



Fare Collection Strategy

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TECHNOLOGIES

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Background

As EMBARK prepares to debut the Oklahoma City Streetcar, the agency is exploring fare collection technology options for the streetcar as well as possibilities for intermodal fare integration. To aid in this effort, the agency has asked Four Nines Technologies for assistance in developing a comprehensive Fare Collection Strategy. This strategy is part of larger study to establish EMBARK fare policy and evaluate its fare structure.

This strategy will touch on all modes under the EMBARK umbrella of services, including fixed route bus, streetcar, paratransit, and ferry with potential integration with parking and bikeshare. It will provide guidance for the agency in the near-term as the OKC Streetcar comes online. The strategy will also speak to the long-term by providing EMBARK with an overview of emerging technologies in the fare collection space and how those technologies might benefit the agency and its users in the future.

Process

In creating this Fare Collection Strategy, Four Nines worked with a variety of EMBARK stakeholders. Meetings were conducted with EMBARK staff from numerous departments:

In addition to stakeholder interviews to understand the strengths and weaknesses and gauge interest in recent fare collection options and trends, a series of meetings have been conducted throughout the study to educate EMBARK on industry best practices and trends, including:

- Stakeholder interviews on January 19-20, 2017
- Fare Collection Technology History, Options, and Trends on April 25, 2017
- Streetcar Fare Enforcement & Fare Collection Alternatives on April 25, 2017
- Mobile Ticketing Vending Vendor Demos on June 2, 2017 (conference call)
- Mobile Ticketing Strategy - Four Nines' Recommendation on July 14, 2017 (conference call)
- Streetcar Fare Enforcement on August 3, 2017
- Ticket Vending Machines & Fare Enforcement Equipment on August 18, 2017 (conference call)
- Review of the Fare Collection Strategy on October 3, 2017

Four Nines incorporated best practices from working with other agencies to plan and implement fare collection systems when we evaluated the strengths and weaknesses of EMBARK's current fare collection system and identified opportunities. This assessment is included in the Summary of Findings report.

Four Nines also reached out to numerous peer agencies, including Cincinnati, Detroit, Atlanta, and Little Rock. Interviews with these operators, all of whom operate a streetcar service, shed light on fare enforcement, fare integration, and fare technology. Four Nines documented the lessons learned into the Streetcar Peer Review technical memorandum.

This fare collection technology strategy incorporates these findings, industry best practices & lessons learned, and direction based on Four Nines recommendations and input received from EMBARK staff.

Goals and Objectives

To guide their fare collection technology strategy, EMBARK established an overarching vision for its system in the form of goals and accompanying objectives. Goals can span a wide array of elements in technology, service, operations, management, and beyond.

The goal of the fare policy and fare collection strategy is a fare system that:

- Provides choices for customers that are easy to understand, explain, and use,
- Attracts new customers and additional trips from existing customers,
- Promotes multimodal fare integration and trip making,
- Uses fare collection technology to enhance fare payment options for riders and assist in fare enforcement,
- Is equitable and takes into consideration a rider's ability to pay,
- Achieves fare revenue needs and strives to achieve EMBARK's farebox recovery revenue target,
- Accommodates accounting and reporting needs,
- Considers transit industry best practices in fare technology for the different modes while taking into consideration the costs of the technology and approaches used by similar size peers, and
- Strives for high levels of system reliability.

Provides choices for customers that are easy to understand, explain, and use: Aiming for simplicity in a fare policy and fare collection technology gives riders a greater sense of personal mobility by enabling them to use EMBARK's services easily. The ability for a rider to readily look up the fare structure and pay with a smartphone in their pocket can support the rider's decision process and make travel from point A to B easy and convenient.

Attracts new customers and additional trips from existing customers: From discussions with EMBARK staff, creating a system which continues to serve its existing riders well is a top priority for the agency in addition to attracting new customers. To encourage existing customers to increase their use of the system and to attract new customers to the system, the fare collection system should minimize barriers to use the system by providing a convenient way to pay for services and transfer between modes.

Promotes multimodal fare integration and trip making: With the introduction of streetcar, it will be important for customers to transfer from bus to streetcar as well as from COTPA parking garages. Thus, facilitation of intermodal trips is a critical a fare collection strategy goal for EMBARK to maximize mobility and use of streetcar.

Uses fare collection technology to enhance fare payment options for riders and assist in fare enforcement: Emerging fare collection technologies can provide riders with greater flexibility and improve the rider experience by increasing the convenience of using public transit. These technologies can be paired with complementary fare enforcement applications that make proof-of-payment systems easier to monitor for fare evasion.

Is equitable and takes into consideration a rider's ability to pay: From a Title VI fare equity perspective, it is important that the fare policy and fare collection system are considerate of different riders' financial needs and ability to use cash. An agency can improve affordability by rewarding regular riders through discounted passes, including by finding innovative ways to introduce new fare products with its new fare collection technologies, such as fare capping that

enables riders to pay towards a pass as they go. As EMBARK implements new fare technologies and promotes electronic fare collection to try to minimize cash collection, it will be critical to continue to provide the option for a customer to pay with cash. EMBARK can also look for ways to provide ways for cash customers to use new technologies, such as mobile ticketing, by working with a vendor to enable cash customers to load cash to their accounts.

Achieves fare revenue needs and strives to achieve EMBARK's farebox recovery revenue target: The fare collection system must promote fare payment and minimize fare evasion by making it easy to pay and offering enforceable fares, especially on the proof-of-payment OKC Streetcar.

Accommodates accounting and reporting needs: New fare collection technologies can provide enhanced data collection capabilities. New technologies can increase the amount and quality of the data in aggregate and by mode. Technological advances in transit can enable agencies to collect data that creates a clearer picture of rider behavior and trends. This geocoded data can be used to analyze routes, stop placement, and other elements of service to create a system that works more efficiently and effectively for riders. Data from fare enforcement can also assist in revenue allocation for intermodal fare products.

Considers transit industry best practices in fare technology for the different modes while taking into consideration the costs of the technology and approaches used by similar size peers: EMBARK has the benefit of being able to look to peers who have already attempted to address many of the goals listed here through innovative fare policies and technologies. As the agency decides what is right for their services and Oklahoma City, they can draw on the experiences of others to avoid common pitfalls and build on existing successes. The ability to extrapolate from others' experiences requires an acknowledgement that each city is different, and some agencies serve as closer examples to EMBARK than others. Overall, there is much that can be learned from peer agencies.

Strives for high levels of system reliability: While not a defined goal by EMBARK, the importance of system reliability is critical for a successful fare collection system. Related to operations and maintenance, EMBARK should establish goals regarding the performance of the fare collection technology. Lapses in reliability, such as maintenance issues, can negatively impact ridership and revenue. The nature of TVM-customer interactions as well as mobile ticketing can greatly influence customer satisfaction with regards to the whole system, and problems in this arena should be identified and addressed early on to prevent negative public perceptions of EMBARK's fare collection system, which could in turn impact ridership and revenue.

Metrics for Success

EMBARK should select a set of metrics to evaluate the agency's progress based off of the fare system goals and objectives established in the previous section. The more metrics EMBARK selects, the more holistic the analysis of the agency's strengths and weaknesses. These metrics should be measurable, either quantitatively or qualitatively, and tied to specific goals.

Metrics can be collected from a number of sources. Some will automatically be collected by the technology system such as the number and types of passes sold. This data can be augmented by surveys that evaluate, for example, ease of use of the fare collection system and general

rider satisfaction. The quantity and quality of fare enforcement will determine whether or not additional insights can be gained from this resulting data as well.

EMBARK will want to evaluate its system to see what metrics would be easiest for it to collect and what metrics are most valuable to the agency.

Goals	Potential Metrics
Provides choices for customers that are easy to understand, explain, and use	<ul style="list-style-type: none">• Customer satisfaction surveys• Fare evasion rates
Attracts new customers and additional trips from existing customers	<ul style="list-style-type: none">• Ridership• Identification of new riders from customer satisfaction surveys
Promotes multimodal fare integration and trip making	<ul style="list-style-type: none">• Number of multimodal trips
Uses fare collection technology to enhance fare payment options for riders and assist in fare enforcement	<ul style="list-style-type: none">• Customer satisfaction surveys• Uptake rates of new fare collection technologies• Fare evasion rates• Number of riders inspected
Is equitable and takes into consideration a rider's ability to pay	<ul style="list-style-type: none">• Customer satisfaction surveys
Achieves fare revenue needs and strives to achieve EMBARK's farebox recovery revenue target	<ul style="list-style-type: none">• Fare evasion rates
Accommodates accounting and reporting needs	<ul style="list-style-type: none">• Data availability for revenue allocation, NTD reporting, planning, etc.
Considers transit industry best practices in fare technology for the different modes while taking into consideration the costs of the technology and approaches used by similar size peers	<ul style="list-style-type: none">• Procurement & design process incorporates best practices
System reliability	<ul style="list-style-type: none">• System up time• Mean time between failures (MTBF)• Customer satisfaction surveys

Approach

For the OKC Streetcar's fare collection, EMBARK will install wayside ticket vending machines (TVMs) at each streetcar station. Riders will use these machines to pay their fare and receive a paper ticket. The TVMs will require exact change to reduce the complexity of the machines and thus lower costs. By structuring operations so that customers purchase their fare before they board the streetcar, wayside TVMs enable customers to board through all doors, reducing dwell time at each stop and speeding up operations.

To supplement the wayside TVMs and in an attempt to expand EMBARK's ridership more generally, the agency is pursuing mobile ticketing technology. Mobile ticketing enables a customer to purchase their fare using a smartphone or tablet, on which the ticket is then housed. Mobile ticketing would also help facilitate integration between bus and streetcar because a mobile ticket could be used to board either service. Current EMBARK fixed route users have expressed this integration as highly desirable.

COTPA garages users have also expressed a desire for integration with streetcar. To meet this demand, EMBARK could allow each parking smart card given to monthly garage users or a paper daily parking garage ticket to be valid for one rider's fare on streetcar. This provides an integration benefit to COTPA garage users while still making financial sense by not allowing an entire carload of people to be eligible for the free fare using a single parking smart card or paper ticket.

Fare collection will be enforced on buses and ferries upon boarding. For mobile tickets, this will be a visual inspection. Methods such as animation and color changes will be used to reduce fraud. TVM tickets will be visually validated. Pre-activated Unlimited Passes that are valid on streetcar and bus will be electronically validated by the farebox on bus and visually validated on streetcar since electronic validation of Unlimited Passes on streetcar would require a backpack on the fare inspection device to validate magnetic stripes passes.

To combat fare evasion, fare enforcement officers will periodically board vehicles to check that each passenger has a valid proof of payment (PoP). Inspectors will carry mobile devices with the agency mobile application loaded. The app will electronically validate mobile tickets. It will also log any visually inspected tickets. For tickets issued from the TVMs, fare inspection officers could visually inspect the ticket or scan a QR code printed onto the ticket in order to check for validity. For mobile ticketing, fare inspection officers could have a number of options depending on the final details of the mobile app, including visual inspection, QR code scan, and/or NFC inspection. For visual inspection, the verification process would include one or numerous techniques to inhibit people from simply taking a screenshot of a valid ticket. Techniques include:

- A moving background,
- Ticket colors along with images, letters or words that change daily and are only known to fare enforcement officers and bus and streetcar operators, and
- An interface that performs a special action when touched such as sending shooting stars across the screen or changing colors.

Fare inspection officers would carry an Android smartphone or tablet with them to conduct these inspections. As part of the procurement of the mobile ticketing app, EMBARK should require the vendor to develop a fare inspection app for the agency. This agency inspection app will be

loaded onto the smartphones or tablets from which the officers will perform multiple inspection tasks including:

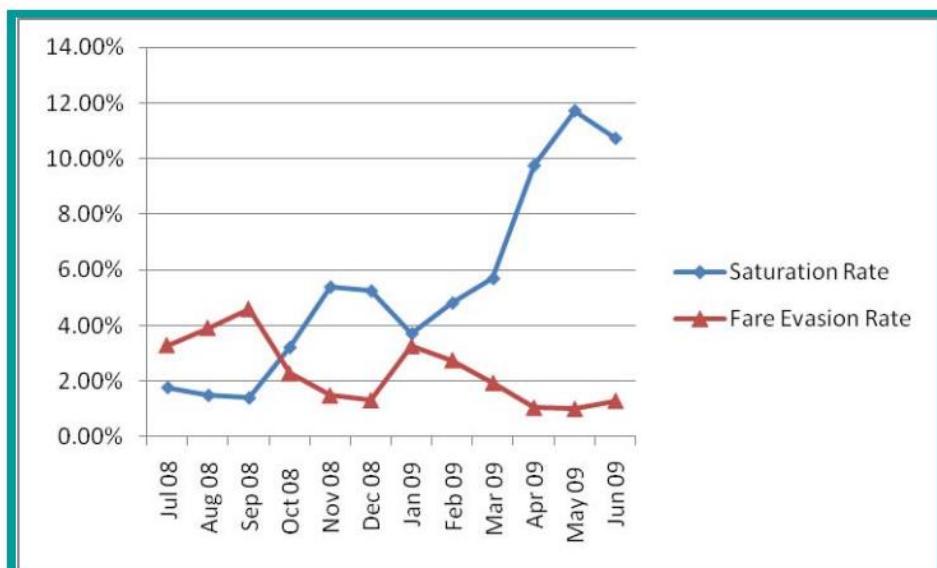
- Logging of TVM paper ticket and mobile ticketing inspections of QR codes using the device's camera
- Manual logging of visual inspections of TVM and parking garage paper tickets as well as mobile tickets
- Logging mobile ticketing using NFC
- Logging ISO 15639 based parking smart cards using NFC

If a fare enforcement officer encounters a rider without valid proof of payment, they will have the choice to issue a citation or to ask the rider to buy a ticket. Tickets and citations will be written on paper slips carried by the officer. Some agencies have chosen to issue tickets and citations using bluetooth printers, but these printers can be unreliable and require maintenance and upkeep. Paper tickets simplify the process and reduce technical difficulties, making fare enforcement more efficient. While there has been discussion about allowing fare enforcement officers to collect fares onboard, this is not recommended as it would require the ability to process credit and debit card and issuance proof of payment.

EMBARK should seek to establish a fare enforcement level that keeps fare evasion to an acceptable rate while remaining cognizant of the agency's financial and personnel restraints. The relationship between fare inspection rates and fare evasion rates is generally converse, meaning that as fare inspection rates go up, fare evasion rates go down. Since fare inspection requires significant resources, EMBARK must weigh the tradeoffs between a higher inspection rate and higher fare evasion, deciding at what point the benefits of higher inspection rates start to outweigh the costs.

In 2010, the Los Angeles County Metropolitan Transportation Authority (LACMTA) studied the relationship between fare inspection rates and fare evasion rates on its system. Their published study includes the chart below:

Chart 1: Metro Saturation and Fare Evasion Rates for FY 2009



Source: <http://media.metro.net/images/oig/10-AUD-05%20Rail%20Fare%20Inspections%204-15-10.pdf>

Note that LACMTA uses the term saturation rate in lieu of inspection rate. They represent the same concept. Based off of the numbers in the chart, Four Nines has estimated the number of inspectors required to achieve a fare evasion rate of 1%.

Our calculations is based on a set of assumptions. The first is that EMBARK is planning to operate 313 round trips per day on the Bricktown and Downtown lines per the streetcar route and operations plans, which results in just under 100,000 trips annually if the streetcar operates 6 days a week. To achieve a 1% fare evasion rate, EMBARK should aim to inspect 10% of the trips per service day, or 32 trips per day. Assuming an inspector can check 5 trips per hour according to streetcar timelines, this results in 6.4 inspection hours required on average per service day. Best practices suggest that these inspection hours should be at varied hours to maintain the unpredictability of inspections. If we extrapolate this to 300 service days in a year, we estimate a need for 1,920 inspection hours per year or roughly one full time equivalent (FTE). This is consistent with the TCRP study that looked at the number of inspectors an agency employed (FTEs) related to ridership. The study found that average number of inspectors per 1,000 daily riders is 0.51. (Source: <http://www.trb.org/Publications/Blurbs/166757.aspx>)

While this analysis provides a good outline for the pattern of thinking EMBARK should follow, there are caveats to these numbers. The LACMTA study does not necessarily represent a statistically valid finding for the entire LACMTA system. Additionally, the context of the Oklahoma City Streetcar is very different from the proof-of-payment rail systems located in the Los Angeles area. Thus, these findings should not be taken at face value, but instead viewed through a critical lens for the value they can bring to EMBARK in forming its fare inspection plan.

System Components

EMBARK's fixed route and paratransit vehicles currently use onboard GFI Odyssey fareboxes for fare collection. Riders can also purchase fares online, at the Downtown Transit Center, and through a limited retail network. The Oklahoma River Cruise uses Square for fare collection, and the Spokies bike share is run through its own mobile and bike share kiosk system.

In order to fulfill the agency's vision for fare collection, new technologies will have to be purchased to augment the current system. Details of the system components that must be acquired are outlined below.

Mobile Ticketing

The implementation of mobile ticketing technology will require EMBARK to purchase the platform from a mobile ticketing app vendor. Many different packages and customizations are available from a variety of vendors to meet the exact needs of the agency. It should be recognized, however, that with increasing complexity (i.e. anything that goes beyond what a vendor offers as the "base model" of an app) comes a longer implementation timeline and higher costs to the agency.

EMBARK will work with a consultant to better define the requirements for the mobile ticketing solution. EMBARK must decide what the agency considers mandatory requirements versus desired requirements. Mandatory requirements represent the threshold a vendor must reach in order to be considered during the procurement process. Desired requirements represent

elements the agency would like to see, but that will be weighed against other factors such as cost and influence on the implementation timeline. These factors will help the agency decide whether to follow through with incorporating some, all, or none of the desired requirements into the final mobile ticketing platform.

During the procurement process, EMBARK will need to be cognizant of the customer service support offered by various vendors. Support in this arena from the chosen vendors will be essential to quickly and effectively address customer concerns and complaints regarding the fare collection system. This is especially true for mobile ticketing, as some issues that arise are likely best handled by the vendor, since they are most familiar with the app's interface. They also have institutional knowledge related to common customer needs when first adapting to mobile ticketing technology that EMBARK lacks. Therefore, a vendor's willingness to support and engage with EMBARK staff should also be a criteria used by which to judge mobile ticketing vendor proposals.

A list of high-level requirements identified during the EMBARK Fare Study is included in Appendix A.

Customer Mobile App

EMBARK will want to procure a customer mobile ticketing app designed for both iOS and Android systems. The agency should also make it explicit during the procurement process that the vendor will be responsible for keeping the app up to date and for offering it for download through all relevant app store platforms.

EMBARK riders will be able to download and use the mobile ticketing app to ride on fixed route buses, streetcar, paratransit, and ferry. A rider should be able to purchase and activate a mobile ticket on their device as they see a vehicle approaching, so processing times within the app will need to be quick. This gives riders more flexibility and could help with boarding times as fewer people would have to pay for a ticket as they board.

Mobile ticketing would be implemented initially with visual validation, followed by beacon validation. Implementation of mobile ticketing with visual validation will enable EMBARK to launch mobile ticketing prior to opening of streetcar because it requires the procurement of no additional technologies for the fixed route bus system. Bus operators will simply have to be trained to visually validate and then record the new mobile tickets. While the dataset from mobile ticketing with visual validation provides geolocation information, it is not as rich as mobile ticketing with electronic validation since customers may activate even when not boarding a vehicle. Thus, Four Nines recommends that EMBARK procure a mobile ticketing app that has the capability to validate using beacon technology.

Beacon-based validation is an emerging approach based on simple and proven technology. The infrastructure costs are very low compared to those for smart cards or barcodes, the enforcement is easier, and the use across modes is identical. Additionally, beacon-based validation can easily be added to a mobile ticketing system launched with visual validation. Beacons work by interacting with a person's mobile ticketing device and, in doing so, log boardings automatically with precise information on when the rider boarded and where. Beacons also have the ability to make a mobile ticket appear on a device's home or lock screen based on its proximity to a public transit vehicle. EMBARK can choose to procure beacon technology at any time. The ease of adding beacon-validation gives the agency flexibility to first see how other agencies approach beacon-based validation. Based on these real world

deployments by other agencies, EMBARK could choose to pursue beacon-based validation upon launch of the mobile ticketing system or at a later time.

Agency Mobile Inspection App

Fare enforcement officers will require new technology in order to inspect riders' proof of payment onboard the streetcar. Along with the customer mobile ticketing app, EMBARK will want to procure a mobile agency fare inspection app from the same vendor. This app should have the ability to log fare inspections. Specifically, the app should be able to record visual inspection, QR code inspection using the device's camera, and NFC inspections, including inspections of ISO 15639 smart cards. This requirement currently mandates that the application be built on the Android platform as iOS devices do not currently support the ISO 15639 standard. Each of these inspections should also record information concerning the type of fare inspected (e.g. streetcar day pass, parking smart card, monthly bus pass, full adult fare, reduced fare). All of this data should be accessible by EMBARK for their records in an easy to use and manipulatable format. This will aid the agency in modifying its fare inspection policies, schedule of fares, and fare allocation between modes if necessary based on the data collected. The agency app should require each user/enforcer to sign in with a set of individual credentials. This step will help EMBARK keep its fare collection officers accountable for reaching the inspection quotas necessary to control fare evasion.

Android Smartphones and/or Tablets

Four Nines recommends that EMBARK procure the smartphones and tablets used to carry out inspections using the agency mobile app separately from the mobile ticketing app procurement. Usually, separating these two procurements results in an agency receiving a more competitive price for the inspection devices. The device procurement process should specify that the vendor will be responsible for providing management tools for the devices, including updates and security. Depending on smartphone capabilities needed for fare enforcement, EMBARK may be able to use their existing vendor for smartphones.

TVMs

EMBARK is planning to purchase new ticket vending machines (TVMs) for the OKC Streetcar. At a minimum, there will be one for each of the 22 stops along the streetcar's route. Four Nines recommends that the TVMs accept cash, coins, debit cards, and credit cards to address Title VI concerns and to avoid the complications and added expense of determining an alternative means of collecting cash onboard the streetcar vehicles.

It should be noted that the streetcar program management consultant had previously suggested procuring wayside TVMs with credit and debit card capabilities, then procuring separate onboard TVMs to accept cash only. Procuring separate cash-only TVMs for the streetcar would complicate technology integration as well as fare enforcement between streetcar and bus. The decision to carry out two separate TVM procurements would also increase upfront capital costs as well as ongoing maintenance costs. For these reasons, Four Nines has outlined its recommendation above to purchase TVMs that accept bills, coins, credit cards, and debit cards.

For the TVMs, Four Nines is suggesting the agency procure "smaller-footprint" TVMs. These models take up less space on the platform and are priced below "full-featured" (larger) TVMs. The smaller footprint means the machine might require more frequent service to replace ticket/fare media and to collect bills and coins inserted into the machine. Also, certain smaller-footprint TVMs might not have all the capabilities desired by the EMBARK team. Thus,

EMBARK will need to ensure that the RFP for streetcar TVMs explicitly outlines the agency's requirements, for example that the TVMs accept cash, coin, debit cards, and credit cards.

The OKC Streetcar TVMs will distribute paper tickets. Depending decision about fare inspection, the tickets may or may not have a QR code printed on them. The tickets will not have a magnetic stripe. Procuring TVMs that print magnetic stripes which are interoperable with the GFI Odyssey fareboxes on fixed route vehicles would significantly increase equipment and integration costs. As such, magnetic stripe tickets are not recommended. While this will not limit the ability of passengers to transfer from bus to streetcar, it will create limitations in integrating the process to go from streetcar to bus. Some of these limitations may be overcome with mobile ticketing that can enable streetcar to bus transfers, but the paper tickets issued by the TVMs are unlikely to enable streetcar-to-bus transfers on their own unless they are inspected visually.

As an additional channel for ticket purchase, the existing on-street parking kiosks could easily be modified to issue streetcar tickets with QR codes that could be inspected by the inspection device. This would potentially lessen queuing at platform TVMs and for customers parking before riding the streetcar and improve the rider experience by shortening the time they spend buying the various tickets. Since revenue from parking tickets and streetcars goes to different City accounts, the on-street parking kiosks would need to be capable of segregating financial settlement based on the type of ticket sold.

The new platform TVMs could be purchased from the vendor who provided the on-street parking kiosks. This would lessen integration costs and potentially reduce maintenance costs through some commonality of parts and service requirements. If EMBARK elects to procure these two elements from the same vendor, it is important to do it within the context of selecting the best vendor for each system and while maintaining the openness of the integrations. If the parking kiosk vendor is chosen to be the best provider for the platform TVMs, EMBARK must require that any APIs they use for communication between the system or instructions they use for the generation of barcodes and other identifiers be open and public, enabling EMBARK to competitively select replacements for the individual systems.

A list of high-level requirements identified during the EMBARK Fare Study is included in Appendix B.

Procurement Approach

49T recommends that EMBARK pursue four separate procurements to begin realizing this fare collection strategy:

1. Mobile ticketing app with fare enforcement app
2. Smartphones
3. TVMs
4. Electronic cash transaction network vendor for mobile loading (such as PayNearMe)

The first three procurements have been described above, including the reasons for their separation into individual procurements.

The fourth procurement is optional for the agency. Following through with it could help address Title VI concerns and prompt a larger share of riders to use mobile ticketing. However,

EMBARK may want to wait to evaluate the initial adoption rates of mobile ticketing and identify what the barriers to adoption are before following through with a vendor procurement.

Procuring a vendor with relationship with a variety of retailers for mobile ticketing would enable EMBARK's riders to walk into a retail outlet and load monetary value into their mobile ticketing account using cash. This type of system allows people who are unbanked to still use a mobile ticketing platform because they now have a means of using cash to purchase mobile fare media. Usually, a mobile ticketing user must have a credit or debit card number they can enter online for mobile payments.

EMBARK should, however, be cognizant of the fact that these vendors typically take a share of every transaction for themselves, thus reducing the agency's farebox revenue. There can also be an additional charge for processing credit and debit cards at retail outlets. EMBARK may want to explore the financial details of other organizations' contracts with these types of vendors before following through with the fourth procurement to see if a mobile loading agreement would be financially viable for EMBARK. As an example, PayNearMe commission rates are:

- 4% if a \$5.00 minimum fare payment can be enforced which is \$0.20 per transaction.
- 8% if no minimum fare payment is enforced which on a \$2.50 fare is \$0.20 per transaction.

Integration Responsibilities

The mobile ticketing vendor will be responsible for several integrations. The type of integrations will depend on what integrations EMBARK identifies during the development of its mobile ticketing requirements. Potential integrations include:

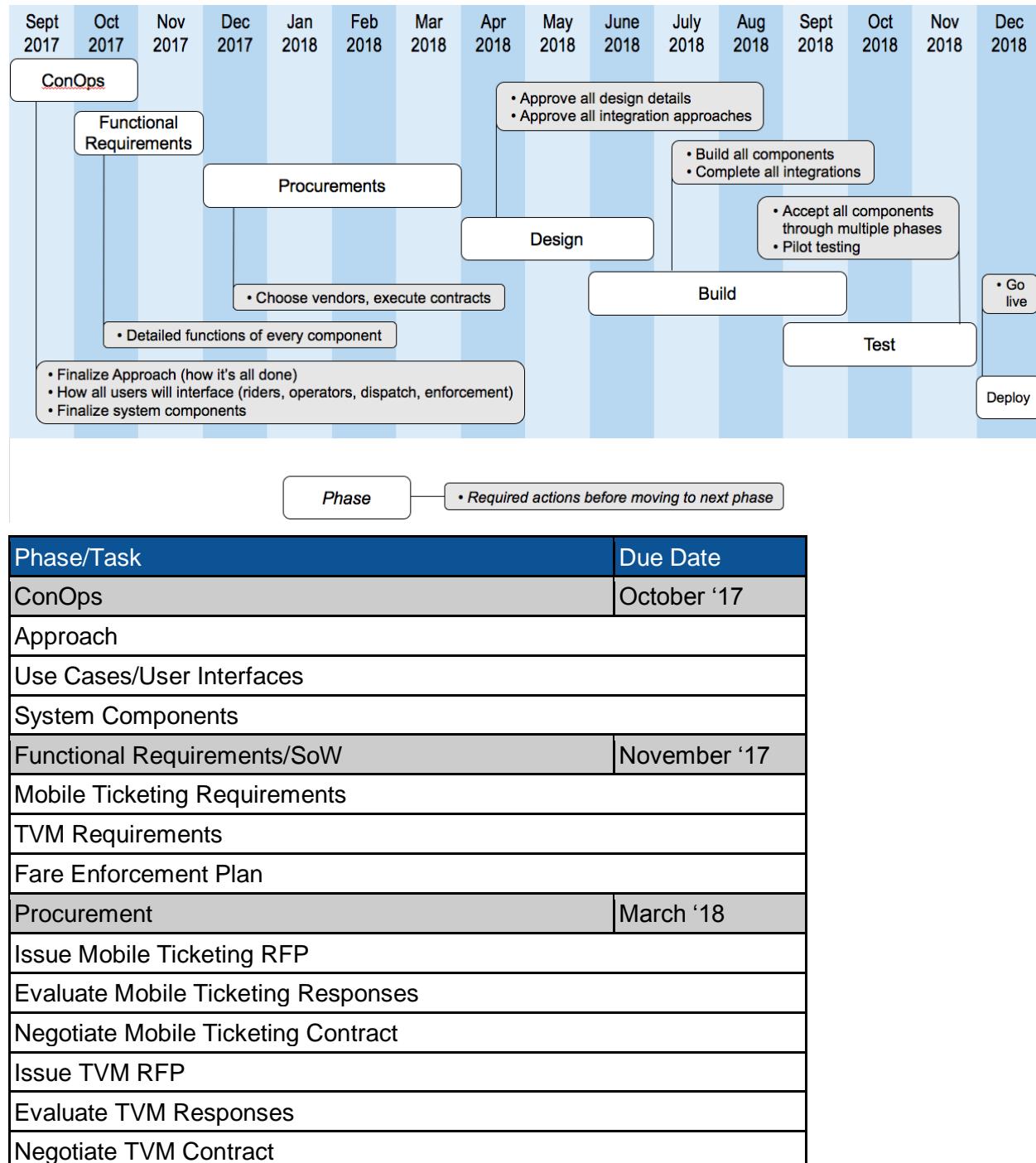
- **TVM Integration:** For fare inspection, if fare inspection officers will be scanning TVM tickets to determine validity and log inspection information, the mobile ticketing vendor will be responsible to work with the TVM vendor and specify how the TVM vendor should create QR codes. This will include design and testing to ensure that the QR codes are readable by the agency mobile inspection app.
- **Parking Integration:** In the future, EMBARK could consider integrating its mobile ticketing app to integrating with its parking garage gates. This integration would require integrating the mobile ticketing and parking fare collection systems. The specific approach would be finalized during design review, but it would require either the linking of the parking and mobile ticketing back offices, or a discount code, specific to the monthly parking account, that will allow for a free ride.
- **Fare Enforcement:** The mobile ticketing vendor will be responsible for designing and building a method for logging issued tickets within the agency mobile inspection app. At the present the plan is to integrate streetcar and parking through the use of the parking garage smart cards and paper tickets. The mobile inspection app would need to enable a fare inspection officer to log a visual inspection of a paper parking ticket, scan and validate the barcode on the paper parking ticket, and read and validate an ISO 15639 parking smart cards. The mobile inspection app would also need to enable a fare inspection officer to scan and validate a paper TVM streetcar ticket or pre-purchased paper streetcar product, such as a monthly pass or convention pass. It would also need to enable the input a visual inspection of a pre-activated Unlimited Pass valid on streetcar and bus.

- **Retail Network:** If EMBARK selects a Electronic cash transaction network vendor for mobile loading (such as PayNearMe), the mobile ticketing vendor will need to integrate their application with vendor to enable customers to load cash to their account, which could then be used to purchase tickets and passes.

Due to the complexity of integrating magnetic stripe tickets issued by the streetcar TVMs with the GFI Odyssey fareboxes onboard the buses, magnetic stripe tickets issued by a TVM are not recommended. If pursued, they would require GenFare to specify how the TVM vendor should encode the tickets and to work with the TVM vendor through design and testing to ensure that the tickets are readable by the fareboxes.

Action Plan

The steps required to implement this fare collection strategy are outlined below. EMBARK is on a tight schedule if they plan to have everything in place before the debut of the OKC Streetcar. This timeline can be shortened by procuring a mobile ticketing system that requires less customization, instead opting for “off-the-shelf” options that a vendor already has readily available. The same can be said of the TVM procurement process.



Phase/Task	Due Date
Design	June '18
Ordinance Change to Issue Fare Evasion Citations	
Mobile Ticketing Conceptual Design	
Mobile Ticketing Preliminary Design	
Mobile Ticketing Final Design	
TVM Conceptual Design	
TVM Ticketing Preliminary Design	
TVM Ticketing Final Design	
Build	September '18
Develop Mobile Ticketing App	
Build TVMs	
Complete Integrations	
Testing	November '18
Mobile Ticketing 'Factory' Testing	
Mobile Ticketing Integrated Testing	
Mobile Ticketing Acceptance Testing	
TVM Factory Testing	
TVM Integrated Testing	
TVM Acceptance Testing	
System Integration Testing	
Pilot Testing	
System Go Live	December '18

Future Integrations

EMBARK anticipates pursuing long-term functionality that would provide fare integration with Spokies bikeshare, integration with paratransit scheduling software, and parking access to gated COTPA parking structures. Additional potential future integrations have also been identified.

Bikeshare

Spokies, Oklahoma City's bike share program, launched in 2012. Spokies is a BCycle bike share and is operated and maintained by Bicycle Transit Systems. EMBARK has identified multiple levels of potential Spokies integration: (1) account level integration with the Spokies back office; (2) field level integration allowing customers to get a Spokies bike with the mobile ticketing application; and (3) ticket level integration so customers can buy a Spokies pass through the mobile ticketing application. EMBARK also envisions opportunities for bike/transit

transfers (e.g. a free bike share ride after riding transit) and combination passes allowing access to both systems.

Paratransit Scheduling

EMBARK currently uses Trapeze for paratransit scheduling. Long-term EMBARK is interested in integrating its mobile ticketing application with its paratransit scheduling software to identify prepayment of scheduled rides. EMBARK is also interested in offering its customers the ability to schedule and pay for paratransit rides within the app.

Off-Street Parking

EMBARK manages five garages and three surface lots that use SKIDATA technologies. In order to offer a parking/streetcar pass, there is interest in the ability for the mobile fare inspection application to be able to identify valid parking garage monthly passes (ISO/IEC15693 smartcards). EMBARK may have SKIDATA walk-up kiosks produce paper tickets for the streetcar - the barcodes on these paper tickets will also need to be readable by the mobile fare inspection app as part of this procurement. EMBARK anticipates future functionality allowing parking access to gated structures using a mobile ticketing app barcode readable by the SKIDATA parking gates.

In the future EMBARK may also want to offer its customers bundled streetcar tickets with flat fee event parking through the mobile ticketing app.

Other Potential Future Integrations

EMBARK is also interested in exploring other integrations in the future. Other potential future integrations are identified below:

- Links in from trip planner
- Real-time transit vehicle tracking
- On-street parking including Parkeon's Whoosh! and NuPark
- Park-and-Ride lots
- Integration with EMBARK Connect CRM app or similar ability to report issues within mobile ticketing application
- Specialty ferry cruises e.g. Haunt the River cruises with a limited number of tickets per cruise
- Enterprise operated vanpool, transit access for monthly pass vanpool customers
- Transportation Network Companies/Ride Hailing Apps (e.g. Uber and Lyft)
- Non-paratransit demand response service
- Share-A-Fare taxi voucher/coupon program
- Guaranteed Ride Home program
- Additional transportation agencies in the region

Appendix A: Mobile Ticketing Procurement High-Level Requirements

The mobile ticketing solution shall provide a mobile ticketing app that:

- Offers a variety of fare products (e.g., single trip, 2-hour pass, day pass, monthly pass, etc.). These fare products may be for select modes (e.g., bus, streetcar, ferry, paratransit) or a combination of modes (e.g., streetcar + bus).
- Enables EMBARK to customize, introduce, or remove fare products offered without additional work by the vendor.
- Provides security measures, including use of QR code, to enable visual and optical inspection of mobile ticket.
- Enables ticket activation when smartphone is not internet-connected.
- Accepts debit, credit, and prepaid debit cards for fare payment.
- Processes and reconciles payment transactions on behalf of EMBARK.
- Integrates with sales channel vendor to enable cash riders to load money to mobile ticketing account.
- Accepts promotional codes for free or discounted rides that are unique for one-time use by an individual or one-time use by multiple individuals.
- Provides ability to distribute bulk tickets and passes to multiple people (e.g., employees, social service clients, conference or special event attendees) using codes or directed logins. Tracks activation of codes and ridership data of users.
- Creates invoice for EMBARK to issue to 3rd parties for payment-based codes or directed login distributed or activated, depending on arrangement with 3rd party.
- Uses deep links to integrate with other EMBARK apps (e.g., EMBARK Connect), EMBARK website information (e.g., schedules, route map, real-time bus departures), and third-party apps and trip planners (e.g., B-Cycle app for Spokies Bikeshare, Google maps). The links will be configurable.
- Supplies metrics to EMBARK that the agency can then use to analyze and improve service, including usage patterns and geolocation information. Reports anonymized usage patterns.
- Gathers and reports customer service metrics related to customer experience with the mobile app.
- Complies with all ADA compliance and Oklahoma state requirements including the design and accessibility guidelines associated with each operating system. Accessibility may also include developing a mobile ticketing app that is available in multiple languages according to the needs of EMBARK's ridership.
- Complies with PCI-DSS standards.
- Enables the validation of tickets using NFC or BLE battery powered vehicles mounted on the vehicle or wayside.

The mobile ticketing solution shall provide a fare inspection app to be installed onto an Android smartphone that:

- Logs fare inspection information including number of inspections and fare evasion rates. The app will also be able to log visual inspections; fare inspector will have ability to enter inspections of paper tickets that cannot be scanned and magnetic stripe tickets issued from fixed route buses using customizable predetermined options.
- Records fare evasion warnings and citation information and tracks repeat offenders. Citations will be issued tickets using handwritten tickets. Ticket information such as ticket number, name, identification, etc. will be logged into the fare inspection device.
- Uses built-in camera to determine ticket validity by scanning QR codes for mobile tickets, tickets issued from a ticket vending machine, or as part of promotion

- Uses built-in camera to determine ticket validity by scanning barcodes on tickets issued from SKIDATA parking gates.
- Uses NFC-V to read ISO 15693 smartcards used by monthly parkers to determine ticket validity.

The mobile ticketing vendor shall provide the following services:

- Ongoing development support, including maintaining the mobile app and providing updates to the system as necessary, for instance as new smartphone operating systems come online
- Customer service support
- Maintaining the up-to-date app in the relevant app stores

Long-term functionality may include:

- Fare integration with Spokies bikeshare
- Integration with paratransit scheduling software to identify prepayment of scheduled ride
- Parking access to gated COTPA parking structures

Appendix B: Ticket Vending Machine Procurement High-Level Requirements

The ticket vending solution shall provide “smaller-footprint” ticket vending machines (TVMs) that:

- Issue streetcar fare products (e.g., single trip, 2-hour pass, day pass, etc.) using paper tickets.
- Enable EMBARK to customize, introduce, or remove fare products offered.
- Print ticket validity information QR codes onto paper tickets to enable visual and optical inspection.
- Accept debit and credit cards as well as cash (bills and coins) for fare payment.
- Issue receipts for transactions either automatically or when requested.
- Meet EMV chip card technology standards.
- Use cellular service for network connectivity and debit/credit card payments.
- Use solar power with battery with an option to use electrical connection if solar power insufficient for location. The battery shall provide _____ hours of charge without solar power.
- Supply data to EMBARK on the type, number, and time of fares issued by each TVM.
- Provide maintenance report data to track reliability and ongoing maintenance issues.
- Comply with all ADA and Oklahoma state law compliance requirements including the design and accessibility guidelines. These guidelines will address the need for audio capabilities for riders with hearing impairments and enhanced tactile equipment for riders with visual impairments. Accessibility also may include developing a menu that is available in multiple languages according to the needs of EMBARK’s ridership.
- Comply with PCI-DSS standards.
- Provide timely issuance of fares with transaction time less than _____.
- Are hardened for secure cash collection.
- Can withstand exposure to the elements as they will be placed outdoors, which includes having displays that can be read in direct sunlight and a variety of other weather conditions.
- Can generate, store, and transmit alert information for relevant events such as reboots, low battery, and maintenance needs.
- Support distribution of at least _____ paper tickets between restocking.
- Accept at least _____ bills between maintenance cycles.