Mobile Fare Payment Technology Phase II

Final Report

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Introduction

This Final Report contains the results of the evaluation of the StarMetro pilot of Token Transit. As of March 30, 2018, StarMetro's pilot of the Token Transit mobile fare payment app, as sponsored by the Florida Department of Transportation, has been completed. The pilot supported several activities, including the configuration of the selected mobile fare payment app, Token Transit, for use by StarMetro and Gadsden Express customers. The pilot also included the development and implementation of a marketing plan and campaign to secure the participation of at least 200 bus riders to test the app, conducting an internal beta test by agency staff, and a seven month public field test of the app by volunteer bus riders who qualified to participate.

This pilot was Phase II of a two-part study. Phase I, completed in spring 2016, reviewed several existing mobile fare payment systems and provided FDOT with a framework for the implementation of a mobile payment pilot with a Florida transit agency.[1] Table 1 summarizes the key tasks of the mobile fare payment pilot of the Token Transit app at StarMetro.

Supporting documents for this final report include three technical memoranda that preceded it. These include Technical Memorandum 1 that documents activities relating to the configuration of the Token Transit mobile app for StarMetro, the development of an evaluation plan and associated draft Focus Group Moderator's Guide, and the development of a marketing plan. These documents are included in Appendices 1.0 through 1.5. Technical Memorandum 2 documents the results of the internal staff beta test of the app, including focus groups, and preparations for the limited public launch of Token Transit to StarMetro customers. Technical Memorandum 2 is included in Appendix 2.0. Technical Memorandum 3 documented the activities of the public test, including the progress of the marketing campaign, handling of customer inquiries, and the conduct of a baseline and final survey of participating customers. The survey measured customer satisfaction. A bus operator survey also was conducted to gauge perceptions of bus operators with respect to operational efficiencies as a result of visual validation of the mobile bus passes. Technical Memorandum 3 contained a tabulation of the results of the surveys and data on the sale of bus passes purchased by customers using the Token Transit app. These documents are included in Appendices 3.0 through 3.8.

[1] Center for Urban Transportation Research. "Assessment of Mobile Fare Payment Technology for Future Deployment in Florida." Florida Department of Transportation. Tallahassee, FL. March 2016. http://www.fdot.gov/transit/Pages/FinalReportMobileFarePayment20160331.pdf

Table 1: Schedule of Key Tasks of Pilot

Tasks	Time frame
• Token Transit app configuration for StarMetro • Marketing plan development • Evaluation plan development	February—June 2017
• Beta Testing by internal staff • Focus groups with bus riders • Bus operator training • Development of marketing campaign materials and incentives, website landing page for signing up bus riders to participate • Pre-test bus rider survey development	July—August 2017
• Launch of marketing campaign and recruitment of participants • Public testing of the Token Transit app by self-selected sample of bus riders	September 2017—March 2018
• Administration of pre-test bus rider survey as bus riders sign up to participate • Post-test bus rider survey development	September—October 2017
• Marketing messaging to encourage taking the post-test survey • Administration of post-test bus rider survey • Tabulation of pre-test survey results	November 2017
• Tabulation of post-test bus rider survey results • Bus operator survey development	December 2017—January 2018
• Administration of bus operator survey	February 2018
• Tabulation of bus operator survey results • Debriefing with StarMetro staff about the results of the pilot	March 2018

This final report contains an evaluation of what was learned during the internal beta test by staff and the public testing of the mobile app by bus riders. This evaluation also includes an assessment of survey results, an evaluation of the

level of satisfaction of StarMetro staff with Token Transit, as explored during a staff debriefing, and a documentation of the capabilities of the Token Transit app to interact with other systems, compared with other existing applications in use in Florida.

Activities Completed for the Evaluation

Assessment of Information Collected During the Beta Test with Internal Staff

The purpose of the internal staff beta test was to conduct a complete run-through of what customers will experience when downloading the Token Transit app, purchasing bus passes using the app, boarding a StarMetro or Gadsden Express bus with the mobile pass, and having the pass visually validated by the bus operator. Success is dependent upon an easily understandable Token Transit app configuration of bus pass purchase options for StarMetro and Gadsden Express bus rides. It also depends on the financial integration of StarMetro and Token Transit accounts to allow for revenue transfers, and the successful training of bus operators.

Prior to the conduct of the internal beta test of the Token Transit app by staff, Token Transit supplied the team with off-line demo accounts. Staff could use the app initially to understand how it works and peruse its many features. The app also was available for use by the volunteer customer testers, during the focus groups. The demo accounts enabled initial app testing on one's own smartphone without having to supply personal identification information and use personal funds. These demo accounts were set up to supply anyone on the pilot team who wanted to try it out, with a test telephone number, mock credit card account, and passcode. The demo accounts enabled initial testing of the process of app installation on one's smartphone, selecting and "purchasing" fare types, and then activating the purchased pass to see what an activated pass looks like on ones' smartphone screen.

This initial demo account test allowed the team to identify any elements about the user interface that were confusing or vague, and communicate these concerns to the Token Transit app developers. Token Transit had the opportunity to consider this feedback and make modifications accordingly, even before the actual internal beta test began.

The beta test generated two primary sources of information. These included the feedback collected during the focus groups, and the input received from internal staff who tested the app in the field. After its configuration for StarMetro and account integration with Token Transit was completed, staff bought and

activated Token Transit bus passes with real money. The beta test also gave the bus operators a chance to apply their training to visually validate actual mobile passes.

StarMetro staff and customers had the benefit of app refinements resulting from earlier deployment of Token Transit at other transit agencies. However, the beta test was still worthwhile because there still were configuration issues specific to StarMetro with the Token Transit system that needed to be addressed. As described by one beta tester: “Since the glitches on the first day, it’s working great! Still doesn’t show my history though.” Other identified issues as experienced on Android phones, were the lack of a working “Feedback” screen, and problems populating the History screen with paid fares. Another beta tester alerted Token Transit that the time showing on her smartphone was for the wrong time zone, and others experienced problems finding the StarMetro option when first entering the Token Transit app. All these issues were successfully addressed prior to the public launch.

Focus Groups

Technical Memorandum 2 provides a detailed account of the conduct and results of the focus groups. Focus groups were used during the beta test to get a preview of the performance of the Token Transit app, from the perspective of actual customers who volunteered to participate. The focus groups provided an environment created to be nonjudgmental and risk-free. For example, the participating focus group members did not have to provide any private information, such as credit card account numbers. They did not have to actually use their own money to buy passes. During the time period when the participants downloaded the test app onto their personal smartphones, if they did not understand something or had any difficulties with the app, focus group leaders were there to answer their questions and provide them assistance on the spot, in the comfort of a conference room. There was no risk of losing money, missing one’s bus, purchasing the wrong fare, or being denied entry to the bus. During this simulation, focus group leaders were able to document questions asked, difficulties encountered, and comments and suggestions provided by the participants.

All focus group comments relating to the functioning of the app were conveyed to the Token Transit developer prior to the public rollout of the app to paying customers. The Token Transit developer chose to apply some of the focus group feedback, such as enabling the customer to purchase multiple bus passes of a particular type, rather than having to buy the passes one at a time. Other feedback was not used, such as the bus rider who suggested allowing customers to pay using PayPal, Apple Pay, and Android Pay. In addition, many

focus group participants were confused by the real time display on the activated bus pass, interpreting it as relating in some way to the amount of time remaining on a valid pass. Token Transit decided to keep the real time display as the means for the bus operator to identify a valid pass, despite the initial uncertainty it aroused in bus riders.

Other customer feedback confirmed the value of some of the existing app features. For example, a focus group participant expressed fear of purchasing a pass by mistake, such as the wrong type of pass, or two of the same type. In fact, the Token Transit Pass Wallet screen displays all stored passes and when a bus rider is in the process of purchasing a bus pass, the Buy Passes screen prompts the rider with “Confirm Choice”, then a subsequent screen prompt displays the selected pass type and asks the rider to “Confirm Purchase”, providing two opportunities for the bus rider to verify the intent to purchase. Regarding purchasing a pass by mistake, this actually happened one time during the public pilot, and Token Transit issued an immediate refund, since the pass had not been used.

Two focus group comments relating to policy were received and were forwarded to the StarMetro manager. These comments involved the length of time that a bus pass remains valid and what recourse a customer has if his or her smartphone battery went dead. StarMetro reviewed and considered these issues, and developed policies that were conveyed in the FAQs within the app as well as to Customer Operations staff to enable them to field inquiries from customers. The FAQs are provided in Appendix 3.7.

One of StarMetro’s goals has been to provide an additional convenient option to customers to purchase bus passes. This pilot sought to evaluate customer perceptions of convenience. During the focus groups, it appeared clear, based upon the feedback from the individual participants, that some of the older bus riders preferred paying with cash, and for them, the simplicity of carrying a roll of quarters defined convenience. However, a few of the older bus riders and all the younger riders in the focus groups expressed displeasure with having to carry cash, running the risk of not having the correct change, and the potential of having to overpay a fare. Based upon the outcome of the focus groups, younger riders seemed more comfortable using smartphones. Providing a mobile fare payment app will likely appeal to more younger adult riders. The survey results from the public test supports this conclusion. The bus riders who signed up to participate in the pilot tended to be younger, with 15 percent of the participants identifying themselves as within the age group of 45-74 years, and 62 percent of the participants between the ages of 18 to 34.

One thing that was unclear about the use of the Token Transit app is customers' understanding of transfers. During the focus groups, one participant said she believed that a "Regular 1-Trip Pass" meant that it did not include a transfer. One must assume that the bus riders who participated in the public launch figured out that their Regular 1-Trip Pass included any bus trips within the 90-minute window, allowing for transfers. Had they interpreted this differently, they may not have used the app, thinking the cost of a bus journey requiring a transfer was more expensive using the app, than by other payment methods. Going forward, it is recommended that this issue should be clarified by StarMetro in customer communication. For example, future marketing of the app should emphasize that transfers are free, similar to other fare media.

The results of the focus groups and the beta testing by the staff lent additional insights into specifically how customers beginning to use the app may become confused, then risk becoming discouraged from using the app. These insights can further inform marketing of the app to ensure easy transition of interested customers to a mobile payment option. The meaning of the real time display and its intended use was a common source of confusion by beta testers and riders during the public launch. One beta tester said, "The time of day display should be changed to a count down timer for the 90-minute transfer. The time of day is not important." Bus riders *want* the time display on the activated pass screen to be for *their* use, rather than for the bus operator's use. In fact, there actually is a count down timer for the bus rider, but it is located on a different screen from that for the activated pass. Because this issue repeatedly came up, Token Transit might want to revisit this design feature. Perhaps there is an alternative way to enable bus operators to recognize a valid mobile pass to discourage fraud. In the meantime, marketing messaging for the app, as well as a "Help" screen or tutorial text within the app, should include clarifying the meaning and use of the real time display, and where to find the Token Transit app screen displaying the countdown for the activated pass.

Likewise, marketing messaging should also explain the meaning and intended use of the word of the day—that it is for the bus operator, and the rider can ignore it.

Evaluation of Riders' Assessment of the App

An evaluation of customer satisfaction with the Token Transit app was conducted through use of a pre-test and post-test survey of participating bus riders.

The method of recruitment of bus riders was through the branding of the pilot, "Test Our E-Pass", and the development of marketing materials to raise the awareness of bus riders about the opportunity to participate. As illustrated in Figure 1, these marketing messages were placed as posters and hangtags inside the buses, as well as broadcast on social media, such as the Facebook page of StarMetro. Notices about the pilot also were posted on the StarMero web site, and issued by email through Commuter Services of North Florida. A brief news item about the pilot was aired on a local television station. Over 80 percent learned about the pilot through the advertisements posted in the buses.

Interested bus riders were directed to sign up by going to www.StarMetroEPass.com, the main landing page for finding additional information about the pilot. Participants could gain entry into pilot participation by first filling out the pre-test survey and providing an email address, to enable researchers to later link answers of the pre-test and post-test surveys to the same participant.

Figure 1. A marketing campaign recruited pilot participants.

Once the pre-test survey was completed, the bus rider would be directed to a secondary web page containing the link and instructions to download the Token Transit app, so that the bus rider could immediately start using it to purchase bus passes. There were a total of 446 responses to the pre-test survey, with a total of 365 complete responses to the pre-test survey.

The pre-test survey asked questions about what bus routes the riders take, bus trip frequency, and trip purpose. Questions also were asked about current method of fare payment, type of bus fare purchased, type of smartphone used, and their current usage of mobile apps relating to bus travel. Questions relating to sociodemographic characteristics also were asked, including gender, age, ethnicity, employment status, household income, and number of vehicles available to their household.

Bus riders who were excluded from the pilot were those under age 18, those who do not have access to a smartphone, and post-secondary school students who already ride the public bus system for free due to their student status.

The pre-test survey began collecting baseline data from bus riders as they continued to sign up to participate in the pilot, from the beginning of September through October. The bus trips that survey participants reported in their pre-test surveys would have reflected trips taken for a one-week period between August 27 and October 28.

The post-test survey was launched Monday, November 6, and it closed on Wednesday, November 22. Weekly marketing messages were issued through social media to encourage participants to complete the post-test survey and be eligible to win small prizes. Incentives were offered, such as the opportunity to win coupons for free products from local businesses, including coffee, donuts, and sandwiches. Topics covered in the post-test survey included whether the bus rider followed through with purchasing bus fare using the Token Transit app, and if not, then why. Questions were asked about frequency of purchasing bus fares, frequency of using Token Transit, whether the bus riders used other means to purchase bus fare besides Token Transit, frequency of pass activation, and type of bus pass purchased. Several questions were asked relating to the level of bus rider satisfaction with the Token Transit app, as well as perceived benefits and challenges with using the app. Questions were asked about how the use of the Token Transit app affected their travel. The bus trips that survey participants reported in their post-test surveys reflected trips taken for a one-week period between October 29 and November 18. Questions were asked about what other features they would like a mobile fare payment app to provide. Finally, questions were asked about any change in status of the bus rider that could have affected their use of the Token Transit app, such as the purchase of a car, change of job or work location, or losing their smartphone.

There were 113 responses to the post-test survey and 106 complete responses to the survey.

Although the pilot was designed for testing by a select group of participants, the use of the Token Transit app spread by word of mouth to other customers as the pilot was carried out. Toward the latter part of the pilot, StarMetro had received inquiries from some customers asking to access the Token Transit app. The pilot team allowed any rider who was interested, to have access to the Token Transit app for the remainder of the pilot through March 30. These bus riders did not access the Token Transit app through the www.StarMetroEPass.com main landing page, and therefore did not take the baseline survey.

An evaluation of bus riders' assessment of the Token Transit app was captured through the answers they provided to the post-test survey. The data are available to link the before- and after- survey results of each participating bus rider, to see any reported changes in travel behavior. The detailed tabulation of survey results are found in Technical Memorandum 3. The discussion below highlights the main findings.

Pre-Test Survey Results

The pilot was available to all qualified bus riders who rode the StarMetro bus system as well as the Gadsden Express. The Gadsden Express provides bus service between Gadsden County and Leon County. Just 5 percent (N=378) of the survey participants indicated that they ride the Gadsden Express.

Survey participants who indicated their gender (N= 372) included 52 percent female and 48 percent male. Figure 2 illustrates the age of participants, which illustrates that the pilot attracted younger bus riders. The largest age group represented in the pilot were those of age 18-24, at close to 34 percent of all the participants.The percentage of participation decreased, the older the age group. There were no participants who indicated that their age was 75 or older.

Figure 3 illustrates the ethnicity as identified by the pilot participants. The largest participant groups were Black or African American at 56 percent, followed by White at 36 percent. The percentages add up to more than 100 percent because some participants selected more than one category.

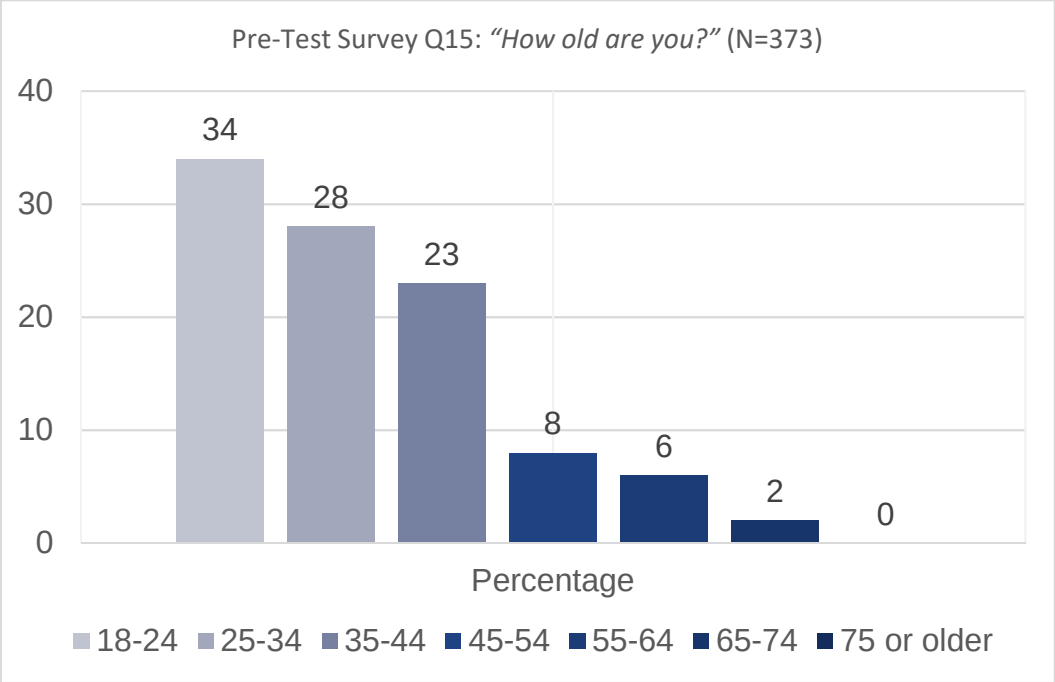

Figure 2. Age of the pilot participants (N=373).

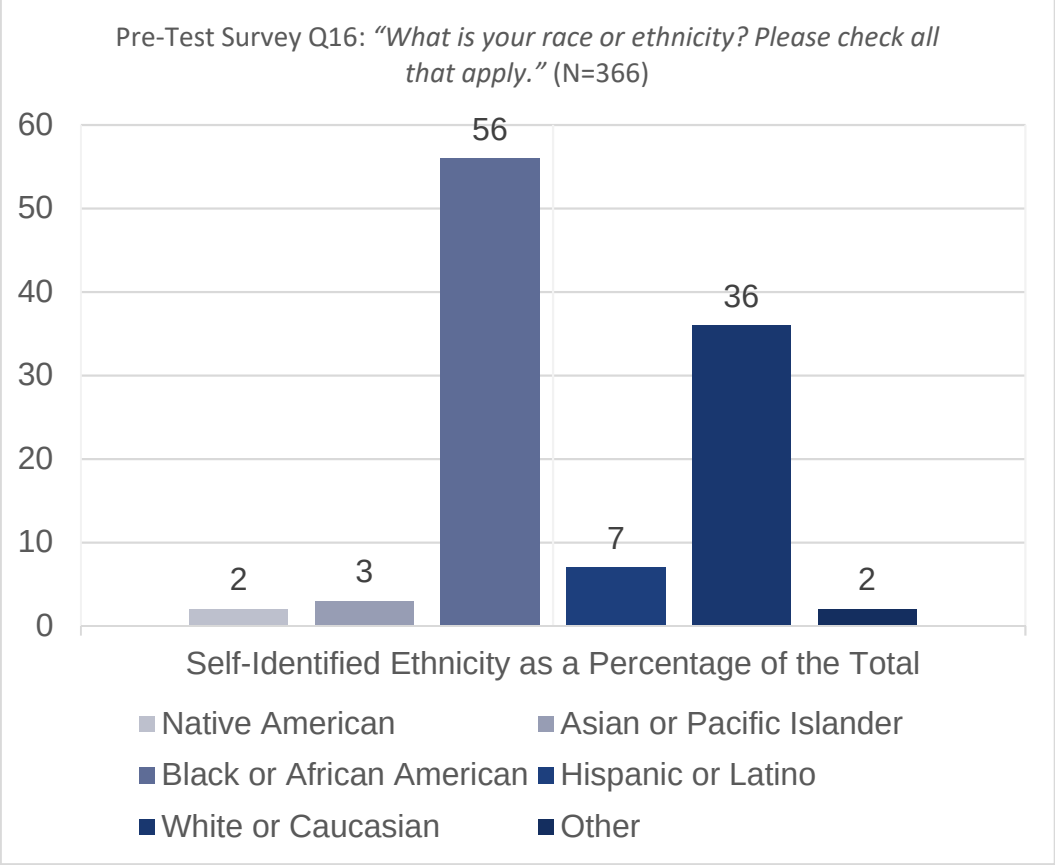

Figure 3. Pilot participants represented different ethnicities.

Pilot participants also identified their employment status, as illustrated in Figure 4. Close to half of the participants were employed full-time. Eleven percent were unemployed and 23 percent indicated that they were students. Again, participants could check all that apply; therefore the percentages shown in the graph sum to greater than 100. Many who indicated that they are students also indicated full-time or part-time employment. Those who indicated "Other", included statuses, such as "Mother", "Disabled", "Self-employed", and "Waiting to start job".

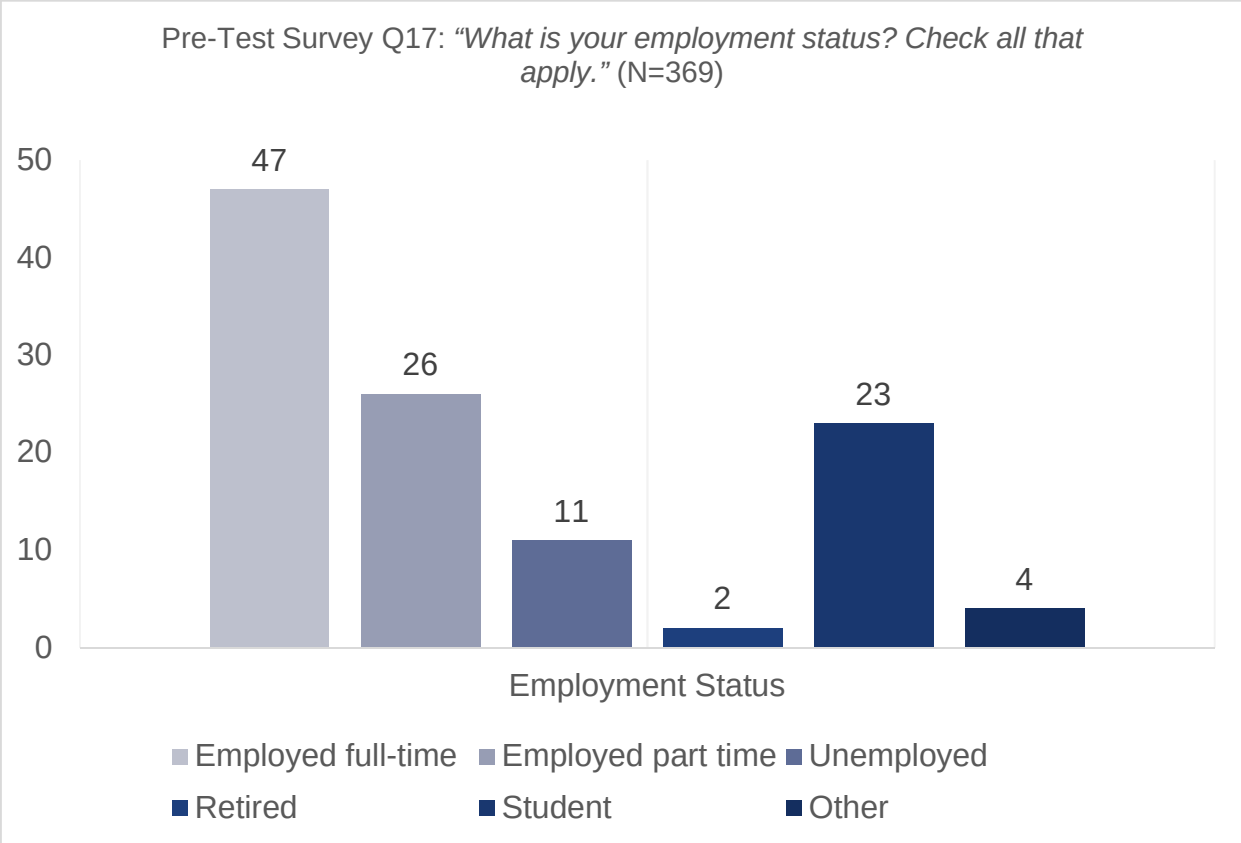

Figure 4. Pilot participants identified their employment status.

Almost 70 percent (N=369) indicated there are no motor vehicles in their household. Approximately 17 percent indicated there is one motor vehicle available in their household, and about 13 percent indicated there were two or more motor vehicles available in their household.

Approximately 42 percent (N=381) of survey participants indicated that they took ten or more bus trips during the previous week. Regarding trip purpose, survey participants were asked to check all trip purposes for which they travel by bus. Over 72 percent (N=346) indicated they travel by bus to go to work,

over 40 percent take the bus to shop, almost 35 percent indicated they travel by bus for personal business, and 29 percent take the bus to go to school. Almost 24 percent travel by bus for medical appointments and over 20 percent ride the bus for leisure and recreation purposes. "Other" specified trip purposes served by bus travel were to attend church, and deliver children to and from school.

Bus riders were asked how they usually pay for bus fare. Sixty-eight percent (N=375) paid by cash, almost 15 percent used the StarCard prepaid card, and almost 11 percent paid using a fare card. Regarding the type of bus fare purchased, the most popular fare types were the regular one-trip fare at almost 40 percent (N=374), and the monthly pass at 27 percent. About 60 percent of survey participants used an Android phone and close to 40 percent used an iPhone.

Post-Test Survey Results

The summary below highlights results from the post-test survey. Detailed results also are contained in Technical Memorandum 3.

Utilization of Mobile Ticketing

Frequency of use of mobile ticketing (e.g., 1x/week, 5x/week) was asked in Q5: *"How often do you typically activate a bus pass before boarding the bus, using the Token Transit app?"* As illustrated in Figure 5, almost 29 percent (N=94) indicated more than 5 times a week, another 23 percent indicated 4 or 5 times a week, another 22 percent indicated 2 or 3 times a week, close to ten percent indicated about once a week, another 12 percent indicated about once per month and about 2 percent indicated less than once per month. That is over 84 percent who indicated they used Token Transit at least once a week. This is an indication that bus riders became comfortable using the Token Transit app.

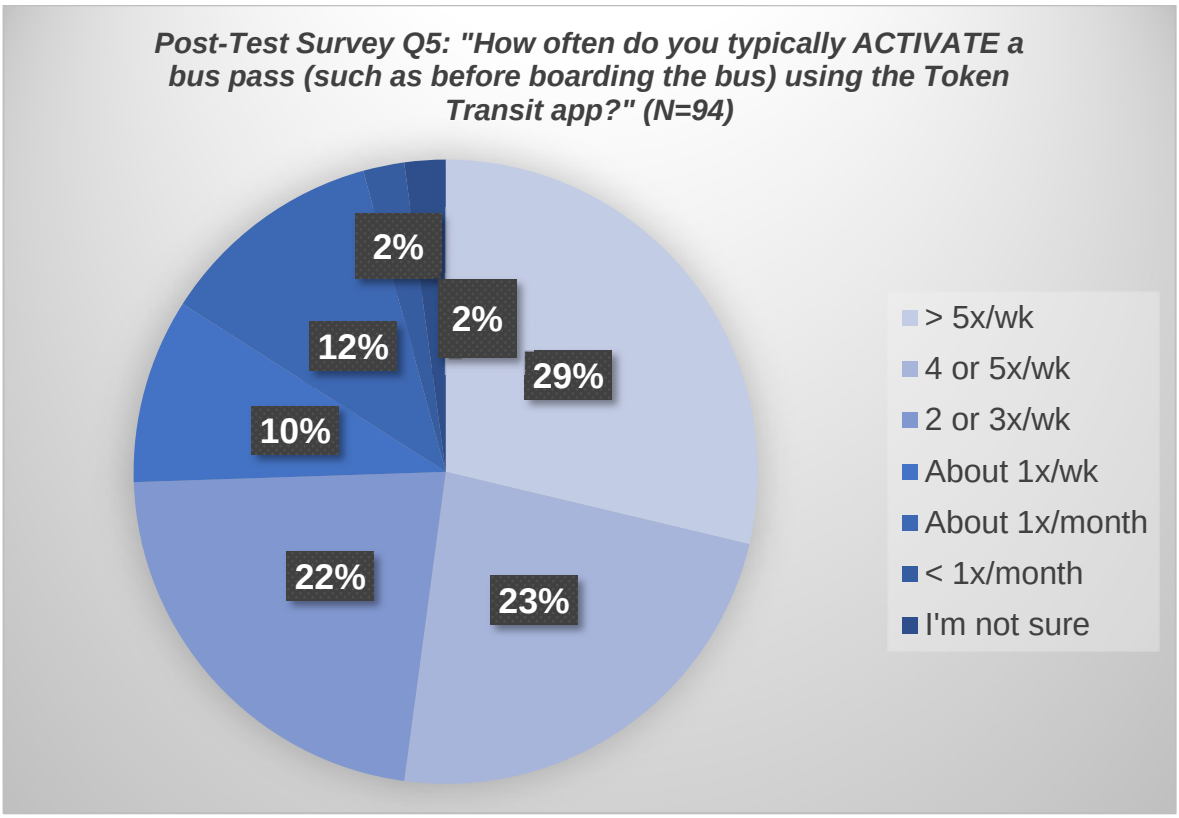

Figure 5. Utilization of mobile ticketing.

Participants also were asked what type of bus pass they have purchased using the Token Transit app (Q6). The most popular bus pass type was the regular one-trip pass, purchased by close to 55 percent of participants, followed by almost 36 percent purchasing the monthly pass. Almost 31 percent purchased the 7-day unlimited pass and over 26 percent purchased the one-day unlimited fare.

Although the survey results indicate that all bus pass types were purchased using the Token Transit app except for the Gadsden Express with a transfer, Token Transit data showed this pass type was purchased one time, suggesting the purchaser likely did not take the post-test survey. Just five individuals who took the post-test survey indicated that they rode the Gadsden Express. The post-test survey results also indicate from some riders that the Gadsden Express bus operators did not accept Token Transit, and that the bus riders could not purchase Gadsden Express multiple-trip passes using Token Transit. Over 60 percent indicated that it was either *somewhat important* or *very important* to be able to use a single app to purchase bus passes for both StarMetro and the Gadsden Express.

Almost 69 percent of bus riders perceived that they use *somewhat less* or *much less* bills and coins to purchase bus passes, and this was a major positive experience cited by many bus riders, in the open-ended comments.

Satisfaction Levels

The post-test survey asked several questions relating to satisfaction levels of bus riders with the Token Transit app.

Over 75 percent (N=95) of bus riders who participated in the post-test survey indicated in Q9 that they were *very satisfied* with the Token Transit app and another 20 percent were *somewhat satisfied*. Over 80 percent (N=94) in Q11 indicated they were likely to recommend the Token Transit app to a friend or relative and another 12 percent indicated they were *somewhat likely* to recommend the app. Over 87 percent (N=95) in Q12 indicated they were *very likely* to continue using the Token Transit app in the future, and another 7 percent indicated they were *somewhat likely* to continue using the app.

Over 89 percent (N=95) in Q13 indicated that using the Token Transit app has made it *much easier* to purchase a bus pass. Almost 75 percent (N=95) in Q14 indicated that they spend either *somewhat less* time or *much less* time purchasing a bus pass using Token Transit. Over 64 percent (N=95) in Q15 indicated that it takes them either *somewhat less* time to *much less* time boarding the bus, using the Token Transit app. However, 20 percent indicated that it takes them *somewhat more* or *much more* time boarding the bus using Token Transit. Based upon answers to issues experienced, this is likely due to Wi-Fi connectivity issues and a delay in being able to activate a bus pass on the bus rider's smartphone. Over 13 percent of bus riders indicated in Q23 that at least once a week, they experienced issues activating a bus pass when boarding a bus, discussed in a later section.

Summary of Highlights from Open-Ended Questions

For nineteen participants who took the baseline survey and qualified to participate in the pilot, but who ultimately did not participate, they were asked why they did not participate. Ten of these participants said they either did not take the bus or didn't need to purchase bus passes, such as if they already had a monthly pass. Eight indicated that it was too complicated or they did not have the time to read the instructions. One indicated concern whether the payment method was secure.

This is useful information for marketing a mobile fare payment app going forward. Messaging should address payment security. StarMetro should consider providing a Customer Operations assistance line to help customers get started using the app. While the Token Transit app is very user friendly to those who are comfortable downloading and using a variety of apps on their smartphones, some less tech-savvy customers may need someone with whom to talk and ask questions.

The survey asked participants to explain why they were or were not satisfied with the Token Transit app (Q10). Sixty-seven participants (N=67) responded with comments, 48 (72 percent) of whom provided comments of satisfaction, 16 (24 percent) provided comments of dissatisfaction, and three (4 percent) provided both comments of satisfaction and dissatisfaction. The responses are paraphrased and summarized below in Tables 2 and 3, listed by the most frequent response first, to the least frequent response. Some of the comments contained multiple reasons; therefore the sum of the comments shown below is greater than 67, the number of respondents. For example, if the response used both the words, "convenient" and"easy", they were both counted below. The actual responses were listed in Technical Memorandum 3.

Table 2: Reasons Given Why Customers are Satisfied with Token Transit

Frequency of Comment	Comment
20	Convenient
19	Easy to use
6	Do not have to carry cash
4	Will not lose bus pass on your phone
3	Saves time
3	Quick
3	Do not have to travel to buy bus passes
2	Reliable
2	Easy pass validation
2	You can store passes on your phone
2	Saves money
1	Efficient
1	Provides great help
1	Allows purchase of more than one pass at a time
1	"I'm satisfied"
1	"It works"

Table 3: Reasons Given Why Customers are Not Satisfied with Token Transit

Frequency of Comment	Comment
6	Slow Wi-Fi, slow to activate purchased pass
5	Wish to be able to use Token Transit offline
2	Worry about dead phone battery
2	Did not know what to show the driver
1	Big Bend passes not available for purchase
1	Not aware you can purchase different pass types
1	Thinks there is no capability to purchase a pass for another
1	Apple Pay, Android Pay, Touch ID not enabled
1	Gadsden Express does not accept mobile app
1	App forgot my card information
1	Not cost effective

The many reasons why bus riders like the Token Transit app can be used to improve future marketing messaging. Likewise, some of the causes of dissatisfication are due to a lack of understanding how the app works. Addressing the sources of confusion or lack of knowledge, by providing information as part of marketing can help bus riders use the app and enjoy the experience. In the future, Token Transit might want to consider allowing other payment methods in addition to credit and debit card. StarMetro also should offer the full array of Gadsden Express pass types on the mobile fare payment app.

StarMetro might wish to consider providing phone charging ports at key bus stations, awarding portable phone chargers as prizes during marketing campaigns, and developing a policy for handling cases where a customer's phone battery is dead. The prospect of a dead phone battery was a repeated concern by customer testers. While StarMetro's policy was made clear at the beginning of the pilot, that the functionality of a customer's phone is his or her responsibility, there might be other ways to handle this to convey sensitivity and good faith on the part of StarMetro. For example, if a bus operator recognizes a customer who rides regularly on that route, the bus operator could be given some latitude in exercising judgment to allow the rider on the bus.

Perceived Benefits of Mobile Ticketing

Bus riders were asked about the biggest benefits experienced using Token Transit. Their answers are paraphrased and summarized here.

1. Less time spent waiting in queues at ticket vending machines
2. Increased access to different fare types
3. Better ability to obtain a refund if a ticket is lost or stolen
4. Increased speed of buses (due to less time boarding)
5. Increased knowledge of spending habits for transit (via account management)
6. Increased information about StarMetro services (provided through the app)

In addition to the themes frequently expressed above regarding satisfaction with Token Transit, listed below are other answers provided.

1. Not having to think about or worry about having enough cash, exact change, fare cards, fumbling for coins upon entering the bus, and keeping track of transfer slips.
2. No waiting in line to purchase a bus pass, and risking missing the bus.
3. For some riders, buying a bus pass is a two-step process: going to an ATM for cash before going to C.K. Steele Plaza or the StarMetro administrative office to purchase passes. Alternatively, the process may involve going to an ATM for cash, then going to a store to break a bill for exact change. Use of a mobile fare payment app eliminates these trips.
4. Easy to keep track of expenses.
5. Environmentally friendly.
6. Secure.
7. Avoiding pass validation problems: “Showing a picture is much easier than getting the card to perfectly align with a target.”
8. Being able to pay with credit card.
9. “No one could talk me into let[ting] them use my pass. Because it is on my phone.”

The simple fact that using a mobile fare payment app enables riders to leave cash at home may even encourage more trips by bus. For example, one bus rider indicated riding StarMetro more often because of using Token Transit: “I am able to ride the bus EVERYDAY instead of having to take an Uber because I do not have cash!”

Perceived Challenges or Issues with Mobile Ticketing

Q23 quantified the frequency with which bus riders experienced an array of issues using the Token Transit app. Major challenges identified by bus riders in the open-ended question Q24 included the following.

1. Issues downloading the application.
2. Service/reception issues when purchasing a ticket.
3. Experience getting Token Transit bus pass validated.
4. Missing desired features in the mobile ticketing app.

Customer feedback largely indicated that using Token Transit to purchase bus passes and board the bus has been an easy experience. However, the ease of the experience is incumbent upon the bus rider's smartphone capabilities, such as a data plan, or Wi-Fi availability.

Wi-Fi Connectivity Issues

Once a rider pulls up his or her pass to activate it, the rider needs an Internet connection over a Wi-Fi or cellular data connection for the pass to be authenticated with Token Transit's server. Pass activation can be implemented by mobile app developers without an Internet connection, but offline activation is not as secure, and security mechanisms can be more easily circumvented. As a result, offline activation is more prone to fraud with riders being able to display what appears to be a valid pass without actually having paid for it.

Many cell phone users in the United States do not have unlimited data plans. These users purchase cellular data in tiers (e.g., with the price increasing 10 GB increments). Because each use of the Internet counts against a user's monthly data quota, they are incentivized to use a free Wi-Fi connection whenever possible. StarMetro offers free Wi-Fi at their major bus stations as well as on their buses that have the same network names.

It is hypothesized that some riders experienced issues activating their passes because of Wi-Fi connectivity issues when they were getting ready to board the transit vehicle. Specifically, StarMetro uses a Wi-Fi "captive portal" that requires users to agree to Terms of Service prior to allowing the device to access the Internet. When a bus arrives, the rider's phone (depending on device settings and prior Wi-Fi hotspot use) may try to automatically connect to the bus Wi-Fi. However, because the user hasn't yet opened their Internet browser and agreed to the Terms of Service, all data connectivity to the Internet is blocked. As a result, when the user tries to activate their ticket, their device cannot communicate with Token Transit's servers and the user gets an error message or is simply stuck waiting for a response.

StarMetro could resolve this issue by removing the captive portal from their Wi-Fi and allowing devices to immediately connect to the Internet as soon as the device connects to the Wi-Fi access point, either on the bus or at the station. Additionally, Token Transit may be able to implement Internet connection checks within their app to help provide the user with a better error message. Unlimited data plans are more expensive than tiered data plans. Households with lower income may encounter this issue more frequently than by households with higher incomes, which purchase unlimited data plans.

StarMetro could also name the Wi-Fi networks differently for buses vs. stations. If the Wi-Fi network name is the same for stations and buses, riders at major stations may mistakenly connect to a nearby bus instead of the station Wi-Fi. As a result, the user's connection to the Internet would be broken when that bus pulls away from the station if the rider is not on that bus.

Other Issues

In addition to the perceived challenges listed above, other identified issues were the following:

1. Not being able to talk on the phone at the same time as using Token Transit.
2. Fear of losing the phone, then having to buy passes.
3. Having to carry a second phone for bus location and alerts.

Listed below are additional comments (Q34) that are different from any that were previously listed under reasons for satisfaction, dissatisfaction, benefits, or challenges.

1. Lack of confidence in reliability of Internet connection
2. Running the risk that one's bus pass will be inaccessible, with the result of losing money, and being late for appointments.
3. Desire that the app be made "senior friendly."
4. Desire for more information about app security and protection of credit card information.
5. Desire that StarMetro enable pass holders to enjoy StarMetro campaign Ride Free Days so that the ride is not charged against an existing paid pass.

Comparison of Pre-Test and Post-Test Surveys: Travel Behavior

The pre-test and post-test surveys both presented a few similar travel-related questions to the pilot participants, as shown in Table 4, pertaining to bus routes they most frequently used, number of trips taken on the bus "last week", and their trip purpose. The pre-test survey, administered beginning in September,

presented participants with these questions prior to their downloading the Token Transit app and using it to purchase bus passes. The post-test survey, administered in November, presented similar travel behavior questions after the pilot participants had a chance to use the Token Transit app.

Table 4: Comparative Survey Questions in the Pre-Test and Post-Test Surveys

Topic	Pre-test Survey questions	Post-test Survey corresponding questions
Bus routes regularly used	Q6 What StarMetro bus route do you ride most often? If you regularly ride more than one route, please check all that apply.	Q28 What StarMetro bus route do you ride most often? If you regularly ride more than one route, please check all that apply.
Number of bus trips taken in the last week	Q8 In the last week, how many trips did you make on StarMetro buses?	Q30 In the last week, how many trips did you make on StarMetro buses? Q21 Has using Token Transit mobile payment app changed the number of bus trips that you take on StarMetro or the Gadsden Express?
Trip purpose	#9 What are the reasons you took the bus in the last week? Check all that apply.	#31 What are the reasons you took the bus in the last week? Check all that apply.
Mode of bus fare payment	#10 How do you usually pay for bus trips on StarMetro?	#7 Since you began using the Token Transit app, have you paid for bus trips in any other way? Check all that apply. #17 Has using the Token Transit mobile payment app changed how much cash (specifically, bills and coins) you use to purchase bus passes?
Use of mobile apps	#13 What mobile apps do you currently use when traveling via StarMetro? Check all that apply.	#20 Has using the Token Transit mobile payment app changed how often you use other apps when riding the bus (such as TransLoc Rider, DigiTally, or Trip Planner)?

Number of Bus Trips Taken

For purposes of comparing before- and after- pilot answers to the survey travel behavior questions to see if there might be any associations between use of the mobile fare payment app and travel behavior, several participants were set aside from the tally. These are for the following reasons:

- Never used Token Transit to purchase bus passes after completing the pre-test survey
- Did not answer the question, "In the last week, how many trips did you make on StarMetro buses?" posed in both the pre-test survey (Q8) and in the post-test survey (Q30).

In addition, participants' post-test surveys were set aside if they experienced any of the following changes in status, which might affect their travel behavior independently of the mobile fare payment app.

- Purchased a car
- Got a driver license
- Changed home location
- Changed job/school location
- Lost smartphone or tablet

In addition, the surveys of four participants were set aside from the tally because their survey responses for the number of trips taken on StarMetro within a one-week period seemed exaggerated or due to data entry error. For example, one of the surveys set aside, indicated taking 60 bus trips in the previous week, or what would amount to at least eight bus trips per day for all seven days of the week. The remaining number of surveys used to tally any change in travel behavior relating to bus trips totaled 60.

The mean number of trips taken in the past week as reported by survey participants in the pre-test survey was 8.4 trips. The mean number of trips taken in the past week as reported by survey participants in the post-test survey was 7.7 trips. It is important to note that when the survey participants were taking the post-test survey, they likely did not remember how many bus trips they indicated in their pre-test surveys. It also is important to note that the answers to trips taken are self-reported based upon memory, so it is likely that some of the answers reported are inaccurate.

Of these 60 participants, five indicated in their post-test survey (Q30) the same number of bus trips taken during the prior week as they indicated in their pre-test survey (Q8). A total of 17 participants indicated in their post-test survey that

they took more bus trips during the prior week than they indicated in their pre-test survey. A total of 38 participants indicated in their post-test survey that they took less bus trips during the prior week than they indicated in their pre-test survey.

Additionally, in the post-test survey, participants were asked if using the Token Transit mobile payment app changed the number of bus trips that they took on StarMetro or the Gadsden Express (Q21). This is a question about their perception of change. Table 5 below illustrates the number of participants reporting less bus trips, same number of bus trips, or more bus trips in the post-test survey (Q30), as compared with how these participants *perceived* change in the number of bus trips they took (Q21), as a result of using the Token Transit app.

There were 15 of the 60 participants, or 25 percent, whose number of bus trips taken in the previous week, as reported in both their pre-test and post-test surveys, matched their perception of change. Three of the five bus riders whose reported number of trips stayed the same in their pre-test and post-test surveys (reflecting trips taken before they downloaded the app and then again after they downloaded the app and started purchasing bus passes using the app), also *perceived* that the number of bus trips that they had taken remained the same. Two bus riders perceived that they took less trips since using Token Transit, matching their reported decrease in trips in their post-test surveys. Ten bus riders perceived that they took more trips since using Token Transit, matching their reported increase in trips in their post-test surveys.

Table 5: Comparison of Reported Trips to Perceived Change in Trips Taken

	Pre-Test Q8 Post-Test Q30 *"In the last week, how many trips did you make on StarMetro buses?"* (number of participants who reported)	Post-Test Q21: *"Has using Token Transit mobile payment app changed the number of bus trips that you take on StarMetro or the Gadsden Express?"*	Number of participants who reported
Number of participants who reported, in the post-test survey, taking **less** bus trips than reported in the pre-test survey	38	I took less trips	2
		I took the same number of trips	22
		I took more trips	14
Number of participants who reported taking **the same** number of bus trips in both pre-test and post-test surveys	5	I took less trips	0
		I took the same number of trips	3
		I took more trips	2
Number of participants who reported, in the post-test survey, taking **more** bus trips than reported in the pre-test survey	17	I took less trips	0
		I took the same number of trips	7
		I took more trips	10
Total	60		

Those participants whose reported number of trips in the post-test survey (Q30) was less than they reported in the pre-test survey (Q8), totaled 38. Of these individuals, two perceived (Q21) they had taken less bus trips, 22 perceived they had taken the same number of bus trips, and 14 perceived they had taken more bus trips. This is illustrated in Figure 6 below, in the stacked column on the left. Each stacked column represents the sum total, or 100 percent of bus riders reporting the number of trips they took.

Those participants whose reported number of trips in the post-test was the same as they reported in the pre-test, totaled five. Of these individuals, none perceived they had taken less bus trips, three perceived they had taken the same number of bus trips, and two bus riders perceived they had taken more bus trips. This is illustrated in Figure 6 below, in the middle stacked column.

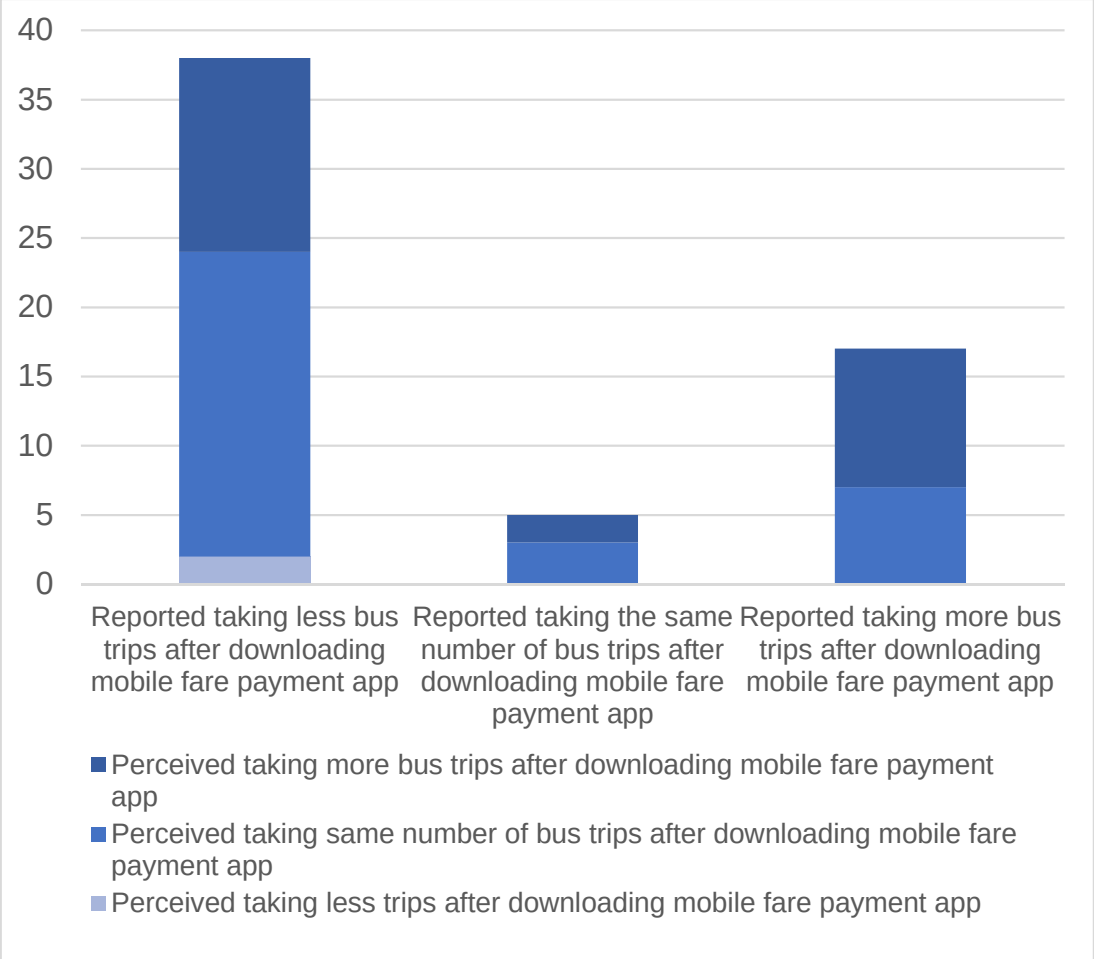

Figure 6. Comparison of reported bus trips with perception of change in number of bus trips taken.

Those participants whose reported number of trips in the post-test was more than they reported in the pre-test, totaled 17. Of these individuals, none perceived they had taken less bus trips, seven perceived they had taken the same number of bus trips, and ten bus riders perceived they had taken more bus trips. This is illustrated in Figure 6, in the stacked column on the right.

For those 38 who reported taking less trips in the post-test surveys, they reported a range of from one to eight less trips, reporting an average of 3.1 less trips. The median number was two less trips and the mode was one less trip.

For those 17 who reported taking additional trips in their post-test surveys, they reported a range of from one to nine additional trips, taking an average of 4.1 additional trips. The median number was three additional trips and the mode was one additional trip.

What explains the discrepancy between the numbers of bus trips reported and the perception of how use of the mobile fare payment app affected the number of bus trips that they took? It is possible that the bus riders could not correctly remember how many bus trips they took for the pre-test survey and/or the post-test survey and incorrectly reported them. It is possible that during those weeks that the participants reported their bus trips, those weeks might not have been typical with regard to their travel habits. Some survey participants might have changed their interpretation of the meaning of a bus trip between the time they took the pre-test survey and the post-test survey (i.e. one-way trip, round trip, one segment of a bus journey requiring transfers). While an attempt was made to eliminate variables that could have affected changes in travel behavior, not all factors could be controlled for. Therefore, it is not possible to conclude that the reported decrease in the number of trips reported in the post-test survey, was due to using the Token Transit app.

Mode of Payment for Bus Passes

Of the 60 participants, 36 used only Token Transit to purchase bus passes during the pilot. Of the 60, 11 indicated in the pre-test survey that they paid for their bus passes using a StarCard, and all but one of these indicated they used only Token Transit during the pilot. Of the 39 who initially paid for bus passes with cash, 23 indicated they paid using only Token Transit during the pilot. Four out of the nine participants who previously indicated paying for bus passes with a fare card, also continued to use other methods to purchase bus passes in addition to Token Transit, such as cash. Because some participants in the post-test survey indicated they had trouble with the Wi-Fi connection (discussed later in detail), it is possible that some paid for bus passes using other means besides Token Transit during the pilot due to this problem.

Trip Purpose

Fifty-seven out of the 60 (95 percent) indicated that they rode the bus for work or school purposes. Thirty of the 60 participants indicated in their pre-test surveys, that they worked full time and that they rode the bus to go to work. Seventeen of the 60 (over 28 percent) reported that they rode the bus to attend school. These trip purposes would seem to indicate that a large number of participants ride the bus for purposes that are regularly scheduled, repeat trips. Many of these participants also indicated riding the bus for other trip purposes as well, such as recreation, shopping, medical appointments and personal business.

Bus Routes Regularly Used

With regard to the question *"What StarMetro bus route do you ride most often? If you regularly ride more than one route, please check all that apply."* (pre-test Q6, post-test Q28). Of the 60 participants, 37 indicated a different set of bus routes regularly used, as compared to the bus routes they indicated in their pre-test surveys. This is so even though these 60 participants were screened to represent those who have not bought a car, obtained a driver license, or changed home, school or job location.

The difference in the answers given, comparing pre-test to post-test, could potentially be explained by a change in their interpretation of what bus routes they ride "regularly", or they may have given incomplete answers in one or both of the surveys, or it may be an indication of a change in participants' activities over time.

Use of Mobile Apps

In the post-test survey, participants were asked about their use of mobile apps, *"Has using the Token Transit mobile payment app changed how often you use other apps when riding the bus (such as TransLoc Rider, DigiTally, or Trip Planner)?"* (Q20). While 40 percent (N=95) answered that they use apps about the same amount as before, and another 24 percent indicated that they do not use any other apps when they ride the bus, 21 percent indicated that they use other apps either *somewhat more* or *much more* often when they ride the bus. Another 8 percent indicated that they use other apps either *somewhat less* or *much less* often when they ride the bus.

As shown in Figure 7, over 75 percent of participants indicated that it was *very important* to be able to use a single app to not only purchase bus fare, but also plan bus trips, and get real-time bus arrival information. When including riders that stated it was *somewhat important*, over 90 percent of riders indicated that using a single app for various transit features was important to them.

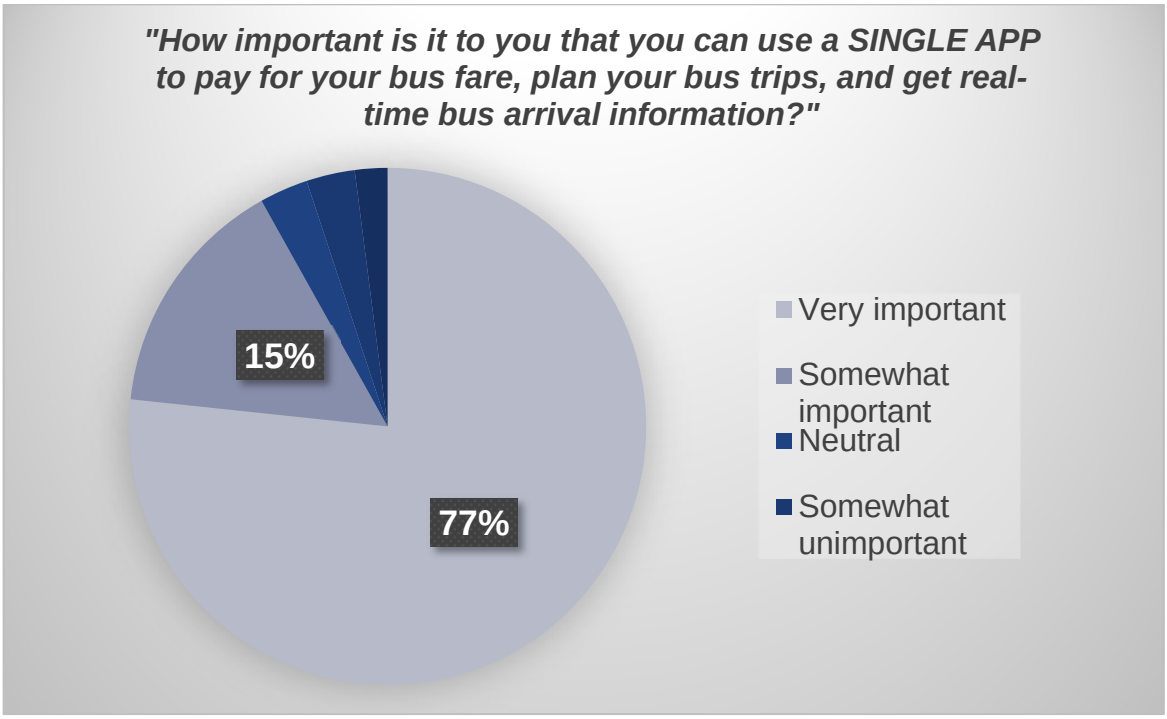

Figure 7. Importance of using a single app to pay bus fare

Over 76 percent also wanted the Token Transit app to incorporate additional features, including bus schedules. Another 67 percent desired receiving alerts about changes in bus service, and 31 percent wished for a “rate my trip” feature.

Other interesting ideas offered by customers for additional app features included offering a rewards program, and providing not only bus schedules, but also additional information on the app, such as route features, like parks, and information on special events, etc.

Customer Inquiries

Customer inquiries were received in two ways. First, customers were able to contact Token Transit staff directly through the “Help” app feature and ask questions via email, text, or phone. Secondly, customers could contact the City of Tallahassee Customer Operations staff if they had questions or were experiencing any problems. Over the course of the public testing of the app, very few questions were received by Customer Operations staff. The lists below contain all documented customer inquiries.

Inquiries Received by Token Transit

1. A Tallahassee Community College (TCC) student asked why TCC students do not ride fare free.
2. An inquiry received by Token Transit through social media inquired if Dial-A-Ride could be purchased through Token Transit.
3. One user accidently purchased two passes. Token Transit issued a refund since the second pass was not used.
4. A customer requested to be able to purchase Dial-A-Ride using the app.

Inquiries Received by City of Tallahassee Communications Department

1. Customer sought link to the Epass.
2. Customer asked what to do if his phone battery went dead.
3. Customer had difficulty completing the Token Transit app download process.

Evaluation of Bus Operators' Assessment of the App

A survey of the bus operators of StarMetro also was undertaken after the Token Transit app had been in use as part of the limited public test for five months. The survey was conducted for a one-week period from January 29th through February 4th, 2018. A link to a SurveyMonkey was provided, and bus operators accessed the survey via computers set up in two main break room locations. StarMetro employs approximately 150 bus operators, 110 of whom operate the fixed routes. There were 45 total responses from bus operators and 43 completed responses. This survey was for bus operators who drove the fixed route bus service provided by StarMetro and not for those who operated buses for the Dial-A-Ride service. Each fixed route was used by at least one bus rider who was testing the Token Transit app. Just one of the 45 bus operators who took the survey indicated that he or she had not encountered a passenger pay bus fares using the Token Transit app. That individual indicated primarily driving a university campus route where students ride for free and have no use for a mobile fare payment app.

The bus operator survey asked questions about the frequency with which the bus operator encountered a passenger paying fare using Token Transit, and level of satisfaction from the perspective of the bus operator. Questions also covered topics relating to perceived impact of the use of a mobile fare payment app upon ease of collecting bus fares, and the amount of time spent collecting

bus fares. Other questions included whether bus operators perceived a change in the amount of cash they handled, as a result of passengers using the Token Transit app, whether the amount of time it took for passengers using Token Transit to board the bus had changed, and how frequently they experienced various possible issues while validating Token Transit bus passes. The bus operators also were asked about their perception of the training they had received. The bus operators also were asked open-ended questions about their perception of the biggest benefit and the biggest challenges about validating Token Transit bus passes and whether they would recommend that StarMetro continue offering a mobile fare payment app for use by customers.

The results of the bus operator survey indicated overall positive perceptions about the Token Transit app. Almost 80 percent of bus operators who took the bus operator survey about the Token Transit app indicated they were either *somewhat* or *very satisfied* with the app. The other 20 percent were neutral. Over 77 percent of bus operators indicated they were either *somewhat likely* or *very likely* to recommend that StarMetro continue to offer passengers the ability to pay using the Token Transit app. Over 93 percent of bus operators indicated it was either *somewhat easier* or *much easier* to collect bus fares using Token Transit.

Regarding perception about the amount of time spent validating bus fares using Token Transit, close to 70 percent indicated they spent either *somewhat less* or *much less* time collecting bus fares, 12 percent indicated the time spent was the same as for other fare types, and approximately 14 percent indicated it took them more time to collect fares using Token Transit.

Regarding bus operator perception about the amount of time it took passengers to board the bus using Token Transit, 75 percent indicated it took either *somewhat less* or *much less* time for passengers to board the bus. Approximately 18 percent indicated it took *the same amount* of time, and approximately 5 percent indicated it took *somewhat more time* for passengers to board the bus. While it is not known why 14 percent of bus operators spent more time collecting bus fares and 5 percent perceived that passengers took longer to board the bus, it might be because of Wi-Fi difficulties reported by passengers in the customer survey. Based upon the answers to Q13, over 37 percent of bus operators indicated they had experienced issues with a passenger who did not have cell service or reception. Additionally, almost 26 percent of bus operators indicated they had experienced issues with a passenger who had a dead phone battery.

Regarding training to validate bus passes using Token Transit, approximately 52 percent indicated they received *the right amount* of training, but over 43 percent indicated they either received *too little* training or *no training* at all.

Mobile apps that only require visual validation of the bus pass avoid the expense of hardware investments in fareboxes that use newer technologies, such as Near Field Communication (NFC). However, over 25 percent of bus operators indicated they had experienced issues with seeing the pass on a passenger's phone. The exact cause of this difficulty in this study is unknown, although in the evaluation of another mobile app CUTR researchers reported users having difficulty seeing the screen due to the bright sun combined with a dim phone screen. It is recommended that StarMetro managers follow up with bus operators regarding the nature of this difficulty. If it is related to screen brightness, Token Transit may want to consider increasing the screen brightness automatically when the pass is being displayed on the phone.

Summary of Highlights from Open-Ended Questions to Bus Operators

Regarding the biggest benefit of using Token Transit, there were 22 bus operator responses that it was quicker, seven responses that it was easier, and three responses indicating not having to collect cash. One operator indicated there was less bill and coin jam in the farebox. Another indicated confidence of "knowing the fare is there." Another operator commented that use of Token Transit by passengers resulted in "getting them away from my fare box so I can move on." Two operators indicated that Token Transit made the boarding process "less aggravating" and "…it helped make the day go smoother."

Six bus operators indicated the problem experienced with service connection on the passenger's smartphone. There were a few additional comments, all of which were positive: "I prefer this method." and "Make it available to all passengers." and "Push this…throughout our entire transit system." and "Not enough people are using it."

Transit Agency Staff Debriefing

A debriefing meeting was held March 22, 2018, with StarMetro staff who had been involved in the Token Transit pilot, in addition to staff from City of Tallahassee Customer Operations, and FDOT staff. The purpose of the meeting was to assess satisfaction with Token Transit.

During the debriefing, CUTR researchers shared highlights from the results of the open-ended survey questions that had not been discussed earlier. CUTR researchers also presented recommended considerations regarding mobile app capabilities. StarMetro staff shared their perspectives about the pilot.

StarMetro staff expressed no dissatisfaction with the timeline of the Token Transit app deployment. App configuration for beta testing by StarMetro was

completed within four months, by the end of June 2017. Following a two-month internal beta test period, the Token Transit app was then released for public testing. Indeed, one of the advantages of a mobile fare payment app using only visual validation is no need for purchased installation of farebox hardware. Use of an "off-the-shelf" app made deployment much quicker than if StarMetro had chosen to develop its own custom app.

No complaints were received from StarMetro staff regarding the training provided by Token Transit. Token Transit staff visited StarMetro during the June 2017 workshop and provided bus operator supervisors with a YouTube training video, a brief illustrated hand-out of instructions, and the demo accounts anyone could use to become familiar with the app. Token Transit staff were responsive to questions via email and conference call.

BowStern was the marketing consultant hired by CUTR to plan and implement a marketing campaign to raise awareness about the pilot, and recruit participants to sign up to participate. StarMetro staff offered no complaints about the BowStern marketing campaign designed for the pilot project. All objectives for bus rider recruitment and participation in the pilot were met. BowStern staff communicated and coordinated regularly with City of Tallahassee Communications staff throughout the pilot.

StarMetro staff were asked a series of questions about the functionality of the app, as well as client services from Token Transit. StarMetro staff answered "yes" to all questions asked, as shown in Table 6 below. StarMetro staff said the Token Transit dashboard was easy to understand and helped them track passes. The dashboard shows real time pass purchases by individual account, linked via phone number.

During the time period of the pilot, in December 2017, StarMetro discontinued the sale of new 31-day StarCards. During the time of the StarCard discontinuation, StarMetro staff reported that there was an increase in calls to customer service regarding other payment options, including Token Transit.

When StarMetro staff was asked what they would recommend to other transit agencies interested in pursuing a mobile fare payment app, StarMetro staff said they would recommend a soft launch for the entire system and not for just a few routes. Indeed, this is what StarMetro ultimately decided to do prior to their own limited public launch. The customer post-test survey indicated participation from riders using all StarMetro fixed routes. StarMetro staff also commented that regular team meetings were helpful during the pilot.

Table 6: Assessment of Token Transit App Functionality and Client Service

Yes	No	Function/Service
✓		Has StarMetro continued to receive daily revenue transfer data?
✓		Has StarMetro continued to receive finance reports on the first of each month?
✓		Has StarMetro continued to have access to daily aggregated updated rider analytics: number of bus passes sold by fare type, month, day of week, total sales, fees, net sales?
✓		Has StarMetro continued to have access to daily individual sales by fare type, date/time, card last4, sale amount, fee, net sale?
✓		Does StarMetro have the capability to issue refunds by accessing individual rider accounts?
✓		Can StarMetro control or change word, image, and color of the day?
✓		Has the color of the day issue been remedied so that the same color does not occur on any two consecutive days?
✓		Does StarMetro have the capability to print color, word, image of the day for just one day?
✓		Does StarMetro have the capability to make changes to fare structure within the Token Transit app?
✓		Does StarMetro have the capability to download raw data as CSV files?

One time during the pilot, the Token Transit app system went down and was inaccessible to riders for a brief period of time. Token Transit immediately reimbursed all affected riders but notified StarMetro after the fact. StarMetro staff commented that they would have liked to have been notified as soon as the incident happened. Nonetheless, StarMetro staff expressed overall satisfaction with Token Transit technical support and customer service. No customer calls that were referred to Token Transit called back to StarMetro Customer Operations.

The Wi-Fi connectivity portals on the StarMetro buses has been a challenge. StarMetro staff inquired if app loading can be done “off Wi-Fi” but a CUTR researcher explained that there would be a security trade-off.

StarMetro indicated they would like to have assistance with the integration of their mobile fare payment app with the other apps provided to bus riders, including DigiTally.

One of the initial appeals of the Token Transit app was its “universality” feature, enabling a bus rider to purchase bus passes for different participating transit systems using the same Token Transit app. This feature is especially helpful for riders who are making a regional trip across transit service areas. This ability requires the different transit systems to contract with Token Transit. Prior to the pilot project, the original interest had been to test this universality feature. As part of this test, the StarMetro project manager originally proposed to offer a discounted “regional” pass to bus riders who wish to ride the Gadsden Express and transfer to a StarMetro route, for $2.00, instead of the current price of $2.25. StarMetro ultimately chose not to do this as part of the pilot.

Going forward, this capability can be offered. It might be worth considering because some of the customer suggestions received through the survey were to offer Gadsden Express bus passes via Token Transit. These customers either did not notice they could purchase the one-trip Gadsden Express passes under the StarMetro menu of fares in Token Transit, or they may have preferred the Gadsden discounted multiple passes not offered through StarMetro. These 20- and 40-ride passes can only be purchased at the Big Bend Transit Office in Quincy. One of the biggest benefits to Star Metro bus riders was to not have to make the trip to the C.K. Steele Plaza or the StarMetro administrative office to purchase passes. The Gadsden Express riders wish for the same benefit.

Documentation of the Token Transit App Capabilities

The following is a discussion of the capabilities of the Token Transit app to interact with other systems.

Mobile App Portability between Agencies

Transit agencies are increasingly looking for universal fare payment options for riders, whether across more than one transit operator or between modes (e.g., parking fees for park-and-ride). The rider benefits from universal payment systems by being able to use the same form of payment for multiple legs of their trip.

The use of visual validation technology for fare payments does not require any physical infrastructure to be installed on a bus. As a result, there are no physical infrastructure barriers to using the same fare payment app across more than one agency. The Token Transit mobile fare payment app, shown in Figure 8, has taken advantage of this design and offers a single app across *all* of their transit agency customers.

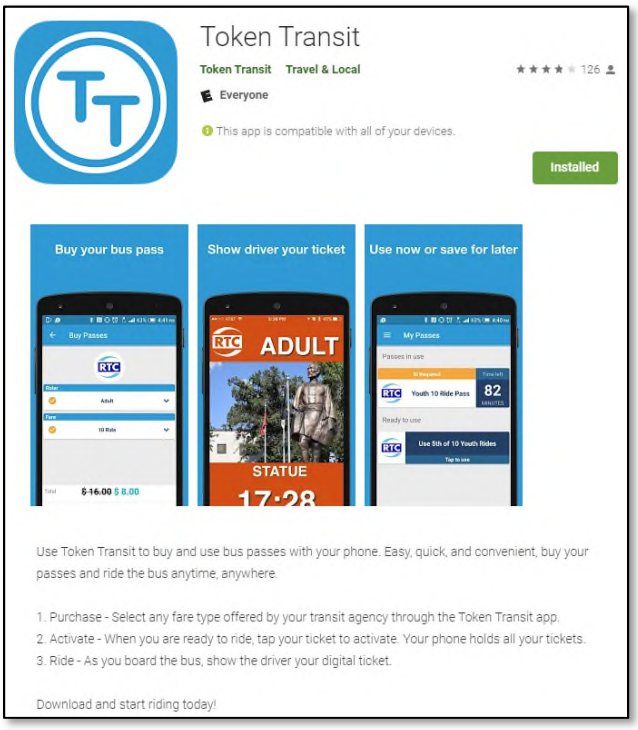

Figure 8. The Token Transit app used by all of its transit agency customers.

In other words, a transit rider downloads the "Token Transit" app from the app store and then can use that same app at any supported transit agency[2]. In the "Settings" section of the Token Transit app, a full list of all supported agencies can be seen as shown in Figure 9 below.

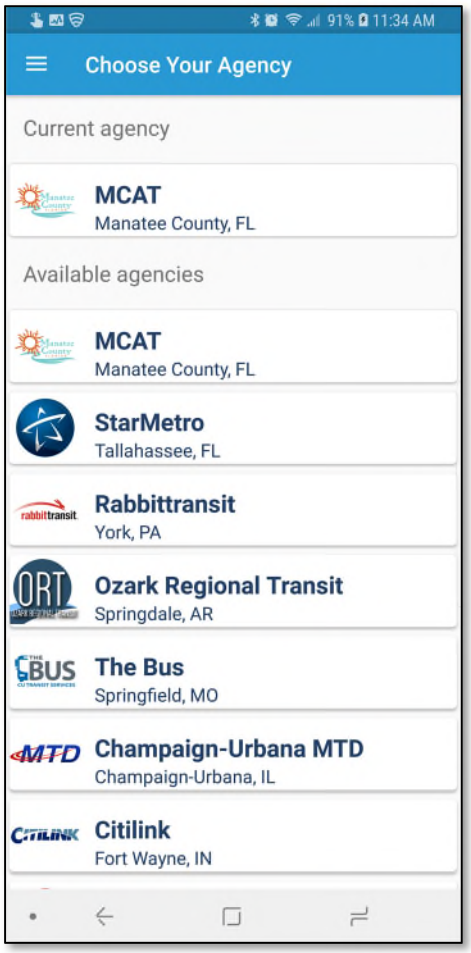

Figure 9. Multiple agencies nationwide use the Token Transit app.

This contrasts with the approach other vendors have taken to deploy a unique app, custom developed for *each* of their transit agency customers. This is currently the case with the LYNX PawPass, shown in Figure 10 below.

[2] While the app can be used by any transit agency that chooses to contract with them, fare purchases are still specific to each local agency. In other words, as of today one cannot buy a pass for a transit agency in Florida and use that same pass for a transit agency in California.

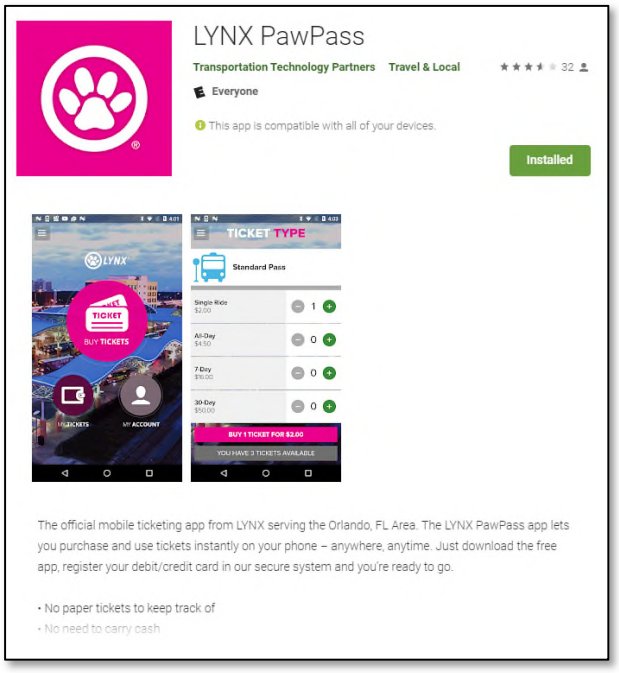

Figure 10. The LYNX PawPass mobile payment app in an app store, specific to LYNX users.

In this model, the transit rider downloads the "Agency X" app (named for the transit agency) from the app store, and can only use the app at that one agency.

The advantage to the single app model is that the vendor only needs to maintain a single app on the app stores, no matter how many agency customers the vendor has. When a vendor deploys an app for each agency, the vendor must maintain and update each of these apps separately. As a result, it takes more effort to scale to a larger number of agency customers, which may result in higher costs to the agency. Additionally, when the vendor rolls out an update or new feature to the single app, it is immediately available for all agencies, even if it was developed to serve a single agency. When the vendor is updating an app per agency, the new feature may not become available quickly to all the other agency apps, as it requires additional effort to update each of these apps. The OneBusAway open-source project has a similar model of one mobile app for all agencies participating in the project, and agencies benefit from features implemented for one region becoming available in other regions at little to no cost to the other agencies.

The disadvantage to the single app model is that the agency's brand is not as apparent in the app store. For example, the LYNX PawPass has it's own app store listing, where the LYNX brand is clearly displayed. With Token Transit, the agency's brand cannot be seen in the app store listing (although it is visible within the app when purchasing and using passes).

Integration Options for Mobile Fare Payment Apps

Transit agencies are very interested in making their services available to riders via mobile apps. Fare payment is just one of these services – many agencies also have apps for real-time arrival and vehicle position information, trip planning, and other services (e.g., flex service, bike share, transportation network companies). As shown in the survey responses from this research project, over 90 percent of bus riders riders either somewhat or strongly prefer a single or primary app to access all of these services, versus having to download and switch between multiple apps, each of which has only one set of information. This is illustrated in Figure 11.

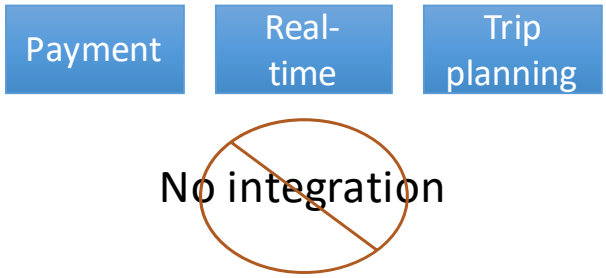

Figure 11. Riders dislike having to switch between multiple transit apps that provide different information.

There are two primary strategies for integrating multiple services, potentially maintained by different vendors, in the same mobile app:

1. Partial integration
2. Full integration

It is strongly recommended that when procuring a mobile app, or contracting with a software developer, agencies should request "deep links", Application Programming Interfaces (APIs), or a Software Development Kit (SDK) (discussed in detail below) to support future flexibility for integration options.

Partial Integration

A diagram for partial integration is shown in Figure 12.

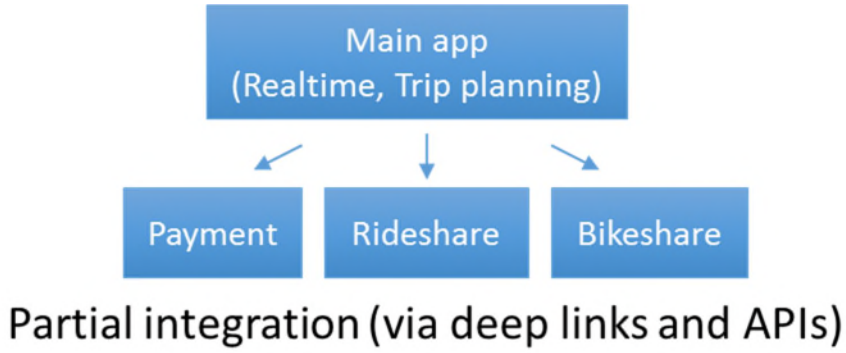

Figure 12. Deep links allow riders to use a main app to link out to other apps as needed.

In this model, there is a main app that contains some features, but for other features when the user taps on the option, they are directed to a separate application that includes this functionality. This is typically accomplished using "deep links" that can take the user to a specific screen in the secondary app. For example, if the main app shows a map with markers representing bikes available to rent, and the user taps on a bike near their real-time location, the main app can pass that bike ID via a deep link to the separate bikeshare app, which then opens directly to a screen to reserve that specific bike and enter payment information. If the user does not already have the bikeshare app installed, they would be directed to the app store to download it the first time they tap on the bike icon in the main app. The main app could get the bikeshare information to display on the map from an Application Programming Interface (API) or data feed provided by the bikeshare vendor (e.g., the General Bikeshare Feed Specification). This is a "read-only" feed that provides information about the availability of bikes. The vendor's app must be used to book and pay for a bike.

Partial integration has the advantage over no integration by providing a clear marketing and branding message to the user—the agency is able to direct the rider to a single main app to download and install. Additionally, the user is able to conveniently access information in the secondary apps based on options they choose in the main app (e.g., the bike marker on the map). When apps are not integrated, the user would have had to identify the bike on the map in one app, remember the ID of that bike, then open the second app and search for a bike with that ID. Partial integration also allows the maintainer of each app to separately improve and change their app as needed--as long as the deep link

and API format does not change, the main app will still successfully direct the user to the right screen within the secondary app (even if that screen changes in design significantly). Because development on each app does not need to be closely coordinated with other apps, the effort to integrate the apps tends to be less than full integration, discussed next.

Full Integration

The full integration approach is shown in Figure 13.

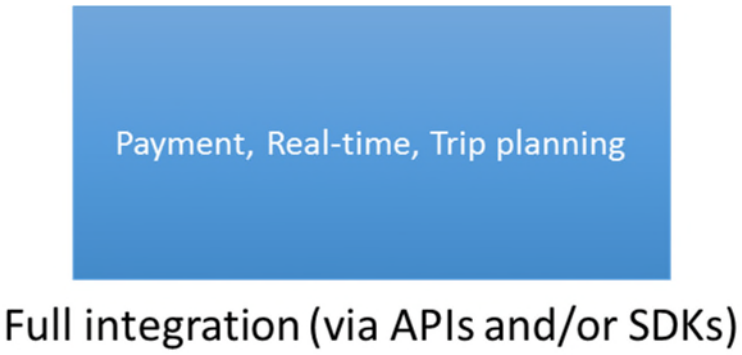

Figure 13. Full integration provides all features in one app.

Full integration is a single app on the app store that includes all features in a single app download. The advantage of this approach to the agency is total control over the look and branding of the main app, as well as how the user interacts with all of the different features in that same app. Additionally, a single app takes up less space on a device than multiple apps, which is important for users with lower-end devices that have limited storage space.

Full integration is typically accomplished with a combination of APIs and/or Software Development Kits (SDKs) that allow the developer of the main app total control over how the information for other vendor systems is presented to the end user. The disadvantage of full integration is that it requires the main app developer to design and implement all of the functionality for various vendor systems within the main app, typically resulting in higher integration and maintenance costs.

As part of this project the research team asked the following vendors of mobile ticketing apps in Florida to provide information about integration options:

- Token Transit (StarMetro, Manatee County Area Transit)[3]
- Transportation Technology Partners (Lynx PawPass[4])
- Passport Parking (Jacksonville Transportation Authority[5], Miami Dade Transit[6])
- Bytemark (Hillsborough Area Regional Transit (HART) and Pinellas Suncoast Transit Authority – Flamingo Fares[7])
- Transdev Link (HART HyperLINK service[8])

A summary of vendor responses is included in each of the subsections below.

Token Transit

Token Transit supports mobile app deep linking (called Universal Links on iOS and Android App Links on Android), as illustrated in Figure 14 below. This feature allows web or app developers to easily integrate Token Transit app behavior by linking out to the Token Transit app via links and buttons in their app. Deep linking allows other apps and websites to direct to specific application behavior such as opening a purchase screen for a specific agency, rider type, or pass type; displaying the user's current passes; or displaying a user's current active ticket. App deep linking does not require any shared code to be embedded in another application, and can be quickly implemented by most app or web developers.

[3] https://www.tokentransit.com/
[4] https://www.lynxpawpass.com/
[5] http://myjta.com/
[6] http://www.miamidade.gov/transit/easy-pay.asp
[7] http://www.gohart.org/Pages/flamingo.aspx
[8] http://www.gohart.org/Pages/Hyperlink.aspx

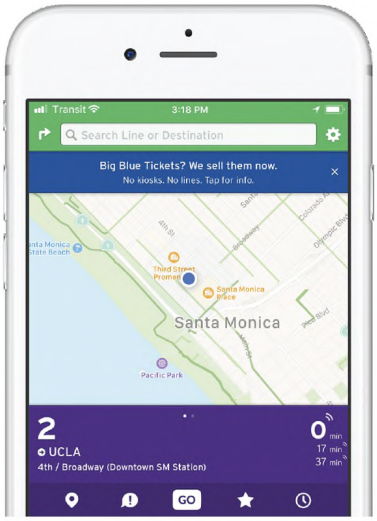

Figure 14. Sample deep link integration in transit app with Token Transit (tap on blue banner to be directed to the Token Transit app.

Basic deep linking to the main screen of the Token Transit app is now available, as illustrated in Table 7, and advanced deep linking is planned for Q2 2018 (agency-specific, purchase screen specific).

Token Transit plans to provide an SDK so other developers can deeply integrate Token Transit's mobile ticketing service into an existing mobile app.

Table 7: Token Transit Deep Link Formats

/	Token Transit Home screen
/purchase	Purchase screen (no agency set)
/purchase/{agency_id}	Purchase screen (for particular agency)
/purchase/{agency_id}?rider={rider_id}&pass={pass_id}	Purchase screen for particular agency with specific options selected

The Token Transit SDK provides access to the full suite of pass purchase, pass activation, and pass display from Token Transit. All user interfaces must be provided by the implementer (main app) except for pass display. The Token Transit SDK is available as an iOS Objective-C framework and an Android Java library. Token Transit plans to make their SDK available in Q3 2018. Figure 15 illustrates a sample SDK integration.

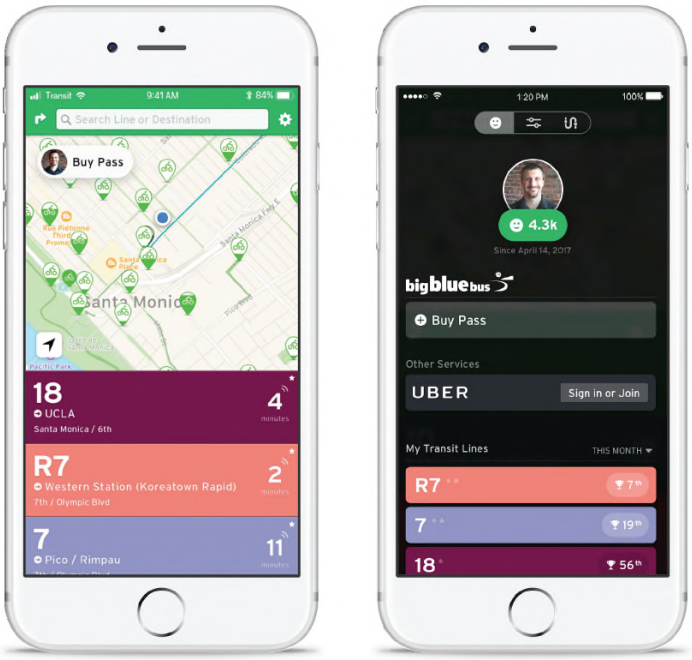

Figure 15. Sample SDK integration of Token Transit pass purchases directly within transit app.

Transportation Technology Partners

Transportation Technology Partners provides a Representational State Transfer (REST) API web service[9] that third parties can integrate to include payment capabilities in a separate app (requires API keys and authentication via OAuth2). Some basic deep linking capability is also available. A roadmap is under development for future features, expected to be available in the June 2018 timeframe. An SDK that can be integrated directly into third-party apps is planned for the mid to long term time frame.

Passport Parking

Passport has the ability to integrate payment for mobile ticketing and other mobility payments (parking or tolling) into a third party application via an API.

[9] https://lynxpawpassapi.ttpapps.com/api/ui/index

These payment APIs allow the third party application developers to control the user interface but use Passport's secure payment ticketing technology.

Passport has deep links to all Android and iOS applications that are deployed for specific agencies that can be embedded into third party applications. Each application has their own unique deep link and can be provided to an interested third party on the same day of request. Passport can also push the fare and customer data into a third party business intelligence tool if an API is available for the business intelligence tool.

Passport has the following on their feature roadmap:

- Q3 2018 - Passport will create a mobile ticketing SDK that allows for the full mobile ticket payment purchasing and ticket display to be embedded into a 3rd party application. Using an API integration is the preferred method to limit application size and control user interface design.
- Q3 2018 - Improved API sets to allow for deeper customer management via unique API endpoints on the front facing application.
- Q4 2018 - Enhanced fare APIs to allow for aggregated mobility fares (parking, transit, and TNCs) bundle payment API.

Conclusions

The conduct of the pilot of the Token Transit mobile fare payment app yielded useful information about mobile ticketing, and some recommendations for consideration by StarMetro and by the mobile fare payment vendor.

Design of the pilot

The design of the pilot was purposely limited to a small subset of StarMetro's and the Gadsden Express' overall ridership. This was to avoid unanticipated calamitous problems systemwide if a serious issue had surfaced, resulting in an overwhelming number of bus rider calls for assistance to Customer Operations. Additionally, participation in the pilot was initially limited to those who chose to sign up (a self-selected group that may not mirror the entire customer population), met certain qualifications (i.e., age 18 and over), and completed the baseline survey. This was for the purpose of collecting before-pilot and after-pilot information about the participants. Later during the public testing, it was decided to allow other customers to use the Token Transit app if they requested it, even though their perceptions would not be captured in the surveys. The disadvantage of an app deployment limited to a small number of users is the inability to draw conclusions with regard to the rate of app adoption, popularity and use of mobile fare payments across StarMetro's and Gadsden Express' entire ridership.

Other transit agencies that had previously deployed mobile fare payment apps advised that conducting a pilot test is time and resource intensive. Because of this, it is better to conduct an initial pilot stage as part of a commitment for a permanent deployment, rather than as a temporary test. This is to avoid discontinuing a service to customers after they have already grown accustomed to using it. This also is to avoid the scenario of replacing one mobile payment app with a different one and potentially causing customer confusion or lost fares.

Customer Difficulties with Wi-Fi

The ease of purchasing StarMetro and Gadsden Express bus passes using the Token Transit app is incumbent upon the bus rider's smartphone capabilities, such as battery life and their data plan, or Wi-Fi availability.

Internet connectivity via Wi-Fi or a cellular data plan is required for the Token Transit app to activate a pass. Without an Internet connection, pass activation can be performed but it is not as secure as requiring an on-line connection – in other words, it is easier for users to bypass security mechanisms that prevent them from showing a pass to the driver that they haven't paid for.

As discussed earlier, StarMetro may want to consider removing the "captive portal" from their Wi-Fi access points to avoid the situation where a rider's phone attempts to automatically connect to Wi-Fi but is then blocked from accessing the Internet until the rider opens their web browser and agrees to the Terms of Service. Alternately, StarMetro could implement a system to require a user to only agree to the Terms of Service once, and then future connections from that device would immediately be directed to the Internet. StarMetro may want to consider naming the Wi-Fi hotspots on their buses and at their bus stations differently to avoid a rider accidentally connecting to a bus Wi-Fi when at a bus station and then having that connection be interrupted when the bus that they are not riding departs.

These Wi-Fi connectivity issues only affect riders that use a Wi-Fi connection on their device – riders that use a cellular data connection are not affected. As a result, riders that do not have unlimited data plans are the most likely to be affected. Because unlimited data plans are more expensive than tiered data plans, lower income riders may be affected more than higher income riders.

Satisfaction with Token Transit

StarMetro used an "off the shelf" mobile fare payment app, instead of attempting to develop an application in-house. Notably, prior to StarMetro's pilot deployment of Token Transit, this same app had already been deployed by several other transit agencies across the United States. This circumstance has likely been advantageous for StarMetro in that most technical difficulties may

have been addressed and lessons learned working for the other transit agencies may have carried over to StarMetro in the form of a smoother experience than StarMetro might have had, were it Token Transit's very first customer. The internal testing of Token Transit was an efficient experience, aided by useful tools, such as Token Transit's demo accounts.

Developing a mobile fare payment app in-house affords the ability to tailor it to the unique requirements and preferred specifications of the transit agency. However, StarMetro is a smaller transit agency than many and its fare collection needs and service offerings are standard, with no unusual circumstances that might otherwise warrant the development of an in-house solution. The main disadvantage of using an app like Token Transit that serves multiple regions is that StarMetro's brand is not the primary focus in the app store listing of the payment app – in other words, the user downloads the app called "Token Transit", not "StarMetro". However, StarMetro did not voice any concern with the lack of agency branding on the app store. StarMetro's branding does appear within the TokenTransit app when the user starts the app in the Tallahassee area.

While contracting with a mobile fare payment vendor may take some percentage of the revenues from bus fares, the positive side of deploying an off-the-shelf product like Token Transit is that the transit agency will not have the responsibility and ongoing expense of updating and maintaining the app.

Marketing Messaging

Marketing messages can include the many reasons why bus riders like the Token Transit app, which will likely entice additional users to download and try the app. However, some of the causes of dissatisfication were due to a lack of understanding of how the app works and frustration with figuring it out. The vast majority of user feedback indicated that the Token Transit app was easy and convenient. However, addressing the identified sources of confusion, such as providing information as part of marketing, could help more bus riders use the app and enjoy the experience. StarMetro might consider promoting the availability of their Customer Operations phone number to help new users get started using the app.

StarMetro might wish to consider providing phone charging ports at key bus stations or even on-board buses, awarding portable phone chargers as prizes during marketing campaigns, and developing a policy for handling cases where a customer's phone battery is dead. The prospect of a dead phone battery was a repeated concern by customer testers, although this was not reported to be a significant problem in the actual deployment of the app. While StarMetro's policy was made clear at the beginning of the pilot, that the functionality of a

customer's phone is his or her responsibility, there might be other ways to handle this to convey sensitivity and good faith on the part of StarMetro. For example, if a bus operator recognizes a customer who rides regularly on that route, the bus operator could be given some latitude in exercising judgment to allow the rider on the bus. As recommended by other agencies that have deployed mobile fare payment apps, StarMetro may want to treat this case similarly to their other policies that already exist but are not related to the fare payment app. In this case, StarMetro may want to treat a dead battery in the same way they treat a lost physical pass.

During the focus groups, one participant said she believed that a "Regular 1-Trip Pass" meant that it did not include a transfer. One may assume that the many bus riders who participated in the public launch figured out that their Regular 1-Trip Pass included any bus trips within the 90-minute window, allowing for free transfers. Had customers interpreted this differently, they likely would not have used the app, thinking the cost of a bus journey requiring a transfer was more expensive using the app, than by other payment methods. Going forward, it is recommended that this potential misinterpretation should be considered by StarMetro, in that it might discourage new users. Future marketing of the app should emphasize that transfers are free, similar to other fare media.

Over 25 percent of bus operators indicated they had experienced difficulty seeing the mobile pass on a passenger's smartphone. The exact cause is unknown, although based on the prior experience of the research team it may be related to the bright sun and a dimly lit smartphone screen. It is recommended that StarMetro managers follow up with bus operators regarding the nature of this difficulty.

It also is recommended to provide ongoing refresher training to StarMetro bus operators and provide further training to Gadsden Express bus operators to validate mobile bus passes, in response to a customer who was told by a Gadsden Express bus operator during the pilot that mobile bus passes are not accepted.

It is recommended that Token Transit highlight their information about security of payment and personal data. Token Transit might wish to consider allowing other payment methods in addition to credit and debit card, to make the Token Transit mobile fare payment app even more available to those who lack credit or do not use a bank.

Integration of Multiple Transit Features in a Single App

The survey results from the deployment of the mobile fare payment app clearly indicate that riders want to be able to easily access real-time information, trip plans, fare payment, and other features within a single app, as opposed to having separate apps for each feature that are not linked to each other. As discussed earlier, partial integration, where a single app serves as the "master" app and links to the other app features as needed, can be accomplished using deep links and APIs. Full integration using APIs and/or SDKs typically requires higher integration and maintenance costs but provides the agency with more complete control over the user interface and branding of all of the various functionality.

To help support either integration option, agencies are strongly encouraged to require that vendors responding to Requests For Proposals (RFPs) include APIs and deep links and/or SDKs in their solutions. The availability of APIs, deep links, and SDKs will provide the agency with more flexibility and integration options when they decide to pursue a single app that includes easy access to multiple transit features (via either partial or full integration). This requirement for open access should also extend to other multimodal solutions deployed in the region. For example, if bikeshare is being deployed in the area, the bikeshare vendor and operator should be required to provide a General Bikeshare Feed Specification (GBFS - https://github.com/NABSA/gbfs). If a de facto or official standard exists for a particular integration area (e.g., GBFS for bikeshare), the vendor should be required to implement that standard.