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16. ABSTRACT

This study explores interest in, and the challenges faced by transit agencies and operators in the adoption of open-loop payment systems. The research team focuses on the ways that agencies view passenger needs in the context of adopting open payments. Challenges with cash payments, an increasingly cashless society, and the expanding offerings of digital payment options have spurred increased interest in open-loop payments among transit operators. Paying for transit with cash can require additional time at boarding, add extra steps for passengers who must pay with exact fare, and result in service inefficiencies. It presents security concerns for drivers, and administrative burdens for agencies. While the full costs of cash handling vary per agency, the cost of handling and moving cash may be considerable. Pioneering transit agencies are adopting open payment systems that accept credit cards, debit cards, and smartphone/watch-based transactions. However, there is a huge diversity among transit agencies and as such, agencies face different challenges and to different degrees when considering the adoption of open payment systems. Challenges can include financial barriers, capacity limitations, technological challenges, the duration of existing contracts, competing needs, and a number of passenger challenges such as lack of credit cards or smartphones, or lack of familiarity with the technology. This study uses data collected from California transit agencies in the fall of 2022 that gathered information about agency perceptions of open-loop payments and the challenges with adopting open fare collection systems, and whether assistance programs would benefit transit agencies interested in adopting open-loop payments. Results of the present study indicate that the majority of agencies are considering or have considered implementing open payment systems, but agencies are not fully aware of the assistance available from the California Integrated Travel Program to help in the transition to digital and open payment systems. This study sheds light on the challenges facing small to medium transit agencies in the transition of California's transit systems to open-loop payment systems.

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All Aboard! Easier Transit Travel with Standardized Payments

September
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A Research Report from the National Center
for Sustainable Transportation

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All Aboard! Easier Transit Travel with Standardized Payments

A National Center for Sustainable Transportation Research Report

September 2023

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All Aboard! Easier Transit Travel with Standardized Payments

EXECUTIVE SUMMARY

This study explores the challenges facing public transit agencies in the adoption of open-loop fare payments at passenger boarding. Open-loop payments accept all forms of digital payments, including credit and debit cards, and mobile “wallets”, such as Apple Pay. They use near field communication (tap-to-pay) in transactions and do not require pre-paid tickets or other fare media specific to a transit operator.

Open-loop payments have the potential to provide more efficient boardings with lower idling times for transit vehicles, and to reduce some costs to agencies associated with the collection of cash payments. However, these systems present challenges for some passengers as well as the transit agencies themselves. In this study we explore the intersection of passenger-related concerns and other challenges that are notable for transit agencies when considering this type of payment system.

We conducted a survey of transit operators in California and received 21 responses (each representing one agency). Though the sample size is small, there are some notable patterns in the responses that provide insight into passenger-related challenges and other potential barriers to transit agency adoption of open-loop payments. In this report we summarize the outcomes of our initial survey.

The agencies participating in the study consist of 11 rural agencies (all with fewer than 25 vehicles, except one that has 50-99), 2 regional (one with 100-249 and the other with 250-499 vehicles) 2 suburban (one with 25-49 and the other with 100-249) and one urban (with 100-249 vehicles). The remainder indicated “other”, and all reported that they are a mix of urban and rural areas; these all have 50-99 vehicles except one that reported fewer than 25 vehicles.

Findings

Though no agencies in our sample have already implemented open-loop payments 3 agencies, about 15% of the sample, report that they are currently implementing open-loop payments. In addition, 80% of the sample is considering it or has considered it in the past. Overall sentiments towards open-loop payments were positive among our participants, however challenges with these systems were identified. When asked about their agreement with the impacts of open-loop payments systems, notable results include:

- A total of 71% of the survey participants agree or strongly agree open-loop payments would improve operational efficiency.
- 50% agree or strongly agree that open-loop payments would help passengers transfer more easily between agencies. Similarly, 50% *disagree* with the statement that open-

loop payments would increase the risk of passenger robbery, while nearly all remaining participants (44%) neither agree nor disagree.

- Participants were also split, when asked whether open-loop payments *would not meet* the needs of passengers (45% disagree vs. 35% agree).
- Half of the respondents (50%) are neutral when considering whether open-loop payments would improve discount eligibility, although many (31%) also disagree.

When asked about challenges related to open-loop payments:

- Technological complexity and backend payment infrastructure were the most frequently selected challenges of open-loop payment systems (65% of the sample selected each of these).
- The next most selected items included the cost of equipment (60%), staff or other capacity limitations (55%), concerns about rider experience (55%), and equipment installation (50%).

Open-loop payment systems do not necessarily mean cash will no longer be accepted, however one of the goals of this study is to evaluate the ease with which agencies expect current passengers to transition away from cash in the context of open-loop payments. The most important passenger-related challenges, as reported by the agencies that took the survey, are new technology and banking. The four statements most frequently selected (and the number; followed by the percent of agencies selecting the item) were:

- Lack of familiarity with new technology (18; 86%)
- Lack of a bank account, cards, or mobile devices (13; 62%)
- New technology does not meet the needs of passengers (13; 62%)
- Difficulties obtaining bank accounts, cards, or mobile devices (10; 48%)

In addition, respondents reported their perceptions of sentiments towards open-loop payments among other groups connected to their agencies. Overall survey participants consider these groups to be supportive as follows: planners (81%), the board (58%), operations (56%), information technology staff (50%), regular (50%) and infrequent passengers (54%), as well as the local government (64%) and community organizations (58%). For each group the remainder of the agencies reported neutral, e.g., neutral for planners was selected by 19% of respondents. “Does not support” was selected in only two instances: by a single agency for regular passengers and another single agency for IT staff.

The agencies that participated in our survey have positive perceptions of open-loop payments and the ability of their agency and passengers to adopt and adapt to these systems. Indeed, 15% of our sample is currently implementing open-loop payments. Transit agencies are interested in open-loop payments, but they likely need assistance to implement these systems. A maximum of 21% of the sample is “not interested” in each of these Cal-ITP programs: GTFS-Realtime data analysis, automating discount eligibility verification, operational data standards,

master service agreements, and procurement assistance. These and potentially other assistance programs may lead more of California’s transit agencies to adopt open-loop payments.

Introduction

Digital payments are increasingly popular across many industries and have been adopted by transit agencies throughout the world. These systems have many benefits, including improved passenger experience, more efficient boarding, safety for drivers, discount verification, and fare validation. However, in the US, digital payment systems typically serve one operator, or a limited regional network of operators, and are closed loop. In other words, the cards or apps used within the system cannot be used anywhere else, and you need a specific card or app to use the system. In addition, save a few agencies in the largest US cities, current implementation requires agencies to continue to allow cash payments at boarding and/or at payment kiosks. In many cases, the locations where value can be added to physical tap cards are limited, adding an extra step for those passengers who rely on paying with cash. This can also lead to missing your ride while waiting to purchase more fare. Thus, although cash provides a mechanism for riders who are underbanked or unbanked to access transit services, cash is not seamless for transit operators or passengers. In the present study, we consider open-loop payment systems that would operate without a cash alternative, in order to assess the ability of agencies to transition to this type of system.

Open-loop payments are an alternative and give agencies the ability to let go of cash payments and allow passengers to use transit without having to factor in time to purchase a fare-card, load up their existing card, download an app, or any other steps prior to boarding. Passengers are able to use a form of payment they already carry with them (whether phone-based, watch based, or a credit/debit card). Un and underbanked passengers, may not have traditional credit and debit cards, but there are an increasing number of alternatives including prepaid debit cards, peer-to-peer apps that work like digital cash, many of which have cards associated with the accounts that can be used like debit cards. For fare payment integration to work at the statewide scale and provide the most benefit to end-users, the open-loop systems that will allow payment processing using riders' credit or debit card, prepaid cards (i.e., Visa debit cards), or phone-based payments should be adopted by all of California's transit providers.

The California Integrated Travel Program (Cal-ITP) envisions a seamless fare payment system for all of California's transit passengers and agencies. Cal-ITP was launched in response to 2004 California legislation to make transit travel seamless. In addition to open-loop payments Cal-ITP aims to automate passenger discounts and to standardize transit information throughout the state with Global Transit Feed Specification (GTFS) and a number of relevant extensions including GTFS-RT, or real time (Cal-ITP n.d.) All of these efforts will enable passengers to easily plan travel even when they will use multiple transit operators, or travel throughout the state. In particular, automated discounts will reduce the burden on travelers eligible for age-based, veteran, or income-based discounts as these will be verified through the payment system, rather than burdensome processes unique to each agency. Open-loop payment systems will also remove the challenges associated with providing cash payment options tied to agency-specific cards. For passengers who still rely on cash, there are fewer restrictions (than there are for agency-specific transit cards) on the use of cash to add value to pre-paid debit cards and other similar services in an industry that is developing to meet the needs of the

un/underbanked. Un- and underbanked passengers will no longer be restricted to using transit-specific cards for transit; they too can use payment mechanisms already familiar to them and will not need to take extra steps prior to boarding, just to be able to use transit.

While there are there are many potential benefits of open-loop payments for transit, agencies are not able to adopt and implement these new systems overnight. Introducing this technology throughout the transit systems of California will require updating and integrating hundreds of agencies serving different types of passengers, geographies, at different scales, and with different levels of capacity and knowledge. Key stumbling blocks include how to a) equitably transition away from cash payments; b) streamline discount verification procedures; and c) understand the options for implementing affordable open-loop fare collection systems, including hardware and software requirements. Some argue that the digital options may be easy for transit operators to implement because the technologies have been designed to use across many industries and are increasingly small in size. However, even these smaller devices may be difficult to implement at scale and may remain expensive for smaller agencies.

How these challenges intersect with the needs and abilities of each particular transit agency, as well as their passengers, is an open area of inquiry, given the significant diversity in agency size, demographics, and technical capacities. Other challenges include coordinating the needs of individual agencies with state efforts such as the resources provided by Cal-ITP. This study explores how transit agencies view their ability to get on board with open-loop payment systems. In this report we enumerate the challenges identified by our respondents.

Literature Review

Public Transit Payment Options

Transit agencies in California accept a myriad of means of payment, including cash, agency specific cards, cross-agency cards, phone apps, credit/debit cards, tickets, etc. Some agencies accept multiple types of payment while others have standardized payment methods. This large variety of options creates confusion and slows down the boarding process in the transit system. Payment options fall into the categories of either closed-loop payment, those that can only be used in the transit environment, or open-loop payment, those that can be used anywhere, and there are benefits and drawbacks to both types.

Closed-loop payment systems refer to those that can only be used within the transit environment such as agency specific cards, apps, or tickets. Previously, paper tickets and tokens were commonly used in the transit environment, but technologies such as magnetic stripe cards, smart cards, and app-based systems are now widespread (Wallischeck, 2015; Blumgart, 2013). Closed-loop systems can be used only in the transit environment and offer benefits to transit operators such as ease of use, internal payment processing, and ability to monopolize the payment instrument (Zamer, 2018). However, closed-loop payment systems can create future challenges such as operational overhead to update the systems, vendor control, resource overheads, inconvenience to riders, and potential revenue loss (Zamer, 2018).

Agency-specific mobile phone applications are one closed-loop payment option that can be used for transit payment. A survey of bus riders and operators in Florida found operators observed lower boarding times among app users and riders spent less time purchasing transit passes (Brakewood, 2020). Apps can also be used to plan trips, view maps of different routes, and stations, and provide real-time information about arrival time; however, these apps are often unreliable, require customers to be aware of and download each app, and are typically not usable across agencies (Cal-ITP, 2020); apps may also require the creation of an account, email verification, adding a payment method and loading funds into the app. Other challenges for passengers might include not having access to a smart phone and/or a data plan, as well as not having an easy way to add value to their account in the app—for instance, if a credit card is required. For those who are less familiar with the use of smart phones, such as the elderly, these apps may also be less accessible. Many apps may also require visual validation by vehicle operator (Brakewood 2022).

Smart cards offer faster processing speeds than previous fare technology and provide ridership and travel data while working across multiple transit operators (Iseki et al, 2007). Smart cards provide useful and prolific data for planners and researchers that can be used to improve service planning and understand travel behavior, although the data collected does not include demographic information or trip purpose the way travel diaries and surveys do (Pelletier, 2011; Faroqi, 2017). Many of the benefits mentioned for the transit smart cards would be found within open-loop payment systems as well such as seamless travel for riders, convenience for users, reduced need for cash, ability to accommodate different pricing structures, and some data collection (Iseki et al, 2008; Pelletier, 2011).

Smart cards, apps, magnetic stripe cards, and other existing closed-loop payment systems on transit can create inefficiencies within the system that negatively impact riders and transit agencies. Closed-loop payment systems are not necessarily compatible with different closed-loop payment systems at other agencies and adding additional agencies to a system can be difficult since it requires the agency to purchase the new fare system (Wallischeck, 2015).

Open-loop payment systems are those that can accept a number of payment options including credit and debit cards, smart-phone applications, and wallets as well as other devices that are not specific to the transit agency. Open-loop payment systems can be defined as: “A fare payment system that can accept third-party payment media, such as bankcards. Open industry interface standards and specifications are often used” (Brakewood 2022). These systems are used in many industries across the world and allow users to pay with a means they likely already carry with them. Removing the need to have any of the other agency specific payment mechanisms noted above, including an app, a card, or a paper ticket. Additionally, open-loop payment systems are universally compatible with other open-loop payment systems, can create time savings for users, allow easy transfer between agencies, and can encourage ridership (Wallischeck, 2015; Cal-ITP, 2020).

Nonetheless, open-loop payment systems can create access barriers and equity concerns for riders who are un- or underbanked. An unbanked person is someone who does not have a checking or savings account with an insured institution and an underbanked person is defined as someone who has access to a checking or savings account but regularly uses alternative financial services (Library of Congress, nd). For these individuals, open-loop systems may not be as accessible.

Some of the equity concerns related to open-loop payment are inherent to existing closed-loop payment systems as well. Distribution of reloading stations can pose inconveniences for cash-reliant users and can have privacy concerns with data usage. Both systems have the potential to accept cash alongside other means of payment, and the challenges with accepting cash for the agencies are not expected to differ substantially between the two, when offered in tandem.

Cash Usage and Equity

Cash is a well-accepted method of transit payment in many systems and is accessible to un- and underbanked riders. Cash payment is often offered alongside closed-loop payment cards, or passengers are able to use cash to add value to agency cards and accounts. However, cash can create considerable administrative costs for agencies and security concerns for drivers.

Understanding the needs of un- and underbanked transit users in California is an important component to changing the fare payment mechanisms.

Un- and underbanked people tend to be lower-income, more likely to be unemployed, and more likely to be disabled than the banked population. In addition, at every income level larger percentages of Black households than white households are unbanked and larger percentages of Hispanic households than white households are unbanked (FDIC, 2021). Disparities in banking access can worsen disparities in access if new payment mechanisms are implemented

without accounting for differences in banking access. There are a number of reasons that individuals may be unbanked, ranging from lack of trust of financial institutions to uncertainties in account balances and unexpected fees (FDIC, 2021).

In 2021, five percent of Californians were unbanked and 13.9% were underbanked (FDIC, 2021). In the transit environment, the un and underbanked rider demographics follow similar patterns of un and underbanked people in general. In a survey of Chicago transit riders, it was found that Black and Hispanic transit riders were more likely to be unbanked and that riders without bank cards tended to be those with lower incomes, lower levels of education, and higher rates of unemployment. Bank card usage was also lower among bus users (Brakewood and Kocur, 2013). Golub et al. (2022) surveyed riders in three cities and found 30% of them relied heavily on paying cash on board. Cash preference and reliance among users is not an insurmountable barrier to implementing open-loop payment, but an obstacle to address in program design.

In a survey of un- and underbanked transit riders in California, Pike and D’Agostino (2022) found that a majority (78%) unbanked transit riders would be interested in using alternatives to cash payments. To ensure equity and access for un and underbanked users in the New York City transit system, Perlmutter (2015) recommended ensuring adequate coverage of locations to purchase and reload transit prepaid cards, providing an outreach campaign for un- and underbanked users on how to maximize benefits of open-loop payment while avoiding fees associated with prepaid cards, and expanding regulatory capacity over the consumer finance sector. While some of these recommendations fall outside of the jurisdiction of Cal-ITP, understanding transit agency concerns with respect to meeting the needs of their un and underbanked users can help Cal-ITP provide appropriate support to agencies.

Discounts

Fare pricing structures vary dramatically between transit agencies and fare pricing structures have implications for equity and accessibility, particularly for low-income transit riders. Wallischek (2015) identified eleven different fare types for TCRP 177, “Preliminary strategic analysis of next generation fare payment systems for public transportation.” Brown (2018) evaluated transit equity by fare type in Los Angeles and found that under current fare structures, low-income riders pay higher per-mile transit fares than higher-income riders. The final recommendation provided to improve equity was discounting per-mile fares for low-income transit riders, which mirrors recommendations by Perrotta (2017). However, discounts for low-income riders are less common than discounts for seniors, people with disabilities, and Medicare cardholders (Saphores et al, 2020; Darling et al, 2021).

All transit agencies that are federally subsidized are required to provide discounts for seniors, people with disabilities, and Medicare beneficiaries (FTA, 2022). Specifically, FTA states that, “Under 49 U.S.C. Section 5307(d)(1)(D) of the Federal Transit Act, federally subsidized transit providers may not charge more than half of the peak fare for fixed route transit during off-peak hours for seniors, people with disabilities, and Medicare cardholders (FTA, 2022).” While discounts based on income are less common than discounts for seniors, people with disabilities, and Medicare cardholders, they are one option for increasing the equity of fare pricing

structures at transit agencies (Saphores et al, 2020; Darling et al, 2021). Systems that streamline eligibility and relieve administrative burdens for discount provision may encourage transit agencies to implement discounts for low-income riders.

Cal-ITP is creating a centralized discount eligibility system that will streamline the process for verifying discount eligibility (Cal-ITP, 2022). Through the Cal-ITP Benefits web application riders can link existing discounts with the card they use to make transit payments (Cal-ITP, 2022B). Currently, Monterey-Salinas transit has connected their discounted fares for passengers 65 and up with their pilot of open-loop payment (Phillips, 2022). California is one of the first states to use Login.gov, from the federal government, to verify age and identity in order to connect transit discounts with open-loop payment (Mass Transit, 2022).

Methodology

This study examines the concerns and challenges of transit agencies when considering the adoption of open-loop payments systems and discontinuing acceptance of cash payments at vehicle boarding. In the fall of 2022, a survey was conducted among a small sample of California's transit agencies. The survey was informed by informational interviews, and through conversations with members of the California Integrated Travel Program. Due to the small sample size, the analysis presented here is largely descriptive.

Survey Development

Informal interviews were conducted with a small set of transit professionals to guide survey development. The major themes that emerged, and that were incorporated into the survey were open-loop payment implementation challenges, cash use among riders, discounts, and barriers to utilizing GTFS-Realtime and other Cal-ITP resources.

The survey also built on the work of others addressing similar research questions. Many of the survey questions in the discount section were based upon Saphores' (2020) survey of California transit agencies and used the same language and question type as Saphores' survey questions. Questions from this survey were included in our survey in order to compare results from the two surveys and allow a temporal comparison between transit operations surrounding discounts in 2018-2019 and 2020-2021. Questions about enrollment process and eligibility requirements for discounts were based on the results of Darling et al.'s (2021) multiple case study of US transit agencies. They collected information from the 50 largest US transit agencies, so the results provided insight into commonly used enrollment and eligibility processes upon which to base multiple-choice options. In the cash preference section, the questions focused on understanding the persistence of cash acceptance at transit agencies.

The survey content is summarized here:

Section 1. The survey opened with several questions about the location of the agency (urban, rural, etc.), and the number of vehicles and types of services provided by the agency.

Section 2. This section covered agency preferences and experience with open-loop-payments.

Section 3. Cash payments: aimed to assess how reliant the agency's passengers are on payments using cash.

Section 4. The discount section of the survey starts with general questions about the types of discounts offered. The general questions were included in order to gauge the current discount landscape among California transit agencies, and then focuses on questions about low-income discounts.

Section 5. This section asked about the adoption and use of the Global Transit Feed Specification (GTFS) and GTFS-Realtime.

Section 6. Awareness of the programs offered by the California Integrated Travel Program (Cal-ITP) to support agency transition to open-loop-payments as well as other elements of Cal-ITP.

Survey Recruitment

The survey was sent out to a convenience-based and random sample of California transit agencies. Cal-ITP provided their 5311 list of contacts. This was merged with the list of California transit agencies that report to the National Transit Database (NTD). This included a total of about 240 unique agencies. Those that were not on the 5311 list were randomly assigned a number from 1-5 and those with a 1 were added to the survey sample along with each agency identified in the 5311 list. This included 42 agencies from the NTD list and another 81 on the 5311 list, about 120 agencies all together. With 21 total respondents, we have a response rate of approximately 17%.

Contact information was found through agency websites and by calling publicly listed agency phone numbers. Survey recruitment was not aimed at a particular type of agency, nor based on agency size or other characteristics, however the initial sample of agencies invited to participate in the study likely has some selection bias. First, the NTD only requires large agencies to report data; there are about 220 in California. Smaller agencies are not on that list. Conversely, most of the agencies on the 5311 list provided by Cal-ITP were not on the NTD list so the gap was partially filled by these smaller agencies. However, those agencies on the 5311 list have had some communication with Cal-ITP either related to open-loop payments, GTFS or other aspects of Cal-ITP's programs. The sample of agencies that participated in this study sheds light on the perspectives of smaller and more rural-serving transit agencies.

A series of three emails were sent to intended survey participants using mailmerge on Google Sheets and Gmail. The recruitment email and follow-up email are attached in Appendix A. Recruitment Material. The first email was sent on the morning of October 26th, and reminder emails were sent in early and mid-November. Emails that bounced back with out-of-office messages were sent follow-up emails at an appropriate date.

Data Privacy and Cleaning

The data was collected using the Qualtrics platform. An alphanumeric key was added to each response. All identifying information was removed from the results and added to a locally saved file with only the old key. A third file that matches the old and new identifying key was saved only on a password protected local computer. Finally, the order of all three files was randomized in excel. All data analysis was performed on the anonymized data with the new alphanumeric key.

Results

As of the writing of this report 21 agencies had participated in the online survey. Recruitment for this study will continue. And, while this is a small sample, there are some patterns in the responses that are notable, and these are presented and discussed below.

Agency Characteristics

Survey respondents tended to be rural agencies with fewer than 25 vehicles in their fleet. Figure 1 shows the percentage of respondents from agencies that characterize themselves as rural, urban, suburban, regional, or a mix of urban and rural. Half of the responding agencies are rural, 2 (10%) are regional, 2 (10%) are suburban, and 1 (5%) is urban. However, 5 respondents (20%) indicated their agency serves a mix of urban and rural.

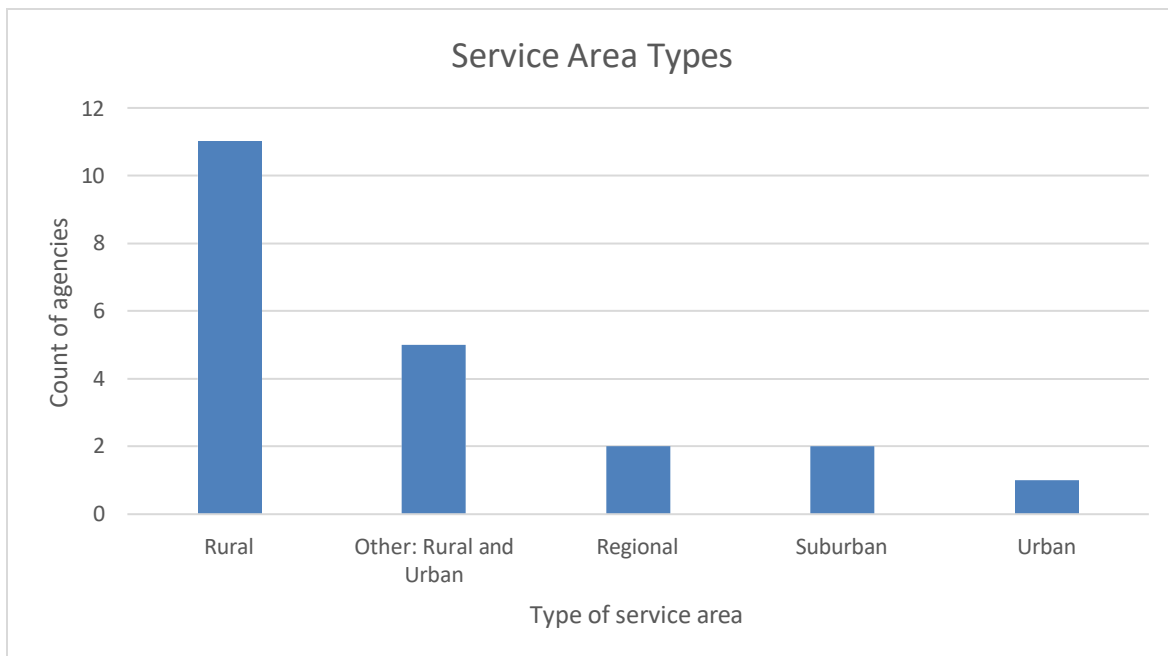


Figure 1. Agency service area type (N = 21)

Figure 2 shows the agency size by number of vehicles in their fleet. Half of the respondents indicated their agency has under 25 vehicles in the fleet. A quarter of respondents indicated their agency has 50-99 vehicles in the fleet.

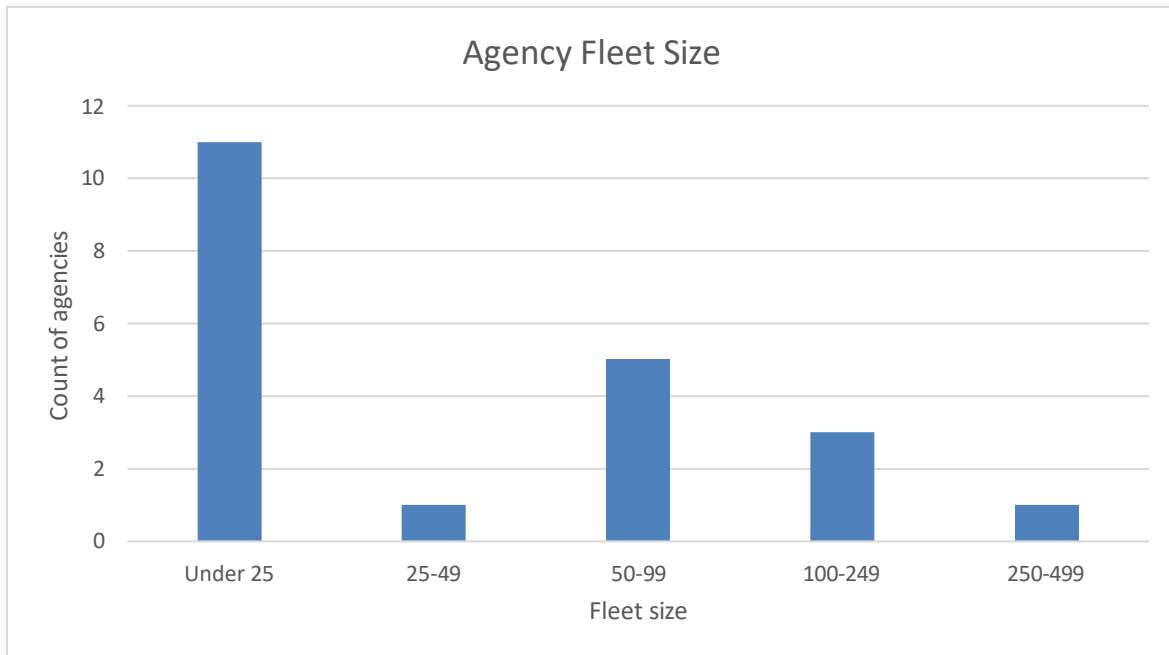


Figure 2. Agency size by number of vehicles in fleet (N = 21)

Respondents were asked which mode types they operate and could pick multiple choices among bus, light rail, heavy rail, paratransit, ferry, on-demand/flexible service (other than paratransit), or other (with text entry). Most of the respondents, ninety-five percent (95%) operate bus, fifty-five percent (55%), operate paratransit, and forty percent (40%) operate on-demand/flexible (other than paratransit). Light rail, heavy rail, and ferry are not represented by the survey respondents.

Current Payment Methods

Turning to currently accepted payment methods, Figure 3 shows which payment methods are accepted at any point in the ticketing process, by the responding transit agencies. Cash is accepted at all agencies that require fares¹, Credit and debit cards and checks are accepted by about half of the agencies while ACH is accepted by only one of the agencies that participated in the survey.

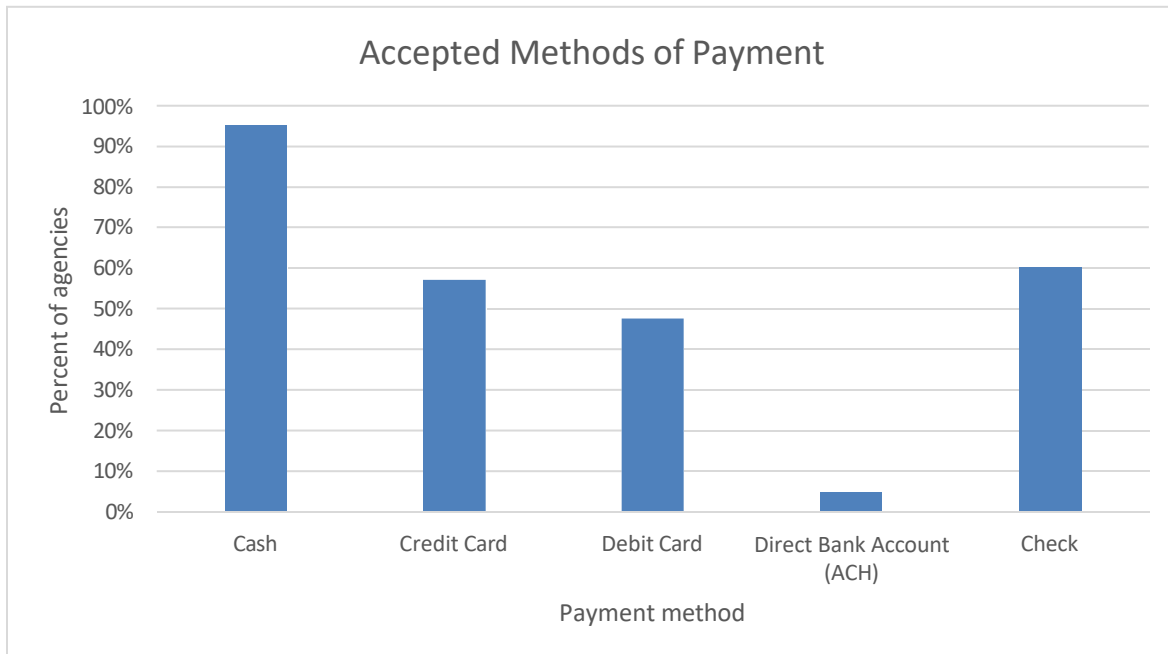


Figure 3. Payment types accepted by transit agencies (N = 21)

Below, we present the locations that each payment method may be used to pay for transit, including purchasing and adding value to fare cards (Figure 4). Only the four most common payment methods (cash, check, credit, and debit) are displayed. The percentages are based on the number of agencies that indicated that payment method is accepted (shown in parentheses for each payment method). Agencies could select all that apply for these questions. Of those agencies that accept checks as a payment method, 92% accept checks at an agency office.

¹ One agency responded to this question by reporting they are fare free, however they later indicated other means of collecting fares; this inconsistency in responses may be due to a temporary fare-free structure.

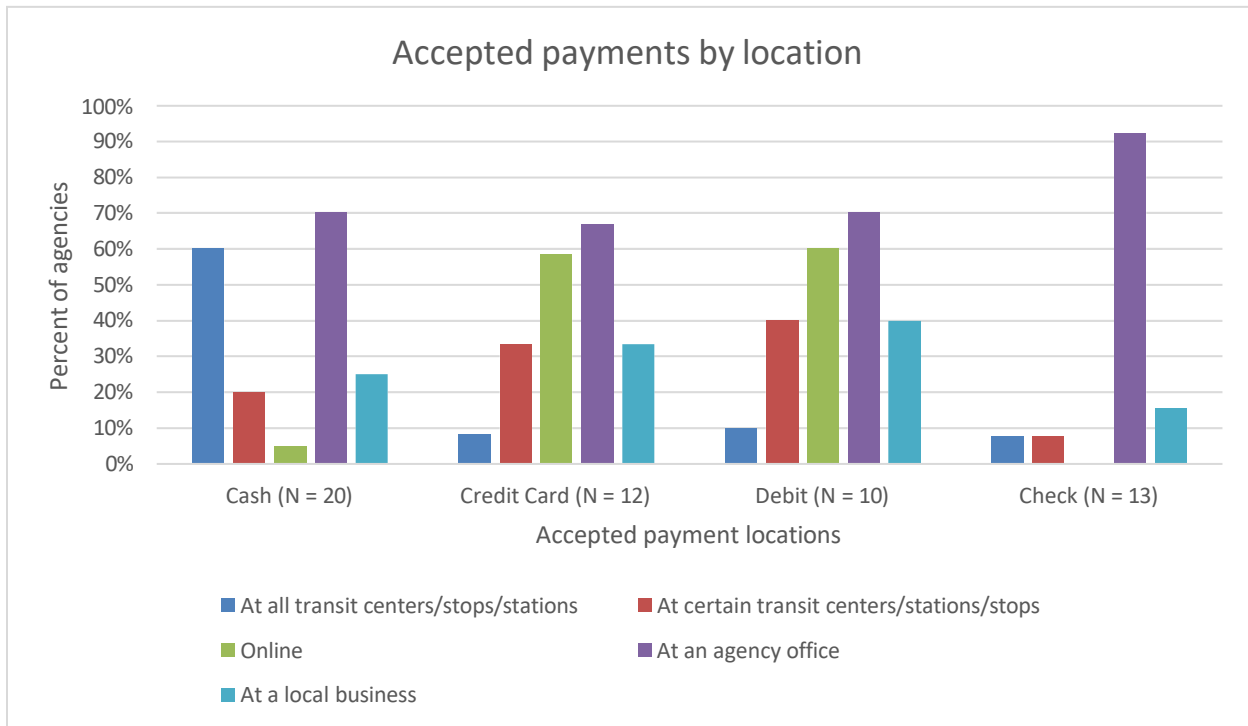


Figure 4. Methods of Payment Accepted at Transit Agency Locations (N = 21)

Cash and credit cards are accepted more widely across transit agency locations than the other means of payment. Debit cards are also accepted at many locations whereas checks are typically accepted only at an agency office.

In addition to payment methods accepted for the purchase of tickets, survey respondents were asked which payment methods accepted immediately before/after boarding and were provided the following options (check multiple):

- Smartphone or smartwatch tap payment
- Smartphone non-tap payment (in-app purchase)
- Agency-issued tap card
- Agency-issued magnetic stripe card
- Agency-issued passes that require direct operator validation
- Credit/Debit card tap to pay (NFC)
- Credit/Debit card swipe
- Physical tokens
- Cash
- Other

All of the responding agencies except for one, accept cash immediately before/after boarding. Other means of payment that are accepted, include agency issued passes (8 out of 21), tap

cards (6 out of 21), smartphone in-app purchases, i.e., mobile tickets (5 out of 21), and magnetic stripe cards (4 out of 21). In addition, two agencies reported accepting tap to pay with a phone or watch. This is likely with an in-app purchase, rather than a smart wallet, as Figure 5, below shows that none of the agencies in our sample have implemented open-loop payments as of yet.

Open-loop Payment in California’s Transit Agencies

Respondents were asked whether their agency has implemented or is in the process of implementing an open-loop payment system. Figure 5 shows none of the responding agencies have fully implemented open-loop payments, however four agencies (14%) are in the process of implementing and eight (38%) are currently considering open-loop payments.

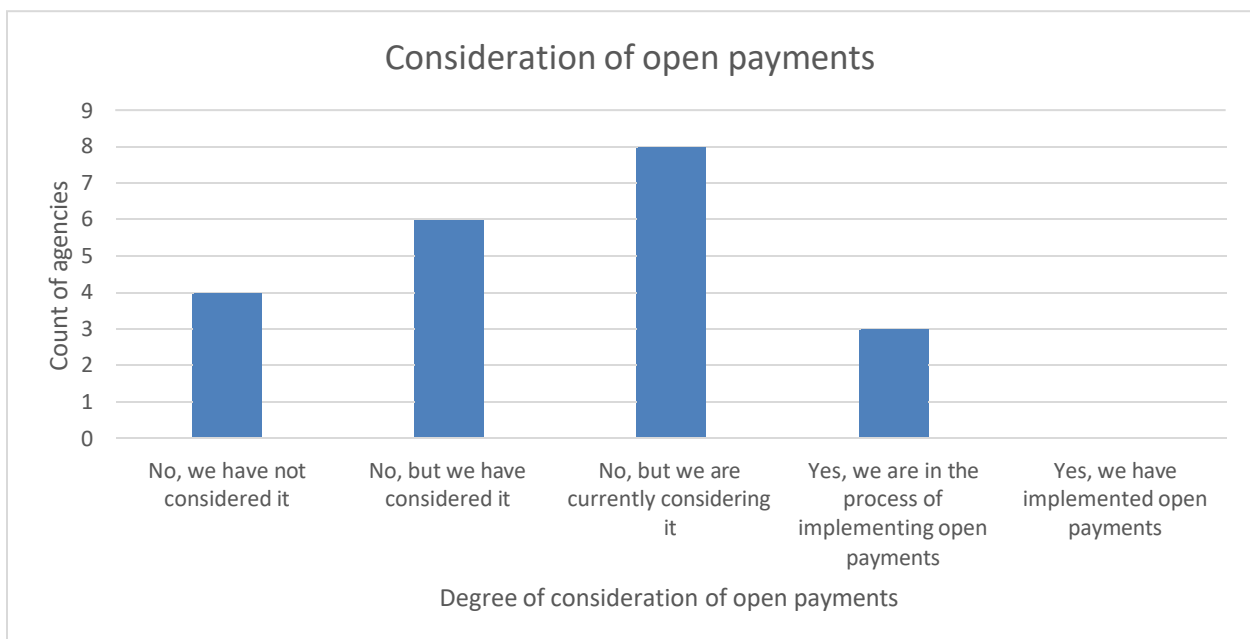


Figure 5. Count of respondents considering open-loop payment systems (N = 21)

Challenges to Implementing Open-loop Payment

Figure 6 (below) shows the percentage of respondents that indicated the following challenges they have faced or expect to face with open-loop payment implementation. In this question they could select as many challenges as were relevant to them (later we asked for the top challenges). Technology and infrastructure constraints were more frequently selected by the agencies in our sample, than other challenges such as contracts, internal factors excluding staff capacity. Concerns about riders were also reported by more than half of the agencies.

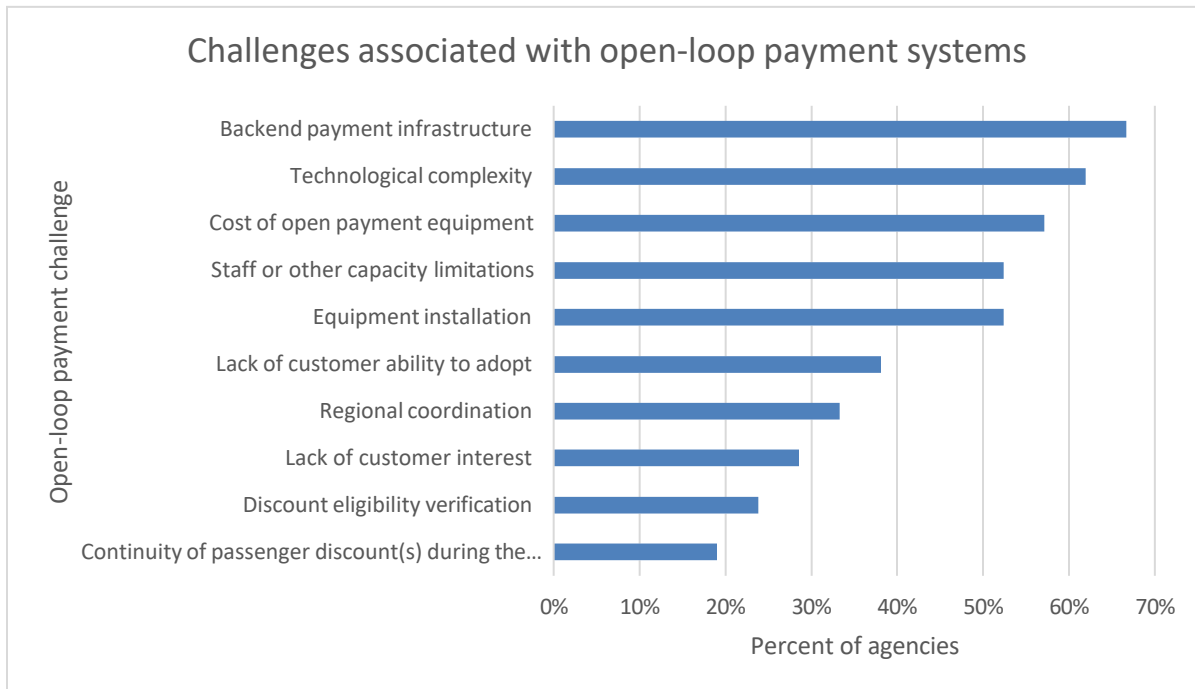


Figure 6. Challenges to open-loop payment implementation (N = 21)

Figure 7 shows which challenges were selected by at least fifteen percent (15%) of respondents as one of the top three most important or challenging barriers to open-loop payment implementation. In other words, each agency could select their top three concerns, and those presented in Figure 7 were selected by 15% or more of the respondents. Top challenges are related to technological complexity, the cost of equipment, backend infrastructure needs, and staff capacity.

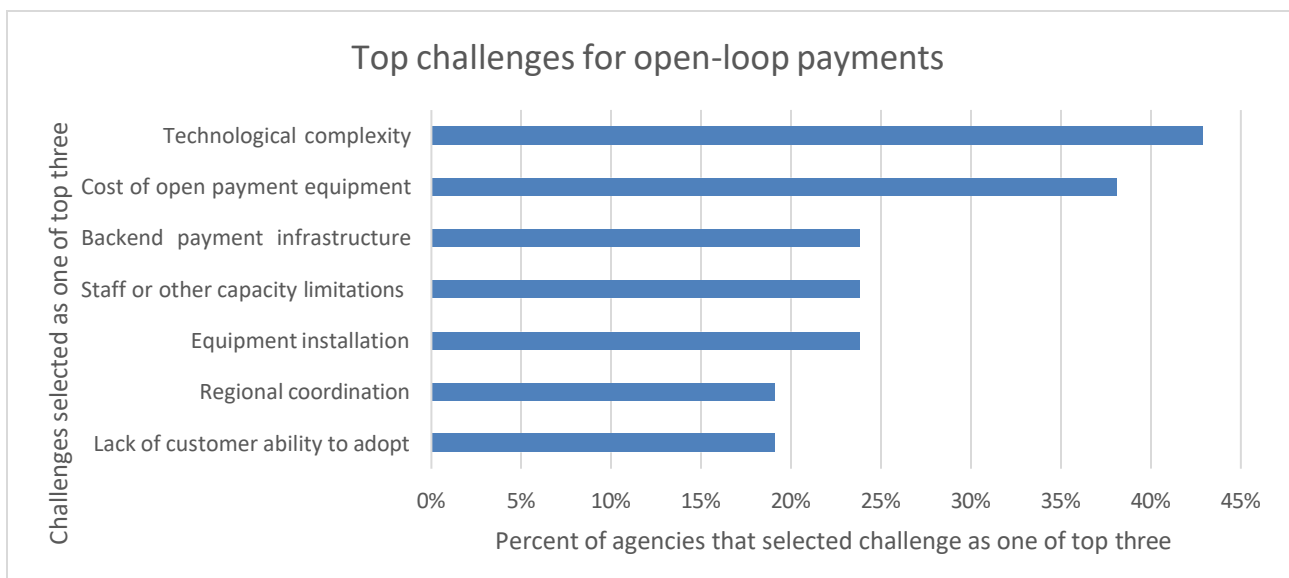


Figure 7. Top challenges to open-loop payment implementation (N = 21)

Half of the responding agencies had fleets smaller than 25 and half had fleets larger than 25 but smaller than 500. The top three challenges listed for implementing open-loop payment were compared between these groups to find differences in agency size versus challenges faced. Figure 8 shows what the top challenges to open-loop payment implementation were by agency size. Both small (fleet size < 25 vehicles) and medium (25 < fleet size < 500) agencies picked technological complexity as a top challenge.

Cost was a top concern for fifty percent of small agencies and only twenty-two percent of medium agencies. Although the small sample size makes it difficult to reliably estimate statistical differences, we would expect this challenge to be a concern for smaller agencies in general. Interestingly, staff or capacity limitations was selected by a higher proportion of medium sized agencies. This may be because these agencies lack the resources of large agencies but have greater service areas and more demands on them than smaller agencies.

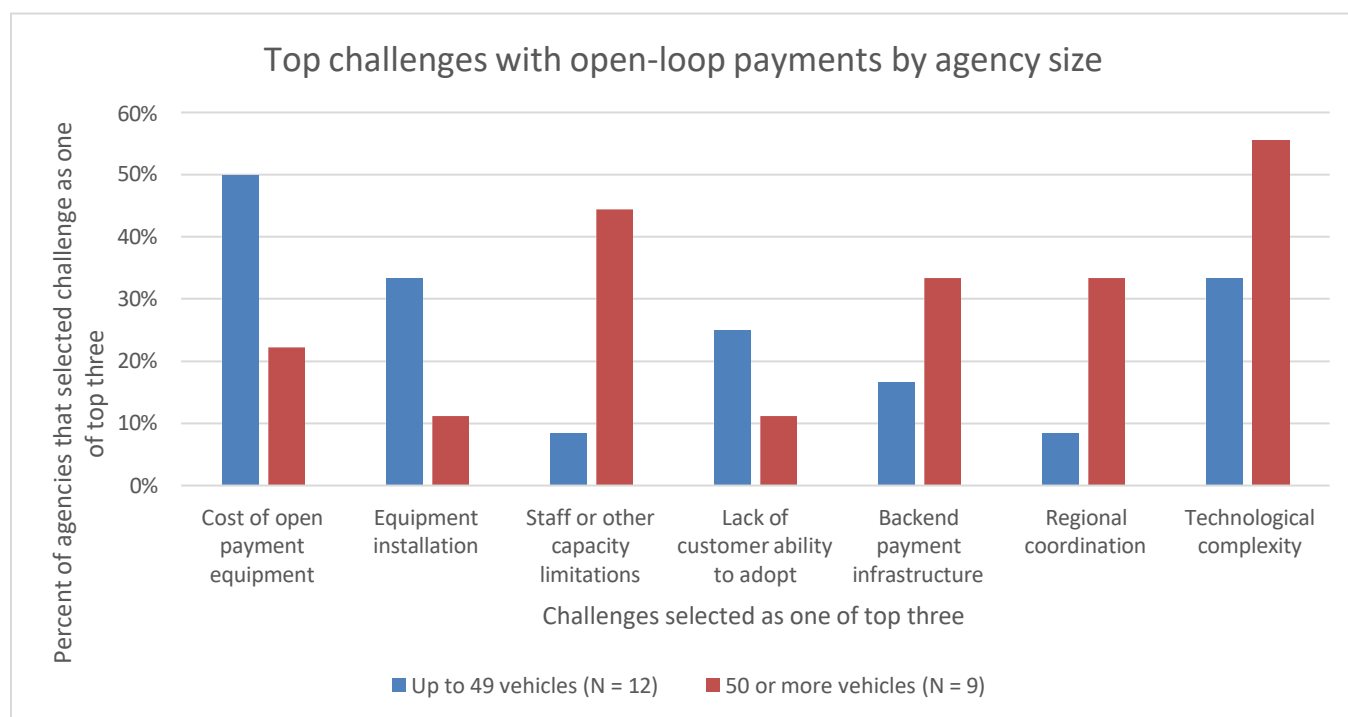


Figure 8. Top three challenges to open-loop payment implementation by agency size

Sentiments about Open-loop Payment

Figure 9 shows how respondents felt about certain risks and benefits of open-loop payment systems. The majority of respondents (71%) agree or strongly agree that open-loop payments will improve operational efficiency, while approximately half of the agencies agree that they will make transfers easier for passengers. These positive sentiments are also reflected in their disagreement with the statements: open-loop payments “increase the risk of passenger robbery” (50% disagree or strongly disagree) and “do not meet the needs of passengers” (45% disagree or strongly disagree). Agencies were more neutral when considering discount eligibility verification (50% neither agree nor disagree) and data or privacy concerns (44% neither agree

nor disagree), and had somewhat more negative perspectives on saving the agency money (38% disagree or strongly disagree).

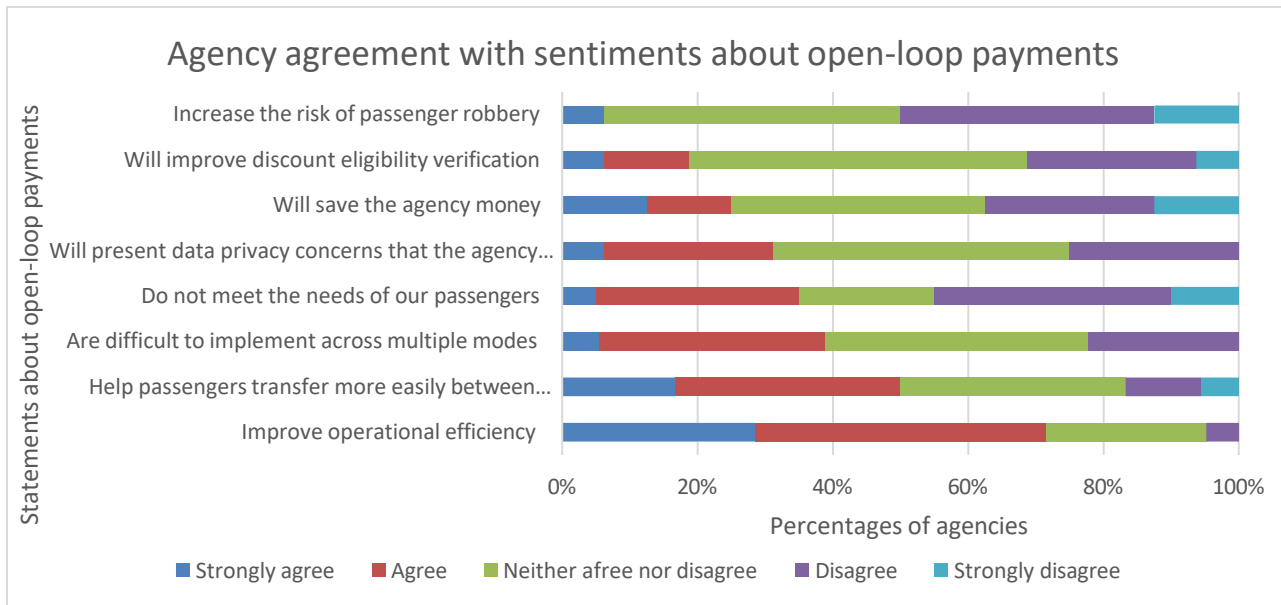


Figure 9. Sentiments about implementing open-loop payment systems (N = 21)

We also asked agencies to tell us how supportive various groups associated with the agency are towards open-loop payments. Though there was some variation in how many agencies responded, half or more than half of those responding to each question reported that the indicated group strongly supports or supports open-loop payments, while the remainder are neutral. There are only two instances of a response that any group does not support open-loop payments: first, regular passengers, and second the information technology (IT) team within the agency. Figure 10 shows how supportive agencies believed certain constituents would be of open-loop payments (and the number of agencies responding for each constituent group).

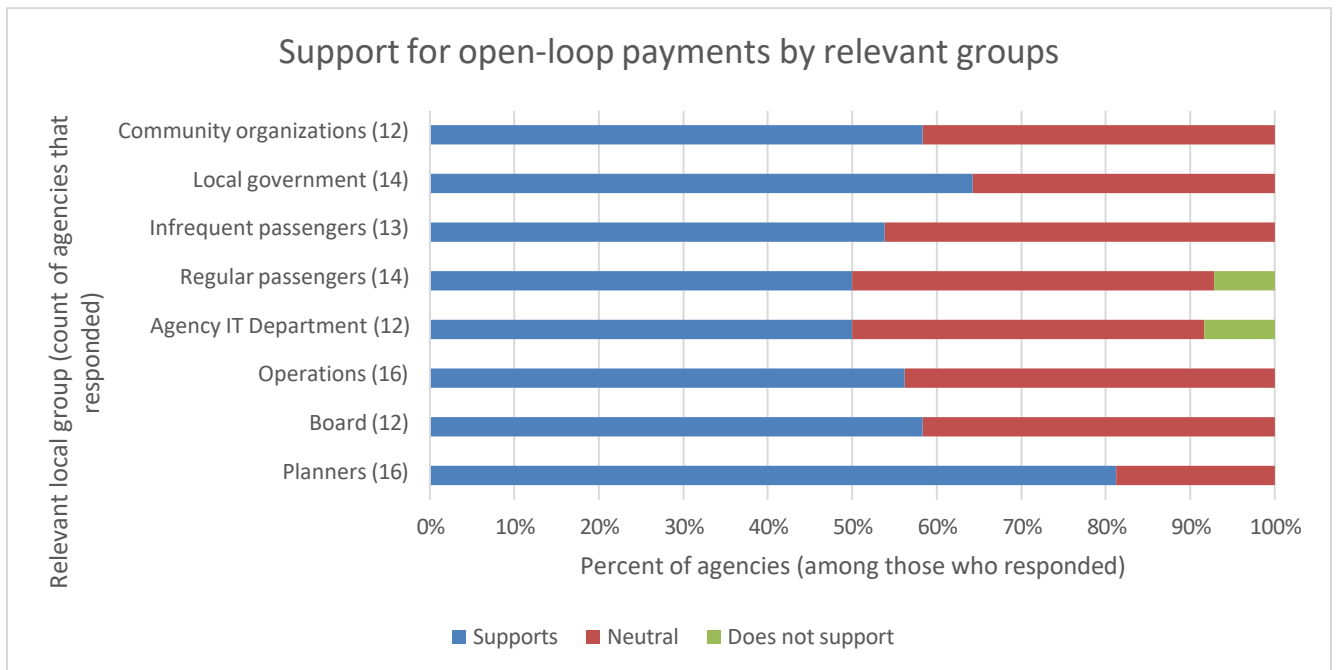


Figure 10. Support for open-loop payments among groups connected to the transit agency¹
¹(All 21 agencies responded to some of these questions, but the sample size is shown for each specific item)

Challenges with non-Cash Payments for Passengers

Turning to the potential for passengers to transition away from payments with cash; our respondents were asked to select the challenges that would prevent passengers from making this transition. The most selected options were lack of familiarity with new technology, lack of bank accounts, and new technology does not fit meet passenger’s needs. We also asked them which of those reasons affected more passengers (as opposed to the top three for the agency above) and the lack of bank accounts was selected by half of the agencies that answered this question.

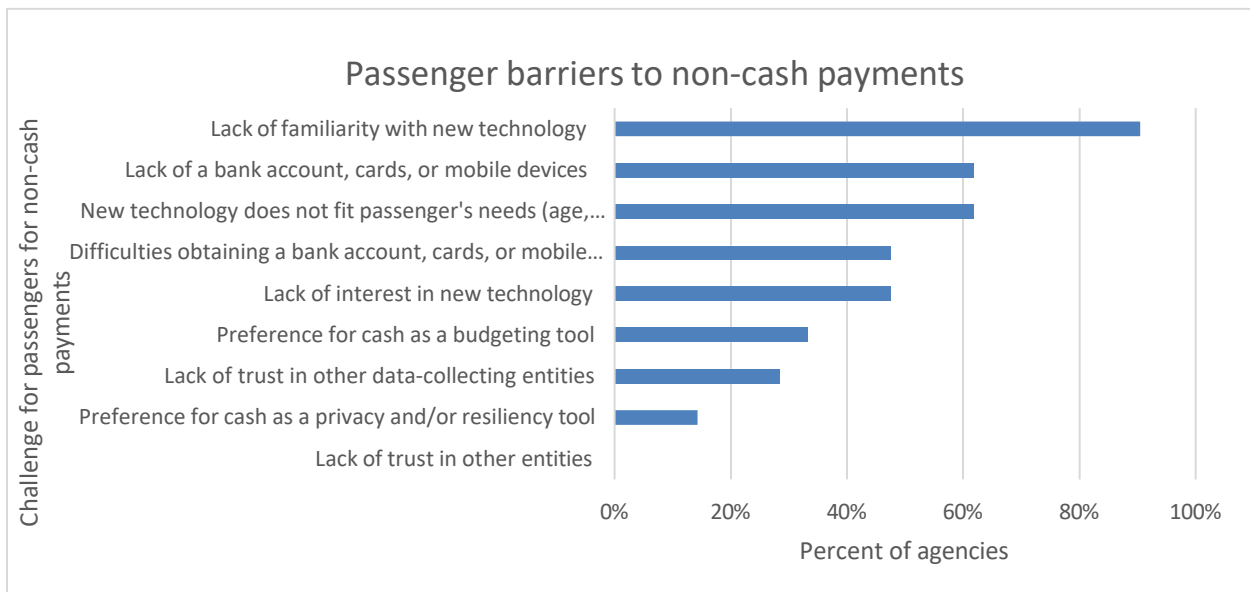


Figure 11. Passenger challenges in transition away from cash acceptance (N = 21)

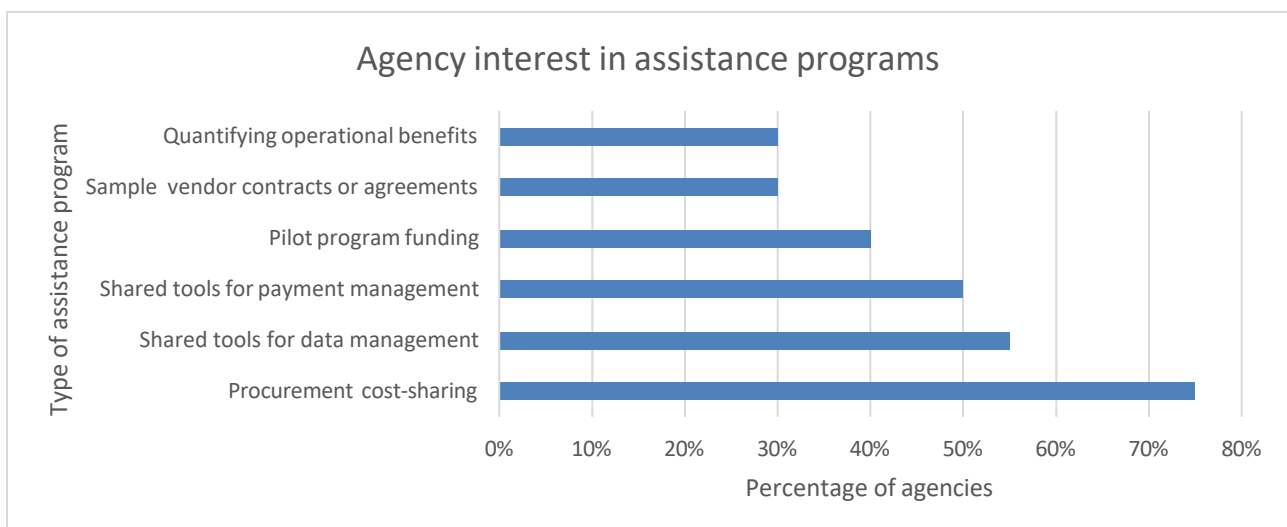


Figure 12. Agency interest in open-loop payment assistance programs (N = 20)

When asked about potential programs that would support agencies to implement open-loop payment systems, and these are somewhat in line with the things offered by Cal-ITP the majority (75%) of agencies would like to see procurement cost-sharing; that is some form of funding assistance for the technology, software and/or services required to run open-loop payments. In addition, about half of the agencies are interested in shared tools for payment (50%) and data management (55%). Smaller though not insignificant numbers of agencies are interested in pilot program funding (40%), sample vendor contacts (30%), and quantifying operational benefits (30%).

Next, in Figure 13 and Figure 14, we present information about the familiarity and interest among transit agencies, in the programs offered already by Cal-ITP. The agencies have the most familiarity with the GTFS-Realtime analysis offered by Cal-ITP, and more agencies have used this assistance than any of the other assistance programs we asked about. Procurement assistance, master service agreements and operational data standards all had low familiarity among the agencies, but a decent amount of interest in terms of learning more and interest in using (see the red and green segments of the bars in Figure 14). Interestingly, and an important finding in its own right, few of the agencies in our sample are aware of the programs Cal-ITP is pursuing to help automate discount eligibility verification, but there is a similar level of interest in this program as all the others. Notably, a maximum of 21% of the sample is “not interested” in each of the services provided by Cal-ITP; suggesting that these assistance programs may provide important agency support with open-loop payments.

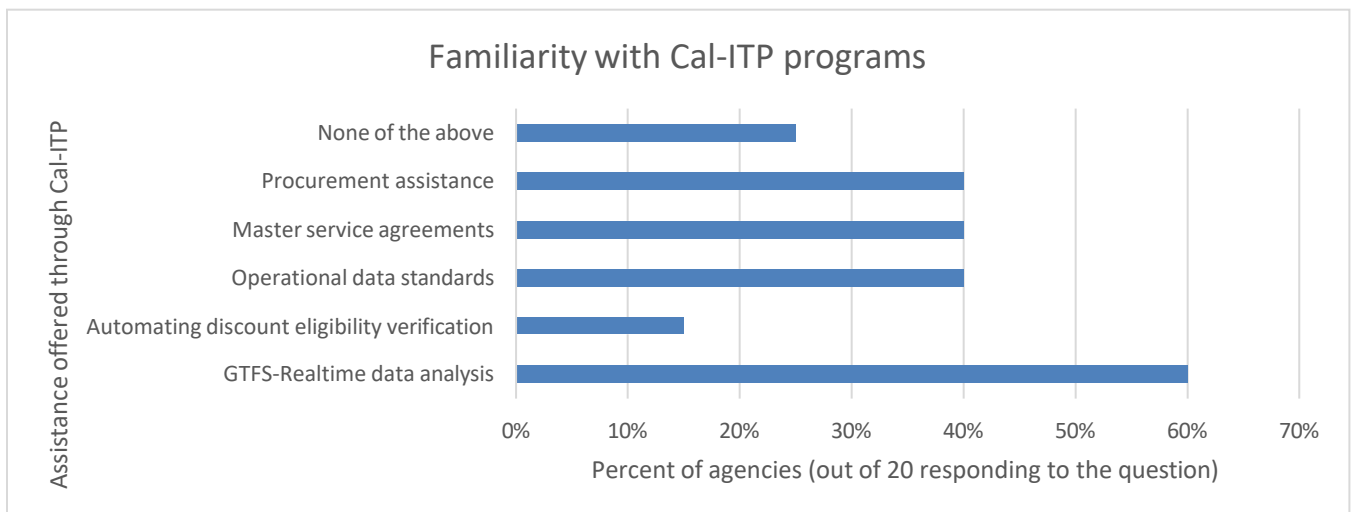


Figure 13. Agency familiarity with assistance programs offered by Cal-ITP (N = 20)

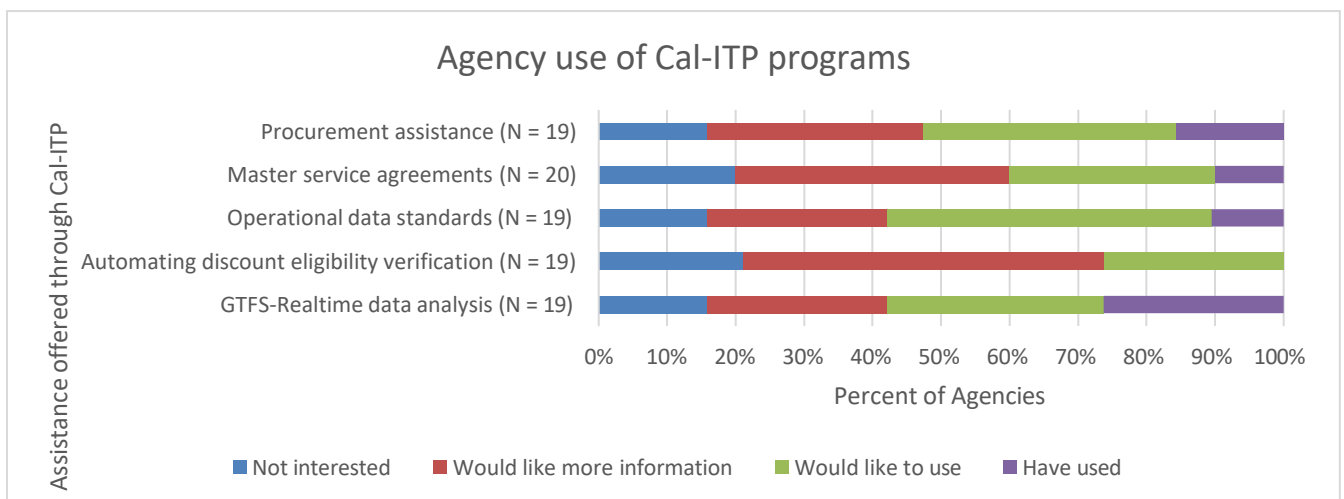


Figure 14. Agency use of and interest in programs offered by Cal-ITP (N = 20)

Real time arrival information

We asked agencies about the potential impacts of providing real time information to passengers. We asked in a more general way than specifically referencing GTFS-Realtime, since the concept can be considered without the specific format of information. Largely, our sample agreed that real time information improves passenger experience and about half agree that it could increase ridership. Similarly, agencies disagreed with the statements “the agency believes that passengers do not/will not use real-time arrival information”, and “the agency does not know whether the real-time tracking is correct”. However, nearly half also agree that they have low staff capacity.

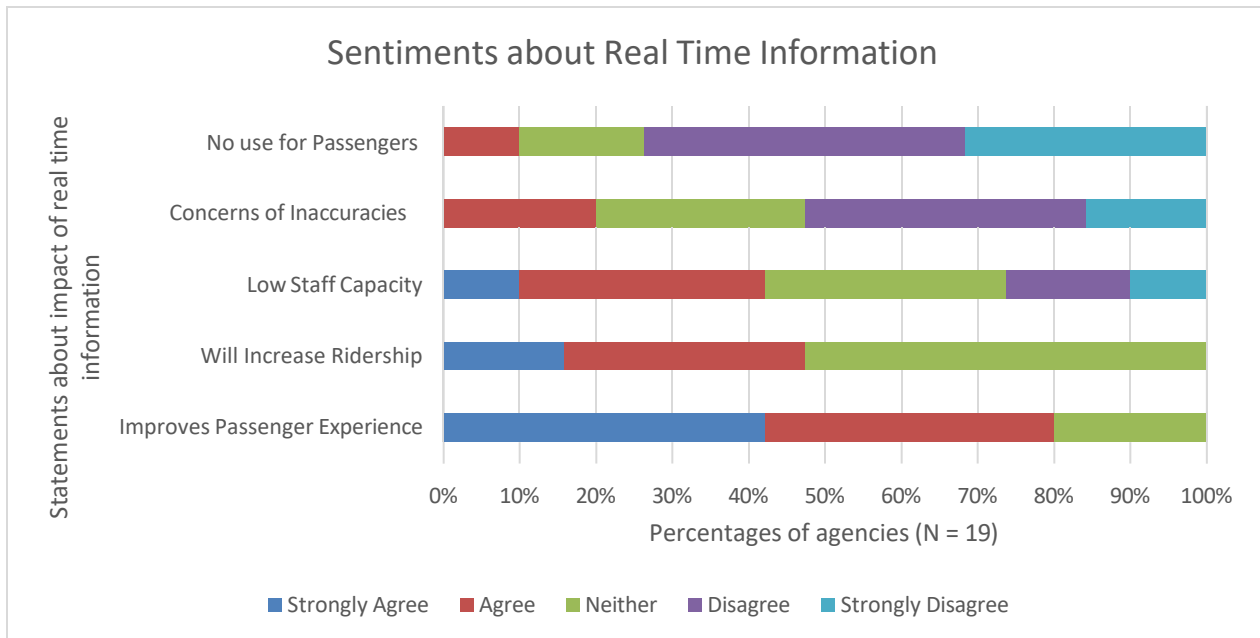


Figure 15. Agency sentiments towards real time information for passengers

In addition to assisting transit agencies in the transition to open-loop payments, Cal-ITP also supports agencies in the use of GTFS and in discount eligibility verification in open-loop systems. In our survey we asked whether agencies were using GTFS and extensions of GTFS. If not, whether assistance would help them adopt the use of GTFS. At the same time, we wanted to know what kinds of discounts agencies are currently offering in order to identify the needs agencies would have when considering those discounts in the context of open-loop payments.

Eleven out of the 21 agencies reported that they have implemented GTFS or another real time information sharing system for passengers, and one additional agency is in the process of implementing real time information.

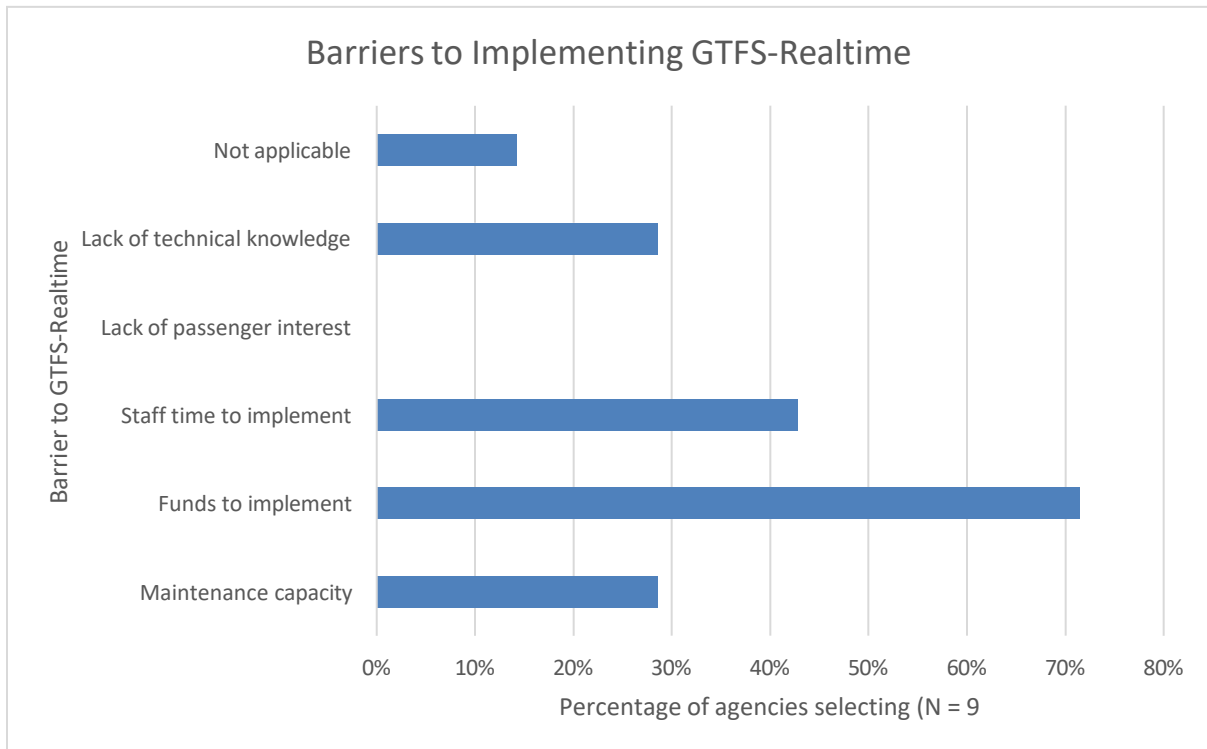


Figure 16. Barriers to providing real time information

Although there were nine agencies that reported they do not have GTFS, one actually does, and the other said they have no fixed route service. These are both removed from the sample in Figure 16. Among the agencies that do not have real time information, Figure 16 shows the percent (out of 7 agencies) that indicated the noted barriers. The most selected barrier is the cost to implement, followed by staff time to implement. Other barriers were selected by one to two of the seven agencies that do not provide real time arrival information.

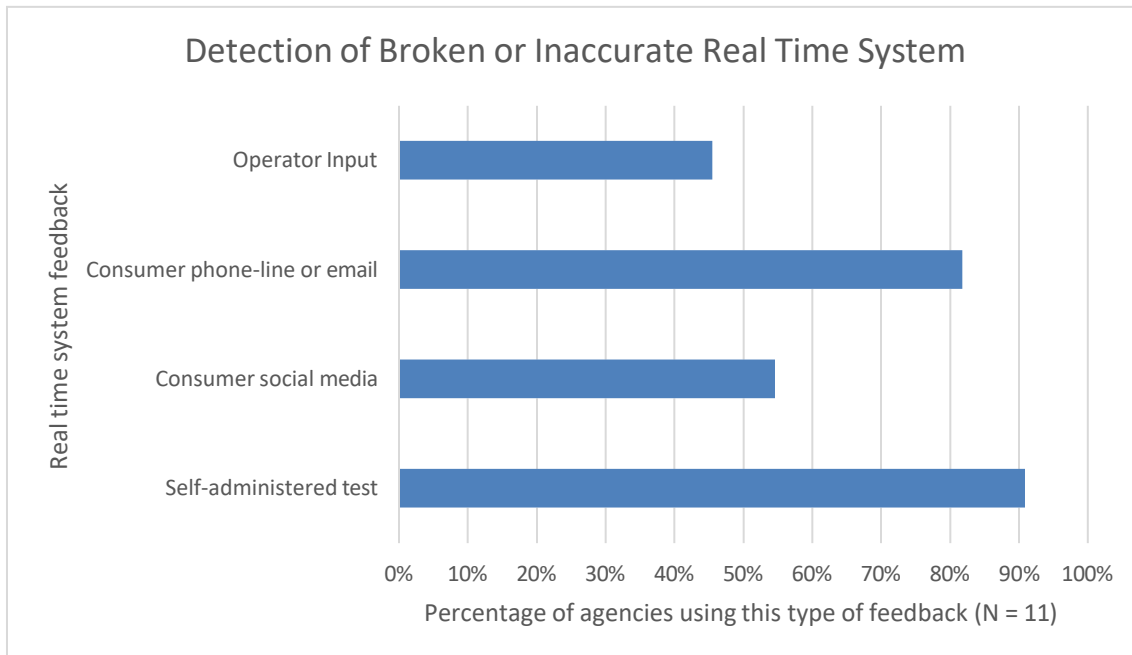


Figure 17. Detection of issues with real time arrival information

For the agencies that do have real time arrival information, we asked how they determine if there are issues with the system. Most agencies reported that they run diagnostic tests (91%), and also hear from passengers (82%). Other sources include consumer social media and operator input each selected by about half of the 11 agencies that responded to this question.

Discounts

Finally, we asked agencies about the types of discounts they currently offer to passengers. Discounts are another potential challenge related to the implementation of open-loop payments, and establishing equitable and non-invasive methods for ensuring discount eligibility is a concern of Cal-ITP and one that is incorporated into the pilot programs they have launched so far.

The most frequently offered discounts are for the elderly and disabled followed by discounts for students, and for those who purchase passes in bulk. Some, though smaller numbers of agencies also offer discounts through employers or geographically based, transfers, for low-income passengers and through fare-capping.

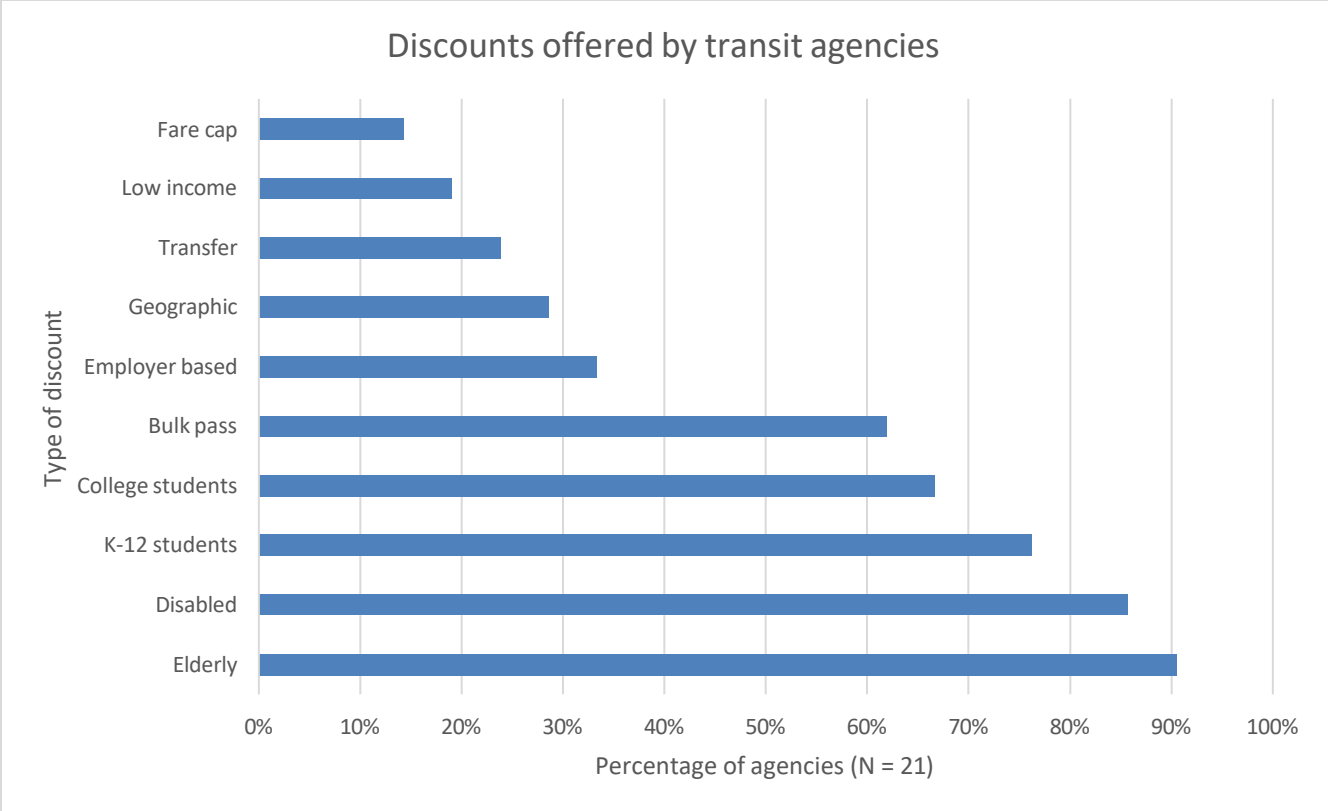


Figure 18. Discounts offered by transit agencies

Discussion and Conclusions

This study explores the challenges, particularly those that directly impact passengers, facing California's public transit agencies in the adoption of open-loop fare payments at passenger boardings. The results of this study are taken from a sample of agencies that are largely smaller and serve rural areas; 15 out of 21 report serving rural areas only or in addition to urban areas. Similarly, more than half of the agencies in the sample have fewer than 50 vehicles in their fleet. We find that most of the agencies in our sample are or have considered open-loop payments and are typically interested in the idea. Agencies also consider those affiliated with them (e.g., the board, staff, passengers, and others) to be supportive of open-loop payments. Nonetheless, there are real and perceived challenges on the part of the transit agencies as well as those they serve.

The agencies we surveyed anticipate improved operational efficiency with open-payment systems. This is expected since open-loop payments require less time for fare payment for each passenger, speed up boarding, and reduce the time vehicles dwell at each stop. Additional efficiency gains may be experienced as agencies no longer need to provide kiosks, apps, and other means to pre-purchase tickets, cards, etc. On the other hand, open-loop payments could impact agencies financially—with the cost of equipment selected by many study participants as a top challenge. Similarly, nearly 40% of our respondents disagree with the statement that open-loop systems would save the agency money. Costs are a concern for many agencies, however there are many factors that will determine whether any individual agency saves money in the near and longer term if they transition to open-loop payments.

When asked about passenger specific challenges, the statements selected by the highest number of agencies (more than 60%) were related to passenger bank account access and adapting to new technology. Survey participants were split when asked whether open-loop payments would *not meet* passenger needs (48% disagree, 37% agree). On the other hand, agencies in our sample agree that open-loop payments may improve discount eligibility.

In addition to these challenges, agencies are concerned about adopting the new technology and backend infrastructure needed to accept and process open-loop payments as well as capacity limitations and equipment installation. Considering the large number of rural agencies among the respondents to our survey, a potential challenge that was not covered in this work relates to internet connectivity. This is needed for GTFS-Realtime tracking of vehicles, as well as for the timely processing of digital payments on board vehicles. We anticipate this challenge could be greater for smaller and rural agencies.

The insights presented here will be strengthened as we acquire a larger sample through additional survey recruitment. Future research on this topic should also continue to track the changes in payments technology and processing tools and how they are used by un and underbanked individuals and households as well as how these evolving tools may be incorporated into transit payments. In addition, related work on mobility wallets, and other forms of financial support aimed specifically at providing transportation benefits to

disadvantaged groups should consider the open-loop payments context, and how to provide EBT and/or reloadable cards that are suitable for open-loop payment systems in public transit.

This work aims to highlight the challenges and sentiments of transit agencies, as it relates to open-loop payment systems. The assistance agencies may require in the transition to open-loop payments should be aimed at addressing challenges faced by passengers as well as those that are experienced by agencies and their staff, such as these Cal-ITP programs: GTFS-Realtime data analysis, automating discount eligibility verification, operational data standards, master service agreements, and procurement assistance. These and potentially other assistance programs may lead more of California's transit agencies to adopt open-loop payments.

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Data Summary

Products of Research

This study collected data through an online survey using the Qualtrics survey platform, hosted at UC Davis. The data includes responses from 21 transit agencies located in California.

Data Format and Content

The data is stored in a comma separated value (.csv) file, and a readme text (.txt) file.

Data Access and Sharing

DOI: Open loop payments for transit - DOI: 10.5061/dryad.9p8cz8wnv

Reuse and Redistribution

There are no restrictions on how the data can be reused and redistributed by the general public. This dataset should be cited as follows:

Pike, Susan (2023). Open loop payments for transit [Dataset]. Dryad.
<https://doi.org/10.5061/dryad.9p8cz8wnv>

Appendix A

Transit Payment Methods Survey

Start of Block: Welcome

Q1.1

Welcome to the Transit Payment Methods Survey!

This survey is part of a study being conducted by the University of California, Davis Institute of Transportation Studies (ITS-Davis), and the National Center for Sustainable Transportation. The goal of the study is to learn about challenges facing transit agencies concerning open payment systems (those that accept all forms of payment, including credit or debit cards, phone-based payments, etc.) The outcomes of this study will inform tools and policies to address the challenges of adopting open payment systems.

This survey takes 15 to 20 minutes to complete. Participation in this survey is entirely voluntary. Your responses will be completely confidential, and all reports and publications resulting from this study will include information only in the aggregate. We will not reference any individual or your agency.

Only people 18 years of age and above are eligible to participate in this study. By participating in this survey, you are indicating that you meet this criterion. If you have any questions or would like more information, please contact Dr. Susan Pike at scpike@ucdavis.edu.

Thank you for your participation!

*Throughout the survey, we use the term **open payment system** to refer to a transit payment mechanism that allows passengers to pay fares with a credit card or debit card, phone, watch, etc., before, at, or immediately after boarding. This contrasts with “closed loop payments,” where a proprietary card, application, or service is required for payment.

End of Block: Welcome

Start of Block: Transit Agency Questions

Q2.1 First, we have a few questions about your transit agency.

Q2.2 Which of the following best describes your transit agency or the area(s) of your service?

- Rural
 - Urban
 - Suburban
 - Regional
 - I do not know
 - Other (please describe) _____
-

Q2.3 To the best of your knowledge, what is the current fleet size of your transit agency?

- Under 25
 - 25-49
 - 50-99
 - 100-249
 - 250-499
 - 500 or more
 - I do not know
-

Q2.4 Which of the following modes does your agency operate? Check all that apply.

- Bus
 - Light Rail
 - Heavy Rail
 - Paratransit
 - Ferry
 - On-demand/flexible service (other than Paratransit)
 - Other _____
-

Q2.5

Now, we will ask questions that highlight a distinction between the **payment method** and the **payment interface**.

The **payment method** is the financial tool that a passenger uses to pay for transit service (cash, card, check, etc.). The **payment interface** is the physical action or tool used to pay (tap, swipe, insert coins, etc.).

Q2.6 Which of the following forms of payment **methods** can be used to pay for transit service(s) (i.e., to purchase tickets, cards, add-value to cards, etc.)? Check all that apply.

- Cash
- Credit Card
- Debit Card
- Direct Bank Account (ACH)
- Check
- Other (please specify) _____

Q2.7 Where can passengers pay with the accepted **methods**? Check all that apply.

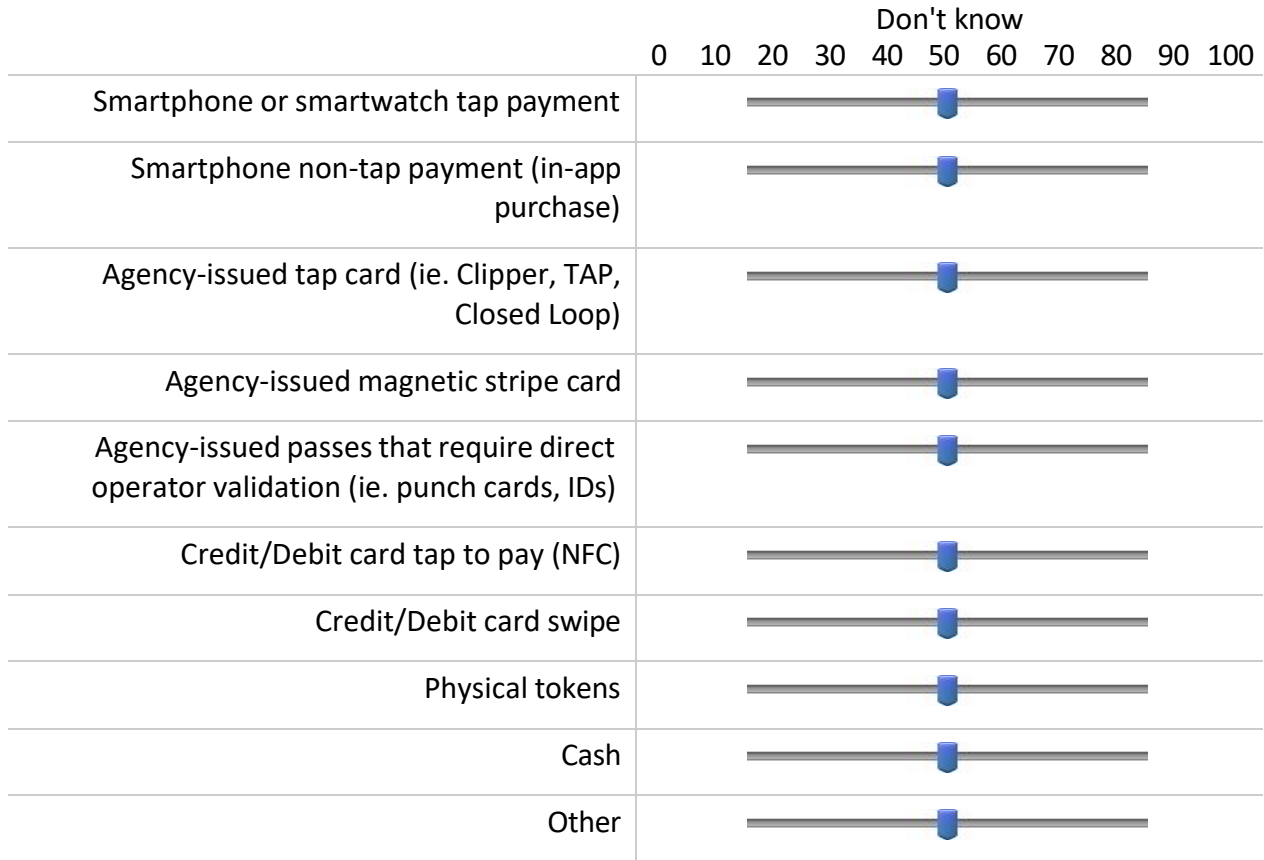
	At <i>all</i> transit centers/stops/stations	At <i>certain</i> transit centers/stations/stops	Online	At an agency office	At a local business
Cash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Credit Card	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Debit Card	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Direct Bank Account (ACH)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q2.8 Which of the following fare payment **interfaces** do you accept for any modes at or immediately before/after boarding? Check all that apply.

The payment **interface** is the physical action or tool used to pay (tap, swipe, insert coins, etc.).

- Smartphone or smartwatch tap payment
- Smartphone non-tap payment (in-app purchase)
- Agency-issued tap card (ie. Clipper, TAP, Closed Loop)
- Agency-issued magnetic stripe card
- Agency-issued passes that require direct operator validation (ie. punch cards, IDs)
- Credit/Debit card tap to pay (NFC)
- Credit/Debit card swipe
- Physical tokens
- Cash
- Other _____

Q2.9 What proportion of passengers do you expect use these payment **interfaces** at or immediately before boarding transit? (The total does not need to add up to 100.)



Display This Question:

If Q2.8 = Agency-issued tap card (ie. Clipper, TAP, Closed Loop)

Or Q2.8 = Agency-issued magnetic stripe card

Q2.10 You indicated that passengers can use agency-issued cards at boarding. Where can passengers purchase cards and add funds? Check all that apply.

- On board
- Some rail stations
- All rail stations
- Some bus stops
- All bus stops
- Local businesses
- Government or agency offices
- Online
- Through an app
- Other _____

End of Block: Transit Agency Questions

Start of Block: Transit Agency Challenges

Q3.1 The following questions relate to **open payments**.

Open payments refers to a payment interface that allows passengers to pay with a credit or debit card, phone, watch, etc., before, at, or immediately after boarding. This contrasts with “closed payments systems,” where a proprietary card or application is required for payment.

Q3.2 Has your agency implemented or is your agency in the process of implementing an open payment system, even if it is only on some of your system?

- Yes, we have implemented open payments
 - Yes, we are in the process of implementing open payments
 - No, but we are currently considering it
 - No, but we have considered it
 - No, we have not considered it
-

Q3.3 What are some of the **challenges** your agency has faced or expects to face when implementing an open payment system? Check all that apply.

- Cost of open payment equipment
 - Equipment installation
 - Staff or other capacity limitations
 - Existing private payment contractor
 - Lack of customer interest
 - Lack of customer ability to adopt
 - Backend payment infrastructure
 - Discount eligibility verification
 - Continuity of passenger discount(s) during the transition
 - Federal or state laws and regulations
 - Regional coordination
 - Increased liability
 - Fraud concerns (first tap problem, etc.)
 - Fare evasion
 - Passenger privacy
 - Risk to passenger safety
 - Technological complexity
 - Other (please specify) _____
-

Q3.4 Of the challenges you selected above, which are the **top three** most important or challenging to your agency?

- Cost of open payment equipment
- Equipment installation
- Staff or other capacity limitations
- Existing private payment contractor
- Lack of customer interest
- Lack of customer ability to adopt
- Backend payment infrastructure
- Discount eligibility verification
- Continuity of passenger discount(s) during the transition
- Federal or state laws and regulations
- Regional coordination
- Increased liability
- Fraud concerns (first tap problem, etc.)
- Fare evasion
- Passenger privacy
- Risk to passenger safety
- Technological complexity
- Other (please specify) _____

Q3.5 To what extent do you agree or disagree with the following statements about open payments:

Open payment systems...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Don't know
Improve operational efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do not meet the needs of our passengers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Help passengers transfer more easily between agencies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increase the risk of passenger robbery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Will save the agency money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Will improve discount eligibility verification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Will present data privacy concerns that the agency is unprepared for	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are difficult to implement across multiple modes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3.6 To the best of your knowledge, to what extent do the following groups support open payments for your agency's services?

	Strongly does not support	Does not support	Neutral	Supports	Strongly supports	Don't know
Agency planners	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Agency board	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Agency operations team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Agency information technology team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regular passengers who frequently use your service	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrequent passengers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local government (city or county)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local community based organizations (CBOs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Transit Agency Challenges

Start of Block: Cash Preference

Q4.1 The following questions ask about the use of cash among your current passengers.

Q4.2 Which of the following do you expect **prevent** your passengers from transitioning away from cash payment options (i.e., to card or mobile payments)? Check all that apply.

- Lack of familiarity with new technology
 - Lack of interest in new technology
 - New technology does not fit passenger's needs (age, ability, etc.)
 - Lack of trust in agency
 - Lack of trust in other data-collecting entities
 - Preference for cash as a budgeting tool
 - Preference for cash as a privacy and/or resiliency tool
 - Difficulties obtaining a bank account, cards, or mobile devices
 - Lack of a bank account, cards, or mobile devices
 - Other _____
-

Display This Question:

If Which of the following do you expect prevent your passengers from transitioning away from cash pa...
q://QID183/SelectedChoicesCount Is Greater Than or Equal to 2

Carry Forward Selected Choices - Entered Text from Q4.2

Q4.3 If you selected more than one choice in the previous question:

Which of the following passenger and/or cash payment issues is faced by the largest number of your passengers?

- Lack of familiarity with new technology
- Lack of interest in new technology
- New technology does not fit passenger's needs (age, ability, etc.)
- Lack of trust in agency
- Lack of trust in other data-collecting entities
- Preference for cash as a budgeting tool
- Preference for cash as a privacy and/or resiliency tool
- Difficulties obtaining a bank account, cards, or mobile devices
- Lack of a bank account, cards, or mobile devices
- Other

Q4.4 In the space below, please tell us anything else you would like to share about the use of cash among your passengers.

End of Block: Cash Preference

Start of Block: Discounts

Q5.1 The following questions are about discounts provided to your passengers during fiscal year 2020-2021.

In this context, discounts refer to any lowering of the fare below what a "regular" fare would be, such as passes, demographic specific discounts, or other methods.

Q5.2 During fiscal year 2020-2021 did your agency offer...

	Yes	No
Monthly/weekly/daily pass with a reduced bulk rate	<input type="radio"/>	<input type="radio"/>
Multi-modal fare caps	<input type="radio"/>	<input type="radio"/>
Interagency transfer discounts	<input type="radio"/>	<input type="radio"/>
Free or reduced fare for certain geographic areas (i.e., feeder lines)	<input type="radio"/>	<input type="radio"/>

Q5.3 Did your agency offer any free or reduced transit fare program(s) during fiscal year 2020-2021 for K-12 Students?

- Yes
- No

Q5.4 Did your agency offer any free or reduced transit fare program(s) during fiscal year 2020-2021 for post-secondary/college/university students?

- Yes
- No

Q5.5 Did your agency offer any employer-based free or reduced transit fare program(s) during fiscal year 2020-2021?

- Yes
- No

Q5.6 Did your agency offer any free or reduced transit fare program(s) for the elderly during fiscal year 2020-2021?

- Yes
 - No
-

Q5.7 Did your agency offer any free or reduced transit fare program(s) for people with disabilities during fiscal year 2020-2021?

- Yes
 - No
-

Q5.8 Does your agency provide any discounts to low-income riders? Check all that apply.

- No, we do not provide income-based discounts
 - Yes, monthly pass reduced rate
 - Yes, daily pass reduced rate
 - Yes, pre-loaded account/card
 - Yes, per-ride reduced rate
 - Yes, other (please specify) _____
-

Display This Question:

- If Q5.8 = Yes, monthly pass reduced rate*
- Or Q5.8 = Yes, daily pass reduced rate*
- Or Q5.8 = Yes, pre-loaded account/card*
- Or Q5.8 = Yes, per-ride reduced rate*
- Or Q5.8 = Yes, other (please specify)*

Q5.9 Provide the name of your low-income discount program below. (If you have more than one low-income discount program, please provide the name of the one that is used the most).

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.10 How do riders enroll in $\{Q5.9/ChoiceTextEntryValue\}$? Check all that apply.

- Passengers can enroll online
- Passengers can enroll on a mobile app
- Passengers may enroll in-person
- Passengers **must** enroll in-person
- In-person enrollment events
- Passenger can enroll by mail
- Other (please specify) _____

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.11 What is the income criteria for receiving a low-income discount?

- 100% of federal poverty level
- 185% of federal poverty level
- 200% of federal poverty level
- Other (please specify) _____

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.12 What information is required to verify eligibility? Check all that are required.

- Receipt of state or federal benefits (EBT, SNAP, CalFresh, housing voucher)
- Valid Photo ID
- Proof of income (i.e., paystub from last 30 days, unemployment paystub, most recent tax return, etc.)
- Proof of local residency (lives within transit service area)
- Other (please specify) _____

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.13 How is the discount provided to low-income riders?

- Bulk paper tickets at reduced price
- Funds added to a smart card
- Funds added to a magnetic stripe card
- Special smart card with lower fares
- Special magnetic stripe card with lower fares
- Sticker affixed to ID or fare medium
- Cash discount at boarding
- Discount is associated with personal account with option to register credit, debit cards, or other payment methods
- Discount applied on mobile app
- Other please specify) _____

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.14 How often do people have to reapply for the low-income discount program?

- Monthly
- Every 6 months
- Yearly
- Every 2 years
- Other _____

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

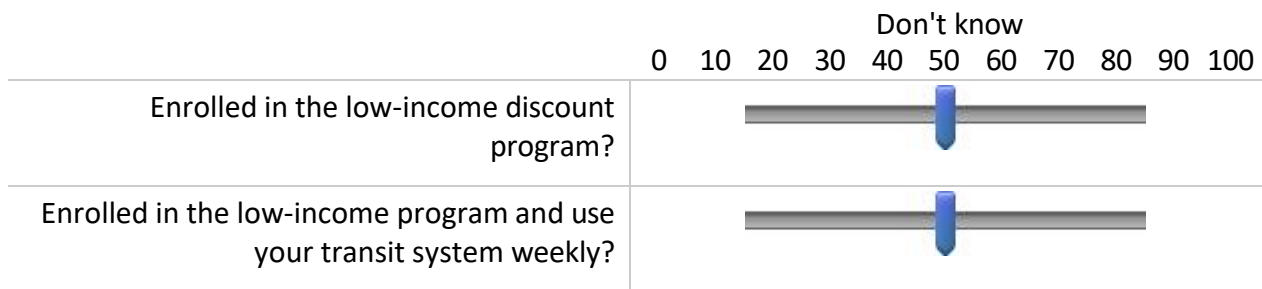
Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.15 What percentage of your passengers are...



Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.16 What were the sources of funding for the low-income discount program during fiscal year 2020-2021? Please check all that apply.

- Subsidy/payment from the city
 - Subsidy/payment from the county
 - Subsidy/payment from the state
 - Subsidy/payment from the federal government
 - No outside funding
 - Other source of funds (please specify)
-

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.17 Do you partner with other transit agencies for the distribution and administration of low-income transit discounts and passes?

- Yes
 - No
-

Display This Question:

If Q5.17 = Yes

Q5.18 Which agencies do you partner with for low-income discount passes? Please type all below separated by a semi-colon ;

Display This Question:

If Q5.17 = Yes

Q5.19 If fare discounts vary for the different agencies connected to the low-income discount pass, explain how:

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.20 Are the low-income discount programs restricted to specific transit modes?

- Yes
- No

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.21 Does your agency partner with an external organization (i.e., non-profit, community based organization) to distribute low-income passes to eligible riders?

- Yes
- No

Display This Question:

If Q5.21 = Yes

Q5.22 What organization(s) does your agency partner with to distribute low-income passes?

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.23 Are all low-income riders provided the same discount?

- Yes
- No

Display This Question:

If Q5.23 = No

Q5.24 If not all low-income riders are provided the same discount, please explain how:

Q5.25 In the past five fiscal years, did your agency offer any free or reduced transit fare program(s) that have now been discontinued?

- Yes
- No

Display This Question:

If Q5.25 = Yes

Q5.26 Please name the discontinued program and briefly provide information about the demographic group that received the discount:

Display This Question:

If Q5.8 = Yes, monthly pass reduced rate

Or Q5.8 = Yes, daily pass reduced rate

Or Q5.8 = Yes, pre-loaded account/card

Or Q5.8 = Yes, per-ride reduced rate

Or Q5.8 = Yes, other (please specify)

Q5.27 If there are other low-income discount programs you did not answer the previous questions about, please list them here:

End of Block: Discounts

Start of Block: GTFS Realtime

Q6.1 The following questions are about General Transit Feed Specification (GTFS) and real-time information for passengers.

Q6.2 Does your agency provide any real-time arrival predictions with GTFS Realtime or another means?

- Yes
- No
- I do not know what GTFS-Realtime is
- I do not if we provide GTFS-Realtime

Display This Question:

If Q6.2 = No

Q6.3 If your agency does not provide real-time information, are any of the following barriers to doing so?

- Maintenance capacity
- Funds to implement
- Staff time to implement
- Lack of passenger interest
- Lack of technical know-how
- Other (please specify) _____

Display This Question:

If Q6.2 = Yes

Q6.4 How do you know when your real-time system **breaks** or is **inaccurate**?

- When we test it
- Customer feedback through social media
- Customer feedback through phone-line or email
- Operator feedback
- Other _____

Display This Question:

If Q6.2 = Yes

And Q6.4 = When we test it

Q6.5 How often does your agency test your real-time system for accuracy?

- More than twice a year
- 1-2 times a year
- Less than once a year

Display This Question:

If Q6.2 != I do not know what GTFS-Realtime is

Q6.6 To what extent do you agree or disagree with the following statements concerning real-time information?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The agency believes that passengers do not/will not use real-time arrival information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Real-time notifications will result in higher ridership	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The agency does not have the staff to maintain the real-time system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Real-time information improves the passenger experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The agency does not know whether the real-time tracking is correct	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: GTFS Realtime

Start of Block: Cal-ITP

Q7.1 The following questions are about ways the California Integrated Travel Program (Cal-ITP) can help your agency.

Q7.2 From the following ways that Cal-ITP or another agency can help with open payments, please select the **top three** that would be most helpful to your agency.

- Shared technological tools for data management
- Shared technological tools for payment management
- Procurement cost-sharing
- Sample specifications to use in vendor contracts or agreements
- Quantifying operational benefits
- Pilot program funding
- Other (please describe) _____

Q7.3 Which of the following services that Cal-ITP provides are you familiar with?

GTFS-Realtime data analysis

- Automating discount eligibility verification
- Operational data standards
- Master service agreements
- Procurement assistance
- None of the above

Q7.5 For the following services, select what is applicable for your agency:

	Have used	Have not used, but would like to	Would like more information about	Not interested in this service
GTFS-Realtime data analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Automating discount eligibility verification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Operational data standards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Master service agreements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Procurement assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Cal-ITP

Start of Block: Thank You

Q8.1 Thank you for taking the time to complete this survey. Your responses are greatly appreciated.

The following questions are intended to help us identify your agency and your role for further contact if necessary.

Q8.2 Which transit agency do you work for?

Q8.3 What is your role or position in the agency?

Q8.4 Please use the space below to tell us anything else about open payments, discounts or any other topics you would like to see considered in future research.

Q8.5 May we contact you in the future for any of the following?

- Questions regarding your responses to this survey
- To participate in future phases of this project, such as surveys or interviews
- No, I do not wish to be contacted in the future

Display This Question:

If Q8.5 = Questions regarding your responses to this survey

Or Q8.5 = To participate in future phases of this project, such as surveys or interviews

Q8.6 Please provide the following contact information

- Name _____
- Telephone number _____
- Email Address _____

End of Block: Thank You
