were reviewed to understand the scale and scope of cash users. In addition to income and bank barriers, we analyzed transportation payment accessibility for people with disabilities and language barriers through policy requirements and implementation reviews. Another policy component included examining privacy laws and their implications for transportation payments.

We examined the sources of transportation funding and their equity implications. For context, we looked at the academic literature by reading leading scholars in the transportation field and used case studies to guide our research. Beginning with transportation funding through local option sales taxes (LOSTs), Brian D. Taylor of UCLA has published multiple articles and studies evaluating LOSTs and their equity implications within the Californian context, so his work was heavily reviewed in our literature reviews. We also reviewed Michael Manville's published research on congestion pricing and equity outcomes to guide our research. Selected case studies demonstrated roadway pricing and an equity initiative through low-income discounts. We used New York's congestion pricing as an American case study because it is the most current example of congestion pricing with low-income discounts in the United States. We used London (UK) as another case study to analyze congestion pricing with low-income discounts within specific boroughs. We used the American Public Transportation Association (APTA) as a source to understand the evolution of transportation payment history within the United States, as they continually track and monitor changes. After gaining a national-level understanding of the status quo of equity in transportation payments, we focused on scholars who evaluated California's state-specific equity initiatives within the transportation payment system.

We examined the policy and implementation of usage-based fees by reviewing each state's Department of Transportation (DOT) for state-managed usage fees, then regional user fees. From there, we were interested in cities or states with low-income programs for their usage fees. Through academic reviews, DOTs' and transportation agency reports, we gained an understanding of the program's history, policy makeup, and low-

income discount outworking. Locally, we evaluated Los Angeles Metro's Express Lanes and San Mateo County's Express Lanes. Nationally, we studied Puerto Rico AutoExpreso Tolls, the Virginia Department of Transportation Toll Relief Program, Oregon's OReGO RUC, Globeville and Elyria-Swansea Tolling Equity Program, and Illinois' I-PASS Assist Program. Much of this review required navigating governmental agency websites and tracking how transportation funds are distributed.

2.2 Inventory data collection and analysis

We searched for transportation agencies worldwide that had an integrated payment system in place or in planning. We selected 49 systems of various sizes and with multiple modes, representing a significant fraction of the global transportation payment market. With these identified, we developed a complete inventory of the characteristics at each agency to catalog different technologies, policies, and payment systems, and to assess patterns and correlations across their features.

For the 49 systems, we identified the payment systems' names and tested the user experience. Within the user experience, we checked for the ability to register for regular or discounted fare/card online, reading grade level of texts, screen readability, number of clicks required for navigation, number of personal information inputs required, what personal identification information was needed, payment medias, any upfront or transfer costs, and policies like negative balances and fare capping policies.

Table 1: Data Collected for Each Payment System

Field	Description
Payment System Name	The name of the payment system operator responsible for financial transactions and fare collection across the agency's network.
Modes Operated	A comprehensive list of transportation modes involved with the agency's network.
Mode Specific Fare	Yes or no answer to whether or not the agency has specific fares for individual modes.
Geographies Accessible with Fare Medium	Specification of the geographical scale of the fare medium. Options included: Regional (multiple counties, Metropolitan Area (various cities), Country-wide, State/Province-wide, and depends on fare medium.
Payment Media Accepted	A comprehensive list of payment media accepted through the agency's payment system. Options included: Cash, Paper Tickets/Vouchers, Smart Cards, Open-Loop Contactless EMV Cards, Mobile Wallets, Tokens, Stored-Value Cards, Electronic Ticket, Biometrics, Transponders, and License Plate Recognition.
Cash Payment Availability	Indication of cash acceptance and the method of cash acceptance. Options Included: Yes or no. If Yes, then an additional record of the following options: Farebox, Load onto Card (Retail, Load onto Card (TVM)
Low Income Fare Availability	Indication of a low-income discount offering and listing of how an individual can apply/access the discount. Options included: Not available, Yes, With Attestation Only,

Field	Description
	Proof of Eligibility Required, Proof of Eligibility not Required, Available at TVM, Only with passes (not single fares), Application by mail, Application Online, Application In-Person.
Fare Features Used	A list of fare features used by an agency, including policy, pricing, incentives, partnerships, etc. Options included: Transit Cards with Photos for Security, Cryptocurrency Integration, Multi-Modal Integration, Dynamic Fare Pricing, Real-Time Payment (based on distance or time), Offline, Subscription Models, Transit Loyalty Programs, Fare Capping, PAYG, MaaS Apps/Service Integration, Automatic Fare Deduction, Partnerships with Ride-Sharing Services, Environmental Incentives, Voice-Activate Payments/ Virtual Assistants, AR Integration, Community-Based and Payment Systems, Gamification.
Fare Cap Variation	If the transit agency had fare-capping policies, we recorded any variations used in those policies. Options included: Geography, Day of Week, Hour of Day, Peak Hours, Fare Media, Fare Type, Mode, Other, and N/A - does not vary.
Upfront User Cost	A numerical value indicating the upfront costs a user pays to use the service or buy a transit card. If there is no upfront cost, $0.00 is recorded.
Fund Transfer Fee	A numerical value indicating the fees users pay to use their card or transfer funds to it. If there is no fee, $0.00 is recorded.
Funds Transfer Time	The amount of time for funds to be transferred to or from stored value accounts. Time recorded in hours.
Exchangeable Stored Value for Cash	A record of the ability for customers to exchange their stored value for cash. The output will be: Yes, No, Conditional, or NA.
Start of Diminishing Balance	A numerical value if stored balances diminish over time. Measured by the number of inactive months required before balances start to diminish. If this information was not applicable, “0” was entered. If information was unknown, the field was left blank.
Negative Balance	Yes/No answer indicating whether the system allows users to have a negative balance.
Requirements of Managing Stored Value	A list of ways riders can manage the balance on their account. Options include: Online Account, Debit Card Transfer (without fee), Credit Card (without fee), Debit Card Transfer (with fee), Credit Card (with fee), Bank Account (ACH) Transfer, Other, and N/A.
Data Required for Managing Stored Value	A record of all data users have to enter to manage their stored value. Options include: Name, Address, Email Address, Phone Number, Birthday, Saved Payment Method, CVV Code, SMS Verification, N/A, Other.

Field	Description
Group Fare on a Single Fare Medium	An indication of whether the agency provides a way for a group to travel with a single pass/ticket/fare. Options are: Yes, No, Unclear, or N/A.
Service Area and Fare Medium	A record of how the fare medium interacts with transfers onto other services within the service area. Options include: Yes, No, No Fare Difference, Transfers Have Surcharges, Only with Passes, Transfers not Possible, Transfers are Discounted, and N/A.
Integration Features	Listing of integrated features within a payment system that can interact with transit payment. Options include: Interagency Transfers, Bikeshare/Scooters/E-Bikes, Non-transportation uses, Freeway Toll / Incentives, Taxis, Rideshares, On-demand Services, and Other.
Personally Identifiable Information (PII)	A collection of identifiers required by agencies to be a general rider and to be a discounted-fare rider.

The full inventory is available in Appendix A.

2.2.1 Accessibility Assessment

The Flesch-Kincaid Grade formula was used to assess the reading grade level of texts. Flesch-Kincaid is a widely used readability score developed to measure how difficult writing may be to understand and to indicate the corresponding grade level with comparable reading and writing scores. This allows us to see the average level of education expected for reading comprehension as an indicator of accessibility, based on education, language proficiency, and cognitive load. The Flesch-Kincaid readability formula is based on average sentence length and word complexity. The numerical score from the formula corresponds to a grade level. The formula is below:

Flesch Reading Ease Score = 206.835 – 1.015 × (Total Words / Total Sentences) – 84.6 × (Total Syllables / Total Words)

The SERPninja online Flesch Kincaid Calculator was used to test two parts of each transit agency's website: (1) the informational text at the beginning of low-income applications and (2) the informational text about purchasing regular, non-discounted fare. An informational overview of a low-income application typically includes eligibility requirements and the information and/or documents needed to apply.

Using the Web Content Accessibility Guidelines (WCAG), we rated how accessible web content is for people with various disabilities who rely on screen reader software, such as VoiceOver, to navigate websites. WCAG is a set of accessibility standards designed to help websites meet the accessibility requirements set by laws such as the Americans with Disabilities Act (ADA). These standards apply to web content on any device (including desktops, laptops, kiosks, and mobile devices). Based on these guidelines, we tested to see if transit agency websites were screen reader compatible. Specifically, we recorded whether the screen reader read aloud titles, lists, images, form field prompts, and links, and tested whether those fields were read in the correct order.

Table 2: Information Collected on Accessibility in Inventory of Transportation Systems

Field	Description
Agency Name	Transit Agency Name and City
Reading Grade Level	The Reading Grade Level shows the education level required to understand text on the transit agencies' transit card website. Grades range from 5th Grade Level (easy) to College Graduate Level (Difficult). The grade level is determined from the Flesch-Kincaid reading score.
Reading Grade Level (Low Income Discount)	The Reading Grade Level shows the education level required to understand text on the transit agencies' low-income discount transit card website (if applicable). Scoring ranges from 5th Grade Level (easy) to College Graduate Level (difficult). The grade level is determined from the Flesch-Kincaid reading score.
Screen Reading Accessibility (WCAG 2.1)	The Screen Reading Accessibility section indicates whether the site is accessible to users of screen readers. Sites were marked as either "Accessible" (indicated by a checkmark) or "Not Accessible" (indicated by no checkmarks). Accessibility was determined by using a screen reader on a transit agency's transit card site and listening to see if the website met WCAG 2.1 guidelines.
Screen Reading Accessibility (WCAG 2.1) (Low Income Discount)	The Screen Reading Accessibility section states whether the low-income transit card registration site is accessible to users of screen readers. Sites were marked as either "Accessible" (indicated by a checkmark) or "Not Accessible" (indicated by no checkmarks). Accessibility was determined by using a screen reader on a transit agency's transit card site and listening to see if the website met WCAG 2.1 guidelines.
WCAG 2.1 Score	The WCAG 2.1 Score measures the accessibility of a transit card's website when accessed with a screen reader. The score can range from 0 (inaccessible) to 6 (accessible). The score reflects how many accessible features the site offers, as well as whether the site's information is presented in the correct order.
WCAG 2.1 Score (Low Income Discount)	The WCAG 2.1 Score measures the accessibility of the low-income transit card's site when accessed with a screen reader. The score can range from 0 (inaccessible) to 6 (accessible). The score reflects how many accessible features the site offers, as well as whether the site's information is presented in the correct order.
Can you register for a physical card online?	This field looked at whether users could register for a physical card online. For agencies that offered online registration, we noted whether the card was mailed to the user, had to be picked up in person, or had to be printed.
Flesch-Kincaid reading score	The Flesch-Kincaid reading score is a score based on the readability of the transit card's website's text. The scores range from 0 (extremely difficult) to 100 (easy). The scores also correspond to the websites' Reading Grade Levels.

Field	Description
Flesch-Kincaid reading score (Low Income Discount)	The Flesch-Kincaid reading score is a score based on the readability of the Low Income Discount transit card's website's text. The scores range from 0 (extremely difficult) to 100 (easy). The scores also correspond to the websites' Reading Grade Levels.
Number of Clicks	The number of clicks represents the number required to proceed to the page for purchasing or ordering a transit card. Scores ranged from 0 to 14.
Number of Clicks (Low Income Discount)	The number of clicks represents the number of clicks required to proceed to the page to apply/enroll for a low-income discount transit card. Scores ranged from 0 to 14.
Number of Inputs	The number of inputs represents the number of inputs required to purchase/order a transit card. Scores ranged from 0 to 23.
Number of Inputs (Low Income Discount)	The number of inputs represents the number of inputs required to apply for/enroll in a low-income transit card. Scores ranged from 0 to 23.

2.2.2 California Parking Assessment

Another component of the inventory contained an assessment for seven parking applications used in the state of California. The parking applications were also assessed by the user experience, the requirement of an account, creation of an account, and how to use the application. Within account creation we noted how many inputs are required, what personal identification information was required and whether a smartphone was required. Each parking application was tested on its readability by grade level according to the Flesch Kincaid Calculator mentioned above. Similar to the transit agencies, every parking application had a screen reading accessibility test to examine whether titles, lists, images, form field prompts, were read aloud and if they were read in the correct order.

The Parking App assessment data is available as a data appendix.

2.3 Case Studies

The inventory preparation process showed significant variation in how transportation agencies apply payment methods, processes, and technologies. We conducted case studies to explore city and regional transportation payments in greater depth, with a focus on contexts similar to California's cities or on salient examples of interest where organizations or regions have implemented approaches that potentially address specific challenges in the California context (as identified in our framework).

In conducting the inventory, we identified several examples that were especially interesting due to their context, technology, or applicability to California's transportation environment and state goals for payments. These case studies included the cities/regions of: Los Angeles, Chicago, the Bay Area, New York City, Milan (Italy), and Portland, Oregon. Table 3 below lists the regions, their payment systems, and our rationale for their inclusion.

Table 3: Overview of Case Study Cities

City/Region	Payment system (administering institution)	Notable/Rationale for inclusion
Los Angeles	Transit Access Pass [TAP] (LA Metro)	TAP is a large, well-established fare system used by 27 transit agencies in LA County; in 2024, it began preparing for open-loop payments.
Chicago	Ventra (CTA)	Ventra experimented early with a joint prepaid debit/transit card. Ventra was also an early adopter of bike-share integration with a transit payment app.
New York City	One Metro New York [OMNY] (NYC MTA)	OMNY was the second open-loop fare payment system in the US (after Salt Lake City), and the transition from magnetic stripe was unique.
Milan (Italy)	ATM (Milan Public Transport)	Milan's ATM offers a combination of passes, travel cards, and tickets, along with an open-loop system for travel and fare policy flexibility. Payments are partly integrated across modes.
Portland, Oregon	Portland Bureau of Transportation (PBOT)	Portland's Transportation Wallet is a comprehensive, multi-system, multimodal payment solution oriented to low-income people and households.

These case studies involved our looking at the history and context of the transportation provider and their payment system. The case study descriptions are in section 3.4.

2.4 Advisory Committee Meetings

We have conducted three one-hour meetings with a project advisory committee, whose 10 members provided us with detailed information on the needs of their parking, transit, and payment systems, as well as the challenges of existing and proposed solutions. The committee, composed of transportation and payment professionals chosen for their experience in government, consulting, and nonprofits, also provided feedback on our early frameworks and, later, on our recommendations. A fourth advisory committee meeting considered recommendations for final feedback.

2.5 Expert Interviews

As part of our focus on documenting the current status of transportation payments and the landscape of challenges, we conducted 30-45-minute semi-structured interviews with eight advisory committee members representing government agencies, consultants, nonprofits, and academics. Interviews were conducted over Zoom with 2-3 UCLA ITS researchers, and questions were tailored to each interviewer's role and context. Our questions centered on efforts to address payment needs for low-income and underbanked individuals and on how

payments could be operationalized for the interviewee's specific context (e.g., parking, EV charging, transit). In these interviews, interviewees provided experience, ideas, and data from their relevant initiatives. We were able to gain financial and technological context from professionals working on similar or related endeavors. Interviewees were also able to speak to their experience working with specific financial institutions and about compliance with pertinent city, state, and federal policies. Their collective perspectives provided insight into the interests of issuers, merchants, vendors, riders, transit agencies, government entities, technology firms, and other stakeholders. We were able to use their experience to help inform our recommendations. The interviewees are listed in Table 4 below.

Table 4: Interviewees and Organizations

Interviewee	Organization
Kelley Jackson	MTC
Lilly Shoup	Rebel Group
Rory Wilson	Rebel Group
Gillian Gillett	Caltrans
Jonathan Wicks	Walker Consultants
Sean Charpentier	City/County Association of Governments of San Mateo County
Aaron Hirsh	Cities for Financial Empowerment Fund (CFEF)
Jon Hamblen	City of Pasadena
Madeline Brozen	UCLA Lewis Center

3.0 Results

3.1 Literature Review

We conducted three literature reviews to outline equity issues in transportation payments and to establish a basis for the framework equity criteria that we used to develop and assess our recommendations (See Recommendations in Section 5).

3.1.1 Equity Issues in Transportation Payments

The first literature review we conducted was on Equity Issues in Transportation Payments, with a focus on transit and on closed and open loop payment systems, and their implications for transit riders. The evaluation of these systems highlighted concerns for un- and under-banked access, low-income households, language barriers, universal design, and privacy. US transit agencies have been slow to adopt open-loop systems, so we also reviewed global examples. Our findings from academic journals and other sources indicate that open-loop systems are more convenient for users and provide more equitable access for riders.

For un- and under-banked riders, a lack of a bank account can create extra administrative effort and additional fees for some transportation payments. As technology changes and cash becomes less accepted, cash users and those with the ability to pay with Venmo, Zelle, or PayPal can be considered in open and closed loop designs through methods like prepaid cards or ticket vending machines (TVMs). In the literature review, we explain why these individuals do not have access to a stable bank account: an inability to pay bank fees or meet minimum amounts, language barriers, or distrust in financial institutions. Through our survey of the literature, we explain that the demographics of under- and unbanked households can include the elderly, disabled, immigrants, and young passengers. We reviewed payment method initiatives from Chicago, London, and Los Angeles that are affecting un- and under-banked riders.

Regarding income-based fare policies, we focused on discounts and subsidies that can be implemented as open-loop payment adoption continues. We evaluated whether fare policies like fare capping are fairer than a discounted time period (day, week, or month) pass. We reviewed applicable programs, including the LA Metro LIFE program, LA Metro ExpressLanes Low-Income Assistance Plan, Cal-ITP Benefits in Monterey-Salinas, ORCA LIFT, and low-income discounts that the federal government does not require. Through reviewing these programs, we explain how the complexity of the application and enrollment processes can impact low-income people and households.

Privacy for riders is another equity issue in transportation payments we explore. In this section, we review the relevant existing privacy laws affecting transit agencies and payment systems. Open-loop payment systems increase transit operators' involvement with data security. Payment systems generate abundant data that can be sold as a product. Strong policy and transparency are required as the potential for surveillance from these transactions is exacerbated in some technology systems.

Universal design is another equity issue in transportation payments we reviewed. This entailed a review of Title II of the Americans with Disabilities Act of 1990 (ADA) guidelines and the Web Content Accessibility Guidelines (WCAG) standards. WCAG standards address perception, operation, navigation, and comprehension, and

support cognitive accessibility for riders with disabilities. As transit fare has increasingly become a virtual process, this highlights the need for websites and apps to be screenreader-accessible for many types of disabilities.

We also evaluated language barriers for transportation payments. We evaluated two efforts in California to include Spanish-speaking and reading audiences in payment design. All of these equity issues and their evaluations informed how we continually evaluated transit agencies and other transportation payment systems.

3.1.2 Status Quo

The Status Quo literature review evaluated transportation funding methods and their equity outcomes. Specifically, we examined Local Option Sales Taxes (LOSTs), congestion pricing, transit payments, and parking payments as sources of transportation funding.

Through academic review, we explain how LOSTs in a Californian context create an inequitable burden on low-income households. LOSTs are regressive taxes, even though they are politically popular. The academic review focused on UCLA scholars' peer-reviewed studies of Californian LOSTs to examine how this financial burden is distributed across income levels and demographics.

For congestion pricing, we provided case studies from London and New York. These case studies evaluated the congestion pricing model and its associated low-income discount. London and New York have a geographical low-income strategy to provide toll relief to burdened areas. For both places, we noted eligibility criteria and personal identifying information required to apply. Through this process, we can see how these low-income discounts interact with other social benefits.

In the transit funding section, we provided an overview of how payments have evolved from cash and tickets to smart cards. Additionally, we evaluated the Californian context by explaining the prevalence of low-income discount options.

There is a section dedicated to efforts to automate discount eligibility verification in California. The section tracks Cal-ITP's collaboration with Login.gov and the California Department of Technology (CDT) to allow users to access transportation discount programs using their CalFresh accounts.

Another factor within the status quo of transportation payments includes the influx of technology. New technologies like apps and payment systems, as well as mobility options like ride-hailing, create a dynamic environment, putting vulnerable people at risk of being excluded from design elements. We discuss efforts in Ontario to simplify digital navigation and review academic articles on technological changes. Altogether, these elements inform us of the status quo of transportation payments and how they interact with low-income discounts and accessible design.

The status quo literature review was provided to the client as an interim deliverable and is available as an appendix to this report.

3.1.3 Usage-based Fees

The Usage-Based Fees literature review was largely case studies of existing low-income discounts within usage-based fees. Finding these programs required an extensive search of city and state transportation department websites and resources. Usage fees are often newer, more limited forms of transportation funding in the US. After reviewing each state, we identified which usage-based fees offered low-income discounts. From that list, we reviewed the following examples:

- Los Angeles Metro ExpressLanes
- Puerto Rico AutoExpreso Tolls
- San Mateo US 101 Express Lanes (Community Transportation Benefit)
- Virginia Department of Transportation Toll Relief Program and Virginia's Highway Use Fee
- Oregon OReGO RUC
- Illinois I-Pass Assist Program
- Globeville and Elyria-Swansea Tolling Equity Program

Each usage-based fee had different levels of discounts available, administration methods, enrollment methods, funding sources, and technology integration. We reviewed resources that explain and inform individuals about the discount, and we recorded parts of the user experience when applying and using discounts. During the search process, we identified EV user fees as a recent trend in the US that could be used to integrate and fund low-income discounts. Overall, usage-based fees can be a more equitable way to distribute transportation costs, but low-income discount schemes may still be needed to achieve equity.

3.1.4 Banking Review

Understanding how the banking system affects transportation payment options in California requires examining an interconnected set of regulations, products and services, financial inclusion efforts, and the global payments system standard. These elements interact to support a recommendation for an equitable, universally available, and low-cost mobility payment approach in California.

3.1.4.1 Banking regulations

Some federal regulations, particularly the Bank Secrecy Act's Know Your Customer obligations, affect financial inclusion in the United States (Welburn et al., 2024). Each bank must develop a customer identification program to collect, at a minimum, a customer's name, date of birth, address, and an ID number (31 CFR § 1020.220, 2025). Variations in this protocol across banks mean that some individuals without US-based identification or permanent housing may not qualify as customers with some banks. However, some banks' customer identification programs accommodate an expanded set of identification documents and individual mailing address circumstances (Welburn et al., 2024).

Digital wallets and peer-to-peer payments

Financial technology firms in the United States have developed digital wallets and peer-to-peer payment platforms that serve as banks or augment banking services for customers with existing bank accounts. Venmo, PayPal, and Cash App are three peer-to-peer electronic payment platforms that can be used to transfer funds between individuals and some businesses. These platforms are generally integrated with existing bank accounts, but can also serve as their own depository accounts (a "digital wallet"). For example, Cash App provides a routing number and account number for direct deposit (CashApp, 2025).

A RAND Corporation survey found that Cash App was the most popular digital wallet in California, used by 26.1% of underbanked and 21.1% of unbanked households in California (Welburn et al., 2024). Cash App offers a service to deposit cash at retail stores throughout the United States for a $1 service fee (Cash App, 2025b). Cash App issues pre-paid contactless-EMV Visa debit cards through a partner bank, and those requesting accounts are

subject to a customer identification program. Cash App users can therefore load cash, receive direct deposits, and use those funds for contactless payments without having a direct relationship with a bank account. Cash App is not an FDIC-insured bank, and only deposits held in linked accounts or for customers with a linked debit card are FDIC insured (Cash App, 2025a).

Payment Cards

A provider of prepaid access cards (e.g. Visa debit cards) to provide prepaid access to no more than a $1,000 maximum balance of funds provided that funds cannot be transmitted internationally, transferred to another user, or reloaded with funds from non-depository sources is exempt from certain federal banking regulations including know your customer requirements (31 CFR 1010, 2025§100(ff)(4)(iii)(D)). This could allow individuals who cannot or do not wish to open a bank account to purchase a prepaid debit card operating on a US payment network without providing their personal information. However, the card would not be reloadable, which could leave residual balances stranded on the card, as with closed-loop transit payment cards..

Federal regulations do provide a pathway for a reloadable prepaid card, provided that it is “closed loop” and has a maximum fund balance of no more than $2,000. The implementing regulation mentions explicitly “a subway system” as an example of permissible transactions involving a “defined merchant or location (or set of locations)” (31 CFR 1010, 2025 § 100 (kkk)). The United States Treasury’s Financial Crimes Enforcement Network has published additional guidance on this regulation, further defining “closed loop” prepaid access. This text is critical to our recommendations and is copied below in its entirety:

> “In circumstances where the ‘defined merchant’ in a closed loop prepaid program extends to a number of merchants, affiliated for purposes of jointly offering closed loop prepaid access, there are a variety of measures commonly employed to identify the participants to the prospective purchasing public. For example, a family entertainment company might choose to offer a ‘get-away weekend.’ To maximize its appeal, the company offers the vacationing family a closed loop product that encompasses theme park admission, lodging, dining, and travel arrangements. As a function of this closed loop program, the entertainment company informs the buyer of its get-away weekend partners, in media promotions, websites, and via marketing materials. The parameters of the closed loop program are distinctly drawn and made known explicitly to the purchaser. As long as the program adhered to the $2,000 maximum value established by FinCEN’s prepaid access regulation for exclusion, the standard of a ‘defined merchant’ has been met.
>
> The preamble to the final rule states that ‘in all of these instances, the prepaid access is ‘closed’ to any other retailers which are not part of the specifically identified group of retailers.’ [4] Some closed loop programs may choose to enumerate the retailers by name (or logo, or trademark) on the prepaid access device or its accompanying materials. Others, we understand, may refer a purchaser to a public website for participating merchants and locations. As long as the universe of merchants is identifiable and articulated to the purchasing public, and the partner merchants are joined for the limited purpose of providing a closed loop prepaid access program, such an arrangement falls within the term ‘defined merchant.’
>
> …
>
> [4] Bank Secrecy Act Regulations: Definitions and Other Regulations Relating to Prepaid Access, 76 FR 45403, 45407 (July 29, 2011).”
>
> Source: (Department of the Treasury, 2016)

This guidance indicates that the Network would exclude from certain banking regulations (e.g., those that require customer identification) the sale of a closed loop prepaid card that adheres to the $2,000 maximum value to be used with a “universe of merchants” that are related by a theme (e.g., mobility services in California) and the participating merchants were communicated to the public via a website and/or common logo on the prepaid card and at the retailer. This key provision is the regulatory foundation for the “California Mobility Card” recommendation introduced at the conclusion of this section and detailed in Chapter 4 (Recommendations).

Guidance also specifies additional requirements for sellers of closed loop prepaid access, including measures that sellers shall take to ensure that no person purchases more than $10,000 in prepaid cards per day (Department of the Treasury, 2011) and that use of supplemental technology, such as a QR code or tolling transponder, can be used to provide prepaid access (Department of the Treasury, 2016).

3.1.4.2 Banking products

Payment Cards

Banks in the United States universally offer deposit accounts (checking and savings) and debit cards for access to automated teller machines (ATMs). In virtually all cases, the payment card with ATMs utilizes the Europay, MasterCard, Visa (EMV) global payment security standard in order to provide debit access to ATMs not directly operated by the financial institution that issued the payment card.

In addition, many banks offer credit cards that operate on the EMV payment network standard. A debit card draws money from an existing account, which must have a positive balance to avoid overdraft fees. A debit card is universal for people with bank checking accounts. A credit card is a loan up to a pre-set credit limit, and the bank that issues it will assess the customer's creditworthiness, typically using a credit score or credit history report. Credit scores and credit history will vary from customer to customer, and not all customers will be eligible to obtain credit cards from all banks. Thus, the debit card is a more universally available form of EMV payment card than the credit card, though both operate on the same payment network and can be used for transactions on that network[1]. Major payment networks in the United States are Visa, Mastercard, Discover, American Express for credit and debit cards, and STAR, Pulse, Plus, and Cirrus for PIN-enabled debit cards.

A key driver of deploying EMV-capable payment cards and point-of-sale devices was the 2015 decision by Visa, Mastercard, Discover, and American Express to shift liability from the card issuer to the merchant if the merchant did not accept EMV-capable cards that use a chip. Around this time, contactless EMV (cEMV)-capable cards and point-of-sale devices were also introduced in the United States.

Expanded identification documentation acceptance

Some individuals who do not have bank accounts are unable to open one because banks require them to provide specified forms of identification. These policies are derived from an interpretation of federal banking regulations and differ by bank. Banks generally accept photo identification issued by the United States government or a state government, such as a passport, driver's license, or state identification card. However, some individuals who wish to obtain banking services in the United States do not possess, or are not eligible to receive, these generally accepted forms of identification.

[1] In some cases, such as when renting a bicycle or automobile, the entity renting the vehicle will require an additional deposit from a debit card holder that functions similarly to a credit card hold, an authorization for payment that is later cancelled after the vehicle is satisfactorily returned to the renting entity.

Bank On certified accounts meet the Cities for Financial Empowerment Fund's Bank On National Account Standards, which strongly recommend that the financial institution accept Internal Revenue Service-issued Individual Taxpayer Identification Numbers (ITIN, available to those not eligible for Social Security Number) and identification documents issued by municipal governments or other governments as documentation for opening an account (Cities for Financial Empowerment Fund, 2024).

Other financial institutions that do not offer Bank On certified accounts also advertise expanded document acceptance for foreign nationals. One example is Majority, a financial technology company that accepts identifications issued by certain foreign governments, including Mexico and Nigeria, when establishing accounts (Majority, 2025). Majority is not itself a regulated bank, but rather a website and smartphone application that offers deposits and federally regulated banking services provided by Axiom Bank of Florida.

Accessibility services and products

Banks can offer services that exceed federal and local regulations. Some large banks are able to invest in technology, processes, and training to provide additional support for people with disabilities. For example, Bank of America and Chase Bank offer large networks of talking automatic teller machines (ATMs) that provide additional support for customers with visual impairments (Bank of America, 2025; Chase Bank, 2025). These additional accessibility services allow people with disabilities to access banking services, including contactless payment cards, that best address their individual needs.

3.1.4.3 Financial inclusion efforts

Two non-profit organizations are working to increase financial inclusion in California. The two organizations differ in their approach to serving unbanked and underbanked populations, but both efforts would serve to increase the number of Californians with bank accounts and contactless-EMV capable debit cards.

Public Banking in California: CalAccount

The California Public Banking Alliance is a non-profit, public benefit corporation (501(c)(3)) that educates and advocates for the establishment of public banks in California, by cities, counties, or the state. This movement has two components: banks for governments to make deposits and obtain credit, and financial services for the unbanked (CalAccount). The alliance explicitly seeks to build a network of "socially and environmentally responsible banks…to build a new alternative banking system" to private banks (California Public Banking Alliance, 2025).

The California Public Banking Alliance has supported approved legislation in California. AB 857 (2019) allowed cities and counties to establish public banks. AB 1177 (2021) required the State Treasurer to commission a comprehensive market analysis. Researchers at the RAND Corporation conducted that analysis (Welburn et al., 2024) and recommended establishing the CalAccount program as a voluntary, zero-fee, zero-penalty, federally insured transaction account linked to government programs, that accepts direct deposits from employers with 25 or more employees, and that allows California tenants to pay rent electronically without fees. The CalAccounts would have provisions to take a wide range of identifications and housing statuses for people without a permanent address. Legislation to establish the CalAccount program failed to move forward in 2025 as AB 1365 (Garcia).

Cities for Financial Empowerment Fund: Bank On

The Cities for Financial Empowerment Fund is a national, non-profit (501(c)(3)) organization that works towards financial inclusion through partnerships with existing banks, credit unions, and local governments.

Working with financial institutions, regulators, government partners, and other key stakeholders, the Cities for Financial Empowerment Fund has created a national certification infrastructure for accounts that meet the organization's National Account Standards. These Standards indicate that the certified account includes many features that are intended to benefit those who would otherwise be underserved by the banking system:

- Checking account or prepaid accounts
- Debit card for point of sale and payment
- Minimum opening deposit of $25 or less
- Monthly maintenance fees of $5 or less if not waivable
- Monthly maintenance fees of $10 or less if waivable by certain criteria
- No overdraft or non-sufficient fund fees
- Now fees for account activation, closure, inactivity, or low balances
- Free and unrestricted access to banking via branches, telephone, and in-network ATMs
- ATM fees of $3.00 or less for out-of-network transactions

(Cities for Financial Empowerment Fund, 2024)

The Cities for Financial Empowerment Fund has supported Bank On Coalitions in Inland SoCal, Los Angeles County, San Francisco, San Diego, and Central California, as well as almost 100 others across the country. These coalitions "are local partnerships between government agencies, financial institutions, and community organizations that work together to improve the financial stability of unbanked and underbanked residents in their communities." The coalitions work with banks and credit unions to make sure that local financial institutions offer Bank On accounts, work with city or county governments on advertising and outreach programs, connect the accounts to large-scale government and nonprofit programs and payment streams, and offer resources on Bank On in multiple languages (Los Angeles County Department of Consumer & Business Affairs, 2025).

3.1.4.4 Payment networks

A payment network is required to process transactions between a consumer or payer and a merchant who use different banks. In the United States, a four-corner payment system using EMV-capable cards and validators is standard. The generalized four-corner model involves the following steps:

1. A cardholder uses a cEMV-capable credit or debit card issued by their bank (issuing bank) and taps this card on the merchant's cEMV-capable payment validator.
2. The payment validator connects with the merchant's bank (acquiring bank) to initiate an authorization request to transfer payment via the applicable network, which is Visa, Mastercard, Discover or American Express.
3. The applicable payment network receives the request from the acquiring bank and forwards it to the issuing bank.
4. The cardholder's bank (issuing bank) determines whether the card is valid and has sufficient funding, checks for fraudulent activity, and sends the response back through the steps in reverse order.

Later in the day, the payment network assists acquiring and issuing banks in settling net transactions between them, and the banks deposit funds into the merchant's account.

More information about payment processing specific to transit agencies in California is available from the California Integrated Travel Project Guide to Payment Processing (California Integrated Travel Project, 2025)

EMV Transit Payment Models

The adoption of cEMV capabilities has led to more public transportation agencies accepting such cards. As public transportation agencies around the world have designed, implemented, and iterated cEMV payments, payment networks have responded by developing payment models that meet the specific needs of mass transportation agencies. These include high throughput (low processing delay per tap payment), unknown payments at first tap (for distance-based fares that require tap on exit), and fare complexity (such as capping or transfers). Card payment networks have developed the Visa Mobility and Transport Transaction Model and the Mastercard/Discover, American Express Pay As You Go models to meet the needs of public transportation agencies and other mobility providers (Cybersource, 2025).

There are specific risks and risk mitigations for transit, summarized in the California Integrated Travel Project Guide to Payment Processing (California Integrated Travel Project, 2025).

Any EMV-capable payment method operating on the Visa, Mastercard, Discover, or American Express payment networks can utilize the existing standards, creating an opportunity for transportation and mobility payments in California to benefit from an accumulation of experiences from other transit agencies.

3.1.4.5 Banking Review Conclusion

Transportation agencies will achieve several efficiency and equity benefits from tapping into features already existing in banking and financial services. These benefits include taking advantage of prior private investment in costs to provide additional support for people with disabilities, people with limited English language proficiency, and people with other individualized needs, and amortizing these costs across all financial transactions rather than just the subset involving a government agency offering transportation services. These features enhance the appropriateness of that support while eliminating the costs of providing such supportive services in payment method administration. Additionally, the Universality of the EMV payment standard means that those with EMV-capable cards issued by foreign financial institutions can pay using EMV. EMV acceptance means that visitors to California, who may have limited English proficiency and/or limited access to US financial services, can pay for transportation services with an EMV-capable payment card they have access to from their country of origin.

Moving to cashless and accepting EMV-capable payment cards or devices supports financial inclusion efforts that provide a pathway to debit cards for those who lack such access. EMV-capable cards and devices offer a path to banking for those who lack a bank account, whether US-based or foreign-based. This is also true for those who voluntarily switch from an existing bank account that may charge a foreign transaction fee for purchases in the United States, and for accounts that charge fees in excess of those of Bank On-certified or CalAccount accounts.

A restricted "gift card" operating on EMV would be a fallback option for those who either lack a pathway to financial services inclusion or demand privacy equivalent to that of cash payments. This restricted "gift card" option is further developed in Section 5.1 - California Mobility Card.

3.1.5 Transportation Legal Review

California Government Code §§ 6150 - 6159 specifies how government agencies in California can accept various payment methods for taxes, fees, and charges. These sections do not require use of cash payment. However, other sections of California law specify additional considerations for payment acceptance for parking, transit, and vehicle tolls.

3.1.5.1 Parking

SB 532 amended Vehicle Code 22508 to specify the conditions under which the Cities of Santa Monica and Long Beach and the City and County of San Francisco may establish "parking payment zones" that allow for payment of parking without the use of parking meters, including multi-space kiosks or payment centers. The bill requires that local jurisdictions first establish an "equitable parking cash payment plan" that:

> "The plan shall provide reasonably accessible alternative means for payment of parking fees using cash. The plan shall assess the feasibility of potential strategies, including, but not limited to, accepting cash payment for parking from a mailed invoice requested through the mobile payment system. The local authority shall consult and work collaboratively with relevant local stakeholder organizations that may include, but are not limited to, racial equity, privacy protection, and economic justice groups, in developing the accessible and equitable parking cash payment plan. The plan shall be approved by the local authority."
>
> (SB 532, 2024)

This bill establishes recent legislative precedent for an accessible and equitable parking cash payment plan when eliminating cash acceptance as an option for a mobility services payment, in this case, parking.

3.1.5.2 Transit

Regulations governing transit payment methods are primarily federal. California PUC 99285(d) mentions "base cash fare" in a formula used for allocating funding within Los Angeles County. Still, this section does not require that any agency accept cash for fares.

The Federal Transit Administration specifies the procedures for performing an equity analysis of changes in fares, fare payment types, or fare media as part of its interpretation of the compliance requirements of Title VI of the Civil Rights Act of 1964 in Circular FTA C 4702.1B (Federal Transit Administration, 2012). The Federal Transit Administration further clarified in a response to questions from grantees that it expects grantee agencies to perform a fare equity analysis as described in this circular if the agency changes fare media policies to "cashless" or "cash-free" for a period of six months or longer (Federal Transit Administration, 2022). Over 150 transit agencies in California, including all major transit agencies, are recipients or subrecipients of Federal Transit Administration grants and subject to this interpretation.

3.1.5.3 Vehicle Tolls

California law (SHC § 27565) and a regulation (21 CCR § 1700.3) establish requirements for interoperability of both tolling communications technologies and billing between agencies. This legislation and regulation intend to allow tolling users to travel throughout the state of California, use tolls, and handle billing with a device and account from a single tolling authority. The proposed regulation would change the technology specification to a "6C Protocol," which is backward-compatible with existing California systems and allows nationwide standardization (California Department of Transportation, 2023). Allowing for inter-state, interagency billing along with this technology standard could allow for tolling users to submit payment to a California agency for tolls incurred out of state, with the California agency then transferring payment to the out-of-state agency.

California law (VEH § 23307) also requires that California agencies which issue an electronic toll payment device and maintain user accounts accept cash payments for those user accounts. A subsection of this law explicitly allows tolling agencies to accept payment via a cash payment network. It requires that agencies not assess an additional fee on top of the cash payment network fee. California tolling agencies do accept cash payments via such networks, and the company PayNearMe notes that its customers include California tolling agencies (Pay Near Me, 2022).

3.2 Inventory

3.2.1 Summary of Payment Systems

Payment Media

Through our analysis of 48 transit agencies, we've mapped out the current payment landscape across public transportation. All agencies accept cash in some form, and a majority of agencies support Smart Cards and Mobility Wallets as payment media. Many transit operators are phasing out tokens and tickets, and more than half now accept open-loop cEMV cards as the technology becomes increasingly integrated into payment systems. The table below shows the prevalence of various payment media across transit agencies.

Table 5: Agency Acceptance of Payment Media

Pavment Media	Amount of Agencies Accepting Media	Percentage of Agency Acceptance
Cash	48	100.0%
Smart Cards	39	81.3%
Mobile Wallets	38	79.2%
Open-Loop Contactless EMV Cards	27	56.3%
Paper Tickets/Vouchers	18	37.5%
Electronic Ticket	12	25.0%
Stored-value cards	5	10.4%
Tokens	1	2.1%

Cash Acceptance

Through our review of 48 transit agencies, we've confirmed that all accept cash in various forms. Most transit agencies accept cash in multiple ways, and the table below illustrates the most common forms of cash acceptance. Many agencies are transitioning away from farebox cash acceptance to improve operational efficiency and reduce boarding delays. Although riders can still reload via Ticket Vending Machines (TVMs) or at retail locations using cash, these options involve extra steps and coordination, slowing down the user experience.

Table 6: Agency Acceptance of Cash Payment

Does the agency accept cash?	Percent of Agencies	Count of Agencies
Yes: Any Method	100%	48
Yes: Farebox	35.4%	17
Yes: Load onto card (TVMs)	79.2%	38

Yes: Load onto card (Retail)	50.0%	24

These options are not mutually exclusive. Some agencies offer cash acceptance through multiple methods.

Privacy and Data

Those applying and enrolling in low-income discount fare programs will have to provide more Personally-Identifiable Information (PII) than the general rider using the transit agency's electronic systems. The lack of integration with social benefits requires low-income households to provide sensitive data repeatedly, which increases administrative burden and time for the rider, and also heightens privacy and data security risks. PII pertains only to identifying information and does not include general inputs asking for non-identifying information (e.g. communication preference). PII were counted across the entire low-income discount application. Across 48 agencies a total of 68 PII were collectively required to sign up for a transit card. Across 26 agencies with a low-income discount a total of 89 PII were collected during the application process. In our recommendations, we suggest an alternative with greater financial integration which decreases the amount a household would have to provide PII.

Forms of PII could include, but are not limited to: name, address, email address, and proof of income or address.

Table 7: Personally-Identifiable Information

Personally-Identifiable Information (PII)	Number of PII Required	Number of Agencies
PII (General)	68	48
PII (Discount)	89	26

Low-Income Fares

More than half of the 48 agencies within our inventory have a low-income fare program. The table below outlines the different enrollment methods used by transit agencies, with some agencies offering more than one.

Table 8: Availability of Low-Income Fares

Availability of Low-Income Fares	Number of Agencies	Percentage of Agencies
Not Available	22	45.83%
Yes	26	54.17%
Yes: Proof of eligibility required	24	50.00%
Yes: Application in-person	20	41.67%
Yes: Application online	12	25.00%
Yes: Application by mail	6	12.50%
Yes: Only with passes (not single fares)	4	8.33%
Yes: Available at TVM	2	4.17%
Yes: With attestation only	2	4.17%

Options are not mutually exclusive as some agencies offer multiple pathways for validating eligibility for a low-income fare.

Physical Card

For each payment system, we noted if it was possible to register for a physical card online. This capability significantly impacts riders without smartphones, without U.S.-based phone numbers, with limited internet access, or those who rely on cash to load their cards. In many cases, discounted-fare applicants are more likely to be able

to initiate physical-card registration online, often as part of their discounted-fare application process. The two tables below show the number of agencies that allow for online registration of a physical card.

Table 9: Registering for a Physical Card Online (Regular Fare)

Can you register for a physical card online? (Regular Fare)	Percent of Agencies	Number of Agencies
No	58%	28
Yes (in any form)	42%	20
Total	100%	48

Table 10: Registering for a Physical Card Online (Discounted Fare)

Can you register for a physical card online? (Discounted Fare)	Percent of Agencies	Number of Agencies
No	23%	11
Yes (in any form)	77%	37
Total	100%	48

Accessibility Analysis

Readability

The accessibility review of each system in the inventory involved manually evaluating each website's user interface and assessing its readability. We did this for both general payment sites and low-income traveler sites. (See Methodology section for details). The results indicate the need for system improvements and emphasize the importance of accessible text for a broad audience. Whereas the 8th-grade level of readability is recommended for comprehension by 80% of the general population, most sites we reviewed scored at a 10th- to 12th-grade reading level. Sites for low-income fare registration pose even greater challenges: most were at the college level, and two were even at the college graduate level. These high-level texts are problematic for households that lack education or time, and have language barriers, cognitive disabilities. The complexity of the text is a major concern, as low-income discount applications and enrollment often involve multiple steps and requirements, creating an elaborate system to navigate.

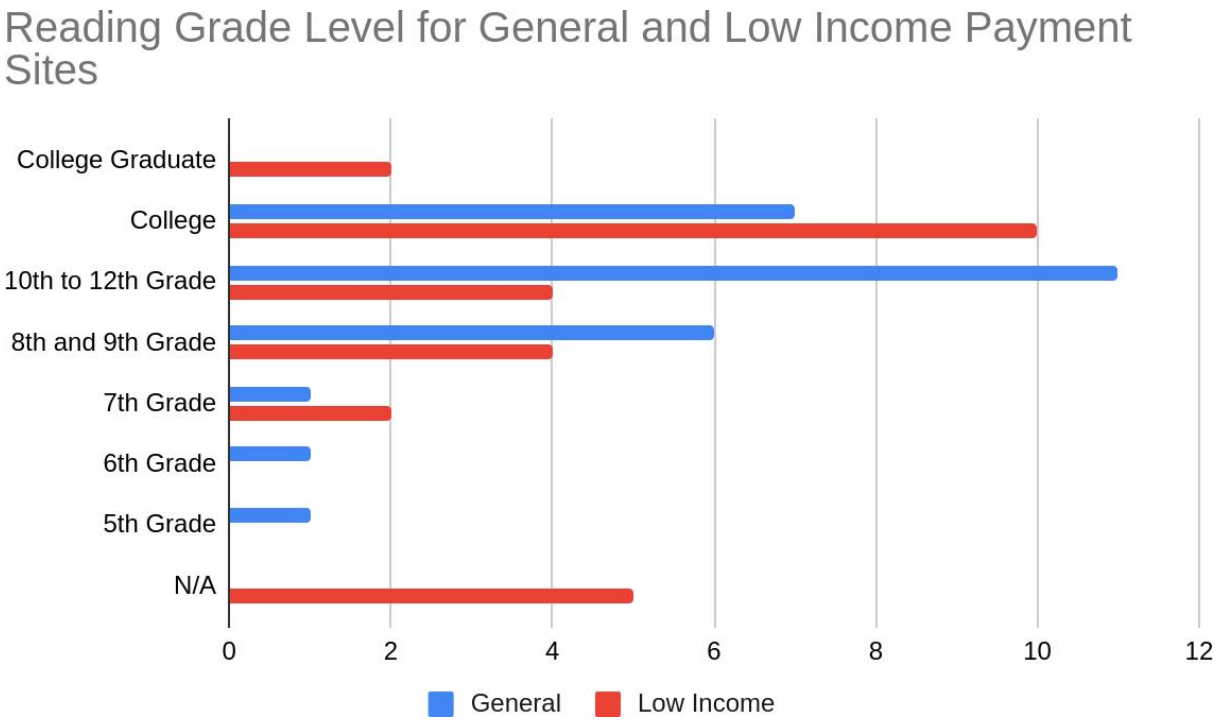

Figure 1: Reading Level [2]

Similarly, we assessed transportation payment sites with the Flesh Reading Ease rubric, which scores text on a 0-100 scale for readability (with 100 being most readable). A minimum score of 70-80 is recommended for a general audience. As shown in Figure 2, only four agencies' websites have readability scores within the recommended range. The vast majority of transit agency sites investigated have readability scores well below the recommended range (indicated by the green "Optimal Range") and therefore are less accessible to a broader audience.

[2] Note: "N/A" refers to transit agencies that do not have a specified low-income discount program.

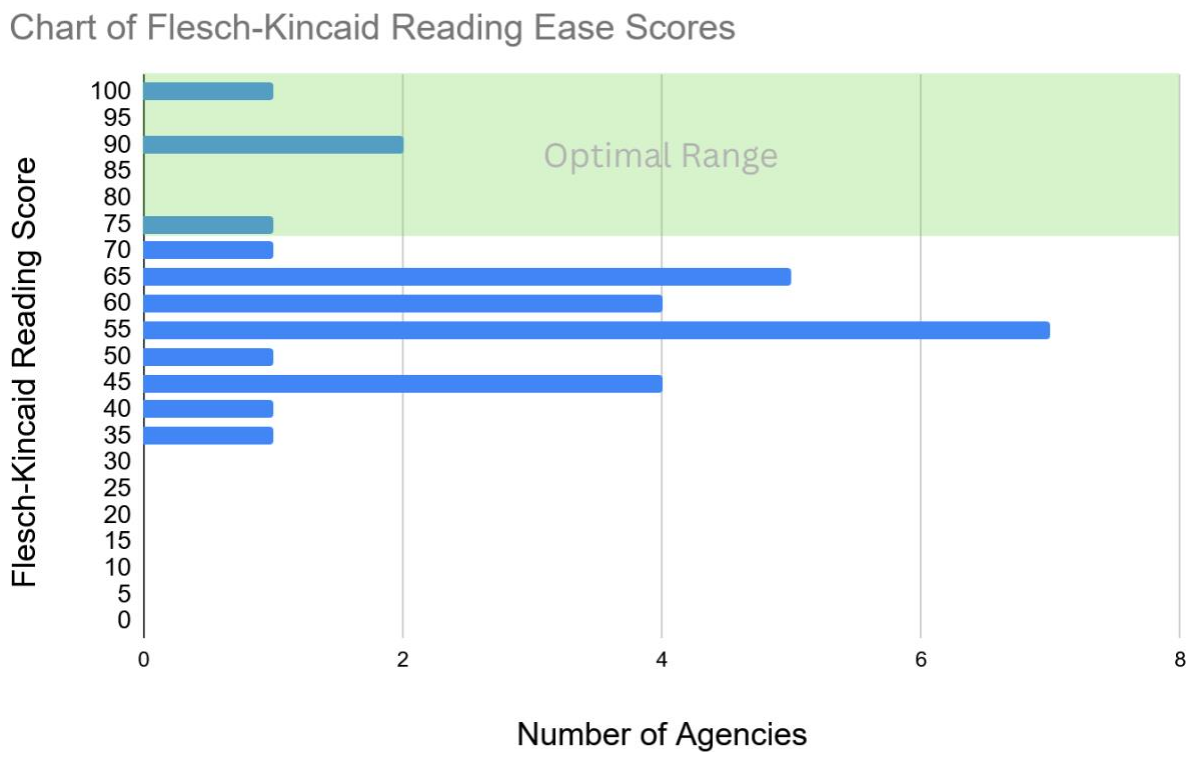

Figure 2: Histogram of Flesch Reading Ease scores for low-income programs

Readability scores were lower (less readable) for low-income sites, suggesting that current online payment systems pose a greater burden for low-income transportation users than for the general public. Scores are likely lower due to the additional information displayed regarding eligibility. Low-income sites contain significantly more text, including more acronyms, addresses, and other required documents and forms of identity. Especially considering users navigate low-income payment systems alongside the general payment system fares and policies, which are neither read at an ideal accessibility for a wide range of users, applicants seeking to apply for discounted transit cards may experience significant accessibility issues.

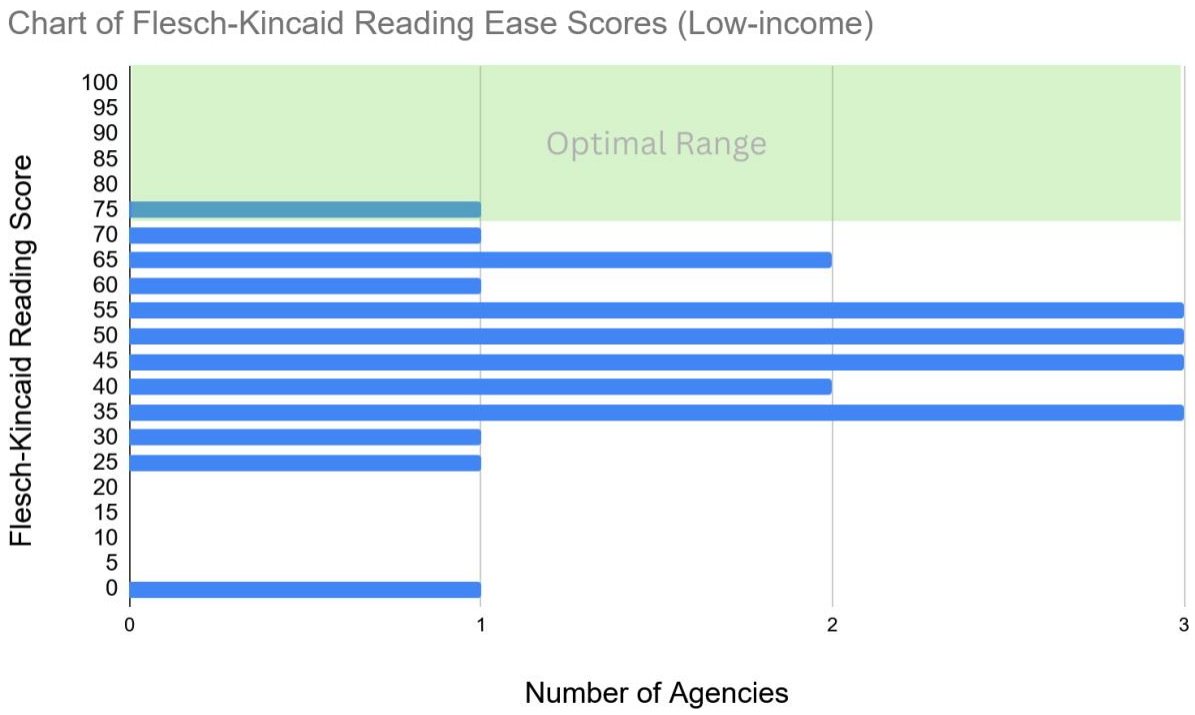

Figure 3: Histogram of Flesch Reading Ease scores for low-income programs

By comparison, using the Reading Grade Level scoring method, low-income users have higher reading grades than the general public. While it is unsurprising that low-income users would face *more* steps in registering for fare media due to their need to enter additional information about income and/or verify eligibility, the reading scores measure not the volume of content but ease of understanding. This finding suggests that agencies offering low-income fares should simplify their language and improve readability.

Table 11: Summary of Reading Levels for General Fare and Low-Income Fare Instructions

% Agency Sites, by Reading Grade Level	General	Low Income
College Graduate	0%	7%
College	26%	37%
10th to 12th Grade	41%	15%
8th and 9th Grade	22%	15%
7th Grade	4%	7%
6th Grade	4%	0%
5th Grade	4%	0%
N/A	0%	19%

Clicks and Inputs

We also reviewed the number of clicks and inputs needed for people to sign up for fare media online to understand the task and cognitive load involved in program enrollment. The data show that the average number of clicks for low-fare users is more than twice that for the general public, suggesting an additional complexity that may burden people with physical or mental disabilities, or persons for whom English is not a first language. A high amount of clicks pose a greater administrative and time burden for benefits and may prevent low-income households from completing eligibility and application. A low-income discount program may be able to increase the number of riders accessing benefits if they are able to decrease their administrative burden. A lower amount of clicks and inputs helps both general and low-income access transit services. The goal should be to reduce complexity for both the general-fare and especially for the low-income rider. These extra clicks add friction to the user experience and pose additional challenges for both users and screen-reading technology. These clicks may also indicate the multistep process for accessing the application and enrollment forms. A user may need to navigate redirection across multiple tabs, multiple sections, and websites.

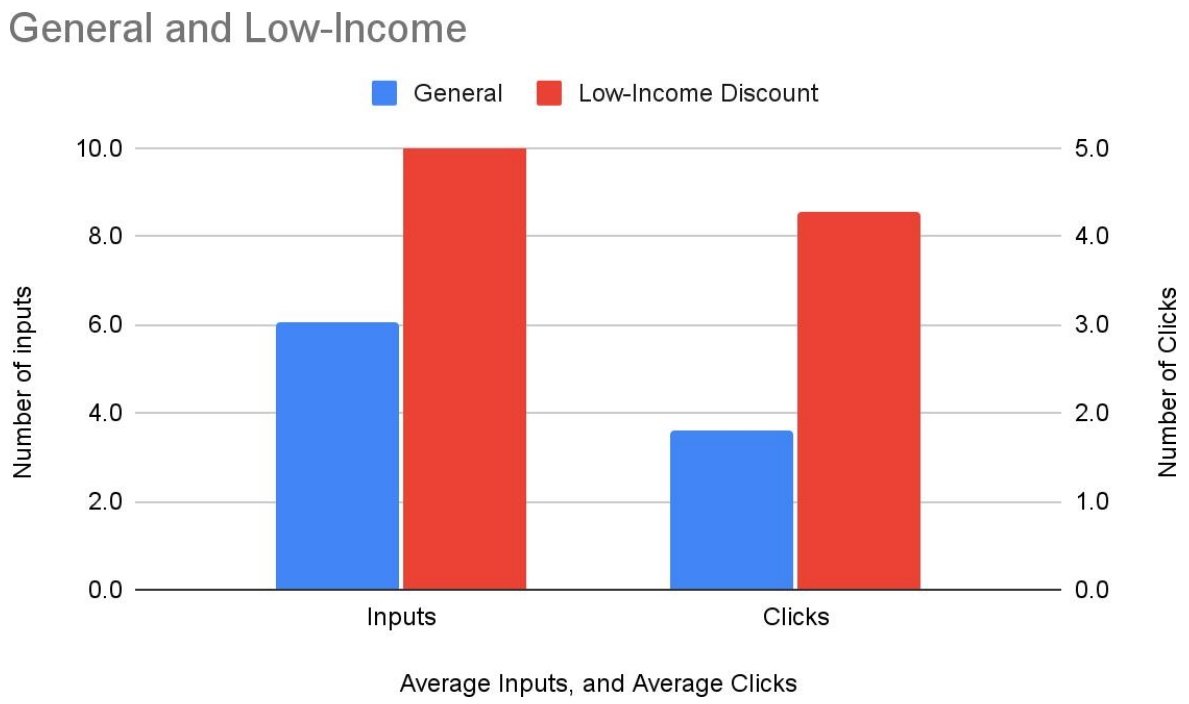

Figure 4: Clicks and Inputs Required for Online Fare Media Application

3.3 Parking Apps

Readability

We analyzed the user experience and accessibility of seven parking apps used in California. None of the parking apps had a connected low-income discount program. Six of the seven parking apps had the general audience-recommended grade level at 8th and 9th grade; one parking app tested at a college reading level, which is not accessible to a broad audience.

Table 12: Parking App Reading Level Assessment

Reading Grade Level	Number of Parking Apps
8th and 9th Grade	6
College Level	1
Total Parking Apps	7

Clicks and Inputs

We assessed the ease of app navigation by measuring the number of clicks and inputs needed to pay for parking.

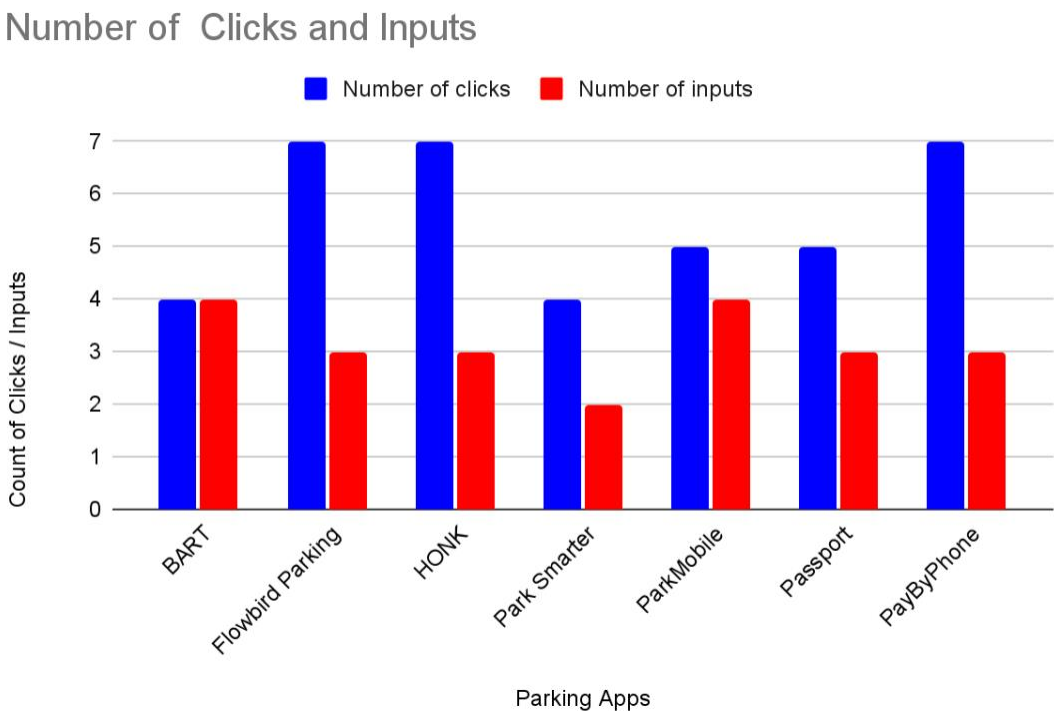

Figure 5: Clicks and Inputs Required for Parking Apps

Privacy and Data

All parking apps required an account for use, meaning various amounts of personal information had to be shared. For every parking app, a user must provide at least an email address. Smartphones were not always required to use an account; any internet connection would work for account creation and use. Below are two tables summarizing the technology and PII requirements for using an account.

Table 13: Technology requirements for Parking Apps

Technology Required	Number of Parking Apps
Account Required	7

Smartphone Required	3

Table 14: Personally-Identifiable Information Required for Parking Apps

PII	Number of Agencies with Requirement	Percentage of Agencies with Requirement
Name	1	14.3%
Email Address	7	100.0%
Phone Number	5	71.4%
License Plate	5	71.4%

Screen Reader Accessibility

The figure below displays the results of the screen reading accessibility test, examining whether titles, lists, images, and form field prompts were read aloud and if they were read in the correct order. A score of five indicates the app is fully screen reader accessible.

In 2024, the U.S Department of Justice published a final rule adopting the Web Content Accessibility Guidelines ("WCAG 2.1") as the technical standards for web content and mobile app accessibility under the Americans with Disabilities Act (U.S. Department of Justice, 2024)

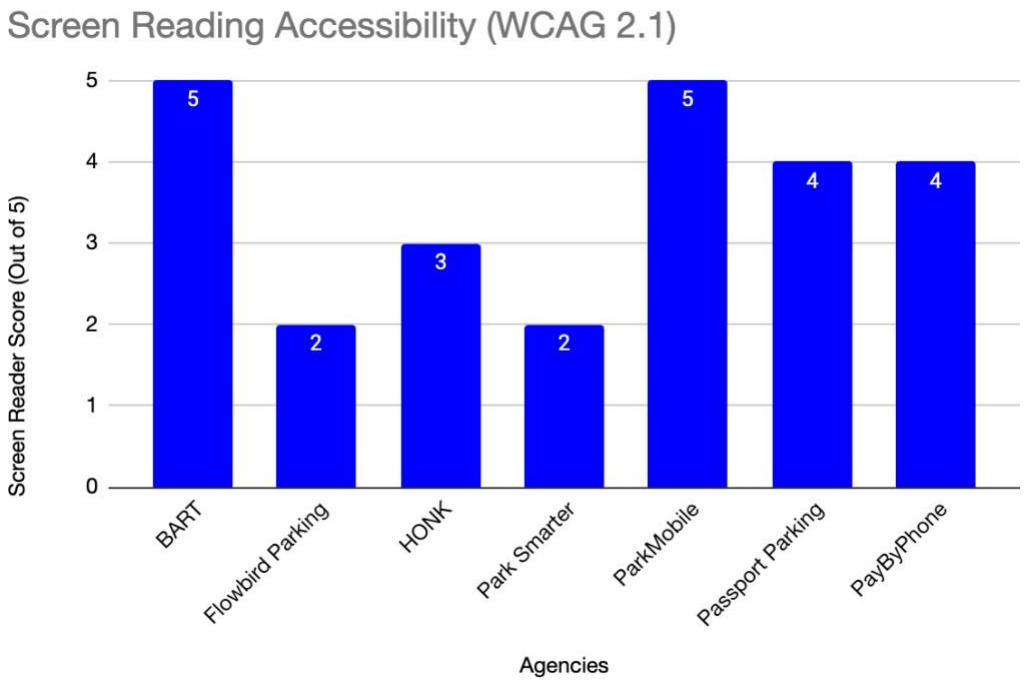

Figure 6: Screen Reading Accessibility

3.4 Case Studies

Case studies on the Chicago Transit Authority (Ventra), Los Angeles Metro (TAP), Milan, the Metropolitan Transportation Commission (Clipper), the New York City Metropolitan Transportation Authority (OMNY), and Portland (Hop) are available in the appendix.

3.4.1 Transit payment method use cases: ticketed and unticketed

From the inventory and case studies, we developed a framework for understanding ticketed versus unticketed payments

3.4.1.1 Ticketed payments

A ticketed fare means the transaction is an exchange of fare for a ticket, and the transaction value is separated from the ticket value. The ticket can hold any number of values beyond the transaction amount and eliminates the need for an "account." For example, the ticketed fare allows a single transaction to cover the fare of multiple people (e.g., a group or family traveling together), simplifying the payment process. In some circumstances, this can result in a simpler and superior user payment experience. Ticketed fares also allow fare bundling, for example, combining intercity travel and local transit fares so a user can pay once to travel seamlessly across modes. Where ticketed fares make fare bundling possible, even airlines can sell local transit fares on their airline ticket (with "air-rail" or "through-ticketing" arrangements), and the user can use a single ticket for these multiple modes, *without* an account. Tickets can therefore make travel simpler and more seamless for users.

Payment methods can be used with or without (user) tickets, and it is possible to use unticketed and ticketed fares together. For example, the California Mobility Card could be debited for unticketed fares and also used to purchase ticketed fares. Tickets could take the form of QR codes (in-app or on paper) and be used in both proof-of-payment and faregated systems (if QR codes are supported). A California Mobility Card can serve as both a value storage option for transportation funds and a means of purchasing a ticket, or as the ticket itself. The flexibility of this payment option should be maintained in policy and technology choices to maximize how transportation systems can work together.

3.4.1.2 Unticked Payments

With an unticketed payment, the transaction is the "fare"; the user has no ticket or proof of payment. A user pays a $2.00 fare with $2.00 in cash or cash value. Unticketed payment has the advantage of nominal simplicity, but the disadvantage of inflexibility: the fare can have only one value – that of the transaction. Rules can be added to the transaction (e.g., free transfers within a specific time period or fare capping by day and/or week). Still, these require tracking transactions with technology, such as a proprietary card, app, and/or backend transaction tracking (primarily when cEMV is used), which means the transaction is necessarily account-based, with a user having an account (even if unknowingly). The limitation of value-as-transaction also complicates rules for inter-operator arrangements: an unticketed payment (no matter how it is made – whether with cash, card, or app) cannot be used for inter-operator or inter-regional travel without some kind of user account for tracking the payment type, which adds complexity. Note that it is not possible at all when cash is used.

Unticketed payment means the fare is tied to a single person or account, so each person must pay for their own transaction. Group and multi-person fares (commonly available in European systems) are not possible, which can be a significant point of friction for families and groups traveling together, and could discourage riders who could otherwise fill transit seats in multiples. Where workarounds exist (e.g., allowing multiple taps on a single payment card or device), they can conflict with payment features such as fare capping. The unticketed payment-as-fare

means that young persons (who seldom have smartphones or bank accounts) must either be exempted from fares, be allowed to pay cash, or be required to have a payment card (which functions similarly to a ticket).

Table 15: Unticketed versus Ticketed Payments

	Unticketed	Ticketed
Pros	• Simplicity of payment ("the fare is what you pay")	• Flexibility; • Simplicity of travel ("one ticket rides"); • Privacy (no account or PII needed)
Limitations	• Limited to single trips unless some kind of "account" is used (with or without user setup) • All users must have their own individual payment method, making group and family travel difficult and possibly cost-ineffective • Cannot be used in proof-of-payment (POP) systems (without accounts)	• "Fare capping" is not possible
Seamless travel	No, unless the account is used	Yes - account not needed
Best use	Single-trips	Multi-part trips, multi-operator trips, multi-person trips
System compatibility	Faregates, fareboxes	Faregates, fareboxes, proof-of-payment (POP) systems
Equity considerations	• Fare capping is possible (with a user account) • User accounts can store sensitive PII • Group travel is a multiple of individual fares, and can be costly for families	• Users must pay the whole cost upfront (no fare capping) • Group travel can make family travel easier and more affordable • App-based tickets can have accessibility features

3.5 California Statewide Transit Payments

California Integrated Travel Project

Cal-ITP curated recommendations to guide transit agencies in simplifying their fare systems, especially alongside updates in fare collection technology. This is a way to coordinate fare practices with the approximately 200 publicly funded fixed-route operators in California. There are three tool kits for agencies offering fixed-route

service: 1) Bus-only, 2) Multi-Modal, with a Substantial Bus Network, and 3) Multi-Modal with Substantial Rail/Ferry Network. Each toolkit has a recommended fare structure, a guided pricing framework with a breakdown of customer categories, proposed transfer policy, and optional fare strategies. If operators and agencies coordinate fare and collection policies, riders will have a seamless way to travel across agencies, leading to more equitable outcomes. Ultimately, the goal is to minimize confusion for riders and assist lower-income passengers who are less able to shift travel times or routes to save money.

California Transit Card Fiduciary Funds

People who use transit payment cards in California add a balance to their cards before using them to pay for transit. This means that transit agencies hold unused funds that can be used for future journeys. In their annual comprehensive financial reports, three California transit agencies report the amount of funds held in escrow or in fiduciary status as “custodial funds,” assets held by the agency on behalf of its customers. The Bay Area Metropolitan Transportation Commission (Clipper Card) and Sacramento Regional Transit (Connect) each report a separate line item for custodial funds. The Los Angeles Metropolitan Transportation Authority reports these, bundled with other grant revenues, as unearned revenues. The San Diego Metropolitan Transportation System includes Fare media payments received in advance as its own unearned revenues line item. The table below shows the fund balance held by each agency in the latest Annual Comprehensive Financial Report available at the time of this research.

Table 16: California Transportation Agency Custodial Funds and Unearned Revenues

Agency	Year	Fund	Item	Amount
MTC	2024	Clipper Custodial Fund	Net Position	$175,499,000
LACMTA	2023	Unearned revenue	Business-type activity (including presale of passes and tokens)	$17,541,000
SACRT	2024	Connect Card Custodial Fund	Net Position	$774,547
SDMTS	2024	Unearned revenue	Fare media payments received in advance	$13,819,817

Cardholders are often not allowed to request a refund from card issuers. Among the agencies listed in Table 16, only Clipper provides refunds to customers seeking to withdraw cash from their cards. To request a refund, customers must visit the Clipper’s website and navigate to the “Forms” section and fill out a Card Cancellation Form. Users must also pay a $5 fee. Other card issuers do not provide refunds barring specific circumstances, stating all sales are final. Connect Card will only provide refunds in the event of a Cardholder’s death, military transfer, or as otherwise required by law. Pronto/SDMTS will only provide refunds to cardholders who were incorrectly charged but none to those seeking to withdraw funds.

3.6 Interviews

Through expert interviews, the research team learned about several issues that affected our subsequent research and recommendations. This included perceived inequities stemming from the lack of interoperability in status quo transportation payments, such as the need to use multiple cards or apps with dedicated, non-transferable balances.

Interviewees also mentioned inequities stemming from a broader societal issue—the transition to digital payments—and the cessation of cash acceptance. This broader issue motivated additional research into financial inclusion efforts and the roles of transit agencies, cities, and transportation authorities in promoting it.

Experts with experience working with or for transit agencies noted that the cost of cash acceptance varies by agency, but is generally high. Fixed costs typically include payments for purchase, operation, and maintenance, as well as cash handling and transport from dozens or hundreds of ticket vending machines, fareboxes, or parking meters. However, as more passengers shift from cash to card- or device-based payments, the fixed costs of cash acceptance become increasingly inefficient.

Experts with experience in payment systems noted the non-universality of bespoke solutions that are developed for an individual transit agency or regional fare media implementation. These experts suggested that meeting multiple accessibility criteria is difficult for a single payment experience designer, which requires a team of user experience designers with advanced training in various accessibility needs. These experts noted that payment standards common in the financial services industry, such as cEMV payments, provide an accessible experience by serving a vast user base and diverse issuers. Many of these experts noted the challenges from cash acceptance as the shift to digital payments decreases cash volume, but cash-processing costs either remain the same or increase as technology updates, therefore the relative expense of accepting cash grows. The issues can stem from outdated fare-boxes, coin and bill validators. There are safety concerns in storing and transporting money. As more riders shift to digital payment methods, cash usage becomes a smaller share of total volume.

Kelley Jackson of the Metropolitan Transportation Commission provided additional insights into the challenges of integrating across contractors and vendors, especially when coordinating technological updates for extensive physical infrastructure, such as ticket vending machines and fare gates. Kelley Jackson also shared that MTC saw increased adoption of cash-to-Clipper vendor services by offering additional incentive payments to Clipper card retail outlets located in low-income neighborhoods.

Lilly Shoup and the Rebel Payments team were instrumental in steering the research team to documentation on banking regulations and payment processing standards.

Gillian Gillett of the California Integrated Travel Program informed the research team of prior work conducted for her program.

Jonathon Wicks of Walker Consultants provided insights on how low-income and underbanked areas are in municipalities' paid parking plans, and John Hamblen of Pasadena shared examples of upgrading technology without excluding cash users.

4.0 Findings

What we found, generally, from our research is that, from a transportation user's perspective, paying for transportation in California today presents several challenges. These challenges are exacerbated for certain users, such as the socially and economically disadvantaged, people with physical and/or mental disabilities, people whose first language is not English, people without a smartphone, and/or credit card or bank account, due to their being indigent or from outside the US.

What a first-time user of transit typically finds is a slew of tasks to find out how to pay for their ride: 1) how much does the fare cost?, 2) what fare types are accepted on board? 3) how do I pay? 4) If a card or an app is required, how do I get that?, 5) am I better off buying a pass?, 6) how do I ride in a group or with family members?, 7) are transfers free?, 8) do I need to tap on and off, 9) how do bus-to-rail or rail-to-bus transfers work, etc. Both transportation payment technologies and policies shape this user experience.

For low-income riders (who rely on transit more than other groups), the challenges can be much more significant. While fare subsidies exist for riders at many agencies, riders face a patchwork of policies. There is no federal law governing fares for low-income riders, unlike those for senior citizens and people with disabilities. As a result, every agency sets its own policy concerning whether to offer low-income fare subsidies, at what level, and how. Typically, low-income riders must register for reduced fares, and this process can be burdensome, requiring paperwork, proof of income, and in-person visits at specific times of day.

In addition, we find that low-income riders face the additional burdens of lower readability and usability scores. Irrespective of the amount of additional information users must enter to confirm their eligibility for low-income discounts, websites for low-income riders are much less readable, presenting an extra challenge, especially for those with cognitive or visual impairments.

4.1 Transportation Payments Equity Framework

From our review of payment systems, the literature we reviewed, and input from members of the advisory steering committee at our second meeting (and revised subsequently based on their feedback), we developed the following framework criteria for assessing transportation payment solutions, in the categories of Accessibility, Technical/Business Rules, Interoperability, and Privacy. These categories represent both the needs we identified from our research and also areas of importance to the user experience.

4.1.1 Accessibility

The "Accessibility" framework criteria address how well payment solutions work for all users, affect the user experience for everyone, and remove barriers to transportation, particularly for those who have the greatest need for transportation services. The accessibility criteria we used to assess payment methods include the following:

The "Accessibility" framework criteria address how well payment solutions work for all users, affect the user experience for everyone, and remove barriers to transportation, particularly for those who have the greatest need for transportation services. The accessibility criteria we used to assess payment methods include the following:

A.1 Vision: Is the payment method accessible to people with vision impairments?

A.2 Cognitive: Is the payment method accessible to people with cognitive impairments, such that they can figure out how to pay for transportation and pay the lowest amount for which they are eligible?

A.3 Language: Is the payment method accessible to people who have limited proficiency in English?

A.4 No U.S. Account: Is the payment method accessible to those without a U.S.-based bank account?

A.5 No U.S. Device: Is the payment method accessible to those without a smartphone, or with a phone that is not US-based and/or does not have access to app downloads due to country app store or phone restrictions?

4.1.2 Technical/Business Rules

The "technical/business rules" category assesses how well a payment method supports discounts, credits, and eligibility status. The criteria include the following:

B.1 Discounts/credits: Does the payment method have a technical capacity to accommodate discounts or credits administered at the account or payment card/device?

B.2 Eligibility for discounts: Does the payment method have the technical capacity to verify eligibility for discounts or credits administered at the account or payment card/device

B.3 Activity-based discounts/credits: Does the payment method have the technical capacity to enable discounts or credits based on card/device activity (i.e., fare capping, equity between pre-paid and post-paid)

B.4 Liquidity: Does the payment method reduce or eliminate the total amount of transportation user funds in an escrow or fiduciary status, and illiquid or unavailable for uses other than transportation payments

B.5 Rewards: Does the payment method have the technical capacity to provide benefits or rewards based on card/device/account activity (e.g., administer complex benefit programs)

4.1.3 Interoperability

The "interoperability" category of criteria follows our findings that interoperability is an equity measure for those who travel between agencies, modes of service, or regions and would accumulate segregated fund balances or lose discount eligibility due solely to their use of multiple systems.

C.1 Interoperability: Can the payment method integrate or otherwise facilitate fund balances and/or discount eligibility across multiple systems?

4.1.4 Privacy

Transportation payments can contain a significant amount of personally identifiable information that, combined with travel data, can be sensitive. Our research suggests that this is a concern for some users and for transportation providers, whose custodianship of sensitive information is burdensome. The privacy criteria include the following:

D.1 Anonymity: Does the payment method offer private or anonymous travel (though perhaps without discounts or credits)?

D.2 Privacy & Security: Is the use of the payment account subject to privacy and security standards that are transparent, meet the requirements of California law for payments, and are in line with industry retail standards, best practices, or regulations (e.g., EMV)?

4.2 Payment Methods Scored Against Criteria

Based on our literature reviews and our inventory, we assessed payment types against the framework outlined above to create the summary table below (see Table 17), which shows the pros and cons of each payment method. For example, cash meets a number of the criteria: it is anonymous (D1), private (D2), liquid (D4), and does not require a bank account or US device (A4, A5), or any high level of cognition or language (A2, A3). However, its interoperability is limited (C1) except when a ticket is used, and although persons with low or no vision use adaptations for handling and using cash, other payment methods offer greater accessibility features (such as voice readouts in an app). There is also no technical capacity to administer discounts (based on eligibility or otherwise), or fare capping with cash.

While all payment methods have advantages and limitations, the payment methods that have the most advantages and meet the most framework criteria are the cEMV card and the proposed California Mobility Card, a prepaid, reloadable transportation card that can be used across the state (see Section 5.1). Both improve cash, proprietary cards, and mobile apps by enhancing usability for people with vision, cognitive, and language disabilities. They can similarly be used without a US-based device and likely facilitate discounts, eligibility, capping, liquidity, rewards, interoperability, privacy, and security. Key differences between the cEMV and the California Mobility Card are that the cEMV card cannot provide anonymity, whereas the California Mobility Card can, but the cEMV card provides easy liquidity, whereas liquidity is more complicated to implement with the California Mobility Card, which would use stored value; liquidity would require additional steps to convert to cash.

Table 17: Summary of Assessment of Equity Criteria for Transportation Payment Methods

	A.1: Vision	A.2: Cognitive	A.3: Language	A.4: No U.S. Bank Account	A.5 No U.S. Device	B.1: Discounts	B.2: Eligibility	B.3: Fare Capping	B.4: Liquidity	B.5 Rewards	C.1 Inter-operability	D.1 Anonymity	D.2 Privacy & Security
Cash	⚠	✓	✓	✓	✓	✗	✗	✗	✓	✗	⚠	✓	✓
Proprietary Card	⚠	⚠	⚠	✓	✓	✓	?	✓	✗	⚠	⚠	⚠	⚠
Mobile App	⚠	⚠	⚠	⚠	⚠	✓	?	✓	✗	✓	⚠	✗	?
cEMV Card	✓	✓	✓	⚠ (non-US bank OK)	✓	✓	✓ (statewide)	✓	✓	✓	✓	✗	✓
California Mobility Card	✓	✓	✓	✓	✓	?	?	✓	⚠	?	✓	✓	✓

Key

✓	Meets criteria
⚠	May meet criteria depending on design options
✗	Does not meet criteria
?	Unknown whether it meets criteria; may be dependent on design options

5.0 Recommendations

Our recommendations flow from the results and findings of our study of transportation payment systems, which included an inventory of 49 systems worldwide, an in-depth look at seven integrated systems, expert interviews, and consultation with our advisory committee.

Our recommendations assume that cashless will be the predominant payment method for California travel in the near future. As discussed, cashless has many operational benefits for transportation providers, and cashless payments offer users significant benefits as well, especially when paired with account-based discounts, rewards, incentives, and fare capping or ticket-based seamless travel.

A coordinated move to cashless payments, facilitated by a statewide adoption of Cal-ITP-style options for the industry, will likely expand and enhance equity outcomes for low-income Californians, particularly transit users, by offering more payment options.

Drawing from our findings, we recommend a pathway to cashless using specific payment types and methods that: a) make use of existing payment infrastructure, b) improve operational efficiency and flexibility, c) have the potential for cross-system integration for seamless travel, d) improve access for people with disabilities, e) provide easier and more equitable outcomes for travelers eligible for low-income transportation payments, f) offer payment options for people without a US bank account and/or smartphone, and g) retain as little personally identifiable information as possible to protect user privacy.

Our recommendations center on the following payment types (or means of purchasing):

- Visa (credit or debit)
- Mastercard (credit or debit)
- Discover (mostly credit, limited debit)
- American Express (mostly credit, limited debit)
- California Mobility Card (for both payment and as stored value)

And following payment methods (or means of transaction):

- Physical card (via EMV payment network)
- On-device NFC wallet (Apple Pay, Google Pay, Samsung Pay, etc. via EMV payment network)
- Payment via smartwatch or other device via the EMV payment network)
- QR Code or Barcode ticket (that can be purchased with the above payment types), possibly standardized as the “California Mobility Ticket,” purchased with the above payment types.

The cornerstone of this recommendation is a new California Mobility Card, which will function on the payment validators and networks required to accept contactless bank card payments and can be used either to purchase tickets (e.g., at a ticket vending machine [TVM]) or be used as a fare/ticket itself (e.g., tap to pay).

5.1 California Mobility Card

5.1.1 Key Features

A central advantage of the proposed California Mobility Card is that it operates on the well-established cEMV system, piggybacking on existing tap-to-pay transitions we identified in interviews and described in our findings. Compared to other non-cash payment methods, another advantage of the California Mobility Card is that it does not require personally identifiable information for issuance, providing both privacy benefits to users and reduced data retention and compliance burdens for agencies and issuers.

The California Mobility Card provides several advantages that other payment methods do not:

1. Does not require personally-identifiable information for issuance
2. Reloadable in order to avoid stranding residual balances on the card
3. Can be used for multiple types of mobility payments in California
4. Likely required to comply with Title VI fare media changes to discontinue cash acceptance
5. Meets requirements of an “accessible and equitable parking cash payment plan”

5.1.2 Key Limitation

The key limitation of the proposed California Mobility Card is that it must meet the U.S. Department of the Treasury’s Financial Crimes Enforcement Network’s (FinCEN) definition of a prepaid access card for a closed loop of defined merchants or locations. This requirement is necessary for the federal regulations exemptions that would allow the card to offer anonymity equivalent to that of cash payments. The California Mobility Card, if accepted for mobility payments across parking, transit, and

tolls, will exceed established banking regulations precedent for closed-loop prepaid access cards. However, applicable regulatory guidance notes regulators' openness to innovation.

The issuer of the California Mobility Card will be obligated to ensure the card meets the regulatory definition, and different issuers, perhaps working with various payment processors, may interpret that definition differently. Because of this market conditions uncertainty, we use the terms "closed loop" and "restricted open loop" prepaid cards to define a limited card that is likely to meet the Networks' definition of closed loop prepaid card (closed loop) and a card that may meet the definition (restricted open loop), given that existing guidance does not discourage expanded offerings.

Because they are not connected to an identity, further investigation is needed to determine whether the California Mobility Card could be enrolled in discount programs based on an individual's eligibility. The California Mobility Card could, in any case, be used to purchase discounted fares or transportation payments as "tickets", even if the Card itself could not, in these instances, be used as direct payment itself.

5.1.3 Merchant Types

The scope of merchants that may accept payment with the California Mobility Card will vary depending on the card's limitations. In both cases, the payment validators will be able to accept any open-loop payment using the NFC contactless communications standard and EMV security. This includes the ability to accept major credit cards and device-based tap-to-pay, such as Apple Pay or Google Pay. The California Mobility Card would also operate on these standards.

5.1.3.1 Closed Loop

Under a closed-loop limitation, the card would be restricted to use for purchases of transportation and mobility products and services from California merchants that use a common payment processor to accept cEMV payments. For a payment to be part of a closed-loop network, the payment processor would administer the closed-loop prepaid payment system in conjunction with the California Mobility Card's issuer. Those mobility providers that accept the card will need to be listed on a website, and a logo for the California Mobility Card may need to appear on or near the point-of-sale validator

Because we recommend that the California Integrated Travel Project establish contracts with payment networks linked to the California Mobility Card issuer via the California Mobility Marketplace/Cal eProcure website for leveraged procurement agreements, the initial merchants are likely to be government agencies. However, it may be possible to include merchants who are not governmental entities but use the same payment processor, or who use a payment processor that has a direct link to the California Mobility Card's issuer that does not rely on the Visa, Mastercard, American Express, or Discover open-loop networks for payment acceptance.

This closed-loop definition would be restricted to certain types of mobility payments, including many in Table 18. However, only merchants that use payment processors linked to the California Mobility Card issuer, are listed on a website, and display a California Mobility Card logo, are likely to meet the closed-loop limitation based on existing guidance.

5.1.3.2 Restricted Open Loop

A restricted open-loop system could be used for a wider range of mobility payments beyond those offered by government agencies, provided the payment processor is directly integrated with the issuer of the California Mobility Card. Because it would use an open-loop network for processing, it may also be referred to as a "restricted open loop." This expanded set of merchants and categories would include private parking payments, bikeshare, micromobility services, taxis, and transportation network companies. Table 18 below shows the four-digit merchant codes used by the financial services industry in the United States.

Table 18: Merchant Code Options for California Mobility Card

Code	Description	Core	Expanded
4111	Transportation - Suburban and local commuter passengers, including ferries	☑	☐
4112	Passenger railways	☑	☐
4121	Taxi cabs and limousines	☐	☑
4131	Bus lines	☑	☐
4784	Bridge and road fees and tolls	☑	☐
4789	Transportation services (not elsewhere classified)	☐	☑
5552	Electric Vehicle Charging	☐	☑
7523	Automobile Parking Lots and Garages	☑	☐
5999	Miscellaneous and Specialty Retail Stores	☐	☑
7524	Self-Service Parking Kiosks	☑	☐
7512	Car Rental Companies	☐	☑
5940	Bicycle Shops – Sales and Service	☐	☑
7999	Recreation Services–Not Elsewhere Classified	☐	☑
9222	Fines (Government)	☐	☑
9399	Government Services (Not Elsewhere Classified)	☑	☐

Achieving a Restricted Open Loop would likely rely on three key decisions by the cards' issuer, perhaps in conjunction with a payment processing network and advice from the Financial Crimes Enforcement Network. These decisions are:

1. prepaid payment card can use an open-loop network for processing,
2. payment card can be restricted by merchant code categories rather than specific merchants or locations, and
3. a payment card does not require individual merchants to be listed on a website or to display a logo indicating card acceptance.

These terms are quite broad given existing guidance, so the caveat may be that the cards are issued under contract with a state government agency, which would establish a precedent similar to the exemption for

Electronic Benefit Transfer cards. However, those cards receive only government funds and cannot be loaded with cash.

5.1.4 Geographic Extent

The California Mobility Card could be used for all public transportation payments in the US, but its use could also be limited to California merchants. Geographic restrictions might also apply to its distribution, e.g., policies that require cards to be mailed to California addresses only.

5.2 Statewide Equitable Transit Cash Payment Plan

We recommend that Caltrans or the California Integrated Travel Project (Cal-ITP) commission a Statewide Equitable Transit Cash Payment Plan that complies with FTA requirements for analyzing the burdens and impacts on classes protected under the Civil Rights Act of 1964. The State may codify, via legislation or funding program requirements, that transportation agencies that wish to cease cash payments meet the requirements of the statewide plan before doing so.

Benefits of the transition to cashless include:

- Reduced transit boarding times and improved transit services
- A common balance, to avoid stranding balances on regional smart cards,
- Increased banking access and appropriate (no/low-fee) accounts for transit users through partnerships and advertising
- Fare capping and improved intermodal transfers (not possible with cash).

The analysis would need to include a comprehensive equity analysis and specify measures that would mitigate equity impacts. Some of these potential measures are discussed below.

5.2.1 Loading Funds on a California Mobility Card

To maintain cash equivalence, California Mobility Card users must load cash onto their cards.

5.2.1.1 Automatic Cash-to-Card Machines

The Statewide Equitable Transit Cash Payment Plan could include specifications for machines that can issue or add funds to California Mobility Cards. These specifications should consider accessibility for people with disabilities, transaction languages, reading levels, and the simplicity of any instructions. These “reverse ATMs” could serve as a model for, or even be part of, the deployment of the California Mobility Card solution.

The Plan can also create Title VI-compliant guidance for the number and placement of cash-to-card machines. Some considerations

1) Placement at major transit stops:
   a) Minimum number of machines per entrance to a transit station
   b) Replacement ratio of such machines when removing ticket vending machines, accounting for the reduced need for ticket vending machines among those with existing tap-to-pay cards or devices.
   c) Consideration of guidelines for mobility hubs and transit centers
2) Placement at municipal parking facilities
   a) Requirement to include at a municipal parking facility with 50 or more spaces
3) Placement at staffed government facilities
   a) Placement at transit or municipal customer service centers
   b) Placement at social services providers
   c) Placement at the Department of Motor Vehicles offices
4) Placements in equity-focused communities with disproportionate numbers of unbanked or underbanked people, including at stores, libraries, and community facilities.

5.2.1.2 Cash Payment Networks

In-person locations are also an option for loading cash onto California Mobility Cards. Although not all locations that reload cards may issue cards, in-person reloading at pharmacies, convenience stores, or gas stations expands accessibility and ease of use of the card. The Plan should consider the benefits and disadvantages of cash payment networks and whether a partnership with one or more payment networks could replace or supplement some of the requirements for cash-to-card machines.

5.2.2 Using the California Mobility Card (CMC)

The California Mobility Card, whether restricted-open or closed loop, gives transportation providers operational flexibility. Because the CMC would use existing financial networks, providers that accept cEMV payments can accept the CMC with minimal re-configuration. Transportation providers with working tap-to-pay (NFC) terminals or faregates could accept the CMC. Transportation providers, such as transit agencies without NFC terminals or faregates, and/or parking services that use proof-of-payment apps or QR code tickets, could also accept the CMC as payment for those tickets. In addition to providing a "drop-in" solution for transportation providers and flexibility for maintaining existing or multiple payment systems, including proof-of-payment, the CMC also offers users a familiar form of payment and requires minimal adjustments in use.

The CMC opens the door to more seamless travel in California in two ways: 1) as the CMC becomes a standard payment method supported via Cal-ITP procurement and is used across state transportation systems, mechanisms for cross-agency and cross-mode payment integration become available, and 2) the CMC's flexibility to be used as a stored value card means that it can also be used to purchase transportation tickets that might be bundled across systems or services. A user could use the same CMC card to pay for an intra-city bus ride with tap-to-pay and use the card to purchase an intercity train ticket, where the ticket is a proof-of-payment QR code or even paper.

5.2.3 Other considerations

5.2.3.1 Promoting financial inclusion

The Statewide Equitable Transit Cash Payment Plan should provide guidance on transit rider engagement and on public advertising of alternatives to cash payment for transit, parking, and tolls. These include financial inclusion efforts to connect unbanked and underbanked individuals with financial services (e.g., Bank ON, CalAccount) and the California Mobility Card option.

The equity analysis should consider the broader impacts of increased financial inclusion for transit users, whose California Mobility Card represents a first step toward cashless transactions and banking. This analysis might investigate the likelihood that previously banked transit users will switch accounts to reduce their banking fees associated with account maintenance and overdrafts, make cashless non-transportation payments, and access banking services at major transit hubs.

5.2.3.2 Fare capping

The plan should weigh the pros and cons of requiring agencies to implement fare capping for California Mobility Card holders, on par with the fare capping benefits offered to customers using an open-loop payment card. This measure provides a benefit to customers who currently use cash and travel enough in a time period to trigger fare caps.

5.2.3.3 Refunds

Offering refunds in cash for any remaining balance on a card may provide benefits equivalent to using cash. However, offering refunds on unregistered cards may also encourage theft or cash-out of third-party funds added to these cards (e.g., by a social services agency that today provides transit cards). Furthermore, offering refunds may also require a Know Your Customer process, as the current exemption is in place to prevent money laundering, and the inclusion of refunds could pose regulatory complexity. The Statewide Equitable Transit Cash Payment Plan should consider whether the added risks of offering refunds outweigh the equity benefits of reloadability (which avoids stranding a low balance of funds on a card) and fare capping (which means the California Mobility Card will provide an equivalent or lower price than a cash fare). If the Plan recommends

refunds, it should also recommend a state law that specifies how refunds would be issued (including whether to require ID-verified refunds), as the Department of the Treasury's Financial Crimes Enforcement Network provides guidance on cash refunds, which are permitted when required by state law (Department of the Treasury, 2016).

5.2.3.4 Public noticing

The Plan should consider the forms and duration of public notification if cash will no longer be accepted for transit payments in advance of implementation. Regional or statewide public notification campaigns with a common implementation date may reduce transit user confusion about the payment methods accepted by the transit agencies they use.

5.2.4 Informing SB 532 Accessible and Equitable Parking Cash Payment Plans

The Statewide Equitable Transit Cash Payment plan and future work can inform statewide guidance for an accessible and equitable parking cash payment plan as required by SB 532 in the limited pilot cities. The California Mobility Card could, in any case, be used in parking meters, apps, and devices that accept cEMV cards. Further analysis, scoping, and decision-making may determine it is possible to develop a statewide accessible and equitable parking cash payment plan from a combination of transit plan work and pilot city experiences that could be used statewide.

5.3 Implementation Guidance

5.3.1 Streamlined, Interoperability Discount Eligibility Verification

The California Integrated Travel Project should continue its work (Cal-ITP Benefits) to improve interagency coordination and customer experiences for discount eligibility verification (California Integrated Travel Project, 2022). The organization may consider whether it will need to modify its future work plan to accommodate other recommendations in this report, particularly for a potential integration between the implementation of the California Digital ID Framework and Strategy and master contracts for payment processors (State of California, n.d.).

Local agencies offering parking, public transit services, and tolled transportation facilities should also continue work to streamline eligibility verification for discount programs.

5.3.2 Launching the California Mobility Card (CMC)

We recommend that the California Integrated Travel Project (Cal-ITP) design, procure, and deploy a California Mobility Card.

To reduce the risk of a failed procurement, the California Integrated Travel Project should work to identify the market and regulatory conditions for the spread of implementations between closed loop, and restricted open loop . This may include additional research on customer needs and market sizing for various merchant classification codes in California.

We recommend that Cal-ITP develop master statewide contracts that transit and other government agencies can use for card and card system procurement. These contracts can be listed in the Cal-ITP Mobility Marketplace. (*California Mobility Marketplace*, n.d.) Contracts should specify the availability of Cash-to-Card machines at

customer service locations and, if applicable, social service locations. Cal-ITP will need to procure the California Mobility Card from an issuer that meets the restricted open-loop requirements.

Update the Existing California Mobility Marketplace Contracts

We recommend that Cal-ITP add the acceptance of "restricted open loop" to the requirements for vendors that have approved state contracts for transit payment processing and payment acceptance/merchant services, so that the California Mobility Card can be processed in addition to the currently accepted Visa, Mastercard, Discover, and American Express.

Cal-ITP can use its statewide market power to negotiate lower rates for merchant services/payment acceptance. Processing will be essential to inducing the adoption of these master contracts, especially for parking transactions.

5.3.3 Cash-to-Card Machines

We recommend that Cal-ITP work to design and procure master sets of Cash-to-card kiosk designs that meet accessibility guidelines and security and environmental operational requirements for the anticipated settings identified in the Equity in Transit Cash Payment Plan.

5.3.4 Payment Protocols in the Marketplace

We recommend that Cal-ITP expand its work on developing Statewide Fare Guidelines into a set of "off-the-shelf" transportation payment protocols available in the Cal-ITP Marketplace for agencies to adopt. The availability of fare structures, pricing, products, and program standards in the Marketplace would facilitate easier coordination across agencies and help to generate a more consistent and familiar experience for users, while at the same time offering operational flexibility for transit operators to choose the model that works for their specific context, whether the system uses tap-to-go faregates or proof-of-payment ticketing.

5.3.5 Ticketing Protocols in the Marketplace (California Mobility Ticket)

In addition to developing payment methods and accounts, we recommend that Cal-ITP also develop a ticketing protocol option for maximum flexibility. A Cal-ITP ticket, perhaps named the California Mobility Ticket (CMT), with a protocol in the Marketplace would allow adopting agencies to harmonize their payment systems with others. The CMT differs from the CMC in that it can be used with any payment method, including the CMC. The CMT, in the form of a QR code, a proof-of-payment app, or a code attachment to card-based accounts (such as cEMVs), would provide transit agencies with maximum flexibility and especially benefit agencies without NFC fare validation or faregates. The CMT is a recommendation based on our findings (in (Section 4.3.2 Ticketed Payments) that the "ticketed" transportation payment has some distinct advantages, including privacy, the ability to "bundle" trips on one ticket without the need for a user account, and flexibility to work across multiple modes and payment infrastructure types (e.g., proof-of-payment systems and faregated systems). The CMT, as a standard offered by Cal-ITP, could advance the goal of providing users with seamless travel across systems, regions, and modes. As the CMT could work with most payment types and would obviate the need for accounts, it would offer agencies a more straightforward solution for bringing "one ticket" rides to their users.

5.4 Legislative Changes

5.4.1 Parking

Revise SHC 22508 to allow all local authorities to implement cashless parking payments if they develop and implement an “equitable parking cash payment plan” and require all of a jurisdiction’s payment acceptance devices to support the cEMV and California Mobility Card requirements.

5.4.2 Transit

After the Equitable Transit Payment Plan satisfies Federal Transit Administration Title VI review, create legislation that requires transit agencies that no longer accept cash payment to comply with the standards and guidelines specified in the Equitable Transit Payment Plan.

5.5 Conclusion

The combination of bank card tap-to-pay and the CMC offers flexibility to operators and familiarity to users. In addition, the use of a standard ticket system for transportation, compatible with nearly all forms of payment, would provide for California cities, tolling authorities, and transit agencies an equitable payment system that:

1. makes use of existing payment infrastructure,
2. improves operational efficiency and flexibility,
3. has the potential for cross-system integration for seamless travel,
4. improves access for people with disabilities,
5. provides easier and more equitable outcomes for travelers eligible for low-income transportation payments,
6. offers payment options for people without a US bank account and/or smartphone, and
7. retains as little personally identifiable information as possible to protect user privacy.

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Appendices

A. Transportation payments inventory (link to CSV file)[3]

B. Accessibility inventory (link to CSV file)

C. Parking app inventory (link to CSV file)

D. Equity literature review

E. Status quo literature review

F. Usage-based fees literature review

G. Case studies

[3] Blank cells either represent unavailable information or irrelevant information to our analysis.

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D. Equity Issues in Transportation Payments

Introduction

Public transit has used closed loop payment systems to handle fares historically. Transport for London introduced the first open loop system in 2012 prompting other agencies to consider this change. The California Integrated Travel Project has led efforts to combine and transition transportation payment systems to open loop. Open loop (or contactless payments) can help cut costs, ensure ease of use across multiple systems, and help provide more efficient service. This transition does not come without concerns for un- and under-banked access, consideration of low-income households, language barriers, universal design, and privacy.

Open Loop Payments

Historically, transit payments have operated as closed loop systems, where riders must buy tickets from a ticket vending machine or load money onto a proprietary transit card to pay their fares. Once transferred, this money can only be used within the respective transit system. Even as credit cards developed for other goods and services, transit fare payments remained closed loop. Transit payments could not consider open loop systems until contactless EMV payments became the standard in the US (John Elliott & Simon Laker, 2019). With EMV payments transit payments could be verified in less than a second, whereas before the verification process required an online authorization with the card issuer. The shift to EMV payment cards occurred later in the US than other places such as Europe because of a relative lack of fraud against which contactless bank cards are protected (US Payments Forum, 2017). In 2015, the payment card industry shifted payment fraud liability onto merchants if their POS (point of sale) equipment did not accept contactless EMV payments (US Payments Forum, 2017).

Early ventures in the US, in Chicago and Salt Lake City, struggled to launch open loop systems due to technological issues, poor community input processes and education, and general lack of interest. Before contactless EMV, it was not possible to verify whether a card was fraudulent in under 1 second (agencies prefer to verify cards within 300-500 milliseconds to ensure limited dwelling time) (John Elliott & Simon Laker, 2019). Salt Lake City discontinued its open loop in 2018 after less than 1% of transactions were contactless. Chicago's social service agencies could not bulk buy or reload cards to distribute to unhoused recipients and low-income residents complained about the high fees on the CTA-Ventra debit card (Streetsblog Chicago, 2013). In the 1990s-2000s, transit fare innovations were focused on smart cards, and in the 2010s, the focus finally shifted to contactless bank cards and mobile payments (Brakewood et al., 2020). Some closed loop systems have adapted to offer a virtual card option thanks to the introduction of mobile wallets. Even while this eliminates the need to refill the card in person, the

user must still check their balance often to ensure they can still pay and mobile deposits may not be immediate.

Open loop payments instead allow the user to pay with credit or debit cards or near field communication (NFC) enabled devices like smart phones or watches without any intermediate steps specific to the transportation vendor. This entails a more convenient experience which increases the speed of boarding and can reduce costs for transit providers. The MTA estimates physical magnetic cards take 2.4 seconds to process during boarding compared to 500 milliseconds for open-loop NFC devices (Tom Pera, 2021). Throughout the development of closed loop systems, transit providers have largely built and managed, or at least contracted, their payment systems. This can be expensive and labor-intensive, so open loop systems can lower the cost of materials and shift some of the burden to transaction companies (Brakewood et al., 2020).

Recent innovations in mobility payments include technology like open-loop payment systems (S. Pike et al., 2024). Most transit agencies in the US currently operate with a closed-loop system, which is shown to be less convenient (Katherine Turner, 2023). Many systems use system-specific electronic transit payment cards that typically use either magnetic or proprietary tap-to-pay technologies for payment at proof of payment (POP) terminals, faregates, or on-board validators. Users can add funds to these payment cards at ticket vending machines (TVMs) or online using credit or debit cards, but users must keep track of the balance on their transit payment cards, and balance inquiries involve several steps, such as going to a TVM or a website or calling a phone number and navigating menu options in each case. Insufficient fares on payment cards lead to missed connections for the user and slower boarding times for the operator. For agencies which have eliminated cash payments at fareboxes, those obtaining physical cards or loading their card with cash must locate a retailer or ticket vending machine (TVM), which takes additional time. These locations can be sparse, especially in suburban areas or near bus stops. Many transit agencies have been wary to implement cashless fare systems due to the exclusion of unbanked passengers. Santa Monica's Big Blue Bus conducted a six-month pilot study after which the agency returned to accepting cash ("At LA Metro, Going Cashless Is a Bumpy Road, Especially for the 'Unbanked,'" 2023). The Greater Dayton Regional Transit Authority went cashless in 2021 after extensive community outreach educating riders on the benefits of a cashless fare system (Brakewood, 2022).

Open-loop payment systems have demonstrated a more convenient payment process, faster boarding, and the ability to gather more ridership data. These systems can also reduce the administrative burden and fare collection costs for transit and transportation agencies depending on whether or how cash collection continues (Broader, 2024). Despite the benefits open-loop systems could bring, they could also complicate access for unbanked or underbanked people, those with intellectual and visual disabilities, low-income individuals, those with limited English proficiency, and immigrants. These populations face barriers such as lack of geographic access to TVMs or retail, difficulty understanding new transit payment systems, lack of accessibility accommodations on apps, complicated discount eligibility verification processes, and distrust in giving public institutions their personal data.

Un- and Under-banked Access

According to the Federal Deposit Insurance Corporation (FDIC), unbanked individuals have no access to a checking or savings account. Underbanked individuals have a checking or savings account but have used an alternative financial service in the past 12 months (including payday loans, auto title loans, rent-to-own services, or check cashing services). Alternative financial services tend to charge higher fees for transactions, inhibit individuals from building credit, and lack deposit insurance (FDIC, 2021). According to the most recent FDIC survey on unbanked and underbanked households, approximately 4.5% of US households (and 5.1% of California households) are unbanked, which is a 3.5 percentage point decrease from a recent high of 8.2% in 2011. According to the FDIC, 14.1% of US households (and 13.9% of California households) are underbanked (FDIC, 2021).

The most common reason individuals did not have a bank account was a lack of funds to meet minimum deposit requirements (FDIC, 2021). Welburn et al. found that only 2 out of 418 banks studied in California offered a checking account with “no minimum opening deposit requirement, no monthly service charge, and no overdraft fee” (2024). They also found that the median monthly service charge is $7.88 and overdraft fees ranged from $0-$49 for commercial banks. At credit unions, these fees were typically lower but these institutions often require each consumer to open a savings account before establishing a checking account (Welburn et al., 2024). While the Consumer Financial Protection Bureau has proposed a new rule under which banks could only charge the cost incurred to bring an account back up to $0, these fees are still a barrier to bank access (Ken Sweet & Cora Lewis, 2024).

The second and third most common reasons for not having a bank account included lacking trust in financial institutions and finding bank account fees too high or unpredictable. Researchers also struggled to determine banks’ fee structures and were often only shown higher cost accounts. Overdraft fees (or non-sufficient fund fees) are a particular concern as they may compound daily at large interest rates for some checking accounts. They are usually levied per-transaction, rather than by the size of the overdraft, which could disproportionately affect those who cannot maintain a positive balance in their checking account (Trevor Bakker et al., 2014). In 2006, 6.4 million accounts were closed involuntarily mainly due to overdraft fees (2024). Another barrier is having geographic access to bank branches. In metropolitan areas, people of any race have roughly equal access to banks. But in rural areas, Indigenous populations have disproportionately low access where one third of the population is more than 10 miles from the nearest bank branch (Welburn et al., 2024).

Despite these drawbacks of and barriers to traditional banking, alternative financial services can be even more expensive and predatory. The median fee for cashing a $100 check is $2.25, money orders cost $0.60 to $4 with maximum amounts of between $500 and $1000, and the prepaid debit cards normally charge balance inquiry, inactivity, and reloading (median of $4.95 per reload) fees and may also charge ATM withdrawal, customer service, monthly, and per-purchase fees.

The number of non-white households that are un- or under-banked is twice that of White households (Welburn et al., 2024). This may be partially the result of discrimination against non-White and Spanish-speaking applicants of banks (2024). The Roosevelt Institute found 30% of its POC and 40% of its Spanish-speaking canvassers were turned away by banks when

attempting to register a bank account, compared to just 4% of their White, English-speaking counterparts (DiVito, 2022). Unbanked and underbanked individuals tend to be low-income, racial minorities, immigrants, and women (Brakewood & Kocur, 2013). Because these identities may overlap with many transit reliant individuals (Broader, 2024) and because almost half of recently banked survey participants cited pandemic stimulus checks as a reason they could open a bank account, the portion of transit riders who are un(der)banked may be greater than the FDIC's overall estimate (FDIC, 2021; Perlmutter, 2015). As some transportation systems phase out on-board cash payment, a significant number of un- and under-banked individuals could be left behind (Pritchard et al., 2015) without proper communication or interventions. Through interviews with bus drivers and riders, Pritchard et al. determined that leaflets and onboard announcements may not be enough to adequately educate the public and that drivers should be directly informed by the agency so they may guide riders toward the alternative payment methods. Therefore, it is imperative to maintain a form of payment which is possible and convenient for unbanked individuals.

In 2019, aggregated across Eugene, OR, Portland, OR, and Denver, CO's transit systems, Golub et al. estimated that roughly 30% of the 2,303 passengers surveyed pay their fare with cash (2022). It is unclear how the COVID-19 pandemic influenced the proportion of Eugene, Portland, and Denver riders who paid with cash. However, more recent studies seem to corroborate their findings. WMATA implemented a pilot study in 2019 on cashless fare for the Route 79 MetroExtra. Before the pilot study, 3% of transactions were cash fares, but acceptance of cash fares resumed after the pilot study ended. Among transit agencies and passengers, there are differing views on whether or not systems should continue to accept cash payments during dwelling. While 22% of surveyed riders refused any alternative payment method, Pike et al. found 50% of respondents were willing to use a prepaid or government-issued debit card and 30% were willing to pay with financial technology phone apps such as Paypal or mobile wallets (2022). Therefore, a significant portion of transit users rely on cash to pay their fare. The US Department of Transportation offers a reloadable debit card called TRANServe, which is deposited with $60 per month for transit purposes and is accepted on any transit system where a Visa card is accepted (*About TRANServe | US Department of Transportation*, n.d.). This is an employee benefit which is only distributed to all US Government employees who apply and choose not to drive to work regularly.

In 2013, LA Metro briefly offered a prepaid debit card with ReadyCARD which had a TAP side for transit payments and a VISA side for regular debit card use at retail establishments (LA Metro, 2013). The program was discontinued due to limited uptake and unaffordable fees. Various agencies have developed interventions, such as the following, that provide an avenue, separate from fareboxes, through which individuals can pay with cash:

- Cal-ITP negotiated the Cash App debit card with Visa. Anyone with a Cash App account can sign up for the free debit card which is accepted anywhere Visa is taken. The card draws on the user's Cash App balance, which can take cash deposits of $5 or more from retailers like 7-Eleven, Circle K, CVS Pharmacy and others with a $1 deposit fee (*The Cash App Card Is a Free Debit Card That Is Connected to Your Cash App Balance*, n.d.). While this provides an option for those without bank accounts, users must have a smartphone and data availability. Currently, few transportation systems accept financial

technology like Cash App and PayPal, so having access to a debit card linked to an online balance opens up those funds for transportation payments.

- DART partnered with PayNearMe allowing riders to buy or reload physical or virtual cards with cash at Family Mart, ACE Cash Express, and 7-Eleven stores (Golub et al., 2021).

- LA Metro sells physical, re-loadable TAP cards for $2 through Los Angeles County Libraries, however these locations only accept cash, cannot sell discounted cards, and do not offer refunds (*LA County Library*, n.d.).

Based on feedback, transportation users were concerned about the equitable geographic distribution of the ticket vending machines (TVM) or reloading areas (Golub et al., 2021). This included ensuring an even distribution throughout the service area, proximity to transportation services, hours of operation, and proximity to places where individuals receive cash like recycling centers. Retail cash partners were the least expensive solution to providing TVM and reloading areas, but still posed geographic discrepancies. Riders also worried that the new cash payment system would force them to make additional trips to access TVMs. Public services like libraries could serve as additional locations to ensure geographic distribution.

While un- and under-banked users signify a challenge, others see the adoption of open loop payments as an opportunity to expand access to financial services (Broader, 2024). These opportunities have manifested through three technologies: government sponsored or mandated fair banking accounts (such as BankOn accounts or a CalAccount program), prepaid debit cards, and emerging financial technology.

David Perlmutter notes many un(der)banked individuals have had bank accounts in the past, but can no longer access any accounts due to credit or overdraft issues from previous financial stress (2015). Any previous accounts were closed and banks will not allow them to open new accounts given their history. In other words, being unbanked can be a last resort. To combat these exclusionary practices, the Cities for Financial Empowerment Fund have developed a rating system to ensure accessible, affordable bank accounts. Founded at the New York Stock Exchange in 2012 as a non-profit, the Cities for Financial Empowerment Fund works with US mayors and financial institutions to increase financial access to low- and moderate-income households. After a $19 million donation from the Bloomberg Foundation's Greenwood Initiative, CFEF has concentrated its efforts on alleviating debt held by Black households. This has resulted in $59 million in grant support disbursed to their municipal partners (Mayor Brandon M. Scott, 2023). BankOn accounts must meet the national account standards including a minimum opening deposit of $25 or less, monthly maintenance fees of $5 or less if waivable, free cash, check, and direct deposits, and no overdraft fees (Cities for Financial Empowerment Fund, 2023). It is strongly recommended, but not required, that account screening only deny customers who have committed fraud in the past, thus acting as second-chance bank accounts. Broader discussed the opportunity transportation agencies have to connect users to BankOn accounts through partnerships and advertising on agency vehicles (Broader, 2024). There are 20 coalitions across the US and three within California which provide transparency on local BankOn accounts and their associated fees. These bank accounts address four out of the five most cited reasons unbanked households do not have accounts:

they keep minimum balance requirements and fees low and provide transparency to garner trust. The second most cited reason, which isn't addressed by BankOn accounts, is valuing more privacy.

Similarly, the California Public Banking Option Act of 2021 commissioned a feasibility study of a CalAccount Program designed to provide low-income households a "voluntary, zero-fee, zero-penalty, federally insured transaction account" (Welburn et al., 2024). Part of this program would include accepting alternative identification, such as foreign passports or student, municipal, or consular IDs. This could alleviate privacy concerns discussed in the FDIC's report (FDIC, 2021).

Another important group among un- and under-banked is students and minors. In the US, individuals younger than 18 are not allowed to open their own checking or savings account, although they can open a joint account with a parent or guardian. Families that struggle to keep one bank account open due to minimum balance requirements would also struggle to manage additional accounts to bank their children. Collins et al. also showed that early independent access to bank accounts from ages 16 through 19 does not improve credit scores in the long run, and negatively impacts these scores from the ages 21 through 24 (Larrimore et al., 2021). Given that it is likely impossible to bank all students, transportation agencies should provide an alternative payment method for minors such as student discounts or passes. LA Metro works with K-12 schools and community colleges to provide a GoPass for each student. With the GoPass, students may ride on 18 systems in the Southern California region for free (LA Metro, n.d.). While school or youth passes may not provide transit for free at every transportation agency, the youth passes do provide a closed loop option for students and young passengers to pay for their fare without using a bank account.

Despite these efforts to bank people, some may still be reluctant due to continued lack of trust, a preference for privacy and anonymity, or a lack of bank locations in their neighborhood. Then, prepaid debit cards are a possible solution. Prior and Santomá envision a network of ATMs and point of sales (POS) through which debit card holders can deposit cash onto their cards, check their balance and use cash back (Prior & Santomá, 2008).

So far, open loop payments are largely only accessible through Visa, Mastercard, American Express, and Discover. Cal-ITP, a statewide program in California which provides resources and a mobility marketplace for transportation agencies, negotiated a new fee structure with Visa that reduces the transaction charge via credit and debit cards. Open loop systems have yet to allow transactions via JCB cards or FinTech solutions like Venmo, Zelle, and Paypal. Current solutions have not always been successful either. When Chicago introduced the Ventra debit card in 2013, the system faced backlash due to its failures. Ventra ran an account-based cloud-based server which would stop working if Wifi stopped working on board and the card charged hidden fees for non-transportation purchases (Perlmutter, 2015; Streetsblog Chicago, 2013).

In 2014, Transport for London transitioned to accept only prepaid cards, credit or debit cards onboard buses. Pritchard et al. conduct an ethnography on the impacts of this policy change (2015). Drivers and passengers feared loss of freedom, state surveillance, and extra work would result from the transition and Pritchard et al. emphasize the importance of effectively communicating the logistics of the transition. When considering its cash-free transition in 2011, consultants for London found only 1% of transactions were paid with cash but 68% of the

37,000 survey responses disagreed with the policy change fearing a cashless system could leave behind the elderly, disabled, and young passengers (Abdoli et al., 2022; *MD1310 Cashless Buses | London City Hall*, 2014). Notably, 3% of those paying cash on the bus did so because they were unbanked; more passengers paid cash because they lost or forgot their Oyster card. The proportion of riders paying in cash may be due to TfL's fare structure. Individuals under the age of 16, 16 to 18 years old who are enrolled in school, 60 and older, or disabled receive free transit. TfL also offers an English National Concessionary Travel Pass; these groups represent 34% of TfL's ridership and may explain why going cashless only affected 1% of riders (*MD1310 Cashless Buses | London City Hall*, 2014). According to the most recent estimate in 2022, 1.3% of the UK is unbanked and 2.1% is underbanked (Richard Murphy, 2023). This is considerably lower than the most recent US estimates in 2021. Despite the smaller un- and under-banked population, TfL's efforts appear to only partially address accessibility concerns since no analysis has been published after going cashless.

In Durand et al.'s literature review of digital inequality in transportation, they note that material access to technology does not ensure individuals can use its functions and raise the possibility that technology compounds existing inequalities rather than erasing them (Anne Durand, 2021). In order to ensure access to cashless systems, agencies should invest in education, continual assessment, and alternative forms of payment.

Income Effects

While the debate around how much transit and transportation agencies should charge low-income households is important, our focus remains on how these discounts and subsidies can be implemented as adoption of open-loop payments grows. To preface, the Federal Transit Administration has no requirements for low-income or student subsidies; however, the FTA does require transit agencies to charge no more than 50% of peak fares during off-peak hours for seniors, people with disabilities, and Medicare recipients. In return, transit agencies are authorized to receive Section 5307 federal funding. Closed loop systems often have convoluted, lengthy processes for means testing, if low-income discounts are offered at all (Saphores et al., 2020). The evolution of mobile payments has enabled concepts such as fare capping and automated discount eligibility verification, although further improvements can be made.

Fare capping came as a solution to the inequity of prepositioning (Klein & Chair, 2023). Many transit agencies offer daily, weekly, monthly, or annual passes provided at a discount depending on how often users ride. This method relies on prepositioning, where users pay for their rides for a given length of time upfront. For example, a 7-day pass using the OMNY system on the New York City MTA costs $34. Because the single ride fare is $2.90, anyone riding 12 times a week (for $34.80) or more would have paid less by buying the 7-day pass upfront. Fare capping effectively gives everyone, including un- and under-banked and low-income passengers who pay per ride the same discounts as passengers who pay $34 upfront. With fare capping, the calculations are done by the agency's backend office, which saves passengers the time, effort, and confusion of determining which pass works best for them.

While fare capping has been adopted by many cities such as London, New York, Stockholm, and Denver, there is still hesitation because the transition can lead to a loss in revenue and may be technologically complex (*Contactless Pay as You Go | SL*, n.d.; *Fares*,

n.d.; OMNY, n.d.-a). However, the US Payments Forum published a technical solution for fare capping verification with a physical card and a mobile device for open loop systems (Transit Contactless Open Payments Working Committee, 2018). In fact, open loop fare capping has already been implemented in many cities, including Rome, London, Guangzhou, Sacramento, and New York City, among others (*Fare Discounts Scheme for Guangzhou Public Transport and Foshan Metro*, n.d.; *SacRT Launches Tap2Ride Contactless Fare Payment Option on April 1, 2025 - SacRT*, n.d.; Matters, n.d.; OMNY, n.d.-b; UnionPay International, 2024).

As previously mentioned, there are no federal requirements for low-income or student subsidies. However, many of programs exist locally including the following:

- LA Metro LIFE program - participants can receive 20 free rides monthly and unlimited free rides for the first 90 days of joining the program. The application, which includes certifying an income below $48,550 for 1 person or demonstrating enrollment in CalFresh, EBT, Medi-Cal, etc., can be completed online or in person at any Metro Customer Center. The 20 free rides credit must be uploaded prior to the 1st of the month and must be added online or on a mobile wallet; the credit cannot be added at a TVM. These ride credits can be used across 15 systems in the Los Angeles metropolitan area.
- LA Metro ExpressLanes Low-Income Assistance Plan - drivers who show proof of income below 200% of the federal poverty line can receive a one-time $25 credit toward either the toll or the transponder purchase. All accounts must be opened in person at their service center.
- Cal-ITP Benefits - Monterey-Salinas Transit has partnered with Cal-ITP to implement the first open loop transit payment system in California and to pilot an automated discount eligibility verification system. Seniors aged 65 years and older using the Monterey-Salinas Transit can verify their eligibility for a senior discount using Login.gov or by presenting a driver's license, state-issued ID, social security number, or phone number associated with their name (Cal-ITP, 2022). The discount is automatically tied to a contactless credit or debit card linked to the user's account. The transit agency uses Login.gov to securely verify the rider's age for elderly discounts (65+). No other discount is available through the website yet and the process can only connect to a Visa or Mastercard card.
- Beale et al. conducted a literature review of bikeshare discount programs (2023). Their critique of the ORCA LIFT card application involved the requirement to apply in person at one location and its lack of integration with the transit card. Additionally, they found the system did not have enough cash payment vendor options.

There is diversity in the application, card format, and size of the discounts among these programs. At many agencies, discounts remain on closed-loop cards erasing any benefits open loop offers. While only discussed in theory, state and federal benefits could be placed on EMV open loop cards instead of their current magnetic stripe cards (S. Pike et al., 2022). The LA Metro Board voted to pursue transportation payments on CalFresh or other state or federal benefits cards; a report is due in December identifying which cards could work and how the payments would be accepted (LA Metro, 2024). In the follow up to this board item, LA Metro staff members shared that CalFresh EBT cards could not be registered on third-party systems nor could the California Department of Social Services share personal information with LA Metro

without a data-sharing agreement (LA Metro, 2025). LA Metro staff instead pursued adding EBT cards as a form of income verification for the LIFE program at ticket vending machines and online. This ties in with another policy Cal-ITP is actively refining: automated discount eligibility verification APIs. Monterey-Salinas Transit was the first agency to roll out this program via Login.gov. Since then, Cal-ITP has developed automated discount eligibility verification APIs with Veteran Confirmation API, CalFresh Confirm API, and Blue Button API to automatically verify veterans, those receiving CalFresh, and those on MediCal. These programs are offered from a limited but expanding number of California transit agencies.

Language Barriers

Around 45% of California residents speak a language other than English at home according to an IPUMS survey from 2021 (*Languages Spoken*, n.d.). In 2015, 19% of Californians have limited proficiency in English (*Limited English Proficient Consumers*, 2016). Therefore, a significant portion of Californians would benefit from receiving information on transportation payments in a language other than English. This is a known gap in service quality, as Santa Clara Valley Transportation Authority (VTA) noted in its 2022 Language Access Plan (VTA, 2022).

Monterey-Salinas Transit made its benefits eligibility verification website accessible in English and Spanish (2022). As public agencies, transit and transportation agencies must be able to communicate with limited English proficiency users by having bilingual staff and translating necessary materials (*Dymally-Alatorre Bilingual Services Act*, 1973). However, discretion is left to each local agency to determine which languages are spoken by a substantial number of residents and which materials are “necessary”. In 2000, the Executive Order 13166 mandated discrimination against individuals based on their national origin occurs when agencies do not adequately provide meaningful access.

The Toll Roads, which manages 51 miles of a toll road network in Southern California, created a Spanish-language app in which users can add or remove vehicles, pay their balance, and edit account information (*The Toll Roads Launch Spanish-Language App | The Toll Roads*, n.d.).

Universal Design

By April 26, 2027, new guidelines for accessibility of web content and mobile apps provided by state and local public agencies throughout the US will go into effect (*Accessibility of Web Content and Mobile Apps Provided by State and Local Government Entities*, 2024). These guidelines fall under Title II of the Americans with Disabilities Act of 1990 and encompass any web content or mobile apps designed by contractors or vendors for governments. Content must meet WCAG 2.1 Level AA standards.

Kameswaran and Hulikal Muralidhar conducted a qualitative study of visually impaired people in metropolitan India focused on issues with cash and mobile payments on rideshare (2019). The respondents trusted mobile payments more than cash because they did not have to rely on another person to verify which bills they paid with. Since many traveled with sighted companions when paying in cash, mobile payments enabled the respondents’ independence.

However, these benefits rely on mobile payments' compliance with WCAG (Web Content Accessibility Guidelines) standards.

WCAG standards are overseen by W3C or the World Wide Web, an open forum with a mission of "making the web work, for everyone" (*Our Mission*, n.d.). Their values include accessibility, internationalization, security, and privacy. Consortium WCAG standards encompass perception, operation, navigation, and comprehension concerns. Requirements include visual and audio interpretations for those with hearing loss or poor eyesight, allowing adaptations to text size or contrast, and ensuring the interface does not pass a lower secondary reading level or change the context when the user interface is altered (*Web Content Accessibility Guidelines (WCAG) 2.1*, n.d.). Some buttons did not contain labels meaning screen readers could not tell the respondent what the button said. Respondents in the Kameswaran and Hulikal Muralidhar study also found it difficult to handle card verification value (CVV) codes. To verify their account, the app would prompt a CVV code sent via text to their phone number. That meant respondents had to click out of the app, navigate to their messages app, screen read the CVV, navigate back to the payment app, and input the CVV code. They often forgot the code by the time they navigated back to the payment app or could not hear the screen reader due to situational impairments. These difficulties could be bypassed by embedding the confirmation within the app, enabling biometrics, or forgoing CVV for small transfers (Kameswaran & Hulikal Muralidhar, 2019).

Dai et al. provided recommendations for ensuring cognitive accessibility of digital payments including simplifying the interface, using unique cues for each task, and allowing for third party help (2023). While these recommendations can improve ease of use within mobile payment apps, research has also shown that mobile payments themselves can serve as assistive tools and give users a sense of independence and control (Borowski-Beszta et al., 2023). However, each person's disabilities vary and people with moderate to severe disabilities largely do not use these mobile payment apps.

Privacy Concerns

As open loop payments are implemented, data security and storage will shift to include the transit operator, any contractors, and payment card companies. Payment card companies were already involved in transactions in closed loop systems. But under open loop systems, each transaction with a credit or debit card may be associated with the location of the traveler's entry and exit points. Payment card companies may see this data as a product. The potential for surveillance from these transactions is exacerbated in systems which have a tap-in tap-out feature and necessitates understanding privacy laws, expectations, and reality in transit.

According to Yao Li, expectations of privacy change depending on whether a country is individualistic or collectivist (2022). Individualistic cultures are more concerned with how their own information is shared while collectivist cultures are concerned with violating others' privacy. As an individualistic culture, privacy models for data collection in the United States often focus on user control of their personal data to gain trust.

At the federal level, privacy protections against the sale or sharing of information does little for consumers. The legislation is fractured by the type of information collected resulting in

seven different laws governing privacy (including HIPAA, FCRA, FERPA, GLBA, ECPA, COPPA, and VPPA) ("The State of Consumer Data Privacy Laws in the US (And Why It Matters)," 2021). Since each open loop payment provides data to private payment card companies, transportation payments could now be covered by the Gramm-Leach Bliley Act of 1999 (GLBA) (Tom Pera, 2021). The act sets privacy standards for the financial services industry (*Financial Privacy | Privacy Rights Clearinghouse*, n.d.)). Companies offering consumer financial products must disclose the categories of information collected and the categories of entities that information is sold to or shared with. There is no requirement that this disclosure name the specific pieces of information gathered or the specific entities with which that information is shared. Consumers have the right to opt out of the sale or sharing of their information; however, exceptions apply to "joint marketers" and financial affiliates (Jay Stanley, 2019). Many advocates, including the ACLU, have argued for reforms such as allowing consumers to opt in instead of opt out. With the current opt out design, every interaction with an applicable entity requires its own opt out action. Given the amount of companies, websites, and apps collecting data, the task of opting out puts an enormous burden on the consumer. The disclosure statements are often difficult to understand and opt out links can be hidden within websites as there are no regulations on the accessibility of either (Jay Stanley, 2019). If you do not opt out, the GLBA offers no protections on the sale or sharing of your data. Private interests have been an important hurdle to bolstering privacy protection laws.

California has a culture that prioritizes privacy above the federal expectation, as it is currently one of only three states with a comprehensive data privacy law. Privacy is also named as an inalienable right in the state constitution since 1972 and is protected by the California Consumer Privacy Act of 2018 (CCPA) (*California Code, CONS SECTION 1.*, 1974; *California Consumer Privacy Act (CCPA)*, 2018). The CCPA gives California residents the following rights:

- Right to Know - what personal information is collected and how it is shared
- Right to Delete - most of the personal information collected
- Right to Opt Out - of the sale or sharing of information
- Right to Correct - any mistakes in the information collected
- Right to Limit - the use of sensitive personal information collected
- Non-discrimination Protection - you may not be denied services or goods for exercising any of these named rights

If your data is breached, you may sue as long as the information leaked includes your first initial (or name), your last name, and another piece of identifying information and the breach is a result of negligence.

The payment card industry has its own data security standard established by all five major credit card companies (Visa, Mastercard, Discover, JCB, and American Express) in 2004. These standards apply to any entity doing business with these companies; compliance levels vary by the number of transactions handled annually by each entity. The requirements include:

- Having a firewall over cardholder data
- Not using vendor-supplied default passwords or security parameters
- Encrypting card data during transmission
- Using and updating antivirus software
- Developing and maintaining secure systems and applications

- Restricting cardholder data to employees with business needs using unique IDs and physical restrictions
- Regularly testing security systems, and more

California also limits the information public agencies may share with each other (*Streets and Highways Code - SHC Division 17. Toll Facilities and Related Matters Chapter 8. Electronic Toll Collection and Electronic Transit Fare Collection Systems*, n.d.). A transportation agency with an electronic toll or ticketing system must provide its privacy policy on personally identifiable information. There are limits for how long a transportation agency may keep information, usually four years and six months after the billing cycle is complete or the card is terminated. If the billing cycle was completed four years and six months ago but the card remains active, the agency may keep information such as the account name, billing address, credit card number, and vehicle information. If the card is terminated, all information must be discarded. Information may only be shared with a law enforcement agency if a warrant is presented. The law enforcement agency must notify the individual in question of the search warrant within 5 days of obtaining the personally identifiable information.

The transit operator can take additional steps to ensure privacy on their end: maintain a payment method which does not link a rider to their credit card (such as cash or anonymous closed loop cards), maintain transparency about privacy policies, which entities collected data, and set temporal limits on internal data storage, use other non personal data for service planning like surveys and community engagement, and remove privacy taxes (Tom Pera, 2021).

MTC developed an anonymized dataset which can be used for service planning by any agencies accepting Clipper (Tom Pera, 2021). However, the anonymization process stripped the dataset of too much information for some transit agencies to effectively plan service. While the dataset maintained origin-destination pairs, the process aggregated trip times by 10-minute increments and deleted date stamps helpful for understanding travel patterns, especially during special events.

“Privacy taxes” - which is commonly used by advocates - include charging more for anonymous transit cards and not offering free transfers to those paying with cash (Tom Pera, 2021). For example, Denmark’s rejsekort (transit card) features an anonymous option (*Rejsekort Anonymous*, n.d.). However, the anonymous rejsekort was designed for non-Danish citizens without an address and has smaller discounts compared to the standard rejsekort. It is also restricted to a certain region determined at purchase. The New York MTA offers a unique way to allow free transfers to cash-paying customers: when paying with cash, the bus will print a ticket which can be presented upon boarding the next vehicle within a two-hour transfer period (*Riding the Bus*, n.d.). Currently, cash privacy taxes are seen in many cities, including Los Angeles (Joe A. Simpson Jr, n.d.).

MBTA - AFC 2.0 decouples account data and PII; only the customer can couple them again

Immigration & National Origin

SF Muni’s MuniMobile app is only available on the US version of the Apple App Store and Google Play. Any passengers using a phone registered to another country are not able to download the app (Belov, n.d.). This presents an additional burden to accessing trip planning

information, fare capping, and contactless payment. Those who are able to download the app but have an international credit card cannot use the contactless payment function if their card provider runs an address verification service (AVS) check.

Global access to apps seems to be a larger research gap. If a user has an Apple ID or Google Play account associated with another country, they may not have access to public transit apps. Additionally, some users may use another application store such as Huawei's, Samsung's, Amazon's, or others. The App Store (Apple) has 175 countries and regions which app developers can offer their application (*Manage Availability for Your App - Manage Your App's Availability - App Store Connect - Help - Apple Developer*, n.d.). On Apple devices, users may gain access to an app by changing the country or region associated with their Apple ID or creating a new ID (*Change Your Apple Account Country or Region*, n.d.). When changing the country or region, however, users must cancel any subscriptions. Google Play users may change their country or region, but only once every twelve months (*How to Change Your Google Play Country - Google Play Help*, n.d.). These solutions ignore the possibility that users rely on apps only available on the previous country's app store. While this is a known issue, the number of individuals affected remains unclear although it seems clear that immigrants may be disproportionately affected. The US Civil Rights' federal protections against national origin discrimination only cover education, employment, housing, lending, public accommodations, law enforcement/police misconduct, and voting (*Civil Rights Division | Federal Protections Against National Origin Discrimination*, 2015). A potential solution is to offer ticketing and information through PWAs (progressive web apps or web apps) which have app-like functionality but can be accessed via browser rather than through an app store and are not tied to app store IDs or accounts. An additional advantage to PWAs is that they are cross-platform, meaning that the "app" needs to be developed only once to work on all devices that use a browser, regardless of manufacturer or operating system.

Surveillance Technology Oversight Project (STOP), a nonprofit advocacy agency and legal services provider, is concerned about NYPD and ICE's ability to track undocumented riders' location and daily movements through the system (Tom Pera, 2021). With OMNY, police can see recent transactions instantaneously, including where riders enter and exit the system, resulting in the dissolution of privacy (Tom Pera, 2021). These transactions are associated with the name on the payment card used. Agencies might consider what purpose data collection serves, what data are truly necessary to collect for the purpose of service planning, and if data are to be collected, whether it is safe to keep data on travel patterns and which entities should have access to that data. In 2023, Joseph Cox reported on an New York MTA tool on its website which could enable remote stalking (*Transit Payment Systems and Traveler Tracking – Papers, Please!*, 2023). Anyone with access to a credit card number could track recent trips taken with that credit card. They could discover the time, origin, and destination associated with each trip; this alarmed domestic abuse advocates to the point that MTA took the tool down within 24 hours. In 2017, Metrolinx shared Presto users' personal information and travel logs with law enforcement agencies 22 times out of 33 requests involving offense investigations and did not ask for proof of a warrant (*Metrolinx Gave Presto Users' Personal Info to Police 30 Times Last Year*, 2018). We see the concern that transit agencies could disperse information without protecting the civil rights of passengers. If data is to be collected, processes must be implemented to ensure data is shared under proper, legal circumstances. Immigration is a

particular concern regarding sharing personal information in California and is protected under the California Values Act (2017) (*California Values Act (SB 54)* | *ACLU of Southern California*, 2019). This law states that “no state and local resources are used to assist federal immigration enforcement”. While this mostly refers to law enforcement, it is important to consider that many transit and transportation agencies have contracts with law enforcement and may be subject to this law.

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E. Status Quo of Equity in Payments Literature Review

Introduction

Roadway pricing is typically implemented with specific goals of reducing congestion and its negative externalities (through greater throughput efficiency), reducing travel demand (by pricing it), and encouraging mode shift. These projects can improve overall transportation outcomes for all users, but discussions of equity in transportation payments often focus on the prominent examples of dynamic roadway pricing and center on the concern for low-income drivers' ability to continue driving at the same rate as before demand was priced. This concern, while very real, does not necessarily take into account 1) existing inequities in transportation funding and 2) inequities in failing to price externalities from driving. This section examines those other two sources of inequity in transportation funding.

Driving

Local Option Sales Taxes

Local option sales taxes (LOSTs) are used by many California counties to fund transportation through an increase to the transactions and use tax (sales taxes). King (2023) estimates that 19% of California's local-level transportation costs are funded by LOSTs (King et al., 2023). LOSTs produce additional revenues without the need for state or federal authorization. LOSTs have shown to be less of a burden on high-income households and individuals and depend on public approval and political appeal (King et al., 2023). However, LOSTS are regressive: low-income people will pay a greater share of their income in sales taxes to fund the transportation system (King et al., 2023). In California there have been 116 LOSTs funding public transportation and 68 have passed, 43 did not receive voter approval and 5 are

still active (Center for Transportation Excellence , 2025). LOSTs are politically popular as they appear to be less of a burden on citizens than road-user fees, or an increased motor fuel tax. (Lederman et al., 2018). Over time LOSTs cost consumers more than an increased motor tax paid per gallon as it taxes all citizens instead of solely drivers and comes from more frequent transactions (Lederman et al., 2018).

Congestion Pricing

Free roads are also not free of externalities, or impacts that are a direct or indirect consequence of the construction, maintenance, and use of roads. Driving an internal combustion engine vehicle creates pollution, and this pollution disproportionately harms low-income households near high-volume roadways and highways (Manville & Goldman, 2018).There are health implications to sustained proximity to large flows of vehicles and make driving and congestion not free (Hosford et al., 2021). Congested roads also take away time away from drivers and increase the likelihood of crashes (Manville & Goldman, 2018).

Case Studies

London

Some congestion pricing implementations come with payment or policy designs that reduce costs for low-income drivers. London, England uses flat charges in their congestion pricing. London charges the same rate 7AM to 6PM Monday through Friday and 12PM to 6PM Saturday and Sunday (Matters, n.d.-a). They also have reimbursement schemes for eligible occupations like care-taking and discounts and exemptions for residents in low income boroughs. Blackwall and Silvertown tunnels have low income residents' discounts, which is a 50% discount for drivers living within one of the eligible boroughs and who also receive a

Universal Credit (needs-based social security payment) or Jobcentre Plus Travel Discount card (Matters, n.d.) The East London low income residents' discount zone includes the boroughs of Barking & Dagenham, Bexley, Bromley, Greenwich, Hackney, Havering, Lewisham, Newham, Redbridge, Southwark, Tower Hamlets, Waltham Forest and the City of London (Matters, n.d.). Most of the boroughs have populations around 300,000 residents. Once they show proof in an online application of residency and social benefits it will be applied to their vehicle toll's account, attaching a discount to their vehicle. The applicant must create a London Road User Charging account with an email, phone number, and address (*Transport for London*, n.d.). The applicant then can use their account to apply for the East London low-income residents' discount. The applicant will also need to connect their registered vehicles, each individual is allowed up to 5 per account. If the driver was pre-registered, they can claim retroactive refunds for any full-price crossings since your application. Being pre-registered requires the driver to have started the low-income discount application, but does not require eligibility documents to be uploaded. The eligibility documents are listed below in Figure 2. They also offer discounts for "cleaner vehicles" with electric batteries or hydrogen fuel cells (Matters, n.d.). Those enrolled can add any number of vehicles that are registered with the DVLA to their name (Matters, n.d.-b).

Figure 1: Low Income Application for Congestion Charge and Tunnels

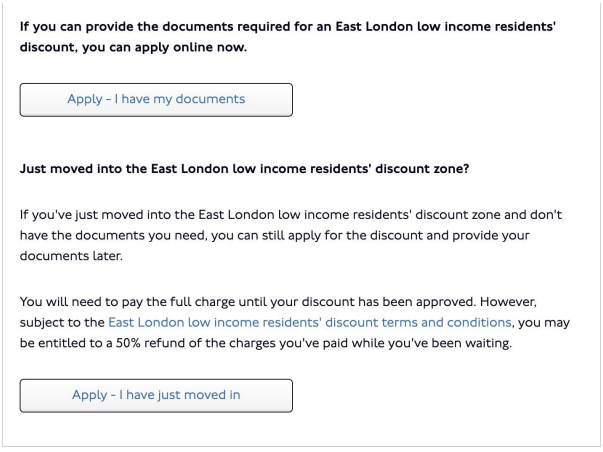


Figure 2: Services which qualify for eligibility

Eligible benefits are:

- Income support
- Income-related Employment & Support Allowance
- Income-based Jobseekers Allowance
- Universal Credit
- Pension Credit
- Child Tax Credit
- Working Tax Credit
- Carer's Allowance
- Housing Benefit

New York

New York has introduced tolls in the Congestion Relief Zone, implemented in 2025,(New York - MTA | Tolling, n.d.). The congestion pricing is in place from 5AM to 9PM on weekdays, and from 9AM to 9PM on weekends (New York - MTA | Tolling, n.d.). New York MTA provides exemptions and discounts for qualified individuals. A 50% discount is available for low-income vehicle owners enrolled in the Low-Income Discount Plan (LIDP). This discount starts only after the driver takes 10 trips in a calendar month, and applies to all peak period trips after that (Congestion Relief Zone Toll, n.d.). Residents of the Congestion Relief Zone with an adjusted gross income under $60,000 can qualify for a tax credit in the same quantity of tolls paid (ibid). From MTA's website, applicants will need one of the following documents (*Low-Income Discount Plan*, n.d.):

- IRS Form 1040 or Tax Return Transcript and corresponding W-2s from the most recent tax year
- Proof of enrollment in Supplemental Nutrition Assistance Program (SNAP)
- Special Nutrition Assistance Program for Women, Infants, and Children (WIC)
- Temporary Aid to Needy Families Program (TANF)

Enrollment in LIDP requires an active E-ZPass NY account with an updated license plate on the file. There is an online application where the applicant can upload one of the required documents. There is a printable paper application option, but the online version is preferred. MTA has an online tutorial of how to apply with around 1000 streams as of June 2025. There is also a Customer Service Center where an applicant can receive assistance (*Low-Income Discount Plan*, n.d.).

Existing implementations of congestion pricing occur in countries with stronger national-level social safety nets, which mitigates the impacts to low-income drivers (Manville et al., 2022) Free roads harm all, especially low-income households. Various pricing of transportation help regulate unnecessary trips and mitigate many negative externalities, but it is imperative, like utilities and food, for transportation to have financial assistance programs for low-income households (Manville & Goldman, 2018).

Transit

Payment Methods

Transit payments have transitioned from coins and tokens to paper tickets and physical stored-value cards and finally to mobile payments and open loop transactions. In Los Angeles beginning in 1877, streetcars accepted 5 cent fares for 51 years, as partially mandated by local law (Southern California Rapid Transit District, 1981). Riders could pay a nickel and be on their way. Philadelphia's transition to electronic transit fare payments on the SEPTA system began in 2009 with an end goal of accepting open-loop payments (Keitel, 2009). Somewhat uniquely, SEPTA planned their transition away from tokens and directly into open-loop payments, although the outcome was a more gradual transition to closed-loop payments first.

According to the American Public Transportation Association's fact books, 25% of US public transit agencies offered smart cards in 2013 and 47% offered them in 2022 (as seen in Figure 1). In 2020, just 20% of agencies offered open loop payments and that rose to 27% in 2023 (APTA, 2018, 2020, 2023).

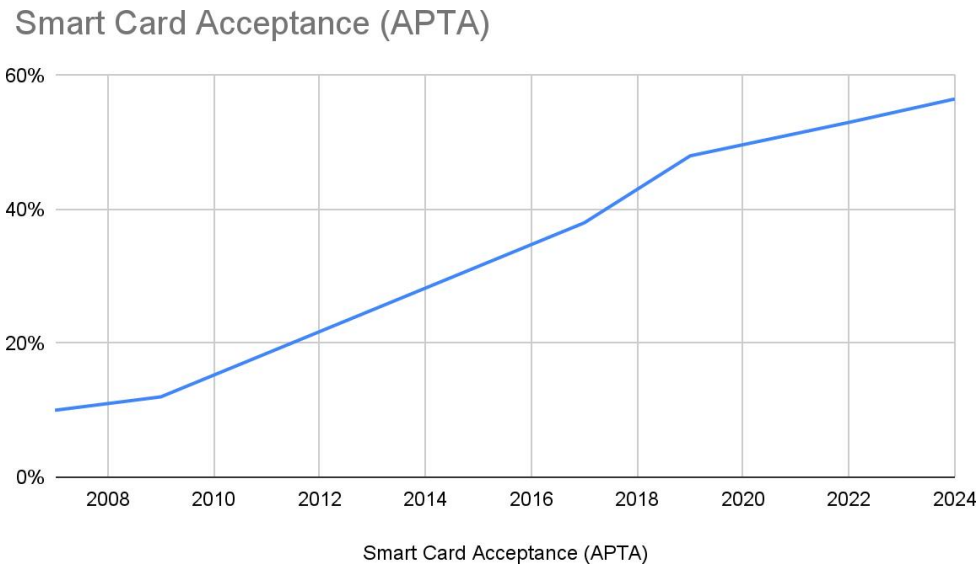


Figure 1. Smart Card Acceptance Rates for US Transit Agencies (2007-2024)

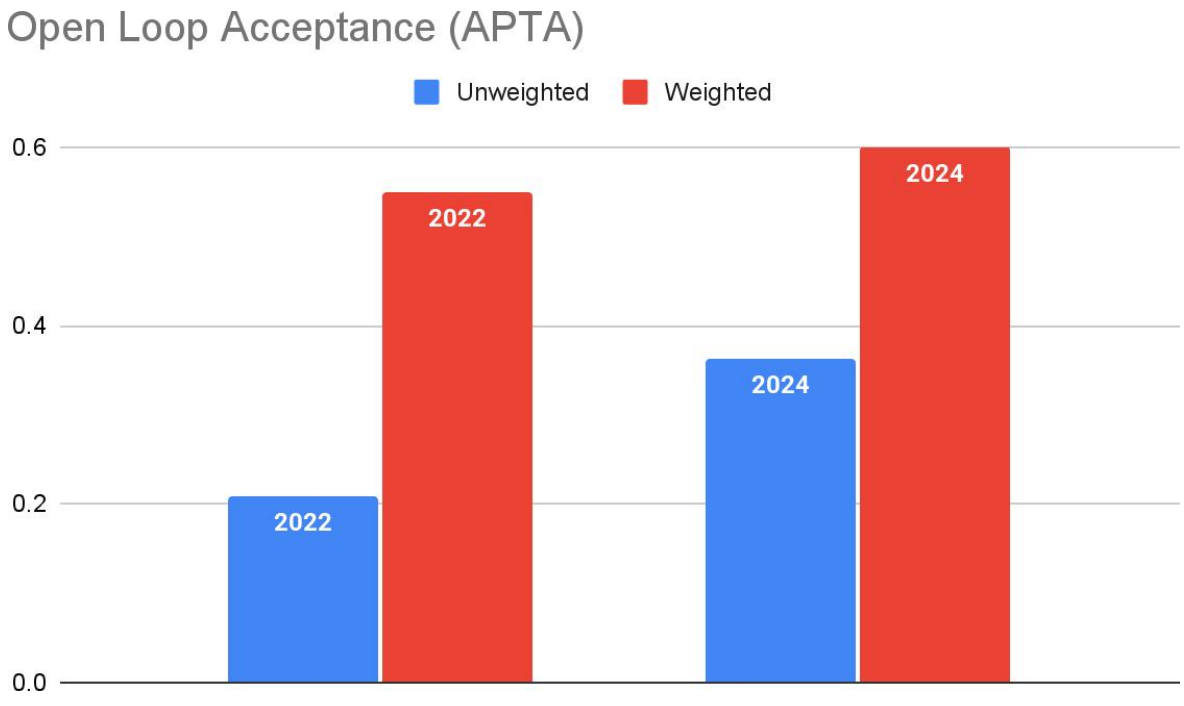


Figure 2. Open Loop Acceptance Rates for US Transit Agencies (2020-2023)

The transit payments industry has seen lots of growth in new payment methods over the past few decades including the introduction of smart cards, virtual closed loop cards, and open loop payments. Transport for London (TfL) launched the first open-loop payment system under the Oyster card name in 2012 (Pritchard et al., 2015). London's removal of cash acceptance on buses in 2014 serves as an example of the importance of communicating policy changes effectively (Pritchard et al., 2015). Pritchard et al. conducted an ethnographic review and interviews with bus drivers and passengers following the policy change. Users could still pay their bus fare with a physical or virtual Oyster card or a contactless bank card. While unbanked passengers still had a means of paying their fare by loading cash onto an Oyster card, this extra step heightened fears and entailed more "money work" (Pritchard et al., 2015). Many bus

drivers mentioned the lack of communication about the policy change and were worried about the additional burden placed on them to fill in the knowledge gap.

Low-Income Benefits Programs

After conducting a survey and analysis of low-income transportation benefits programs in California, Harold et al. determined that these programs were not offered by 61% of the 31 main metropolitan and regional agencies, partially due to the lack of federal government mandate (Harold et al., 2025). Harold et al. (2025) researched California transit agencies and found that only 12 out of the 31 agencies studied across the state offered low-income discounts. Some of these are the same program - every transit agency in San Francisco and Oakland County are part of the Metropolitan Transportation Commission's (MTC) Clipper START program and 16 of the 27 TAP-accepting agencies in the greater Los Angeles area also accept the Metro's TAP LIFE program. Harold et al. included two of those 16 agencies in their study (namely LA Metro and Metrolink). Smaller agencies face barriers to offering a low-income benefits program because of the potential administrative costs and fears of impacts to the farebox recovery ratio (ibid). Unlike seniors and disabled individuals, the federal government does not mandate local transit or transportation agencies provide a benefit to low-income users. This means eligibility, verification of eligibility, and the benefit conferred is entirely proscribed by local agencies. Of the programs that do exist, agencies tend to pull funding from a variety of sources including local measures, state propositions, grants, operational budgets (for long-standing programs like Metro's LIFE), and even California's cap and trade program (for the short term; this includes the LA Mobility Wallet and Clipper START). Many programs offer cross-program eligibility so users who are enrolled in other benefits programs, CalFresh/EBT for example, can use that eligibility verification to assert their eligibility for the transportation benefit. Additionally, Harold et al.

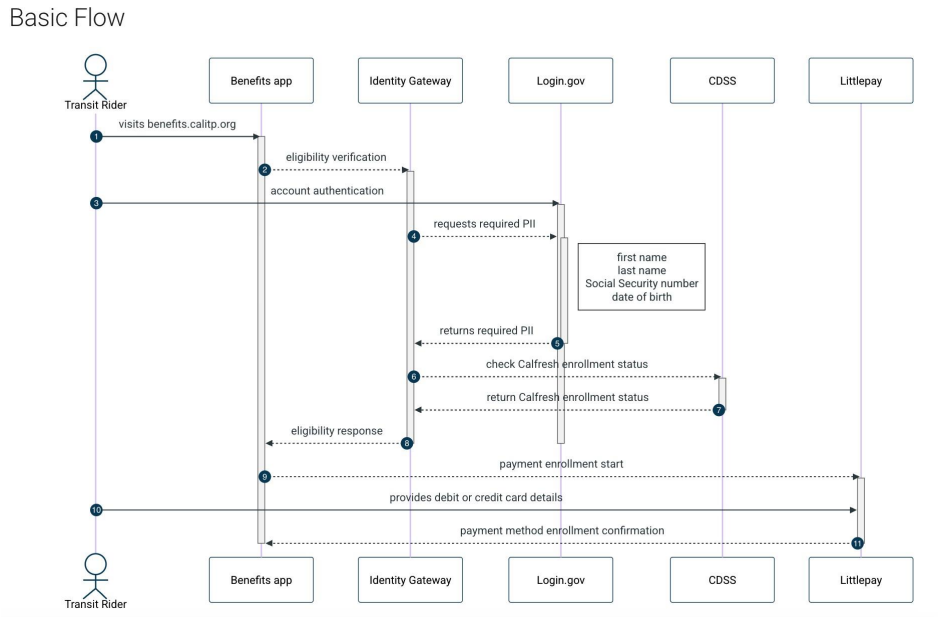
discussed the possibility of adding QR codes to EBT cards to offer transit passes or rides seamlessly.

Additionally, some transit agencies (like LA Metro) offer fare discounts for low-income riders but require them to reload their benefit onto their transit card on a monthly basis (achaparro, n.d.). If riders do not manually add their 20 free rides to their TAP card before the first of the month, they forego their benefit until the next month. This is in addition to the application a user must submit every two years while enrolled in the LIFE program. This represents another level of “moneywork” (Kameswaran & Hulikal Muralidhar, 2019) low-income riders must pass through to use the benefit.

Automated Discount Eligibility Verification

Cal-ITP has been collaborating with Login.gov and the California Department of Technology (CDT) to implement automated discount eligibility verification for transit agencies (*Project Overview - Cal-Itp/Benefits: Documentation*, n.d.). While this program is currently running for older adults, medicare cardholders, and US veterans through select transit agencies (Monterey-Salinas Transit, Santa Barbara Metropolitan Transit District, Sacramento Regional Transit District, and Nevada County Connects operate at least one of these programs), the low-income verification process is not yet online. Once it is offered, the program will allow users to use their CalFresh account (through the California Department of Social Services) to verify their low-income status and to use their Login.gov account to verify their identity (name, social security number, and date of birth) online with Cal-ITP (ibid). This process would automatically transfer the appropriate transit discount to a contactless debit or credit card without supplying any additional information to the transit agency in question (ibid). This likely poses a barrier to undocumented users as login.gov requires a social security number; given that Login.Gov is a part of the General Services Administration (GSA), an agency of the federal government, some

users may not be comfortable offering their information (*Frequently Asked Questions (FAQ)* | *Login.Gov*, n.d.). In the future, this verification process is technologically capable of linking with other benefits programs.



MetroCards

The New York Metropolitan Transportation Authority (MTA) is phasing out MetroCards by ending sales after December 31, 2025 and ending acceptance 2027 (MTA, 2025). Remaining balances will be eligible for transfer or reimbursement for two years after the expiration date on the MetroCard (MTA, 2025). Until then, the minimum balance for new cards is $5.80 (the cost of two rides), plus the new card cost of $1 (MTA, 2025). MetroCards are available at MetroCard vending machines located at many subway stations, selected local retailers and MTA mobile sales vehicles. The vending machines accept cash, but can only return a maximum of $6 in change (MTA, 2025). On a monthly basis, mobile sales vehicles travel around the five boroughs, making regularly scheduled stops at senior citizen centers, shopping centers, and along major bus routes with staff who can assist in any metro related issue.

Meiping Sun at Fordham University analyzed how the implementation of a $1 card fee in 2013 changed financial behaviors of riders and increased profits of MTA. The $1 card fee was

promoted as an environmental policy to decrease discarded MetroCards (Sun, 2022). Printing and cleaning-up discarded cards from stations costs, on average, $20 million a year (Sun, 2022). According to the MTA, the $1 fee was estimated to save around $2 million from printing fewer MetroCards and clean-up costs (Sun, 2022). Overall, the findings indicate the new card fees lead to regressive impacts on low-income consumers and increased the amount of expired stored balances.

The fee disproportionately affected low-income neighborhoods and those using cash or debit cards. Deposited amounts increased more for cash or debit card payments than credit card payments (Sun, 2022). The percentage of riders who made cash deposits of $10 or $20 significantly increased, from 33% to 63% (Sun, 2022). These larger deposits caused monthly revenue to increase by 9.4%, from around $160 million to $175 million (Sun, 2022). Consequently, these stored balances lead to over $20 million of unredeemed fare annually (Sun, 2022). This unredeemed balance was escheated to the MTA after their 18 month expiration and became assets of the MTA under the category "expired fare revenue" (Sun, 2022). Sun (2022) calculates that leftover balances on expired MetroCards increased by about 50%. The new card fee for prepaid transit cards influenced riders to put higher balances on cards, but in turn, lost more money when balances expired. Although MTA was able to print fewer physical cards and increase profits, riders, especially low-income riders, lost more money through expiration policies. Since Sun (2022) analyzed MetroCard's payment system, the updated expiration policy states, "the [expiration] date is located at the upper left corner on the back of the card. The expiration date is usually about one year from the date of purchase (*MetroCard*, n.d.)." After the approximate one year expiration date, a rider will have two years to mail the expired card to MetroCard Customer Claims or use a postage-paid envelope from a station agent to request transfer/refund. After two years the balance is no longer available for a refund or transfer (*MetroCard*, n.d.). In summary, the $1 new card fee interacted with payment mode, expiration policy and financial behavior to create a regressive payment system.

Parking

On-street parking has historically been free or priced at a fixed-rate in the US. This has often led to shortages of parking spaces, especially in highly populated areas like central business districts (CBDs) (Federal Highway Administration, 2020). However, in developing performance-based pricing, many jurisdictions have faced pushback due to the potential equity implications. Many fear pricing parking varyingly across space and time will make those spaces unaffordable for low-income drivers. Donald Shoup and others have argued for comparing performance-based parking with the status quo to truly understand the equity implications of pricing parking (Donald Shoup, 1997). Parking spaces, especially in cities, reserve valuable publicly-owned land for those wealthy enough to own cars. To pay for street and mandatory minimum parking spaces, the cost is hidden in other prices including rent and product prices at stores. Car ownership is typically higher among higher-income groups and even when low-income individuals own cars, they tend to take fewer trips (Giuliano & Hanson, 2017).

So, those without cars are forced to subsidize those with cars making free street parking an inequitable use of space (Savignano, 2023). The alternative imagines the curb serving many purposes other than parking, such as commercial loading, disabled parking, and car share parking. (Yang, 2020). Willis identifies other uses for curb space in the Sunset Park neighborhood of Brooklyn in New York (*Redistributing the Curb: Improving Transportation Equity in Sunset Park - ProQuest*, n.d.). This includes thinking about the bicyclist and pedestrian experiences, ingress and egress for the local commercial corridor, food vendors, delivery

vehicles, and buses. Non-optimally priced parking, and subsequent double parking, force anyone not parking a private vehicle into a small, crowded section of the streetscape.

Another benefit of performance-based parking is the reduction of congestion. Many people, especially low-income individuals and women in charge of household responsibilities, experience time poverty. They lack “adequate discretionary time outside of sleep and paid and unpaid work to engage in activities that build social and human capital” (LADOT, 2021). Donald Shoup estimated that up to one third of all cars in CBDs are cruising to find a parking space and contributing to overall congestion. By pricing parking spaces according to current and local demand, cities could take those cars off the street and ensure faster travel times for everyone. Additionally, if parking pricing schemes are unaffordable for low-income individuals, it is technologically feasible to offer discounted on-street parking via pay-by-phone apps (Savignano, 2023).

While we have not discovered any programs which currently offer a discount on street parking, there are several examples of low-income discounts offered for off-street parking monthly passes or for parking violation fees. Discounted parking rates have been introduced in Durham, North Carolina in 2022, but only for the city’s parking garages in the downtown area (City of Durham, 2022). Applicants must submit proof of eligibility that they work in the downtown area and earn at most 60% of the area median income. The discount is 50% off for monthly passes only. A similar program is also available in Downtown Santa Monica. Participants must go in person to the GoSaMo center with an ID, proof of employment, and a completed validation form. They are able to purchase up to 20 validations per month with cash, money orders, checks, or credit cards for $6 for 6 hours and $9 for 12 hours.

Other low-income programs surrounding street parking often waive parking violation fees or offer a payment plan (Nelson, n.d.). LADOT has established a program which allows people currently experiencing homelessness to have their parking tickets waived if they complete community service (*Parking Ticket Waivers Help LA’s Unhoused. California May Follow Suit*,

2022). In Santa Rosa, CA, after Donald Shoup visited the city in 2009 to discuss parking pricing, the city adopted new parking fees including a low-wage employee permit for two downtown garages in 2017. The parking permits would be sold for 50% of the original cost to any employee earning less than 60% of the area median income in Sonoma County (*Low Wage Employee Parking Permit | Santa Rosa, CA*, n.d.). To prove eligibility, employees must fill out a paper form, including a section their employer must complete, and submit the form and advance payment in person to the City of Santa Rosa. This program is only available to employees who work within a four block radius in Downtown Santa Rosa. The City of Olympia established a low-income parking permit discount for residents who qualified for TANF, WIC, SSI, SNAP, Lifeline, or other low-income assistance programs (City of Olympia, n.d.).

Additionally, Commuter Benefits programs allow companies to use tax-free dollars to subsidize employees' transportation costs through the Internal Revenue Code, Section 132(f) - Qualified Transportation Fringe (*Commuter Tax Benefits | Bay Area Rapid Transit*, n.d.). Commuters can set aside up to $315 per month for transit or parking expenses. Meanwhile, mobility wallets like LA Metro and Portland Department of Transportation's low-income programs (Mobility Wallet and Transportation Wallet Access for All) forbid participants from using benefits on private vehicle use costs including parking (LA Metro, n.d.; *Transportation Wallet*, n.d.).

Influx of Technology

The past few decades have seen a large growth in transportation payment technologies, including the introduction of mobile payments, smart cards, and transponders. Digital inclusion has been shown to decrease carbon emissions partly through the potential that more people adopt public transportation and micro mobility, take fewer trips where public services are digitized, e-commerce becomes more efficient for goods movement (Kwilinski et al., 2023). Kwilinski et al. examined the relationship between digital inclusion, the development of digital

public services, growth in e-commerce sales, and reductions in CO_2 emissions using panel data gathered on countries in the European Union from 2006 to 2020 (ibid). Using trade openness, governance and policy environment, and technological innovation and environmental regulations as control variables, they estimated a feasible generalized least squares method to determine that digital inclusion was associated with a statistically significant negative effect on CO_2 emissions. Through new mobility technologies (like ridehailing, on-demand transit, micro mobility, and mobility-as-a-service) transportation agencies can fill inequitable service gaps (Palm et al., 2021). One concern among this widespread adoption is whether these technologies leave people behind, especially when payments are involved. The digital divide refers to the discrepancy in access to and understanding of technology (ncbroadband.gov, n.d.). While these new forms of payment technology provide ease of use, it is important to ensure payments are still accessible and legible to all users. Khan and Thomas (2024) envision equitable integration of technology to include app and payment alternatives for those without consistent access to devices or banking and public WiFi at transit stations. Additionally, Khan and Thomas advocate for the integration of transportation network companies (TNCs, like rideshare and bikeshare) with transit payments as Innisfil, Ontario has done to simplify payments and reduce “app fumbling”. Innisfil, Ontario offers a toll-free number for those without smartphone access to book Uber rides. While new options become available, it is important to maintain wayfinding and payments possibilities for those without access to smartphones or bank accounts.

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F. Usage-Based Fees

Introduction

As usage-based fees become an increasingly popular revenue stream for transportation funds, many are concerned about low-income households' ability to afford transportation and others see the revenue as an opportunity to leverage more funds for low-income households. We explore a few examples of implemented usage-based fee equity programs which designate revenues for low-income direct benefits or discounts on various transportation modes. Not every state has implemented usage-based fees, so we combed through states which have an active usage-fee. From there, we created a pool of states with low-income programs for their usage fees. California and Oregon were especially on our radar because they were 2 of 14 states that received federal grants to implement usage fees or any other alternative transportation funding sources (*State Road Usage Charge Series*, n.d.) Virginia was notable because they are one of the first states to create a low-income discount for tolls. Los Angeles Metro's Low-Income Assistance and Transit Rewards programs, San Mateo's Community Transportation Benefit program, Virginia's Toll Relief program, Virginia's Highway Use Fee and Oregon's Honored Citizen program serve as key examples. Globeville and Elyria-Swansea Tolling Equity Program, located in Denver, Colorado is an example of a usage-based fee formed from a federal requirement in tandem to newly instituted tolls. The I-Pass Assist Program in Illinois is an example of a state initiative assisting low-income households with administrative fees of tolls including the transponder cost and their minimum fees. These various examples collectively display multiple approaches to low-income discounts connected to usage-based fees. We also note that usage-based fees for alternative-fuel vehicles (in lieu of fuel taxes) serve as an opportunity to leverage these programs across a larger geographic region. After a rigorous search, it seems equity programs funded by usage-based fee revenues are not common yet in

the US. The following examples are the full extent of such programs currently operating in the US.[1]

Los Angeles Metro ExpressLanes

Los Angeles Metro introduced ExpressLanes (dynamically-priced HOV lanes) on the I-110 and I-10 corridors in 2012 (along with the FasTrak Flex transponder) (Jager, n.d.). To deal with congestion, drivers could purchase a FasTrak transponder and pay a per-trip amount to drive in designated lanes. The intent of the program was to minimize congestion without forcing every driver to pay to use these freeway corridors and to maintain a minimum average speed of 45 MPH ExpressLane (Metro & Caltrans, 2012). Prior to ExpressLanes in 2012, during evening rush hour, carpool lanes were averaging 42 mph . After conversion to the ExpressLanes, average speed increased to 55 mph during the evening rush hour ("L.A. Metro Celebrates ExpressLanes 10th Anniversary," n.d.). With the Flex transponder, drivers could communicate whether they had one, two, or three or more people in the car to receive varying discounts. Those driving with three or more people in the car, including the driver, could use the tolled lanes for free.

Since its inception in 2012, the ExpressLanes project has offered two programs designed to address equity concerns. Due to SB 1422, which was adopted by the California state legislature in 2008, LA Metro had to develop "value-pricing" and "transit development demonstration" programs to complement the planned HOT lanes on the I-10 and I-110 freeway corridors. The first is the Low-Income Assistance Plan which provides a one-time $25 credit and a waiver of the $1 monthly maintenance fee (Jager, n.d.). This credit was designed to cover the cost of a FasTrak transponder as noted in the Final Low-Income Assessment which cited literature naming transponder acquisition as a cost-prohibitive barrier (*Equity Concerns Raised*

[1] We went through each state's usage-based fees from each city and state's Department of Transportation Website, then created a smaller pool of usage-based fees with low-income discounts.

by Transportation Congestion Pricing Can Be Addressed to Make Approach Viable, 2009). In addition, participants must submit their application for this program by providing proof of eligibility (which is a household income up to 200% of the Federal Poverty Line) in person at a Metro ExpressLanes Service Center via one of the following documents: Check Stub, Public Benefit, MediCal, Tax Return, Lifeline, LAUSD Lunch Recipient, or EBT. The Lifeline program provides discounted mobile and landline phone services for eligible California households. In the Final Low-Income Assessment, LA Metro determined that low-income drivers were unlikely to regularly choose the ExpressLanes but might find the tolled lanes useful during "urgent situations" (LA Metro, 2010). In those cases, reducing the barriers to participating in congestion pricing would ensure low-income drivers may participate when their value of time is higher than the toll fee (for the subsequent time saved). The report also cited Puerto Rico's AutoExpreso as a model for providing access to unbanked drivers wishing to use tolled roads through prepaid balances. Transponders are sold at toll gates, where cash is also accepted, and drivers receive a magnetic card linked to their transponder for account replenishment purposes (ibid).

The other program offered by ExpressLanes is Transit Rewards, where participants can earn a $5 toll credit by tapping their TAP card for 16 one-way trips during peak hours along either the I-10 or I-110 corridors (*Transit Rewards – Metro ExpressLanes*, n.d.-a). Once awarded, the credit must be used up within 90 days. The TAP card is added to one's FasTrak account and the credit will automatically be applied (*Transit Rewards – Metro ExpressLanes*, n.d.-b). To enroll in Transit Rewards, users are required to have a registered TAP card. Using an online registration portal, users enrolling in the program are required to provide information regarding their name, address, phone number, vehicle information, and payment information. As Metro states, this program is the first of its kind in the country; the program serves as a proof of concept of linking usage-based fees with transit accounts.

King County followed Metro's suit with its own transit rewards program but the rewards include free electronic transit tickets and discounts on rideshare and bikeshare, not discounts on

tolled roads (*Transit GO Rewards - King County, Washington*, n.d.-a). King County uses the GO Ticket app to track and redeem credits by using a phone number and following the prompts to complete the transaction. The app will store the reward until the user wants to redeem their credit. These rewards do not expire as long as the app is used once every six months (*Transit GO Rewards - King County, Washington*, n.d.-b). Metro predicted that frequent transit riders could earn up to $60 annually from this program and estimated that low-income transit riders would already benefit from the installation of VOT (vehicle occupancy toll) lanes. This is because some of the program's revenue had been set aside to increase service frequency on the tolled lanes' corridors (LA Metro, 2010).

Puerto Rico AutoExpreso Tolls

In 1999, the Puerto Rico Highways and Transportation Authority (PRHTA) faced major delays at toll plazas in the San Juan Metropolitan Area during peak hours (*Providing Electronic Toll Collection to the Unbanked and Underbanked*, 2021). Tolls were being collected manually and by Automatic Coin Machines. In lieu of expanding the number of lanes to accommodate demand, PRHTA mandated electronic toll collection (ETC) to increase throughput. The agency established in-lane replenishment (ILR) lanes in each toll plaza where drivers could purchase a package complete with a "windshield-mounted RFID transponder and an AutoExpreso magnetic stripe card" (*TransCore | Puerto Rico's Conversion to All Electronic Toll Collection Debuts with Dramatic Results*, n.d.). Each user could register the linked transponder and cards to an account online or via phone. The magnetic stripe card (renamed the MovilCash card) can be used for those without a bank account or debit/credit card for replenishing their account with cash at 168 retail locations or in the ILR lanes of the toll plazas (*AutoExpreso*, n.d.). According to TransCore, 55% of users replenish their accounts with cash and 60% of transponder sales and account replenishments occur in the ILR lanes (*TransCore | Puerto Rico's Conversion to All*

Electronic Toll Collection Debuts with Dramatic Results, 2024). The MóvilCash card can be recharged or purchased at designated toll lanes marked with an "R" or "R+" symbol (AutoExpreso, 2025). These lanes are individually serviced by workers and are known to move slowly. To use an already charged MóvilCash card, it must be inserted into a designated slot at the toll booth in the "R+" lane. The system will deduct the appropriate toll amount from your card's balance (AutoExpreso, 2025).

Figure 1 - Photo from puertorico.com showing how lanes are labelled (2022).

San Mateo US 101 Express Lanes (Community Transportation Benefit)

San Mateo County Express Lanes Joint Powers Authority introduced VOT express lanes along the US 101 corridor in 2023 along with transportation benefits meant for historically underserved communities (C/CAG, 2021). Initially, the City/County Association of Governments of San Mateo County (C/CAG) considered four alternatives for the transportation benefit:

preloaded toll tags ($50), Clipper cash ($50), place-based improvements, and carpool rewards ($50) (ibid). Following a community engagement process and study, C/CAG recommended two options: $50 preloaded onto a toll tag or $50 annual Clipper cash as a one-time benefit. These benefits would coincide with C/CAG providing resources and capacity to CBOs to enroll participants in the transportation benefit and the newly introduced Clipper and FasTrak START programs. The first year of the program distributed $100 credits for Clipper or FasTrak to 1,913 participants (C/CAG, 2024). These participants had to apply in person and earn less than the County's Area Median Income; C/CAG partnered with local social service agencies to promote and provide support through the application process. Of those participants, 83% chose the Clipper credit and 17% chose FasTrak; of the FasTrak users, 70% of the credits were used on tolled bridges and 17% on the US 101 express lanes (ibid). The credit was spent down in an average of three months. The program has since been renewed with an increased credit of $200 and aims to continue to address concerns from community meetings like a lack of travel options, potential uneven distribution of Express lane costs and benefits, difficulty accessing Express lanes, and the need for continued engagement (*Community Transportation Benefits Program* | *San Mateo Express Lanes*, n.d.).

Virginia Department of Transportation Toll Relief Program

The Virginia Department of Transportation (VDOT) and the Elizabeth River Crossing (ERC) created a Toll Relief Program in 2016 using funds from ERC and the Commonwealth Transportation Fund to help residents most financially burdened by placement of toll roads. This program is set to go through 2036. Within 16 cities and towns (Chesapeake, Gloucester County, Hampton, Isle of Wight County, James City County, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, Williamsburg, York County, Franklin, Surry County or Southampton County) individuals who earn $65,000 or less per year to receive a fifty percent

discount on a maximum of 14 trips per week (*Toll Roads | Virginia Department of Transportation*, n.d.).

The next tier of this program allows residents of Portsmouth, Norfolk, Hampton, Newport News or Franklin who earn $50,000 or less per year to receive a 100% discount on up to 14 trips per week. Both tiers are to aid those who live near the tolls and may be subjected to paying tolls more often. These five areas in the second tier were selected by the Commonwealth of Virginia's research showing these residents were the most heavily impacted by Hampton Road's electronic road tolls (ERT) (*Toll Roads | Virginia Department of Transportation*, n.d.).

The discount is attached to an individual or household's Virginia E-ZPass account which allows multiple vehicles (*Glossary | E-ZPass® Virginia*, n.d.). The application process is in-person at 1 of 3 centers: DriveERT Customer Care Center, Portsmouth E-ZPass Customer Service Center, Norfolk E-ZPass Customer Service Center. Proof of residency is required for eligibility and can be accepted through: driver's license, utility or telephone or cable bill, bank account statement, property tax bill, proof of ownership through mortgage, rental contract, or military documentation confirming city of residence (*Toll Roads | Virginia Department of Transportation*, n.d.). Also, eligibility required proof of income through: social security statement, W-2, 1099-Misc, a month of pay stubs, IRS 1040, notarized employer's statement, or self-declaration of no income (*Toll Roads | Virginia Department of Transportation*, n.d.).

Virginia's Highway Use Fee

To combat decreasing gas taxes, Virginia's Highway Use Fee (HUF) charges drivers with fuel-efficient and electric vehicles annually at the DMV (*What Is the Highway Use Fee?*, n.d.). Fuel-efficient vehicles are considered to have a combined fuel economy of 25 miles per gallon (MPG) or greater (*What Is the Highway Use Fee?*, n.d). Combined fuel economy is the vehicle's average fuel efficiency across both city and highway driving conditions, a weighted average

determined by the Environmental Protection Agency (EPA) in the U.S. according to the Code of Virginia § 46.2-772 (Virginia Law).

Funds from HUF go into the Commonwealth Transportation Fund for roads, highways, transit and airports maintenance and programs. The annual charge is based off the following calculation taken from VDOT:

> HUF = [((11,600 average miles traveled * fuels tax rate) / 23.7) - ((11,600 average miles traveled * fuels tax rate) / vehicle's MPG rating)] * .85

Virginia's Mileage Choice Program is an alternative option for HUF where eligible vehicles pay per-mile instead of an annual fee at the time of registration renewal (*Virginia's Mileage Choice Program,* n.d.). The implication being: if an individual drives less, they pay less. The Mileage Choice Program caps at annual highway use fee and requires voluntary enrollment (*Virginia's Mileage Choice Program*, n.d.). To enroll, a driver must create an account with Emovis before renewing their vehicle registration. The driver must share their vehicle information and a credit or debit card to set up an account. Then, Emovis will send a device to be placed in the vehicle to track mileage (*Virginia's Mileage Choice Program*, n.d.).

Virginia's tolls and HUF contribution to the Commonwealth Transportation Fund partially goes to the Virginia Department of Rail and Public Transportation (DRPT) (Virginia DRPT, 2025.). DRPT oversees the Transit Ridership Incentive Program (TRIP), which allocates funding to transit agencies to create more accessible transit networks including free and reduced fare pilot programs (Virginia DRPT, 2025.) These funds are allocated as grants providing funding to transit agencies and local governments to enhance accessibility, safety, and regionally significant transit networks (Virginia DRPT, 2025.). These goals translate to four project categories: zero and reduced fare, regional connectivity, public safety, and passenger amenities and facilities. One of these programs includes Washington Metropolitan Area Transit Authority's (WMATA) Metro Lift, a reduced fare program for customers who receive Supplemental Nutrition

Assistance Program (SNAP) benefits from DC, Maryland, or Virginia (*WMATA | Reduced Fare Programs*, n.d.).

Oregon OReGO RUC

The state of Oregon's OReGO road user charge is a voluntary enrollment program where the incentive is a reduced DMV fee (*Oregon Department of Transportation : FAQ : OReGO : State of Oregon*, n.d.). Drivers pay two cents per mile driven and the funds are deposited into their State Highway Fund, in the same way that fuel tax revenues are used (O*regon Department of Transportation : FAQ : OReGO : State of Oregon*, n.d.). This usage-based fee began with pilot projects conducted by the ODOT in 2006 and 2012 (*Road Usage Charge Fact Sheet: Oregon*, n.d.). The program has fully operational been running since 2015 under ODOT (O*regon Department of Transportation : FAQ : OReGO : State of Oregon*, n.d.). In 2023 the Oregon Transportation Commission (OTC) approved plans for a low-income discount on tolls and usage-fees (*Oregon Department of Transportation : Latest News : Oregon Tolling : State of Oregon*, n.d.). Residents of both Oregon and southwest Washington can receive a 50% discount if their income is up to 200% of the federal poverty level. This plan was approved by members of the Equity and Mobility Advisory Committee (EMAC) and ODOT staff (*Oregon Department of Transportation : Latest News : Oregon Tolling : State of Oregon*, n.d.).

The Statewide Transportation Improvement Fund (STIF) program established in Section 122 of House Bill 2017 to provide funding for increased accessibility of public transportation for all riders (*Oregon Department of Transportation : Statewide Transportation Improvement Fund : Public Transportation : State of Oregon*, n.d.). There is a potential for STIF to financially aid fare programs like TriMet's Honored Citizen (*Oregon Department of Transportation : STIF Program Overview : Public Transportation : State of Oregon*, n.d.). Those who qualify for Honored Citizen reduced fare pay $28 a month for unlimited rides (York, 2025). TriMet partners with around 150

organizations, agencies and service providers in addition to government funding sources (like STIF) to maintain reduced-fare programs (ibid). This is a more indirect passage of user fees to equity payment initiatives.

Illinois I-Pass Assist Program

The state of Illinois charges tolls on tollways throughout the state. Users have the option to purchase an I-Pass transponder, providing discounted fares for drivers. Launched in 1993, the I-Pass system in Illinois has become the most common way drivers pay for tollway usage in the state (Samuel, 2013). However, purchasing the transponder requires a transponder deposit and users are required to keep a minimum balance. This presents a barrier to low-income road users who may be unable to afford the upfront and maintenance costs of owning an I-Pass transponder. To provide more equitable access to tollways and inexpensive tolls, the State of Illinois introduced the I-Pass Assist Program, providing discounted transponders and lower minimum balances to low-income road users (Illinois Tollway, n.d.). In addition to lower costs, I-Pass Assist enrollees may also have invoice fees/unpaid tolls dismissed once enrolled. To be eligible for the discount, the applicant’s household income must not exceed 250% of the Federal Poverty Level or they must be enrolled in a cash or food assistance program such as SNAP benefits (Illinois Tollway, n.d.).

Family Size	2024 Federal Poverty Level (FPL)	I-PASS Assist Eligible (250% FPL)
1	$14,580	$36,450
2	$19,720	$49,300
3	$24,860	$62,150
4	$30,000	$75,000
5	$35,140	$87,850
6	$40,280	$100,700

Since the I-Pass Assist Program was introduced, the State of Illinois has continually lowered the financial barrier to buying and maintaining an I-Pass account. In 2021, the Illinois Tollway waived the transponder deposit (originally $10), reduced the minimum prepaid tolls required to open an account from $20 to $4, and reduced automatic account replenishment from $10 to $4 (Illinois Tollway, 2021). The department also provided $20 gift cards to those who enrolled in the program to further incentivize and expand enrollment. In 2022, Illinois Tollway Board of Directors expanded the program to include additional, retroactive fee dismissal in an effort to further reduce financial burdens associated with toll fees (Illinois Tollway, n.d.). Through these initiatives, the Illinois Tollway has taken significant steps to improve accessibility to the I-Pass assist program and expand enrollment through lower barriers to enrollment.

Globeville and Elyria-Swansea Tolling Equity Program

Located in Denver, Colorado, the “Central 70” is I-70 between I-25 and Chambers roads and is a dynamically priced toll corridor. Vehicles with two or less people are charged a toll depending on congestion levels. Those with three or more in a vehicle can use the HOV3+ lane

for free with an ExpressToll account and a Switchable HOV transponder (*I-70*, n.d.) The pricing for July 2025 to June 2026 is laid out from Colorado Department of Transportation (CDOT) below:

Westbound

Time of Day	Rate Type	ExpressToll® Rates	LicensePlateToll® Rates
4:00AM - 9:00PM	Dynamic Pricing	Minimum: $1.55 - Maximum: $6.00	Minimum: $3.90 - Maximum: $15.00
9:00PM - 4:00AM	Flat Rate	$1.55	$3.90

Eastbound

Time of Day	Rate Type	ExpressToll® Rates	LicensePlateToll® Rates
4:00AM - 9:00PM	Dynamic Pricing	Minimum: $1.55 - Maximum: $6.00	Minimum: $3.90 - Maximum: $15.00
9:00PM - 4:00AM	Flat Rate	$1.55	$3.90

Tolling began in 2023 with an equity initiative: The Globeville and Elyria-Swansea Tolling Equity Program. The Equity Program was approved by the Colorado Transportation Investment Office CTIO Board of Directors in April of 2022 and began with stakeholder engagement. The equity program was a federal requirement on the Central 70 project. Under federal code 23 U.S.C. § 129, the equity program was required both to comply with federal tolling impact regulations (*FHWA - Center for Innovative Finance Support - Tolling Programs - Section 129 General Tolling Program*, n.d.). The geographical area was determined by communities most affected by the Central 70. Additionally, CDOT holds a list of households displaced by Central 70 and these households are also eligible for these benefits. According to CDOT (2025), over half (around 5,623) of GES residents are eligible for the program.

Funding for this program comes from 15% of the annual net toll revenue from the Central 70 Express Lanes. The Transportation Commission approved an Intra Agency Agreement (IAA) between CDOT and CTIO, contributing one million dollars for start-up costs (Logan, 2025). Administrative costs of the program, the transponder and promotional credit is paid by CTIO.

The program is a yearly benefit system for residents of Globeville and Elyria-Swansea (GES) with an annual household income below 100% of the Aera Median Income (AMI). The table below breaks down income levels for eligible households (CDOT, 2025).

Household Size	100% AMI
1	$48,834
2	$56,372
3	$63,867
4	$70,574
5	$76,013
6	$81,451

Residents with a GES address and have an eligible income can apply to receive a switchable transponder, BancPass reloadable card with a $100 toll credit and a free transit pass. The applicant's vehicle may be registered to an address outside of GES (80216), as long as they can prove residency in 80216 (*Toll Equity Form*, n.d.). Their vehicle must not be registered to an ExpressToll account, but they can call ExpressToll customer service to remove the vehicle if needed. If the resident has multiple cars, they will have to apply once per car (*Toll Equity Form*, n.d.). Applicants will need to provide the following information: name, cell phone number, email address, vehicle information (plate number, vehicle make, model and color), proof of address (driver license / Colorado ID / US passport; or bill with name and address on it; or tax returns; or lease agreement), proof of income (Medicaid; or SNAP Benefits; or LEAP Program; or Free and Reduced School Lunch Program; or tax returns; or one month of pay stubs for all earning household members) (*Toll Equity Form*, n.d.). After application is submitted, a transponder package from BancPass will be mailed within one month with a welcome package (*Toll Equity Form*, n.d.).The transit pass is available for pick up at distribution sites including select libraries, schools and recreation centers.

According to program managers, the transit pass is used more than the toll credits (Logan, 2025). In 2024, the program spent $258,000 on 48,820 one way transit tickets, which is 54% more from the previous year (Logan,2025). BancPass is CTIO's partner to manage the

tolling portion of the program (Logan, 2025). BancPass is a pay-as-you-go Toll Sticker and is reloadable by cash or card and has no minimum balance. CTIO picked BancPass because they have more touch points to notify users of low balance and provide services in English and Spanish (Logan, 2025). As of January 2025, just under 100 vehicles have been registered for this program, at a total cost of $14k (Logan, 2025). CTIO conducted a door to door survey of GES residents to inform the neighborhood of the program and asked a series of questions. 18.4%, 45 out 245 survey participants, said they would not enroll in the program due to privacy concerns about sharing documents and information. CTIO plans on continuing outreach to the GES community and program assistance for those already enrolled especially to increase toll benefit uptake.

EV Trends

An increased trend across state DOTs include the introduction of usage based fees for electric vehicles. This may be a usage-based fee to be utilized for equity programs. There are 39 states with EV usage-based fees, but none with a direct low-income discount. Most fees are added to Transportation Funds or road maintenance (Shinkle and Wicks, 2025). Hawai‘i has found EV vehicles are more common among high income households (*HiRUC*, n.d.). The state is replacing the $50 EV surcharge with a road usage charge starting July 2025 (*HiRUC*, n.d.). EV drivers will pay either eight dollars per thousand miles or fifty dollars annually when they renew their registration (*HiRUC*, n.d.). This type of RUC could be utilized in equitable redistribution funding (*HiRUC*, n.d.). Wisconsin, Virginia, West Virginia, and Vermont have already implemented special fees for alternative fuel vehicles to replace lost revenue from fuel taxes (*EV Infrastructure Fee | Department of Motor Vehicles*, n.d.; “West Virginia Code Section 17A-10-3C,” n.d.; *What Is the Highway Use Fee?*, n.d.; *Wisconsin Department of Transportation Vehicle Fuel Surcharge*, n.d.).

Conclusion

Usage-based fees are an emerging transportation financing mechanism which can fund programs seeking to ensure local transportation systems are more equitable and affordable to low-income households. Los Angeles Metro's Low-Income Assistance and Transit Rewards programs offer low-income households in Los Angeles County discounts and benefits to ensure access to the I-10 and I-110 HOT lanes. San Mateo's Community Transportation Benefit program offers either a one-time transit benefit or US 101 toll road benefit to low-income households in San Mateo County. Virginia's Toll Relief program provides discounts on ERT roads to low-income households in the surrounding counties. Oregon's OReGo Road User Charge allows individuals to pay less of the annual fee if their annual mileage is less than the average user. Revenues from the charge fund programs which offer reduced transit fares to low-income riders. These programs all offer discounts or credits which only apply to transportation uses and fund themselves through priced roads (either congestion pricing or tolls). While some programs encourage low-income households to be multimodal transportation users, others aim to reduce barriers to accessing private vehicular transportation.

Finally, we noted that alternative fuel vehicle fees are becoming more prolific throughout the US and may be a potential revenue source for additional equity-oriented discount and credit programs. We also noted many programs similar to our five examples which did not fit our scope but still provided some insight. For example, Hawai‘i intentionally designed an EV user fee to target high-income drivers, but has not created a link for these funds to assist low-income households. These included programs designed to use revenues from usage-based fees to make transportation more affordable or accessible to low-income households without offering direct benefits to individuals. Brief descriptions of these programs can be found in the appendix.

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Appendix

This appendix contains information from our research process. We collected information from the states' department of transportation websites. Other US cities have spent time ensuring procedural, distributional, and structural equity is embedded in their usage-based fees but have not implemented direct low-income programs which would be relevant to our project.

Table A1:

State	Usage-Based Fee	Usage-Based Fee Low-Income Discount	Notes
Alabama	Yes	No	
Alaska	Yes	No	
Arizona	No	NA	
Arkansas	No	NA	
California	Yes	Yes	Included in report
Colorado	Yes	Yes	Globeville and Elyria-Swansea Tolling Equity Program
Connecticut	Yes	No	Usage-based fee is for heavy duty commercial vehicles
Delaware	Yes	No	
Florida	Yes	No	
Georgia	Yes	No	
Hawaii	No	NA	
Idaho	No	NA	
Illinois	Yes	Yes	I-PASS Assist Program
Indianna	Yes	No	
Iowa	No	NA	
Kansas	Yes	No	
Kentucky	Yes	No	

Louisiana	Yes	No	
Maine	Yes	No	
Maryland	Yes	No	
Massachusetts	Yes	No	
Michigan	No	NA	
Minnesota	Yes	No	
Mississippi	No	NA	
Missouri	No	NA	
Montana	No	NA	
Nebraska	No	NA	
Nevada	No	NA	
New Hampshire	Yes	No	
New Jersey	Yes	No	
New Mexico	Yes	No	For commercial vehicles only.
New York	Yes	Yes	Mentioned in a different report
North Carolina	Yes	No	
North Dakota	No	NA	
Ohio	Yes	No	
Oklahoma	Yes	No	
Oregon	Yes	Yes	Mentioned in Report
Pennsylvania	Yes	No	
Rhode Island	Yes	No	For commercial vehicles only.
South Carolina	Yes	No	
South Dakota	No	NA	
Tennessee	Yes	NA	The fees are still in development.
Texas	Yes	No	
Utah	Yes	No	

Vermont	Yes	No	
Virgina	Yes	Yes	Mentioned in Report
Washington*	Yes	In development	Road Usage Charge still in development, tolls are functional
West Virginia	Yes	No	
Wisconsin	No	NA	
Wyoming	No	NA	

*The state of Washington worked to understand the impact that pricing of a road usage charge would have on urban versus rural users and how much privacy could be maintained via the new system (*Washington State Road Usage Charge (WA-RUC)* | *Why RUC?*, n.d.). Their research found that low-income households own on average older and less fuel-efficient vehicles, leading them to pay more in gas taxes compared to wealthier households (*WA-RUC*, 2022). The implication shows a usage-based fee can reduce this disproportionate burden. In the report, WA RUC proposed using a usage- based fee for a more equitable distribution of transportation funds (*WA-RUC*, 2022). Public focus groups' concerns mostly revolved around how much and through which mechanism users paid the new fee.

In the counties of Kent, Jackson, Hillsdale, Lenawee, and Wayne in Michigan, Feonix has developed a mobility wallet designed for veterans (*Feonix - Michigan Mobility Wallet Challenge*, n.d.). MDOT and Michigan Office of Future Mobility and Electrification fund the Mobility Wallet. The wallet can be used for “public transit, private, specialty, Uber, volunteer, and micro-mobility transportation” (ibid). Feonix focuses on veterans' transportation insecurity for accessing healthcare. They currently are not accepting any new applications, but a form to join the waitlist is available (*Feonix - Michigan Mobility Wallet Challenge*, n.d.). An interested party would need to provide address, email, phone number and affiliation to the military. The program always recruits volunteer drivers to meet the need for rides. Volunteers receive mileage

reimbursement (IRS rate of $0.65/mile) and select their driving schedule (*Feonix - Michigan Mobility Wallet Challenge*, n.d.).

G. Case Studies

We conducted case studies of the systems in Los Angeles, Chicago, the Bay Area, New York City, Milan (Italy), and Portland, Oregon.

G.1 Chicago (CTA): Ventra

G.1.1 Introduction

Ventra is available on Chicago Transit Authority (CTA), Pace, and Metra in the Chicago metropolitan area (which had a population of 9.44 million in 2022) (*Resident Population in Chicago-Naperville-Elgin, IL-IN-WI (MSA)*, 2023). CTA is one of the largest public transportation agencies in the US and serves the city of Chicago and 35 surrounding suburbs with bus and rail service; in 2024, CTA's total ridership was 309.2 million (CTA, 2025). Pace offers commuter bus service to Cook, Will, DuPage, Kane, Lake and McHenry counties and provided 16.9 million trips in 2024 (Pace, n.d.; Regional Transportation Authority, 2025). Metra offers commuter rail service and provided 35.1 million trips in 2024 (Metra, 2025). Ventra, an open and closed-loop accepting payment system was introduced on these three transit service providers beginning in 2013 and offers some lessons learned from the initial implementation.

G.1.2 History of Fare Payments

There is a rich history of transit (both publicly and privately operated) throughout Chicago starting with horse car service in 1859. Streetcars were introduced to the city's streets in 1890 while the first rail line opened in 1892. During this period, fares were around 5-10 cents with tokens offered in bulk at a reduced fare (*Chicago CTA Fare History*, n.d.; National Museum of American History, n.d.). Fare cards were introduced in 1997 and the Ventra fare system - including open loop acceptance - was completed in 2013. The RFP process for open loop acceptance began in 2009 (CTA, 2010). Metra notably does not accept value from a Ventra card; instead, Metra tickets can be purchased and loaded onto a Ventra card (VentraChicago, 2020).

G.1.3 Payment Technologies

Closed Loop

Chicago has a long history of closed loop payments from the tokens accepted when the first rail line opened, to the sale of 14-day and monthly passes and magnetic-striped paper tickets, to the RFID smart Chicago Card (Foote et al., 1999). In 2013, Ventra introduced updated closed loop cards with the introduction of the Ventra system. The Ventra card, a closed loop RFID smart card, is available for purchase online, on the Ventra app, at Ventra Vending machines in CTA rail stations, at participating Ventra retailers, over the phone, and at the Ventra customer service center at the CTA headquarters (*Featured Questions*, n.d.). The Ventra Card costs $5

which is returned as transit value if the card is registered online within 90 days of purchase (ibid). Cards purchased online or over the phone are received in the mail. Single-ride and one-day paper tickets are still available for purchase at Ventra Vending machines.

Open Loop

In 2013, Ventra was introduced with open loop acceptance. The Illinois state legislature mandated regional compatibility of payment methods in Chicago, hence the integration with Pace and Metra, which operate commuter bus and rail, respectively (Illinois General Assembly, n.d.).

G.1.4 Payment Methods

Mobile Wallet

The Ventra app was originally designed by Moovel, a software company known for providing mobile ticketing apps and for its subsidiary ParkMobile. The app transitioned to Cubic Transportation Systems' responsibility as CTA explored further connectivity options with micromobility (Cohen et al., 2021; *Professional Services – Moovel*, n.d.). The virtual Ventra card, purchased via the app, can be added to Apple Pay, Android Pay, and Samsung Pay mobile wallets.

Faregates

CTA currently uses faregates at rail stations and recently installed ADA compliant faregates in late 2023 and early 2024 (CTA, 2023). These faregates replaced Special Access Gates at 143 rail stations throughout the system.

G.1.5 Payment Policies

Low-Income Benefits Programs

Fare capping was introduced for open loop payments (known as Pay-as-you-go/PAYG). In addition to fare capping, the Chicago Access Pilot Program offers low-income reduced fares to residents of Cook, DuPage, Kane, Lake, McHenry, and Will counties. The program is running from Feb. 1, 2024 to July 31, 2025 for SNAP recipients (*Fair Transit Access | Regional Transportation Authority*, n.d.; RTA, 2025). These SNAP recipients (those earning up to 165% of the Federal Poverty Line) must apply to receive an Access Permit. With the Access Permit, individuals are able to purchase reduced fares on Metra, the commuter rail system in the Chicago region. This program was recommended by the Chicago Metropolitan Agency for Planning in 2023, in addition to region-wide fare capping and a free youth transit pass (Chicago Metropolitan Agency for Planning, 2023).

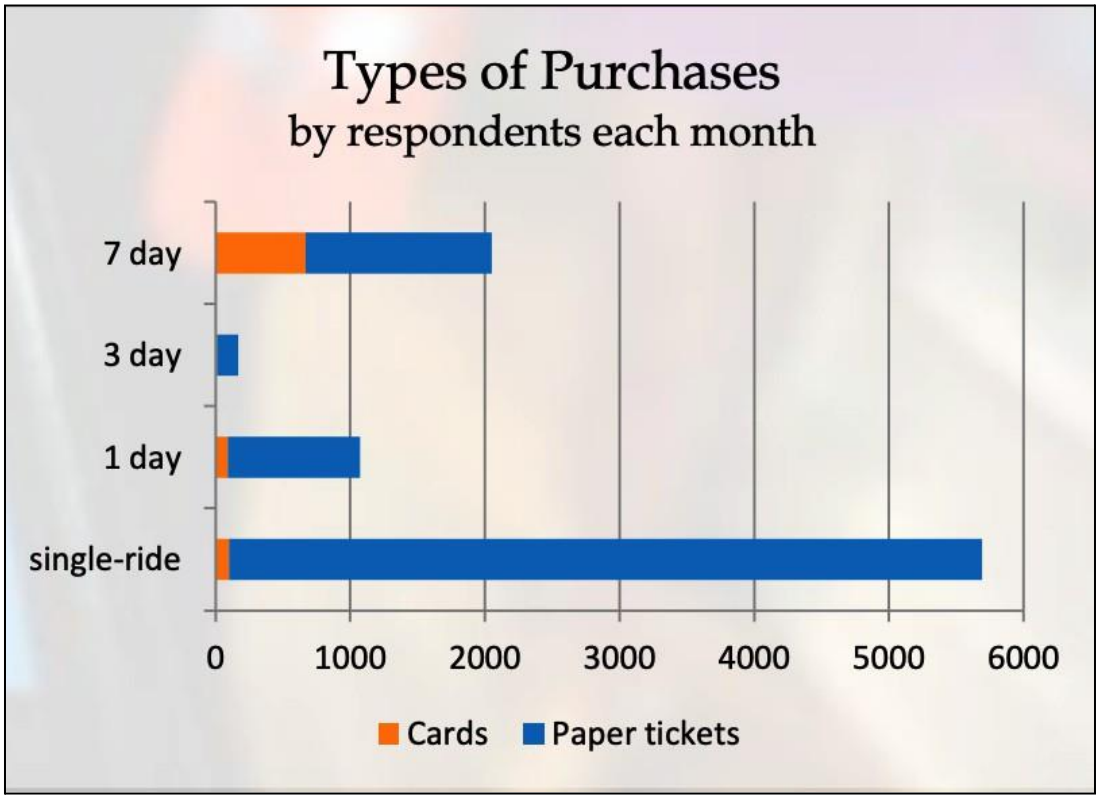
Unbanked Access

For those relying on cash, physical closed loop Ventra cards can be purchased in person at Ventra vending machines (which accept cash) or at one of the 1,300 retailer locations across the region, which include drug stores and currency exchanges (Ventra, n.d.). Ventra vending machines are available at all 145 CTA rail stations (Steven Vance, 2013) and major locations including Chicago Union Station, Ogilvie Transportation Center, Millennium Station, Navy Pier, and the Museum of Science & Industry.

Ventra briefly offered a joint prepaid debit/transit card with Mastercard (John Greenfield, 2013). The card was first introduced in 2013 and was phased out in December 2017 following a lack of "significant demand" (John Greenfield, 2017). Any users with remaining balance on the debit portion of their card can transfer the funds to a Money Network card (Money Network was the company that was in charge of the debit functions while the Ventra card was offered) and would receive a transit-only Ventra card in the mail (ibid). The joint card likely lacked demand because of the various fees initially associated with the debit portion including a $1.50 ATM fee, a $2 general customer service fee, a $6 fee for closing the account, a $2 paper statement fee, a $2.95 fee for adding balance from a personal credit card, and a $10/hour fee for resolving account discrepancies (ibid). Many of these fees were quickly eliminated including the ATM fee, the general customer service fee, the fee for adding balance from a personal credit card, and the account discrepancies fee (Steven Vance, 2013). However, Money Network still charged up to $4.95 for each deposit made at a retail location (ibid).

Additionally, Ventra faced backlash from the social service agencies in Chicago for the system's failure to initially accommodate their needs (Chicago Jobs Council, 2016). In 2015 - two years after the Ventra system was introduced, CTA still used paper applications and checks for bulk orders and 63% of the social service agencies surveyed by the Chicago Jobs Council in late 2015 stated those bulk orders had long wait times (ibid). These agencies often resorted to buying paper tickets in person in lieu of bulk orders, but this came at a cost of $0.50 per ticket (See Figure 1).

Figure 1. Chicago Jobs Council surveyed social service agencies on the types of tickets they purchased to hand out after Ventra was introduced



(Chicago Jobs Council, 2016).

G.1.6 Connectivity

Micromobility

In 2015, the Ventra app began integrating with Divvy bikeshare (Cohen et al., 2021). The first phase of the project was completed in September 2020 when the Ventra app displayed real-time availability of Divvy bikes which are stationed at 84% of CTA's rail stations and 70% of the agency's bus stops (ibid). Deployment of payment integration for Divvy bikes was planned for Fall 2021 (ibid).

The Chicago Department of Transportation (a department of the City of Chicago) launched Divvy for Everyone (D4E) which offers a $5 annual membership to Divvy bikes to households earning up to 300% of the Federal Poverty Line (John Greenfield, 2015). The program is designed to provide access to unbanked households and those without smartphone access, so the usual requirement of linking a credit card to the users' account as collateral is waived. The application is offered in person at five locations throughout Chicago and users must provide proof of income and residency (ibid). The $5 price is only available for the first year, but the City was reportedly looking into payment plans or cash payment options to help users handle the usual $75 charge.

G.1.7 Privacy Concerns

To register a Ventra Card, users must supply their name, address, email address, and phone number (*Get A Ventra Card*, n.d.). During this literature review, we found no evidence of community dissatisfaction with the level of personally identifiable information Ventra collects or the security practices surrounding data storage. Recently, CTA partnered with Chicago's mayor, Brandon Johnson, to launch a "Know Your Rights" campaign, and released a statement refuting rumors that immigration ID checks had been performed in CTA stations in early 2025 by ICE (City of Chicago Office of the Mayor, 2025). CTA and the City of Chicago have demonstrated their disagreement with current federal immigration policies, and affirmed they are not cooperating with such efforts by providing rider information. CTA does charge a privacy tax on paper tickets. Compared to single rides taken with a Ventra card or a debit/credit card via open loop, users buying paper tickets pay $0.50 more (*Fare Information*, n.d.). Users may still be wary to use public transportation in a way that provides the agency with personal information; in such cases, CTA makes it more expensive for users to travel.

G.1.8 Evaluation

Chicago's implementation of Ventra provides many lessons for equitable payment system design. Ventra received backlash during its launch because of the inconsistency and uncertainty of several policies surrounding the joint prepaid debit/transit card, social service agency's bulk purchasing options, and privacy tax on paper tickets.

G.2 Los Angeles MTA (LA Metro)

G.2.1 Introduction

The Los Angeles County Metropolitan Transportation Authority or Metro, is the regional transportation authority for the county. The agency plans and implements local, express, and commuter bus and light rail services since its founding in 1993 (LA Metro, 1994). The agency was formed after the California state legislature merged the Southern California Rapid Transit District and the Los Angeles County Transportation Commission (ibid). With 9.6 million residents in the county in 2023, LA Metro saw 1.18 billion passenger miles across 74 million bus and 29 million rail service miles (LA Metro, n.d.-b; *U.S. Census Bureau QuickFacts*, n.d.). LA Metro's fare payment system provides insights related to regional universal fares and multimodal connectivity thanks to its interoperability with bikeshare and parking.

G.2.2 History of Fare Payments

Officially established as a Universal Fare System in 2001, TAP (Transit Access Pass) offers a universal fare collection technology across 27 transit agencies in Los Angeles County (Bill Heard, 2001; TAP, n.d.-a). Before TAP was introduced, LA Metro's fare collection system used

monthly passes, tokens, and paper transfers resulting in an estimated annual fare fraud cost to the agency between $5.5 million and $11.1 million (ibid). A universal fare system across the county was first considered by the Los Angeles County Transportation Commission in 1990 (LA Metro, 2023). Many of the 27 agencies now offer free or discounted transfers between one another. While fares may differ between agencies, they can all be paid with the TAP smart cards or virtual TAP cards on mobile wallets (such as Apple Wallet or Google Pay).

On June 27, 2024 the Metro Board voted to contract Cubic Transportation Systems, Inc. to implement open loop payments within the TAP system (LA Metro, 2024a). Cubic Transportation Systems, Inc. handled the rollout of Apple and Android mobile wallet options (Cubic Corporation, 2021) and fare capping (*Fare Capping on Metro*, n.d.) for LA Metro and TAP; the private Transportation Systems, Inc. has had a business relationship with LA Metro since 2002 (Cubic Corporation, 2019).

G.2.3 Payment Technologies

Closed Loop

As mentioned, the current fare payment system uses RFID stored value smart cards called TAP. Riders can purchase a plastic TAP card for $2 at any ticket vending machine (TVMs, usually by rail stations), or from select vendors including county libraries, pharmacies, convenience stores, grocery stores, and some alternative financial service providers. Virtual TAP cards are distributed for free online, on the TAP app, or over the phone with customer service. TAP users can reload their physical TAP cards on the TAP app, at TVMs, at bus fareboxes, at any of the physical locations selling the cards, online, or over the phone. When loading value onto TAP cards, users are not charged for any fees. Metro has encouraged riders to switch to TAP cards from cash for benefits like reducing onboarding time. Senior riders were directed to switch to TAP cards in 2010; they were previously offered paper or sticker transit passes (LA Metro, 2010b).

Open Loop

TAP Plus, which would accept open loop contactless payments, was approved by the Metro Board in June, 2024 (LA Metro, 2024b). LA Metro plans to maintain its closed loop TAP card options and simply add open loop payments. This would benefit unbanked riders since they would not need to acquire a bank card to pay for transit. During the same meeting, the Metro Board approved the Expanding the LIFE Program Through Technology Motion (LA Metro, 2024a). With directions to report back in 2024, the Metro CEO was tasked with identifying social benefit programs which could replace the separate LIFE program discount eligibility verification process and determining whether it would be technologically possible and state or federally supported to load LIFE benefits onto an existing social service card (pending the card's transition to EMV).

Almost a year later, at a Metro board meeting in April 2025, Department of Social Services (DPSS) and California Department of Social Services (CDSS) determined they cannot legally

share data with Metro under the federal Supplemental Nutrition Assistance Program (SNAP) regulation (LA Metro, 2025). Additionally, California privacy laws and DPSS policies also restrict data sharing. Without DPSS sharing users' personal information, TAP is unable to auto-enroll eligible EBT customers (LA Metro, 2025). Even with Metro's open-loop implementation of TAP Plus, EBT cards would need to be registered online for discounts to be able to function as a fare card.

G.2.4 Payment Methods

Mobile Wallet

The current closed-loop TAP card began offering a virtual mobile wallet option on Apple devices in 2020 and on Google devices in 2021 (Cubic Corporation, 2021). Virtual TAP cards must be added to a virtual wallet and registered. This entails providing Metro with personal information including the user's name, address, email address, phone number, and TAP card number (TAP, n.d.-b). Users may add stored value through the TAP app or through any bank card already added to their mobile wallet and may add passes through the TAP app. LA Metro also allows users to add LIFE benefits to their virtual TAP card (LA Metro, n.d.-a).

EZ Transit Pass

EZ Transit Pass, a monthly pass accepted across 23 Los Angeles County transit agencies, may be added to a user's TAP card. Senior or disabled discounts are offered for 39% lower than the standard price (*Fare Capping on Metro*, n.d.). EZ Transit Pass costs vary by agency and each agency is assigned a travel zone. The user must determine the highest zone through which they travel and pay that fare, although occasional trips through higher zones are accepted with an upcharge. EZ Transit Passes are not subject to fare capping, although they may cost less overall than paying individual fares while transferring across multiple agencies if inter-agency transfers are charged. Since EZ Transit Passes are not fare capped, they are not as equitable or accessible to low-income riders as TAP cards.

Faregates and Proof of Payment

LA Metro has had a mixed approach to fare enforcement in the past. Currently, the agency uses an employee-led proof of payment policy on buses and rail. Bus riders must pay their fare upon boarding; bus drivers are in charge of enforcing this process. Rail riders must pay their fare at a faregate upon entering an under- or above-ground station or at a scanning device at an at-grade station.

In July 2024 LA Metro introduced a pilot program in the North Hollywood station which enforces tapping in and tapping out (ABC7 Los Angeles, 2024). This program came as a response to rising violent crime rates on public transportation throughout the agency; between March and April 2024, LA Metro saw a 16% increase in crimes against people. LA Metro argued that 96% of violent crime offenders did not pay fares and that stricter fare enforcement could help prevent further crime (ibid).

G.2.5 Payment Policies

Low-Income Discount Programs/Income

LA County residents can qualify for the LIFE (Low Income Fare Is Easy) program if their household income falls under 200% of the Federal Poverty Line or if they are already enrolled in “CalFresh, EBT, Medi-Cal, a reduced lunch program, SNAP, Social Security, or Social Security Disability or TANF” (Metro, 2025). The application can be completed online, at a sign-up event, or via mail. The LIFE program does not require applicants to provide proof of income, although applicants should be prepared to produce one of the aforementioned forms if LA Metro were to confirm their eligibility. If applying in person, the applicant must provide a photo ID as well as personal information including their name, address, email, date of birth, and TAP card number (if they already have one). LIFE recipients can ride for free for 90 days after obtaining the TAP card and receive 20 free rides per month until their qualification expires. Residents must reapply annually.

The Metro Board voted on July 25, 2024 to automate the discount eligibility verification process for riders who are already recipients of a state welfare program (LA Metro, 2024a). Those already receiving benefits run by the LA County Department of Public Social Services and other government entities would be guaranteed automatic enrollment in the LIFE program. Part of the program involves determining which benefits cards, when updated with EMV technology, would be compatible for fare payments. The first report was due December 2024 but was submitted in April 2025 (Metro, 2025). Unfortunately, the Department of Social Services and Metro cannot share personal information and EBT cards are not allowed to be registered on third-party systems. As an alternative, Metro staff recommended EBT cards could be used to validate LIFE eligibility online and at ticket vending machines (TVMs) in this approved motion (LA Metro, 2024b). This improvement to the LIFE program will ensure low-income passengers, who are more likely to be unbanked, also reap the benefits of open loop payments. This program would eliminate another barrier - in this case, another application process - low-income riders face when trying to use their transportation system.

Without a known timeline, the next steps for Metro include approving verification of valid Electronic Benefit Transfer (EBT) cards at Ticket Vending Machines (TVMs) (LA Metro, 2025). After approval, the EBT card can be validated at a TVM which would dispense a free TAP card with the LIFE 20-Ride benefit activated (LA Metro, 2025). Metro Ticket Vending Machines (TVMs) are an estimated $600,000 cost and are budgeted within software upgrades (LA Metro, 2025). Some stipulations include: each EBT card can only be used once for the free fare card. After using the dispensed card, users are required to apply to regular LIFE benefits (LA Metro, 2025). If the card entered has already received the benefit, the user will be encouraged to apply for the LIFE program to receive additional benefits. There are over a million qualifying EBT cardholders in Los Angeles County and is seen as a preliminary step to enrolling in the full LIFE benefits (LA Metro, 2025).

Fare Capping

Fare capping is available for all TAP cards, including discounted TAP cards over 1-day and 7-day periods (*Fare Capping on Metro*, n.d.). Each calendar day signifies one day and the 7-day pass begins at the first tap, rather than a particular calendar date or day of the week. Rides fulfilling a 1-day cap also count toward the 7-day cap. Rides are free after spending $5 or after the third ride for the 1-day cap. For the 7-day cap, rides are free after spending $18 or after the eleventh ride. It is important to note that fare capping only applies to paid trips taken with LA Metro. While other agencies, including New York MTA, offer lower fare caps for discounted riders, LA Metro maintains the same fare cap for all passengers. Since only paid rides count toward the fare cap, LIFE participants are much less likely to see the benefits of the fare cap.

Unbanked Access

For the most part, cash payments are accepted on buses within the TAP system (*Fare Capping on Metro*, n.d.). Cash is not accepted on rail; instead riders must pay with a TAP card. Unfortunately, cash paying riders are not given free transfers or fare caps; this signifies a privacy tax and an additional fiscal burden to those riders. However, it is possible for riders to load cash onto a TAP card and receive free transfers and fare capping without access to a bank card.

In 2013, LA Metro briefly offered a joint debit/TAP card with ReadyCARD Balance, a for-profit corporation (*FINAL_TAP INTEGRATION - BOARD BOX _DC.Doc - Google Docs*, n.d.). On one side was the TAP card function meant specifically for transit. On the other side was the debit card function which could be used anywhere Visa cards are accepted (*ReadyCard VISA Vendor Bulletin*, n.d.). The ReadyCARD was discontinued due to limited uptake; this may be due to the debit card's unaffordable fees. This is a common issue un- and under-banked individuals face when considering financial transaction and deposit options (FDIC, 2021).

G.2.6 Connectivity

Metro Bike Share

In addition to fixed-route transit and express toll lanes, LA Metro also administers the Metro Bikeshare, which is run by Bicycle Transit Systems, Inc (*Los Angeles – Bicycle Transit Systems*, n.d.). Metro Bikeshare is associated with a customer's TAP card. Users may unlock a bike with their TAP card, but they must use the debit or credit card information associated with their TAP account - not their TAP card balance - to pay for the ride or pass. Unlike transit, there is no fare capping for bikeshare. The passes offered include 1-Ride, 1-Day, 30-Day, and Annual lengths. The 1-Day, 30-Day, and Annual passes provide unlimited 30-minute rentals within the allotted time but users are charged for any additional time.

Metro ExpressLanes

Since 2007, Southern California has seen a rise in vehicle ownership and a fall in transit ridership despite increasing transit service miles (Manville et al., 2022). The fall in transit

ridership is largely due to a slight increase in income for low-income households who bought vehicles and began driving (ibid). According to the 2022 American Community Survey, 68% of commuters in the city of Los Angeles drove alone to work. Therefore, connecting transit payment methods with toll and parking payment methods would provide ease of use to multimodal trips and lifestyles. LA Metro runs ExpressLanes along the I-10 and I-110 corridors, meaning drivers can buy access to lanes with less traffic congestion. Tolls are paid using the FasTrak standard or Flex transponders; FasTrak technology has been integrated across the state. With the Flex transponder offered by LA Metro, drivers can communicate whether they are driving alone, with one passenger, or with two or more passengers using a switch. Vehicles with two or more occupants on the I-110 and vehicles with three or more occupants on the I-10 do not have to pay the toll (Metro ExpressLanes, n.d.).

LA Metro offers a one-time stipend of $25 to low-income drivers who prove their income qualification. However, drivers must obtain this benefit by applying in person at the Metro ExpressLanes Service Center in Torrance, California (LA Metro, 2010a). Metro also offers Transit Rewards (*Transit Rewards – Metro ExpressLanes*, n.d.) to individuals who take frequent trips along the I-10 or I-110 corridors. For every 16 one-way peak-hour trips taken on public transportation through either of these two corridors, drivers are given a $5 toll credit.

Metro Parking

Parking lots at Metro rail stations have some connectivity to TAP cards. A functional TAP card is required to obtain monthly, carpool, or Flex parking permits at locations where parking is charged (LA Metro, n.d.-c). The TAP cards must be actively used to maintain the permit. Commuter checks, a tax-free employee benefit offered by some firms, are accepted as payment. This level of connectivity is similar to bikeshare because TAP cards are necessary to complete the transaction but may not be used to pay for the charge itself. This functionality is also constrained to Metro operated parking lots; on-street parking and off-street parking run by any other entity do not offer this level of connectivity.

G.2.7 Privacy

LA Metro has relatively high privacy standards compared to the US due to more stringent California laws. Since 1978, privacy has been an inalienable right in the state constitution (*California Code, CONS SECTION 1.*, 1974). The California Consumer Privacy Act of 2018 is one of three comprehensive state privacy laws in the US (*California Consumer Privacy Act (CCPA)*, 2018). Consumers are protected from retaliation by companies if they opt out of the sharing or sale of their personal information. LA Metro is subject to Streets and Highways Code Division 17 Chapter 8, which prohibits transportation agencies from selling or sharing personally identifiable information gathered from electronic tolls or transit fare systems to any person or entity unless the agency meets the specified requisites (*Streets and Highways Code - SHC Division 17. Toll Facilities and Related Matters Chapter 8. Electronic Toll Collection and Electronic Transit Fare Collection Systems*, n.d.).

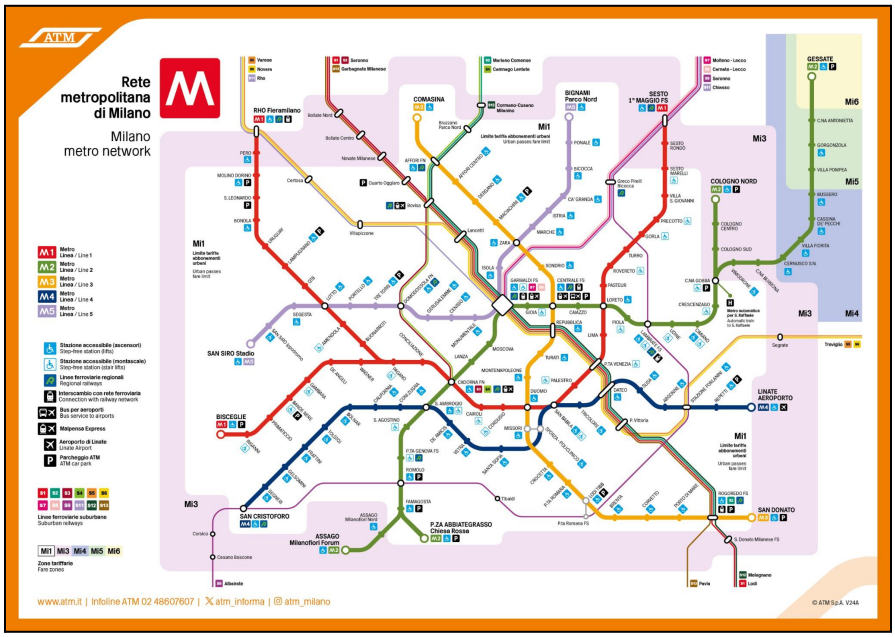
In addition to maintaining secure personally identifiable information, Metro allows virtually full functionality to anonymous riders using a TAP card. Riders may load value or

passes to their TAP card with cash at a TVM or retail location. The TAP app and website allow riders with unregistered cards to check their balance and fare cap status (LA Metro, n.d.-d). Anonymity may be lost for TAP card holders if they wish to use bike share, ExpressLanes, or parking. Metro Bike Share and Parking require bank card information and ExpressLanes require registering a transponder.

G.3 Milan

ATM (Azienda Trasporti Milanesi) is a 100% municipally owned transit company which runs the subway, streetcar, light rail, commuter rail, local and express bus, and micro mobility services across Milan and 42 surrounding municipalities in the Lombardy region (ATM, n.d.-a). ATM also operates roadside parking payments through four apps and parking meters (ATM, n.d.-b) The ATM group also operates rail lines in Copenhagen and Greece (ibid).

Figure 2: Azienda Transporti Milanesi service map



G.3.1 History of Fare Payments

The first Metro line in Milan opened in 1964. Magnetic tickets and electronic pass cards were introduced by ATM in 2004. Milan began accepting cEMV open loop payments in June 2018 in metro stations with fare capping (Piacquadio, 2020). In June 2025, ATM will stop accepting old

physical tickets and require users to obtain a RicaricaMi top-up card instead (Top up Ticket ATM, Azienda Trasporti Milanesi, n.d.).

G.3.2 Payment Technologies

Closed Loop

The Lombardy region offers the Io Viaggio card to travel across the region for 10 euros. You can purchase any of the following rail passes to load onto the card: Trenord pass, Integrated pass STIBM, Integrated pass Trenomilano, Integrated pass Trenocittà, Integrated pass IO VIAGGIO in Provincia, Integrated pass IO VIAGGIO in Lombardia, Cross-border travel pass Lombardia - Canton Ticino (Io Viaggio, n.d.). Tickets through STIBM vary in price through Mi1-Mi9 tariff zones in concentric zones. The city of Milan comprises zones Mi1-Mi3.

Open Loop

Open loop was introduced in June 2018 on Milan's 4 Metro lines which is run by Azienda Trasporti Milanesi (ATM) (Atm, al Tornello Con La Carta Di Credito, 2018; "Ticketless" Access to Milan's Subway and Other Potential Tariff Reforms - European Commission, n.d.). Open loop acceptance was expanded to buses in 2021 (Dan Balaban, n.d.). The open loop capability was rolled out to the entire system in 2023 (Jaquez, n.d.). All surface level vehicles accepted open loop payments by April 2023 (The ATM Group, n.d.).

G.3.3 Payment Methods

Mobile Wallet

The ATM app allows users to purchase tickets and cards through their mobile devices (Personal Travel Card ATM, Azienda Trasporti Milanesi, n.d.). Any virtual cards bought through the app will automatically show up in the Wallet app of the device (Travel Pass on the Smartphone ATM, Azienda Trasporti Milanesi, n.d.) However, this option is not available for unbanked individuals; they must purchase a physical ticket or card.

G.3.4 Payment Policies

Low-Income Benefits Program

Users who qualify for ISEE (Equivalent Economic Situation Indicator) or University ISEE as students are able to purchase reduced passes(Godano, 2021). However, reduced price tickets are not available. The pass must be purchased in person at a Tax Assistance Center or at the

ATM service center at Duomo for unemployed users (ISEE ATM Discounted Subscriptions, Milan Transport Company, n.d.). ISEE recipients must show a valid ISEE form, an identification document, their tax code, an ATM card or passport photo, and an ISEE discounted subscription application (ibid). The card must be purchased by the 10th of the month before the pass is valid (cards accepted beginning in October must be purchased by September 10th). Where a typical annual pass in the urban area of Milan would cost 330 euros, unemployed and ISEE recipient users pay 50 euros.

Unbanked Access

ATM introduced a tap in-tap out policy when open-loop became available; this feature offers fare capping to open-loop users only. Unbanked users are also unable to use micromobility as BikeMi only accepts credit card payments.

G.3.5 Connectivity

Parking

ATM operates street parking and park and ride lots near some metro stations (ATM, n.d.-b). To pay for parking, ATM offers four apps: Drop Ticket, Easypark, MooneyGo, and Telepass. Drop Ticket is a telephone operator authorized to operate by the Bank of Italy (About Us | DropTicket, n.d.); the company offers short-term and long-term parking passes. ATM suggests purchasing a parking pass, called SPID, online or at the Duomo station service center. On street parking meters also accept cash in addition to debit or credit cards (ATM, n.d.-b). Monthly or annual parking passes are offered on the Easypark and MooneyGo apps. Certain transit passes, including Trenomilano and Io Viaggio, can be used to purchase discounted monthly or annual parking passes through the MooneyGo app (ibid). Parking has been somewhat integrated with closed-loop transit payments, but ATM has yet to integrate open-loop payments.

Micromobility

BikeMi offers a discount to annual ATM travel card holders (ATM Agreement - BikeMi, n.d.; How It Works - BikeMi, n.d.). BikeMi annual passes, which include unlimited unlocks and 30 minute trips, are reduced in price from 36 euros to 24 (or 12 for cardholders under the age of 27). This discount is offered through the BikeMi app; users must unlock and pay for bikeshare through the app or website as well. Payment is only accepted via credit card; debit cards and cash are not accepted (Frequently Answered Questions - BikeMi, n.d.).

G.4 Bay Area Metropolitan Transportation Commission

The Metropolitan Transportation Commission was established in 1970 to oversee the San Francisco Bay Area's transportation systems. While the MTC originally oversaw the construction of the Bay Area Rapid Transit System (BART), it now acts as the region's metropolitan planning organization coordinating across 24 different transit agencies. These agencies' service spans across San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Marin, Napa, Solano, and Sonoma counties with a combined population of 7.7 million people (What Is MTC?, 2021). The Bay Area transit agencies offer transit across various modes including heavy or commuter rail, light rail, bus, ferry, paratransit, and micromobility (Bay Wheels).

G.4.1 History of Fare Payments

MTC began offering region-wide transit payments in 2006 under the name TransLink using ERG Transit Systems as its contractor (Chris Corum, 2004). In 2010, TransLink was renamed Clipper to honor the Bay Area's clipper ships circa the Gold Rush era (TransLink Becomes Clipper Today | 511 Contra Costa, 2010). With this rebrand, MTC entered into a contract with Cubic Transportation Systems, Inc. to implement, operate, and maintain the fare payment system through 2019 (MTC, 2022a). In 2018, the memorandum of understanding was amended so Cubic would also implement the Next Generation Clipper system (better known as Clipper 2.0) which would bring account based open loop fares to the Bay Area.

G.4.2 Payment Technologies

Closed Loop

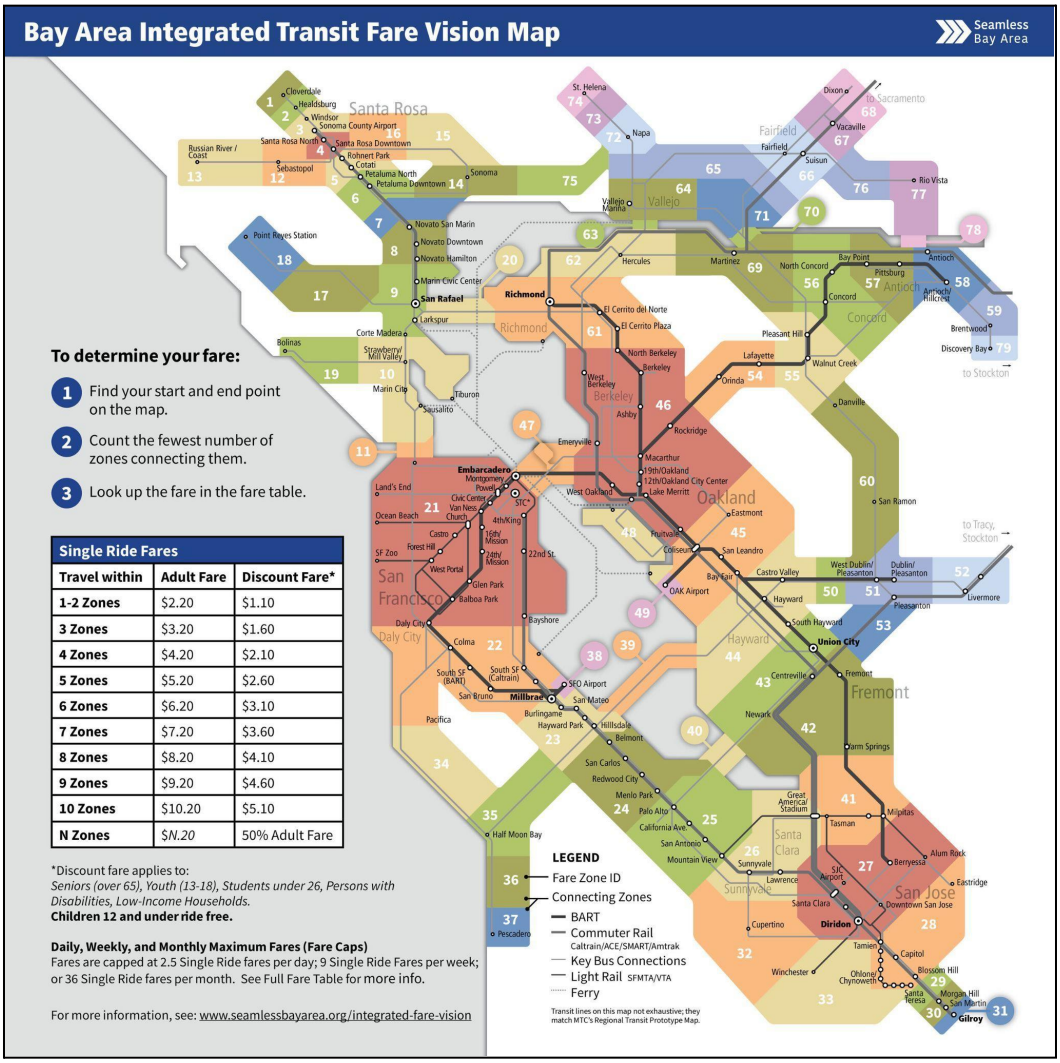
Established in 2006 as Translink, then renamed in 2010, Clipper is a closed-loop fare payment system serving 24 transit agencies across the nine-county Bay Area (Clipper® Turns 10 | Metropolitan Transportation Commission, 2016). Clipper cards are physical or virtual stored-value smart cards (Metropolitan Transportation Commission, 2024). Each card costs $3 to purchase, although this fee is waived if the user sets up automatic reloading. With Autoload, users can load cash value when the card's balance dips below $10 or purchases a transit pass after the previous one expires. Credit card charges are approved instantly while checking account charges may take up to 10 days to verify for the first transaction. Clipper is available at certain in-person locations, retail partners (including Walgreens), and at ticket vending machines (TVMs) (Metropolitan Transportation Commission, 2024). Users may also purchase a Clipper card at clippercard.com or on the Clipper app. Cards purchased online are mailed to customers.

Similar to LA Metro and MTA's policy, users are not charged any fees for loading value onto Clipper cards. Clipper currently differentiates between cash value and transit passes. If cash

value is loaded onto a card, it cannot be used to purchase a transit pass. Since fare capping will only become available with the implementation of Clipper 2.0, this poses a challenge to low-income riders with minimal discretionary funds and exacerbates “fund fumbling”.

While the Clipper Card has integrated fare payment technology, many of the 24 transit agencies maintain individual fare structures. Traveling across multiple transit agencies can be expensive. Seamless Bay Area, a 501(c)4 nonprofit organization, has advocated to integrate both fare payment technology and pricing mechanisms (About Us, n.d.). The organization’s mission is to “transform Bay Area’s fragmented and inconvenient public transit into a world-class, unified, equitable, and widely-used system by building a diverse movement for change and promoting policy reforms.” Seamless Bay Area has published an integrated transit fare vision map (see Figure 1) which establishes travel zones to determine how much a user is charged per trip (Integrated Fare Vision, n.d.).

Figure 3. Seamless Bay Area’s Integrated Fare Vision Map (Integrated Fare Vision, n.d.)



Open Loop

While work on an open loop version of the MTC's fare collection system, called Clipper 2.0, began in 2019, it is unfortunately not available as of January 2025. The system has been delayed twice due to a global chip shortage and technological issues (Seamless Bay Area, 2022). Clipper 2.0 is now expected to come online in April 2025. Thanks to the passage of Measure 3 in 2018, MTC entered into a contract with Cubic Corporation to acquire and implement an open loop payment system which accepts cEMV cards (MTC, 2023). Clipper 2.0 will offer fare capping, online applications for youth and senior discount cards, and free or reduced price transfers (Seamless Bay Area, 2022). Free or reduced price transfers would subtract any previous fares paid from the new agency's fare. Where discounted transfers apply, if the first agency's one-trip charge was $2.50 and the second was $1.50, the user would pay $0 to transfer. If the first agency's one-trip charge was $2.50 and the second was $3, the user would pay $0.50 to transfer. The current plan is to begin introducing Clipper 2.0 in April 2025 (Seamless Bay Area, 2024).

As mentioned in the New York MTA case study, Cubic has struggled in 2024 with meeting deliverables for a number of open loop implementations across the US (WBUR, 2024). The MBTA open loop acceptance and MTA OMNY system have also been delayed in 2024. Many transit fare professionals blame Cubic's 2022 transfer of ownership to a private equity firm, which resulted in the loss of two fare payments veterans (Kevin Duggan, 2024).

G.4.3 Payment Methods

Mobile Wallet

MTC also offers the Clipper app which can be connected to mobile wallets like Google or Apple Pay on any NFC-enabled device (Metropolitan Transportation Commission, 2024). Youth, Senior, and RTC cards may be added to mobile wallets. Each Clipper account may have a physical or virtual card, but not both at the same time (Metropolitan Transportation Commission, 2024). Virtual card users can enable Express Transit to automatically pay without prompting the user to log into their device. Currently, virtual Clipper cards do not operate with different fare structures than physical cards.

Faregates

Fare enforcement strategies are not unified across Clipper accepting agencies. Some transit agencies - like BART, Caltrain, Golden Gate Transit, Marin Transit, San Francisco Bay Ferry, SMART, and Sonoma County Transit (Metropolitan Transportation Commission, 2024) - charge fares based on the distance traveled and require tapping in and out. In recent years, many large transit agencies in the Bay Area bolstered their fare enforcement efforts after facing an increase in fare evasion since the COVID-19 pandemic began. Many of these agencies face a fiscal cliff following a drop in ridership post-pandemic and the expiration of COVID-era stimulus funding for operations (A Looming Operating Fiscal Cliff and the Future of Transit | SFCTA, 2023). Muni and SFMTA increased its fare inspector staff by three dozen after suspecting fare evasion increased from 12% pre-pandemic to 20% in 2024 (Culross, 2024). BART established a new

fare evasion ordinance in 2018 (BART, n.d.). Any adult within a paid area who had not paid their fare, as verified by BART police, would receive a civil administrative citation for the first and second violation and a criminal citation for the third violation within a 12-month period. VTA requires riders to provide proof of payment on light rail to patrolling fare inspectors (Santa Clara Valley Transit Authority) (Does VTA Require and Enforce Proof of Payment on Light Rail?, n.d.). MTC has not recently expressed interest in unifying fare enforcement policies through the Bay Area region.

G.4.4 Payment Policies

Low-Income Discount Programs

The Clipper START pilot program, which began in 2025 and has been extended through June 30, 2025, offers 50% discounts across 22 transit agencies to low-income riders (Clipper Start, n.d.; MTC, 2021). The program launched with only four transit agencies, which grew to 17 in 2021 and 22 in 2024. Clipper START cards are only offered as physical cards; they cannot be added to a mobile wallet. Applicants must not make more than 200% of the Federal Poverty Level or already have an RTC discount card to qualify (Clipper START, n.d.). Clipper START applicants must show proof of their income and can complete the application online or in person at a social service agency or Clipper's In-Person customer service centers at the Embarcadero BART Station, the San Francisco Ferry Building, or AC Transit. Applicants cannot use the same form to apply for multiple Clipper START cards; applicants also must reapply every two years. The application requires personal information including the applicant's name and address. There are concerns of anonymity as the cards have the name of the recipient printed on them and the program collects information in order to prove eligibility.

Unbanked Access

MTC will maintain a closed loop option after the rollout of Clipper 2.0. Unbanked riders may use a physical or virtual Clipper card and load value or passes at transit station TVMs, Walgreens, other retailers, or staffed transit locations throughout the Bay Area (Metropolitan Transportation Commission, 2024). While these in-person locations are prolific in San Francisco, Oakland, and San Jose, they become more sparse the further one moves away from one of these three central business districts. In fact, MTC mapped Clipper retail locations from 2020 through 2022 against its Equity Priority Communities to ensure in-person card sale locations were accessible to those who may rely on public transit the most (MTC, 2022c).

In 2022, MTC conducted an equity analysis on Clipper mobile card media to determine if minority customers saw a disparate impact or if low-income customers faced a disproportionate burden due to differences in acquisition fees for physical and mobile cards (Rodrigues, n.d.). Looking at peer agencies across the US and analyzing Clipper card purchases, MTC determined that the difference in acquisition fees did not have a disparate impact or disproportionate burden.

While unique to AC Transit, the Tempo bus Line offers paper tickets at ticket vending machines (TVMs) (Alameda-Contra Costa Transit District, n.d.). When transferring to the All Nighter Line 801, riders may transfer for free by presenting their paper ticket. This is a very limited use case, but it could be expanded to accommodate cash-paying riders throughout the MTC region.

G.4.5 Connectivity

Parking

Some parking garages have enabled drivers to pay for parking using their Clipper Card (MTC, 2022a). This is a significant advancement as other connectivity efforts in California transportation systems have mainly used transit cards to identify an account, but not to pay with loaded value.

Micromobility

Bay Wheels, bikeshare offered through the Bay Area by Lyft, allows riders to unlock a bike using a physical Clipper card (Metropolitan Transportation Commission, 2024). Virtual Clipper cards do not offer this functionality. Users cannot use stored value on their Clipper card to pay for the bikeshare rental; they must use a bank card to do so.

G.4.6 Privacy

Clipper's Privacy Policy outlines the personally identifiable information (PII) collected from Clipper, Clipper Start, RTC, and Clipper Youth and Senior cards, how the PII is used, and the third parties which MTC may share the PII with. Clipper collects PII such as
Clipper PII may be shared with Clipper contractors for the strict purposes of "managing patron accounts, storing information, operating the Clipper Mobile App, determining eligibility for Clipper START, Clipper Youth and Senior Discount Cards, and RTC Discount ID Cards, and revenue collection." (MTC, 2022b) PII is discarded after no more than 90 days (ibid).

MTC has been at the forefront of anonymous data analysis for service planning purposes (Tom Pera, 2021). Ory and Granger-Bevan anonymized trip data from MTC by randomizing each Clipper card serial number for every 3 AM to 3 AM 24-hour period, sampling only 50% for each day, only selecting three random Mondays in each month, and truncating time stamps to every 10 minutes (2016). These adjustments were made to allow wider sharing of trip information without compromising any individual's travel patterns. Each card had a less than one percent chance of being selected for a full work week. The dataset was criticized for limiting the ability to see the effects of special events on ridership, but at the same time for the potential that the data could be combined with other sources to determine the date a trip was taken. Not all 24 transit agencies linked each transaction to a location or route. While this is a valiant attempt, it may take more effort and collaboration to ensure this data product is both secure and useful for service planning.

G.5 New York City Metropolitan Transportation Authority

The MTA (Metropolitan Transportation Authority) originated in 1965 and currently houses six agencies: MTA New York City Transit, MTA Bus Company, MTA Long Island Rail Road, MTA Metro-North Railroad, MTA Bridges and Tunnels, and MTA Construction & Development. The network serves 15.3 million people in the tri-state area with 2.6 billion trips per year (MTA, n.d.-b) MTA's adoption of open loop acceptance, commitment to access for unbanked riders, and controversy around privacy and data sharing policies can enrich the dialogue around equity in fare payments.

G.5.1 History of Fare Payments

New York city fares have evolved with transit as it has progressed from horse-drawn carriages through omnibuses to modern buses and trains. While coins were originally accepted, tokens were introduced when fares increased to 15¢ in 1953 since the fareboxes could not accept two different coins (Markowitz, 2003). Tokens were discontinued in 2003 (ibid). MetroCard, the first closed loop smart card, was introduced in 1993. OMNY (One Metro New York), which offers a closed loop smart card and accepts open loop cEMV payments, began as a pilot study in 2006 along the Lexington line and in 2010 in collaboration with the Port Authority and New Jersey Transit (John Elliott & Simon Laker, 2019). OMNY officially launched in some stations in 2019 (Advancements in Electronic Fare Payment: Contactless and Open Loop Technologies | ITS Deployment Evaluation, n.d.). Following various delays to rolling out OMNY functionalities, New York MTA has indefinitely delayed the discontinuation of the MetroCard (Kevin Duggan, 2024; Kevin Duggan & Dave Colon, 2024).

G.5.2 Payment Technologies

Closed Loop

MTA accepts both closed and open loop fare payments. MetroCard, the older of the two current closed loop options, was introduced in 1993. Contrary to its status as a frontrunner in adopting open loop payments, MTA was one of the last subway systems to introduce smart cards. MetroCard is a magnetic stripe stored-value smart card accepted on MTA services as well as the Nassau Inter-County Express, PATH, Roosevelt Island Tramway, AirTrain JFK, and the Bee-Line (MTA, n.d.-a). MTA planned to discontinue the MetroCard in 2023. This has been indefinitely delayed since the agency has struggled to implement all closed loop functionalities OMNY must replace (Kevin Duggan, 2024).

The OMNY card, the newer closed loop option, was introduced in 2019 with the OMNY open loop system. Both MetroCard and the OMNY card cost $1 to obtain from a ticket vending machine (TVM), retail location, or MTA ticket office (MTA, n.d.-a). Users may load value with

cash or a bank card at any of the three locations mentioned without paying any fees. MetroCards and OMNY cards do not have to be registered, although MTA offers balance protection if the user does choose to register. OMNY cards are not accepted on all MetroCard platforms yet. So far, MTA, AirTrain JFK, the Roosevelt Island Tram, and Hudson Rail Link accept OMNY cards (ibid).

Open Loop

One Metro New York (OMNY) was the second open loop fare payment system to be implemented in the United States, after Salt Lake City, Utah (John Elliott & Simon Laker, 2019). MTA chose to contract Cubic Transportation Systems, Inc. to implement the OMNY open loop system in 2017. While other agencies in the US had transitioned from magnetic stripe cards to RFID smart cards, MTA remained on a magnetic stripe card (MetroCard) (Cubic Transportation Systems, n.d.). This presented Cubic with a unique transition. Along the way, MTA underwent multiple leadership changes and Cubic lost two prominent leaders after being acquired by a private equity firm. As a result, Cubic faced numerous challenges implementing OMNY and lost a portion of its MTA contract. Following long delays in expanding OMNY acceptance to the Long Island Rail Road (LIRR) and Metro-North train services, MTA replaced Cubic with Masabi to carry out this functionality (Duggan, 2024). Before reassigning the contract to Masabi, Cubic stated the company would integrate the LIRR and Metro-North in 2027, six years behind the initial launch date. The integration will link OMNY accounts with LIRR and Metro-North's existing TrainTime app, which Masabi currently operates.

Cubic Transportation Systems, Inc. notably has implemented or is contracted to implement open loop payment systems for LA Metro, MTC, and the New York MTA. The consultant has struggled with matching its previous level of service in 2024; this is seen by the delays with MTC's Clipper 2.0 and MTA's OMNY system. In fact, Cubic has lost out on two open-loop conversions for DC's WMATA and Ireland's national system in 2024 alone (Balaban, 2024b, 2024a). Meeting deadlines for open loop rollouts is important because they often occur in phases. Transit authorities tend to introduce non-discounted fares first to confirm the system functions properly before offering open loop options to discounted riders. For those discounted riders interested in open loop, they either have to wait longer or forfeit their discount. As regions and states consolidate payment systems, the responsibilities associated with each contract will inevitably grow. It is important for government agencies to appropriately assess the capabilities of each contractor and to use the Request for Proposal (RFP) process to ensure the needs of all users are adequately met.

G.5.3 Payment Methods

Mobile Wallet

Transit fare payments were not available on mobile wallets until OMNY was introduced in 2019 (OMNY, n.d.-a). Even then, only open loop options can be used to pay using a phone or mobile device. Thus, unbanked individuals are not currently able to pay using a mobile wallet. Unbanked riders are still offered many options, which will be discussed later.

Faregates

MTA subways mainly enforce fares using faregates while buses use fare inspectors (MTA, 2024b). Some New York organizations, including the Legal Aid Society Cop Accountability Project, have recently criticized MTA and NYPD's fare evasion tactics after police fired at a fare evading suspect and injured four individuals (Graeme Baker, 2024). A bystander, Gregory Delpeche, was in critical condition shortly after he was shot in the head (Erica Brosnan, 2024).

G.5.4 Payment Policies

Low-Income Discounts

MTA offers low-income discounts through the Fair Fares program offered by the City of New York (Fair-Fares-FAQ-OMNY-English.Pdf, n.d.). MTA does not offer low-income discounts, however they have implemented federally-mandated discounts for seniors, disabled users, and those on Medicare (OMNY, n.d.-c). Since the OMNY system and MetroCards have been operated simultaneously, registration for the Reduced Fare OMNY can be transferred from an existing Discounted MetroCard or EasyPay account. All currently registered discount riders are to receive a Reduced-Fare OMNY card in December 2024 (MTA Announces Upcoming OMNY Milestones in 2024, n.d.). Reduced-Fare applicants may apply by mail or in person at a mobile sales bus or van (OMNY, n.d.-c). The application requires providing a form of identification and, for applicants with disabilities, documentation of their disability. Mail applications must include a passport-style photo to print on the OMNY card. Reduced-Fare recipients may pair their account with contactless payments on their phone or mobile device (ibid).

Fare Capping

OMNY offers a 7-day fare cap of $34, equivalent to 12 rides, which starts at the first tap rather than on a certain calendar day or day of the week (OMNY, n.d.-d). MTA is sending out Reduced-Fare OMNY cards to registered riders in December, 2024 when they will gain access to fare capping . The Reduced-Fare 7-day fare cap will be half of the regular cap at $17. Fare capping is restricted to the OMNY system, so MetroCard users must buy a pass to avoid paying more than each fare cap.

Unbanked Access

With both MetroCard and OMNY cards, riders may load value at TVMs, retail locations, or ticket offices using cash. MTA offers over 2,000 retail locations; however, they cannot control whether these retailers place the cards in a prominent or clear position. MTA acknowledged this limitation in 2022 (Nessen, 2022). In 2024, MTA's website asserts TVMs have been added to every subway station. However as of May 2024, just 37 of the 472 stations had cash-accepting OMNY TVMs (Duggan, 2024). This discrepancy led MTA to replace Cubic's contract for OMNY TVMs with another consultant, Scheidt & Bachmann (Duggan, 2024). Offering cash payments and closed loop options only provide access to unbanked users if cash loading sites are prolific and equitably distributed across the service area.

To alleviate potential gaps and provide additional in-person service, MTA offers in-person services at mobile sales vehicles across the five boroughs and in Westchester (MTA, 2024a). The vehicles visit most locations once or twice a month for three to four hours. Users can get help applying for Reduced Fares, transferring MetroCard balances, reporting a lost or stolen Reduced-Fare card, and signing up for OMNY. The sales vehicles do not accept credit cards.

Cash and MetroCard riders may receive a paper ticket from a kiosk before boarding a bus to ensure a free transfer (MTA, n.d.-a).

G.5.5 Privacy Concerns

Local activism in New York city has detailed how important privacy policies can be for the general public, but especially for immigrant consumers. While California laws like the California Consumer Privacy Act of 2018 (California Consumer Privacy Act (CCPA), 2018) and the Streets and Highways Code Division 17 Section 8 (Streets and Highways Code - SHC Division 17. Toll Facilities and Related Matters Chapter 8. Electronic Toll Collection and Electronic Transit Fare Collection Systems, n.d.) already protect consumers from many of the issues the New York MTA has faced, it remains helpful to note the best practices.

The Surveillance Technology Oversight Project (STOP), a non-profit organization which focuses on legal services and advocacy protecting against local government mass surveillance, has noted several issues with OMNY's privacy practices. While sharing information between government agencies is prohibited in California, MTA may have less restrictions. This could pose a risk to immigrants if MTA shares personally identifiable information with local law enforcement or ICE (Tom Pera, 2021). OMNY's privacy policy maintains that MTA may collect personal information including a user's name, age, photograph, email address, birthdate, OMNY password, mailing address, phone number, bank card information, the last four digits of their Social Security number, disability status, and geolocation information (OMNY, n.d.-b). MTA previously offered an online tool for riders to track OMNY payments. However, the only security protocol required to view the location and times of each tap-in and tap-out was the credit card number. This angered activists and organizations, including STOP, who feared domestic violence survivors could be stalked remotely (ibid). MTA has since removed this tool from their website.

G.6 Portland

The Portland Bureau of Transportation (PBOT) manages the City of Portland's transportation infrastructure. However, PBOT, while often working closely with, does not manage or oversee Trimet, Portland's public transportation agency. Therefore, PBOT manages transportation services unrelated to public transit in Portland. This includes the management of parking, road maintenance, traffic systems, micromobility programs among other transportation services (*Portland.gov* n.d.). Advisory committees inform and influence PBOT's decisions. These

advisory groups represent different transportation interests and advise PBOT and city council on key tasks, policies, and outcomes (*Portland.gov*, n.d.).

G.6.1 History of Fare Payments

Before Trimet, Portland's transit ridership fell in the 1960s causing institutional change from the main transit service, Rose City Transit Company. In January 1969, the Portland City Council created the Tri-County Metropolitan Transportation District of Oregon (TriMet), to take over the local service and create a more regional transit service (TriMet, 2025a). Paper tickets and passes were used by Portland-area transit agencies. The tickets needed to be validated at ticket validators on the Streetcar or at MAX and WES stations. Beginning in 2017, Hop Fastpass, replaced paper ticketing with an electronic fare system implemented by INIT Innovations in Transportation, Inc (Hughes-Cromwick, M., 2019). Since then, transit payments are on an open-loop system and riders are able to use mobile wallets, contactless credit/debit cards, plastic Hop cards or virtual Hop cards and cash on buses.

G.6.2 Payment Technologies

Closed Loop

TriMet accepts both closed and open loop fare payments. At first, discounted Hop cards (elderly adult, child, disability) were only available on physical Hop cards. Monthly passes were also only on physical cards. Then in 2018, TriMet made virtual Hop cards available on Android Pay or Samsung Pay. A year later in 2019, Apple Pay users could create virtual Hop cards as well. Fare discounts continue to only be available only on virtual or physical Hop cards and not applicable to open loop payments within debit and credit cards (Paying With Your Phone Using a Virtual Hop Card, n.d.).

Open Loop

TriMet made changes in 2017 to distance itself from proprietary software and hardware by designing Hop Fastpass through "open architecture" with flexibility to adapt individual software and hardware components (Hughes-Cromwick, M., 2019). Hop Fastpass' open loop system allows TriMet to work with changing technologies without obligations to a single vendor who could minimize changes to the fare payment system over time. In the long term, TriMet wanted to gain a transit payment experience with multiple vendors across the user interface, vending machines, and back-end operations (Hughes-Cromwick, M., 2019). A way they implemented this "open architecture" was choosing INIT as their systems integrator which has open application programming interfaces (API) available to multiple external partners (Hughes-Cromwick, M., 2019). Meaning, they are able to work with as many digital partners without violating any contracted partnership.This "open architecture" makes an open loop payment system seamless for Trimet. Since 2017, Hop Fastpass has accepted credit or debit cards in addition to Hop cards and paper ticket riders paying cash. Hop Fastpass' open APIs means they can support multiple payment systems simultaneously (Hughes-Cromwick, M.,

2019). Some of the TriMets partners include CH2M, Moovel, INIT, Wells Fargo Merchant Services, Ready Credit, Scheidt & Bachmann, Trapeze, and The Brigade (Progressive Rail, 2017).

G.6.3 Payment Methods

Mobile Wallet

In Portland, mobile transit fares are paid primarily through two methods: the Hop Fastpass or tapping a credit or debit card on a fare machine. These two methods can be connected to a mobile device through mobile wallets like Google or Apple Pay on any NFC-enabled device (Trimet, 2025). Hopcards (discounted fare pass for youth, seniors, people with disabilities, or low-income riders) can also be added to a mobile wallet. However, users with a Photo ID Hopcard cannot add their card to their mobile wallet.

Faregates

Fare is collected in three different ways for Trimet riders. Bus riders tap their card or phone at the front of the bus when they board. Wes/Max riders pay fares by tapping card readers prior to boarding the train. For bus riders paying with cash, they have to tell the operator whether they want a 2 1⁄2-Hour or 1-Day ticket, then insert coins and bills into the farebox and grab the ticket from the printer. Wes/Max riders paying with cash will have to purchase and load a Hopcard at a kiosk prior to boarding.

Trimet enforces fares by conducting occasional random checks. Riders with discounted fares may be asked by fare inspectors to show a form of identification upon fare inspection to verify their identity. To ensure fairness in their fare evasion policy, Trimet routinely asks for an independent party to examine their fare enforcement practices (Trimet, 2025). Additionally, Trimet prohibits arrests for fare evasion and fare enforcement officers do not detain fare evaders. When passengers receive a citation, they can choose to either pay a fine or participate in community service with each additional offense resulting in higher penalties (higher fees or longer community service requirements).

Paper Tickets

At the moment, some MAX train stations cash riders can purchase day passes and 2.5 hour paper tickets at ticket machines. Riders can choose their fare bracket (Adult, Honored Citizen or Youth) (Paying With Cash, n.d.-a) and would only need to verify the fare bracket during random fare checks. The rider then would use the printed ticket on the green Hop reader at the station to validate it before boarding (Paying With Cash, n.d.-a). These ticket machines can dispense tickets for bus or train rides.
Beginning in 2025, Trimet has been transitioning their ticket vending machines to touch screen technology which will no longer dispense paper tickets at train stations (Graf, 2024). Trimet said

the old ticket machines are obsolete and are no longer manufactured (Graf, 2024). The new machines will only reload Hop cards or allow riders to purchase a new Hop card.

Paper Hop tickets will continue to be available at the Customer Support Center and on TriMet buses for riders who pay with cash. The bus operator can choose the fare price bracket for rider (Adult, Honored Citizen or Youth) and then the rider will insert the exact amount of coins or bills into the farebox. No change can be administered on the bus. After the amount is deposited a ticket will be issued for riders to keep with them.

G.6.4 Payments Policy

Low-income discounts and Transportation Wallet

Honored Citizen

For those who are enrolled in: Oregon Health Plan, SNAP or TANF, and/or if they earn less than twice the federal poverty level (FPL), they may acquire TriMet's reduced Honored Citizen fare. Participants must re-submit documents verifying qualification every two years (York, 2022) for low-income eligibility. Applications can be submitted online or in person with a government-issued photo ID at one of the eight designated centers. TriMet accepts the following identity verification: a driver's license, passport or photo ID from any state, country or foreign consulate, armed services ID, tribal ID, or US Certificate of Citizenship/Naturalization Certificate (with signature and photo) for the application process. Without an ID, Oregon residency can be verified through: a recent postmarked piece of mail, a utility bill or a rental agreement with name and current Oregon address.

Money can be loaded on a physical or virtual Hop card and Honored Citizen riders pay half the price of a 2.5 hour fare and less than one-third the price of an adult 1-Month Pass Honored Citizens can also pay with cash or use the ticket vending machines. During random inspections, a person must present either: A photo ID showing proof of age 65 or older, a red, white and blue Medicare card with photo ID, or a TriMet Honored Citizen Photo Identification Card after verification in the program. To use an Honored Citizen fare, riders can use any of the payment methods besides tapping with a debit or credit card.

Transportation Wallet

Portland residents may also access different forms of transportation through participation in the Transportation Wallet program. The Transportation Wallet is Portland's Bureau of Transportation's Universal Basic Mobility program. Recipients of the Transportation Wallet are provided a "basic level of mobility to meet their transportation needs, regardless of their income or where they live." PBOT offers three different Transportation Wallets: Parking Districts, Access for All, and New Movers. The three versions provide users with varying levels of transit, bike, TNC, and other forms of mobility access. These wallets provide users with either digital or

physical cards to access the different forms of transportation available to residents of Portland. The program is intended to discourage driving among participants and encourage new travel modes, manage on-street parking demand, reduce issues of parking permits, and alleviate the burdens of transportation costs for people living on low-income (*Portland.gov*, 2025).

Transportation Wallet in Parking Districts

The Transportation Wallet in Parking Districts provides residents and employees discounted transportation package options in the Central Eastside and Northwest Parking Districts (Portland.Gov, 2025). The goal is to disincentivize driving, reduce parking demand and incentivize use of transit services, bike-share and e-scooters. Eligibility is location-based and does not take income as a factor. Anyone can purchase this transportation wallet for $99 and the benefits last a calendar year. At the moment, the opt-in payment portal only accepts credit cards (Amex, Visa, Mastercard) as payment methods and excludes cash and debit cards. If an individual lives or works (including attending school, volunteering, regular use of a co-working space) in parking zone M, G, or N area then they are eligible to apply for a free transportation wallet by choosing not to receive a parking permit, or trading in a parking permit for the wallet (Portland.Gov, 2025). As of 2025 the Transportation Wallet in Parking Districts includes: $200 TriMet Hop card, annual Portland Streetcar pass, BIKETOWN Annual Membership, $99 BIKETOWN e-bike credit, $30 in e-scooter credits (Portland.Gov, 2025).

To use the BIKETOWN credit, the individual must have the BIKETOWNpdx mobile app, create an account, add a payment method then enter the promo code provided from the transportation wallet (Transportation Wallet Frequently Asked Questions | Portland.Gov, n.d.). The $200 TriMet Hop card and annual Portland Streetcar pass are connected to a physical Hop card which can be added when applying or a physical Hop card can be requested. At the moment, a virtual Hop card is not able to be connected to this benefit, but a rider can add the physical Hop card to their phone after receiving the credit.

The application to enroll in this program is stated to take 5-10 minutes. The application requires name, email and mailing address and is only available online.

Transportation Wallet: Access for All

Transportation Wallet: Access for All is a program for people and households living on low-incomes (Portland.Gov, 2025). It is a free package of transportation options, including: transit fare, bike or scooter-share ride credit, and ride-share (Uber/Lyft) or taxi ride credit (Portland.Gov, 2025). This program is designed to reduce barriers, like cost, technology access, credit/debit card requirements, and low-income verification processes for different providers. To be eligible for this transportation program one must meet the following requirements: a Portland resident (either individuals or households) who meet income qualifications and are associated with partner organizations (Portland.Gov, 2025). Due to budget constraints, Access for All is only available to those who receive services from participating community-based organizations and an individual would receive a registration link from one of participating community-based organizations. PBOT and the Portland Clean Energy Fund (PCEF) collectively approved organizations applications to be part of 2025-2026 cohort of community-based organizations.

The (PCEF) financially supports the Transportation Wallet: Access for All program (Transportation Wallet, n.d.). This is a part of the Climate Investment Plan which was passed in 2023 at Portland City Council to be a five-year plan of climate action through key investments. The Transportation Wallet: Access for All program was included as one of the key transportation decarbonization initiatives, where $25 million was allocated over the course of five years and is intended to help promote equitable clean transportation access.

Email, phone number and address are required for the application process. There are 3 options, each valid for one calendar year, for those who qualify:

1. Transit Only (individual) – 1-year pass loaded on an Honored Citizen Hop card. In order to receive this credit, applicants must already have an Honored Citizen TriMet Hop card.
2. All Modes (individual) - $200 on Hop card and $75 on prepaid Visa card for Uber/Lyft/Taxi, e-scooter, car-share, and BIKETOWN for All.
3. All Modes (household) – depending on household size $225 - $300 on Hop card and $100 - $175 on prepaid Visa card for Uber/Lyft/Taxi, e-scooter, car-share and BIKETOWN for All

The extensive list of services which qualify riders for Transportation Wallet: Access for All:

Transportation Wallet: Access for All is only available to Portlanders who live on low incomes.

To qualify, you must receive one of these services:
-TriMet Honored Citizen Card for people with qualifying incomes
-BIKETOWN for All
-Portland's Sewer, Stormwater and Financial Assistance Program
-Oregon Health Plan / Medicaid
-SNAP Program / Oregon Trail Card
-Temporary Assistance for Needy Families (TANF)
-Free & Reduced-Price Lunch
-HUD Housing Choice Voucher
-LIHEAP (Home Energy Assistance)
-Employment Related Daycare
-Women Infants and Children (WIC)
-Oregon Promise
-Pell Grant recipient
-Affordable Housing Resident
-Unemployment
-Social Security Disability award letter

Transportation Wallet: New Mover

The Transportation Wallet for New Movers is a program for residents of Portland's new multi-unit buildings with more than 10 new units in commercial mixed-use and multi-dwelling zones permitted after May 2018. These buildings fit a criteria which requires developers to pay a Multimodal Incentive Fee to fund transportation options for residents. The fee amounts to $1,100 per market-rate unit or $308 per regulated affordable unit which is the cost of a TriMet annual pass (Transportation Wallet for New Movers | Portland.Gov, n.d.). This requirement is under Portland code 17.107.035: Pre-Approved Multimodal Incentives for Development (17.107.035 Pre-Approved Multimodal Incentives for Development. | Portland.Gov, n.d.) and

funds incentives like the Transportation Wallet: New Mover to increase the use of transit, bicycling, walking, and other alternatives to driving(17.107.035 Pre-Approved Multimodal Incentives for Development. | Portland.Gov, n.d.).

The more dense housing is paired with transportation credit to create communities less dependent on cars. There are 3 options for this transportation wallet:

1. $100 TriMet Hop card + $100 BIKETOWN credit
2. $100 TriMet Hop card + Access to Adaptive BIKETOWN. Adaptive BIKETOWN is for people with disabilities or seniors who are unable to ride a traditional two-wheeled bicycle {Updating}.
3. TriMet Honored Citizen 1-year Pass (a $308 value) for those who have already applied and approved for Honored Citizen fare.

If you live in a building that's part of the program, once your residency has been established, you will receive a welcome flyer (like the one here) with a unique code in the mail with instructions on how you can get a Free Transportation Wallet. Welcome flyers are mailed out by PBOT staff on a quarterly basis.

Fare Capping

Fare capping has been available since the switch from paper tickets to Hop Fastpass in July 2017 (APTA, 2019). TriMet has multiple levels of fare capping for riders The **nondiscounted** fare rate of $2.80 gives riders 2.5 hours of rides without an additional charge (Fares, n.d.). The maximum amount a rider would spend is $5.60 a day. Monthly fares will cap at $100 (Fares, n.d.). Those who have an **Honored Citizen fare pass**, $1.40 is the maximum amount for 2½ Hours. Fare caps at $2.80 daily and $28 monthly (Fares, n.d.).

Unbanked Access

The way TriMet accepts cash varies by mode. Bus riders using cash will have to insert coins and bills into the farebox and grab the ticket from the printer after indicating to bus operators whether they are purchasing a 2.5 Hour or 1-Day ticket (Paying With Cash, n.d.-b). For train tickets, riders can buy a ticket using cash from the ticket machines at MAX stations. The fare options include: adult, Honored Citizen or youth fare. Cash riders can also purchase a Hop card for $3 and load a minimum of $5 on the card. Retail locations include Fred Meyer, Safeway and New Seasons stores, as other local stores and pharmacies(Paying With Cash, n.d.-b).

G.6.5 Privacy Concerns

Oregon's Consumer Privacy Act was enacted in 2024, expanding consumer's privacy rights. However, this does not apply to government agencies such as PBOT or Trimet. This presents a concern for passengers of Trimet as they are not entitled to the new protections mandated by law (Portland Department of Justice). Trimet is not required to comply with consumer requests for their personal information to be edited or deleted.

PBOT contracts the software company Mitchell Humphrey to manage PBOT's permit applications, specifically vehicle-for-hire applications (PBOT, n.d.). Mitchell Humphrey states they do not share consumer information unless required by law. They further do not collect personal information without the user's knowledge and explicit consent. However, their Privacy Policy does not state what further measures they take to secure consumer information. This presents a major concern for residents applying for the Transportation Wallet programs. Applicants' data, whether handled by Mitchell Humphrey or by PBOT will not be well protected as Mitchell Humphrey's own privacy policy is relatively weak and the Oregon's Consumer Privacy Act does not apply to PBOT because government entities are exempt ("Privacy Law FAQs for Consumers," n.d.).

Riders on Trimet are offered better protection. Trimet's privacy policy outlines what data is collected from users of Trimet's digital and transit services. Personal data collected ranges from account information to payment card information to location data (Trimet, 2021). To protect users, Trimet collects aggregated and anonymized data. To provide a further layer of security, Trimet encrypts communications between customers and their services. Additionally, the agency will only provide collected data to provide riders with services or products they order or when permitted or required by law. However, despite better protection, Portland residents' data may be exposed or vulnerable if they use services from both agencies. Thus, harmonization of privacy policies should be considered in the future for both agencies.

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