RTA Seamless Fare Integration Project
Phase 2 - Concept of Operations

Concept of Operations

August 1, 2019

LTK Engineering Services

Table of Contents

Revision History:

Version	Date	Description of Change
1.0	January 24, 2018	Initial draft version for internal comment
2.0	March 27, 2018	Second draft for comment
3.0	August 1, 2019	Final

1 INTRODUCTION

1.1 Overview

In 2015, the Detroit Department of Transportation (DDOT), the Suburban Mobility Authority for Regional Transportation (SMART), the Ann Arbor Area Transportation Authority (AAATA), the Detroit Transportation Corporation (DTC), the M-1 Rail (M-1 or QLINE), and the Regional Transit Authority of Southeast Michigan (RTA) began an effort to study current conditions and identify issues and opportunities for regional fare integration. In 2017, these agencies, acting through the RTA, initiated a second study to develop a regional approach to revenue collection that will not only modernize the process of collecting fares, but also enhance the mobility of passengers between its respective jurisdictions. This report is based on data from CY2017. It is important to note that since the beginning of this study, these agencies have dramatically improved regional fare coordination and that the proposed changes would be the next step for true regional fare coordination.

These agencies are predominately bus operators which collect fares using eight to ten year old GFI Odyssey fareboxes. DTC uses GFI Transentry turnstile equipment installed between 1986 and 1988. DDOT, SMART and DTC are all having difficulties with the reliability and operation of their fare collection equipment, in addition to which the equipment is becoming increasingly difficult and expensive to maintain. QLINE uses a proof of payment system including new Ventech ticket vending machines at stations, which accept only credit or debit cards, and GFI FastFare Fareboxes for self-service cash payment on-board QLINE vehicles.

Transit agencies across the country are taking advantage of emerging payment technologies to enhance the customer's convenience while also creating operational efficiencies. In Jacksonville, implementation of a smart card system has allowed the agency to eliminate issuing fare media on buses. In Dallas, a successful mobile payment application has reduced the frequency of cash payments on buses. In Chicago, Atlanta, and numerous other cities, smart card and mobile based payment schemes have enabled agencies to benefit from measurable shifts from cash-onboard to preboard, electronic payments.

Many of the industry advances in fare collection practices cannot be supported locally at this time due to software and hardware age and limitations, including secure account-based operations, replenishing card funds on the web or at third-party retailers, Near Field Communication (NFC) technology, acceptance of third-party issued cards, and mobile/credit/debit cards payments, in addition to a long list of customer-centric fare policies.

Such advances would enhance the customer experience for virtually all customers. Depending on the combination of new alternative payment schemes and pricing policies offered, the share of trips paid with cash will likely drop by one-half or more, providing customers with reduced boarding times and therefore faster and more reliable bus travel.

1.2 Project Scope

One of the principal goals of this project is to develop a Concept of Operations Plan (Plan). The Plan is needed to describe the transition from the current fare system to the account based Open Payment and Open Architecture system selected as a preferred alternative in the Seamless Fare Integration Study for the Detroit Region. This system will offer a regional electronic fare-payment infrastructure using third-party produced and distributed prepaid cards and contactless devices such as smart cards, credit and debit cards, RFID tags, secure bar codes and NFC devices. The new state-of-the-art, integrated, electronic fare payment, distribution, collection and processing system will utilize best practices of modern technologies in the consumer and fare payment sectors, capable of interfacing with both bank and non-bank financial clearing systems for transaction processing and settlement.

The Plan will allow the participating agencies to focus on the details of how a new system would fit into existing system sales, revenue processing, banking, reconciliation, accounting, and customer support. It will also allow for the documentation of current revenue collection practices and create recommendations for new processes under the selected alternative, with a focus on transfers and reconciliation. Further, it will provide clarity on the integration of new technology on vehicles and in system integration, and descriptions of data and process flows.

The Plan will be supported with a Business Case that identifies the benefits of the planned system to the participating agencies, their customers and other stakeholders, and the region in general. The Plan will support development of technical documentation that can be included in a request for information from a system integrator for the preferred alternative.

This project will generate positive outcomes associated with revenue enhancement, cost reduction, regional mobility, operational efficiency and customer satisfaction.

1.3 Purpose of the Concept of Operations Document

This Concept of Operations document incorporates objectives and priorities into a concise document to assist the agencies in finalizing the procurement strategy

and technical design for the new system. The Concept of Operations is intended to provide a clear and thorough definition of this regional system and its functional requirements, in order to solicit written comments and suggestions for enhancement and improvement. The document will be shared with key stakeholders including interested parties in industry for their review and comment.

Feedback on this document will be used for finalizing the scope of services to be solicited from a systems integrator, who will design and install the system, and other companion contracts that may be required for interfacing systems or to perform necessary services to support system operation. It will be updated as system design progresses to serve as a common reference for all stakeholders.

LTK bases its recommendations for the system on information collected from agencies in the Greater Detroit Area and the experiences of other mid-sized and large transit agencies.

2 EXAMINATION OF CURRENT SYSTEM

2.1 State of Current System

The three bus system operators (DDOT, SMART and AAATA) all utilize GFI Odyssey fareboxes, installed within the past ten years. The DTC operates GFI Transentry turnstile equipment, installed between 1986 and 1988. The QLINE Streetcar has Ventek ticket vending machines at each station as well as GFI Fast Fare on-board fareboxes.

Odyssey fareboxes can accept and process coins, bills, tokens, magnetic fare cards and low security smart cards, though none of the agencies currently offer smart-card passes to the general public. GFI Odyssey fareboxes have the functionality to accept account based smart cards, and AAATA has piloted some applications. To conform to current standards in technology, all agencies would need to upgrade at a minimum to a new smart card processer for Odyssey fareboxes.

All of the bus agencies, but especially DDOT and SMART, are seeing some increase in farebox failures. These primarily result from failures of the TRiM units, and secondarily from failures related to accepting cash (jams and reader failures). DDOT and SMART also perceive cash fare payment as a major factor slowing service on busy routes and especially at busy stops.

GFI Transentry equipment is very limited in features, and cannot accept transfers from other agencies or network its fare gate system without initiating equipment upgrades.

Bus fares among the providers range from $0.75 to $2.00. DDOT and SMART coordinate on fare products and currently have agreements in place allowing for customers to pay for transfers between services. QLINE has an agreement with DDOT and SMART that allows QLINE customers to purchase a transfer for $0.25 to also ride on DDOT or SMART. Although the farebox recovery ratio has fallen in recent years (concurrent with ridership), DDOT collects the most fare revenue of any agency in the region at more than $20 million.

Each agency experiences different utilization patterns for fare types offered. The majority of DDOT and SMART customers (60-70%) pay via cash or transfer, where most transfers were purchased on-vehicle with cash. AAATA has the largest majority of pass users, due in large part to its ridership agreement for University of Michigan MCard holders. This agreement constitutes nearly half of the agency's ridership. DTC customers tend to use an even mix of cash and passes, though this varies greatly with fluctuation in sporting events and conventions. QLINE has been collecting fares for less than six months at the time of this document's preparation and its fare utilization has not yet stabilized.

2.2 Limitations of Current System

The age of the existing system limits the diversity and quantity of fare products that can be offered by each agency in the region and offers limited data for evaluation and planning. This in turn hampers the ability of DDOT and SMART to allocate revenues from joint fare products and to introduce targeted products to reduce the use of cash on-board vehicles. There are significant risks and costs associated with cash handling as well as ongoing corrective maintenance to fareboxes. Calendar-based fare media require constant reprinting, inventorying and distribution; nationwide many agencies have migrated to permanent smart cards which better address the high level of customer service and flexibility that today's consumers expect when making purchases. The current system results in extended delays for boarding, harming service reliability and on-time performance. The existing system also limits opportunities for fare coordination between bus and non-bus service operators.

3 AVAILABLE TECHNOLOGIES AND APPROACHES

3.1 Payment Trends in Transit

Transit agencies in most major metropolitan areas are transitioning to account-based, open-payment and open-architecture systems using smartphones and contactless smart cards. Indeed, there has been a 63% increase in the use of Mobile Ticketing Applications within the past three years, and 85% of reported transit agencies aim to end the use paper products by 2021. The benefits of system modernization include:

- Opportunity for new fare policies and structures, such as “Best Fare”
- Greater security and flexibility for agencies and customers
- Forward-compatibility with developing technology
- Ability to interact with a variety of payment sources
- Opportunity to replace equipment available from a number of suppliers
- Long life-span and lower life cycle costs
- Compatibility with open payments requirements of financial system providers

These trends are described further in the sections below.

3.2 Open Architecture

In an open architecture system, the equipment and interfaces are designed around industry standards, or at the very least use proprietary technology that is made available to all. Even in the best circumstances, an "open" architecture may still have some proprietary components, such as the communications interfaces and protocols to the devices, the database design, Application Program Interfaces (APIs) to the web portals, etc. As long as these are fully documented and the agencies have rights to them in perpetuity, the system would be considered "open" architecture.

A sufficiently open system, then, is one where the fare media and the back-end central data system designs are fully documented and available to the transit agencies and all potential suppliers, with the suppliers subject to the same restrictions/requirements as the agency. In this way, the transit agencies may alter the system; including adding new equipment types, adding equipment of an existing type, replacing equipment, enhancing equipment, etc.; using a competitive procurement process. The goal is to allow equipment from another supplier to simply be "inserted," becoming a parallel component of the existing system, subject to their meeting the interface requirements. As such, the agency would be able to seek bids from numerous manufacturers to supply a new type of equipment. If one or more suppliers have an existing product that satisfies the need, the agency would be able to save the non-recurring engineering costs when

obtaining competitive pricing as well as benefiting from economies of scale for a regional procurement.

A sufficiently open system also allows the addition of additional transit agencies or other transportation provider. Many system start with a core group of agencies and are designed so that additional agencies can participate in the system by doing little more than purchasing and installing compatible equipment.

3.3 Open Payments (or “open loop”)

The definition of "open payments" is an ecosystem of customer choice, in which patrons can utilize the payment method that is most convenient to them. This replicates the payment process they utilize at the other retailers they visit every day, and frees customers from the potentially onerous purchase rules defined by the agency or its third-party retailers. Furthermore, an open system is payment agnostic, and extends beyond the acceptance of contactless bank cards to all forms of payment.

With the implementation of an open payment system, transit agencies are reducing their own fare media distribution chain and the resources required to manage it, and instead leveraging the payment infrastructure of others (such as mobile phone carriers and the financial payments industry). Mobile ticketing applications, web-ticketing applications, contactless bankcards and NFC-enabled mobile phones can be used as both the payment method and actual fare media, reducing the reliance on (but not necessarily replacing) traditional fare payment system operations. However, it is important to provide a variety of options to ensure convenient access to fare media for those that do not possess third-party media, unbanked and under-banked customers, and during transition.

An open payment system therefore allows agencies a greater focus on their core functions of providing transit services. The vision of a cashless transit system can become feasible by leveraging the electronic payments infrastructure and accepting a wide variety of payment methods that consumers are accustomed to using for the payment of other goods and services. This will result in a reduction in revenue servicing costs and diminished expenses for cash handling and security. Accepting some of these payment methods can also allow transit agencies to potentially generate new revenue through partnerships that not only benefit the transit agency, but also increase convenience for its customers.

The alternative to open payments is closed payment (or "closed loop") where fare payments can be in cash or through the use a fare medium (e.g., magnetic card or smart card) that is only usable on the agency's system and which generally uses a vendor's proprietary technology. In this case, the agency has the principal responsibility for creating the fare medium's supporting infrastructure, i.e., the methods for distributing the fare medium and adding cash value or other fare products (e.g., passes) to the medium.

It is important to note that agencies can create a system that is capable of open payments without necessarily accepting all possible fare payment methods. While it is unknown what the payment landscape will look like in 5-15 years, it will likely be very different than today. Planning for open payments now offers agencies the ability to add new payment methods over time, which will be important to transit agencies in order to "future proof" their system, thereby maintaining a positive image in the eyes of customers and further reducing cash payments.

3.4 Account-based Systems

In an Account-based system, the fare media functions as a single credential to identify the rider to the transit system (for access) *and* to associate that rider with an account (for transit fare payment). All transit fare payment transactions take place at the back end, within the rider's account, rather than on the fare media itself. This type of system therefore can more readily provide tools to support innovative fare structures, including 'best fare" or "fare capping". With such fare structures, individuals pay for each trip they take, until the total they have paid equals the price of the unlimited calendar pass, and then can ride for free for the remainder of the calendar period. Additionally, account-based systems can support pre-tax transit benefits programs and readily offer customers loss-prevention in the event of a lost or stolen card.

The alternative is a Card-based system, in which only a transit card serves solely as the fare medium. The card serves as a credential to identify the rider to the transit system and directly as the payment method. It can contain a pass, granting the right to use the transit system for a set period of time, or value, which is decremented each time the rider is granted access to the transit system.

3.5 Fare Payment Equipment

The hardware needed for automated transit fare collection and distribution is rapidly changing. As agencies upgrade technology, an increasingly popular approach is to supplement existing fareboxes (which may have sufficient useful life to be used for cash fare collection) with on-board validators that can handle more advanced payment methods. These validators are significantly less expensive and easier to replace than standard fareboxes. Validators typically communicate with the "back-end" system in real time by way of a "cellular network". This offers customer the ability to immediately use reloaded value and agencies the protection to immediately cancel lost or stolen cards. This makes it simpler and less expensive to update the system as new fare payment technologies are developed.

Currently many agencies are moving from magnetic fare media to contactless smart cards and smartphone applications as fare media. Smartphone applications present an opportunity for transit agencies to leverage the technology capabilities of a device already in the hands of nearly 90% of the U.S. population. Smartphone applications can be designed for visual inspection by an operator or fare inspector, or to interact with other fare equipment by displaying a bar code or using Near Field Communications (NFC). Contactless smart cards require radio signaling, generally using Near Field Communications (NFC), and so cannot be visually inspected by an operator. Furthermore, in many places fare vending machines

are being quickly supplanted by alternative sales channels such as mobile ticketing web portals and third-party retail networks.

3.6 Technology Alternatives

One of the strengths of an open architecture fare collection system is that agencies have increased options with regard to their technological approach, which in turn have impacts on current and future capital and operating costs. Four of the key decisions are as follows:

- **On-Bus Technology** -- As a result of using an open architecture approach, each agency will be able to select the equipment used on the buses as the system interface. While cash is accepted, a farebox will need to be installed to collect it. Agencies are increasingly choosing to keep their existing fareboxes solely to collect cash while using new readers, or On-Board Media Processors (OMPs) to interface with the new fare collection system.
  - New Readers (Recommended)
    - Lower initial capital costs and virtually no maintenance
    - Shorter lifespan, so more easily updated for new technology
  - New Fareboxes (Alternative)
    - Have the ability to issue fare media on board the buses
    - Longer lifespan, so agencies will need to purchase new readers/boards as technology and security standards change
- **Back-end System Location** – Businesses are increasingly facing a choice between purchasing technology as a service and purchasing hardware and software that it will be responsible for administering and maintaining. This same choice now applies to aspects of the fare collection system, including whether the back-end system is hosted, administered, and maintained by and third-party on behalf of all of the agencies jointly, or whether one or more of the regional agencies purchasing the hardware and software, and takes responsibility for administration and maintenance.
  - Third-party Cloud-based Hosting (Recommended)
    - Lower capital costs and no maintenance costs
    - Smaller in-house staff
    - Neutral third-party host to reduce conflicts between agencies
    - Provides redundancy and expert security
    - Allows agency to focus on core function of operating transit service
  - Agency Owned and Operated (Alternative)
    - Reduces or eliminates cost of future contracted services
    - Greater control over system and data
- **Fare Media Sales** -- Agencies need to decide on their principal approach to the distribution of fare media. In addition to this approach, agencies often have separate

agreements with large schools, employers and social service providers for group sales of passes.

- Third-party Retail Network (Recommended)
  - Taps into existing private networks, including drugstores, supermarkets, etc.
  - Agencies can focus on core functions as Network assumes responsibility for:
    - Merchant relationships
    - Inventory risk
    - Inventory management
- Direct Sales Agreements (Alternative)
  - Agency has greater control of where fare media is sold
  - Eliminates the cost of future contracted services

- **Web Portal Design** -- An important element of an updated payment approach is customer access via the web. A well designed web portal allows customers to access and interact via a variety of devices: computer, IPhone, Android Phone and tablets.
  - Regional – consolidated for all agencies (Recommended)
    - One development phase and platform
    - One acquirer/processor; focused Payment Card Industry (PCI) compliance
    - Shared costs
    - Can include pages customized with each agency's branding and linked to each agency's website
  - Agency specific (Alternative)
    - Multiple development phases and platforms
    - Duplicative costs

4 OBJECTIVES OF REGIONAL FARE PAYMENT SYSTEM

Each of the agencies participating in the Seamless Fare Integration project has its own goals and objectives, as do the stakeholders potentially impacted by this project. The overall objectives of this project are to support the goals of these agencies, and assist them in providing enhanced customer service and convenience to drive measurable increases in ridership.

4.1 Individual Agency Goals

In October through December, 2017, the project team interviewed staff from the principal transit agencies in the Detroit region, including DDOT, SMART, AAATA, DTC, and QLINE. Following these interviews, the team analyzed the data and invited agencies to review it with the project team. The following table shows the goals that were identified as desirable ("+"), very important ("++") or key ("+++") for each agency.

	DDOT	SMART	AAATA	DTC	QLINE
Facilitate the reduction in the acceptance of paper money and coins on-board vehicles, resulting in reduced maintenance costs, as well as operational efficiency and service planning benefits.	++		+		
Reduce fare collection and fare product distribution costs.	+	+	+		+
Reduce fare evasion.	+	+			
Reduce agencies' role as the issuer of fare media.					+
Facilitate agencies in adopting multi-agency and regional fare products.	+	+			+
Facilitate agencies in adopting new fare policies and products, such as "best fare", leading to increased ridership and/or revenue.	+++	+++			
Minimize capital costs through leveraging existing capital assets and achieving the best pricing on fare system investments.	+	+	+	+	
Facilitate agencies in partnering with other entities including for events with special transportation needs (e.g., sporting events), other mobility providers (e.g., bikeshare, UBER & LYFT), and other transportation related services (e.g., parking)	+	+			
Provide accurate and timely ridership and revenue data that can support revenue allocation for joint fare products, as well as detailed analysis and reporting of ridership practices.		++			

4.2 Risks

Risks are associated with any investment in new technology. This regional effort will seek to minimize its exposure to risk through a variety of means, including a methodical procurement process (such as sharing both this Concept of Operations and a RFI or draft RFP with industry for input and comment) and a phased implementation of new systems and technologies.

Risks that the regional agencies will be seeking to manage include, but are not limited to, the following:

- Technology, including systems integration.
- Regulatory/Statute/Operating regulations and fees – If agencies choose to accept third-party media, such as contactless credit and debit cards, they are subject to the applicable federal regulations. In addition, by accepting these media they are agreeing to the contracts and rules of the credit and debit card issuers and financial system processors. These regulations and contracts address issues such as privacy, data security, and risk of loss from stolen or fake cards, and can impose obligations and potential financial liability on the agencies. Furthermore, as these regulations, contracts and rules can be periodically changed, the obligations of the agencies may change at any time in the future.
- Data security – The increased quantity of field devices and expanded network infrastructure, the increased amount of data collected, and the increased frequency of communications all add to the difficulty of protecting customer and corporate information.
- Account-based approach – Account-based systems are generally new to public transit fare payments and can increase risk agency's risk of financial loss, especially when they operate in an off-line environment (i.e., when they do not have real-time communications with the back office).
- System and communications reliability – Account based systems rely on real-time communications to a central system as account balances are not stored locally on fare media.

5 SYSTEM DESCRIPTION

5.1 System Overview

The regional fare payment system will be account-based, utilize an open architecture approach and be designed to accept open payments. The focus of the system is to offer more convenient fare payment methods for customers and more efficient business and operational processes for agencies within the region. Essential to the new system is enhancing fare payment options while improving the on-board payment processes.

The general approach will be to strategically upgrade the current fare payment system as needed to ensure that an integrated, cohesive fare system is available for customers. The system will leverage and overlay new devices and functionality upon the existing fare payment system in a cost-effective manner. The system will be supported by real-time communications with central systems capable of handling fare calculations (in support of the subset of transactions in which a calculation from a central as opposed to a local point of sale is required) and media authentication. Account management functionality will be integrated into a central system used to manage accounts.

The account-based system, together with a third-party retail network, will allow customers to purchase and reload media online through a regional web portal as well as at commercial retail locations throughout the service area.

The focus on open architecture will require that Application Programming Interfaces (APIs) be designed and developed to support systems integration with future equipment suppliers. This is essential since the system will evolve over time, as operational and policy needs change.

The ability to accept open payments means that the system will be capable of processing a variety of new fare media, including agency branded contactless regional smart card, as well as mobile phones, third-party issued contactless credit and debit media, and bar codes. Customers therefore will be able to use more convenient fare media to pay fares as an alternative to using cash and magnetic fare media, and will have access to new and innovative means for fare payment, while providing the agencies with more modern and efficient means to collect fare revenue. While agencies may not elect to initially offer all payment forms, it is essential that the system be capable of supporting all functionality to provide future flexibility.

5.2 Regional and Agency Fare Policies

The regional fare payment system will allow each participating agency to set its own fare policies, providing strategic direction concerning fare products, the rules for their use, and their pricing. These documents will also define sales channels, transactions on and off vehicles and use cases. The regional fare payment system will provide information to feed ridership and revenue modeling tools, which agencies can use to analyze various potential fare policy changes and to simulate the ridership and revenue impacts of new fare structure/payment method scenarios. Creation of, and participation in, any multi-agency or regional fare products will be determined individually by each agency.

Agencies will preferably define uniform rules regarding eligibility for discounted fare products, such as a uniform regional rule defining the age at which an individual is a senior or a uniform regional rule defining which children may travel for free or at a reduced rate. Agencies will be free to define different rules regarding the discount received by eligible individuals.

5.3 Fare Products

The system and smart fare media will support agencies offering:

- Stored Value: The cost of a trip is deducted at the time of sale.
- Trips: Customers may purchase a number of rides.
- Calendar Passes: Customers may purchase calendar-based, unlimited ride, passes. This shall include daily, weekly, monthly, and yearly passes
- Floating Period Passes: Customers may purchase time-based, unlimited ride passes. This shall include 7 day, 30 day, and 365 day passes.
- Best Value: Customers may purchase fares which consider usage over a day, week or month to assure their payment does not exceed the price of a calendar pass for the same period.
- Transfers: Customers may be afforded a reduced fare for accessing additional vehicles within a specified period of time.
- Reduced prices for qualified customers, such as seniors, disabled, students and others.
- Time-of-day pricing.
- Promotional Fares: Special pricing or fare types available in conjunction with special events, targeted routes or promotions.
- The ability to support stored value as well as a calendar or floating period passes simultaneously on a single account (card).

Agencies may elect to only issue portions of the above list. The fare engine must support fare policies associated with each operator and be sufficiently flexible to support periodic changes.

5.4 Accounts and Fare Media

The regional fare collection system will be designed to accommodate cash as well as fare media that act as a "token" to identify an individual or an account to the fare collection system. An individual farebox or validator will need to communicate with a central system to confirm that the individual or account has a valid fare product providing the ability to pay for transit (e.g., stored value) or some other right to use transit (e.g., a pass). Generally this will occur at the time the token is presented to the farebox, but an agency can also download a list of valid tokens to fareboxes, such as a list of tokens which are associated with a valid multi-day pass. These fare media can include smart cards and cell phones linked to a transit account containing cash value or a pass, as well as direct payment from credit/debit cards and apps such as Apple Pay on IPhone. Tokens and accounts will be anonymous, i.e., not linked to an individual, unless the owner or entity funding the account registers the card with the fare collection system.

The following identifies the specific items that customers will be able to use to interact with the regional fare collection system.

Personal Fare Card for Long-Term Use

This new system will offer a contactless smart card that, as the credential to an account, has the flexibility to handle any fare or fares that a customer will need while travelling on any of the participating agencies. It is intended for re-use; as the fare value, associated trips or calendar pass is used, additional fare can be added to the account. Smart cards typically last five years or more.

No fare products or personal information will be encoded directly on the smart card.

A regional branding strategy would be cost effective he smart card could display a common logo and brand name for the fare program, display the name of a specific transit agency or a company or government agency that is cooperating with the regional effort, or some combination of both. The smart card will be printed with no information on fare type, value or times/dates of validity. Verification of validity by agency personnel will require equipment to read and display data encoded on the card via proximity wireless communication and to process each transaction.

Acceptance of Contactless Bank Cards

The regional fare collection system need not initially accept bank-issued contactless credit and debit media, but all hardware and software will be required to be capable of processing such media once the agencies elect to utilize this

functionality. Upon delivery the new system will need to be certified by the financial services industry to be secure and compliant should open payments be a near term likelihood. This decision should be made prior to finalizing the RFP.

Mobile Devices

The regional fare collection system will be designed to accept smart phones as acceptable fare media through the use of an "off the shelf" mobile ticketing application. The mobile ticketing application will include a secure bar code or QR code for reading and validation by the on-board reader, and also include a display option for visual inspection by operators as an interim measure before all equipment is operational.

Limited Use Media

The regional fare collection system will accept limited use fare media. Limited use smart cards are very thin smartcards intended for short applications, generally not exceeding one week. Each can be sold by participating agencies with a specific value or use, such as a one-day pass, a one-week pass, or a convention pass. Limited use media can be printed with other information so that it can, for example, also serve as a ticket to a sporting or musical event.

Other Smart Devices or Media

The regional fare collection system will be designed to be capable of processing any other smart devices or media that can meets the ISO standards, a smart phone, or bank-issued contactless credit and debit media. This will include identification issued by third parties, such as corporate or university ID cards. Acceptance of such products will be negotiated by the participating agencies and the third party.

5.5 Fare Purchase / Adding Value

Customers will be encouraged to obtain smart fare media for multi-year, long-term use. Such media can be loaded and reloaded with fares, either on a recurring basis by subscription, or on a one-time basis as directed by the cardholder. In actuality data resides in the back-end system, not on the smart card, and this provides an enhanced level of security to both the user and agency. The majority of agencies charge a fee for smart cards although some, such as Chicago and Philadelphia, distributed cards freely for an initial period to support a successful transition.

Linked Fare Card

At the customer's choice, the fare media can be associated to a bank or credit/debit card account, with programmed instructions on automatically reloading the card. Associating the card to an account enables the customer to ride transit without the worry of insufficient funds or an expiring calendar pass. Reloading instructions may be for recurring reloads of a fixed amount when remaining value on the card falls below a pre-defined threshold. Alternatively, the customer may subscribe to reload a period pass onto the card.

The subscription can be set up as an individual account by the customer, by employers to issue and manage transit value and passes as an employee transit benefit, by social service agencies, or by schools or other organizations. For example, linked fare cards are often used for UPass programs, allowing a school to quickly identify for the system which individuals are continuing students (and continue to ride under the UPass program) and which individuals are no longer eligible for the UPass. These will require that the organization register the card, identifying the cardholder and the individual or entity funding the account. Organizations and cardholders will be able to manage and view their accounts online or they may obtain assistance by telephone. There will be unique web-based support portals for individual account holders and organizations providing benefits or funding.

Customer Service Centers

Each agency will be able to sell fare media and any fare products at their customer service centers, or such other location as desired. This will include adding value or fare products.

Additionally, service agents will be able to provide customers with an advanced level of support and service through these locations. It is envisioned that these agents shall be able to register accounts, replace lost cards, research payment and

usage history, and make account adjustments or issue refunds as appropriate, using electronic Point-of-sale equipment tied to the back-end.

Third-Party Retail Outlets

Many transit agencies are choosing to offer a wider variety of sales channels to better serve the broad array of customers. The current best practice is for agencies to offer customers an alternative to a linked account through a third party retail network. With this network, the regional smart card becomes similar to the gift cards displayed by many retailers. The cards have no value until activated through the use of a retail point of sale (RPOS) device, which is typically the electronic cash register system used by the retailers. These devices offer immediate internet access for processing transactions. This greatly reduces the potential liability of retailers, and therefore increases the willingness of small retailers to participate in the program. Retailers usually handle these transactions at a customer service desk and are responsible for the value of the media once it is activated. The best practice is for agencies to work with companies that have existing networks for the distribution of gift cards, including gas stations, grocery stores, drug stores, dollar stores, and other convenient retail distributors such as office building lobbies or college campuses. This minimizes the effort that the agency needs to make while facilitating expansion of the agencies' retail network. Furthermore, cardholders will be able to purchase and load fare products into their account at participating merchant retailers, regardless of the fare media they use or its initial point of purchase. Third-party retail outlets are particularly convenient for the unbanked and underbanked customers as cash is always welcome.

On-Board Sales

Agencies' long term fare policy often provide that Customers boarding without a pre-paid fare card or mobile fare pay a higher fares on-board as a disincentive. The system shall be capable of accepting cash in addition to the fare media described above. Agencies will have the ability to determine if they will issue fare media on-board vehicles (provided they upgrade their fareboxes to issue limited use fare media) and if customers will be able to purchase fare products for cash (e.g. adding a pass to an existing account) on-board vehicles. Typically larger metropolitan areas such as Chicago, Buffalo and Philadelphia will not allow on-board reloading due to the unfavorable impact on boarding times and schedule adherence, while smaller a city such as Louisville

may envision on-board loading as a transitional strategy for a successful rollout of the new program.

5.6 Mobile Ticketing

Operating Plan

The system will incorporate an "off-the-shelf" mobile ticketing application to offer Customers the ability to purchase fares on their mobile device in lieu of smart cards. The single application will offer the fares for all member agencies as well as regional products. The easy-to-use application will be downloadable to all "smart phones" and will include a secure bar code or QR code for reading and validation by the on-board reader. The application will directly interface with the back-end system.

Transition Plan

Mobile ticketing can be implemented using moving displays or other visual cues that are inspected by the operator for validity. This approach may not be suitable for long-term application, but it has been implemented by many transit agencies as an interim step, providing customers with material evidence that the new system is being implemented.

5.7 Vehicle / Station Hardware

Media Reader

To support the contactless fare payment media, all participating agencies will require new media readers or On-Board Media Processors (OMP). The OMPs will be standalone devices that interface with existing fareboxes and other on-board systems and will offer visual and audio messages to customers and vehicle operators and capable of reading contactless smart media. Once the OMP has read the smart media, the unit will communicate with the Central Processing Back-end System via the wireless network. The OMP shall be capable of reading ISO-14443 compliant contactless media, including agency issued media, as well as contactless credit and debit media. Additionally, the OMP shall incorporate a barcode reader for the processing of various forms of electronic ticketing, including a future mobile ticketing application. All OMPs will have real time communications for validation, including the ability to store and forward data, as well as local decision-making capabilities to address temporary communication failures or delays based on rules adopted by the owning agency.

To the extent possible, OMPs will be commercially available, "off-the-shelf" devices available from multiple suppliers.

The OMPs shall:

- Accept fare payments consistent with the above sections.
- Transmit encrypted data to the back-end system.

As applicable, the agencies may elect to have the OMP interface with various systems in the bus. This most notably includes interfacing with existing fareboxes to simplify driver interaction with the system ("Single Logon").

As the system is implemented, on-board cash transactions would continue to be collected via the farebox while other transactions would migrate to the new reader. Transition would occur at the pleasure of each agency.

Ticket Vending Machines

Select agencies currently utilize, or have in the past utilized, Ticket Vending Machines. These machines are deployed for varying modes of operation. Additionally, these machines accept varying forms of payment and dispense magnetic ticket media.

The QLINE Ticket Vending Machines may or may not be compatible with the regional fare collection system. Any other agency that chooses to use Ticket Vending Machines with the regional fare collection system will purchase new machines which accept cash as well as contact debit and credit cards, is capable of issuing regular and limited use smart cards, and is capable of adding stored value or other fare products to an account.

5.8 Agency Point of Sale

Agencies will have equipment capable of issuing and activating media, and access to the fare collection system capable of creating new accounts, registering accounts, linking accounts to new bank accounts or credit or debit cards, and adding value to or correcting errors in customers' accounts.

5.9 Garage Equipment

Garage equipment is focused on removing cash and detailed transactional data from on board transit vehicles and sending them for further processing. Cash may need to be assembled at a single location, and needs to be counted and ultimately sent to a bank. Data needs to be sent to the central office.

The recommended alternative does not involve replacing the existing fareboxes, and therefore requires no changes to cash handling, vaulting or counting.

Detailed ridership data will be collected from standalone validators and possibly from current fareboxes, if upgraded with improved communications, through the use of Wi-Fi communications or the cellular network. Many systems require Wi-Fi communications for system upgrades due to the speed and simplicity of data transfer, as well as to handle the considerably larger volume of data (e.g., lists of valid and invalid fare media as well as transactional data) which will be transferred between the vehicles and the central system.

5.10 Fare Media Distribution/Third-party Retail Program

Operating Plan

As part of the approach to reducing the use of cash on-board vehicles, a fare media distribution and reload network will be established. This network will allow customers to buy and/or reload agency-issued fare media. This retail program network will utilize a commercial, third-party network and not rely on agency-specific infrastructure. This network will provide means to ensure access to fare media and services for all customer groups, including the unbanked and under-banked.

The agencies will retain responsibility for distributing fare products to bulk accounts including university and school pass programs, employers with bulk purchase agreements, and social service agencies, as well as the right to sell fare products directly from a website and their own sales locations.

Transition Plan

As part of the open architecture, open payments approach, the system will be designed to accommodate commonly available smart cards. The initial testing and roll-out of the system will be made using smart cards distributed by the agencies, initially to selected beta testers and later to bulk customers and individuals purchasing directly from the agencies. No agency sales channels will be closed until the third party retail network is fully functioning.

5.11 Central Back-end Processing System

The new system will incorporate a single regional back-end computer system for managing all aspects of this fare collection system.

Processing Modules

The heart of the system will be a centralized back-end system that will include integrated modules to provide a seamless, cohesive fare payment system for Customers. The envisioned modules are as follows:

- Account management – primary purpose is to maintain customer accounts, fare media information, transaction and usage history. This function will be split into several components for managing account information in regard to registered transit card users and management of the overall "master back-end" reconciliation, settlement and data analysis/reporting functions.
- Payment card processing - primary purpose is to interact with the banking network to process payment card (e.g. credit, debit, prepaid) authorization and settlement messages.
- Authentication system – primary purpose is to provide a fast response to readers after a customer presents fare media requiring authentication. System will manage local "accept" and "deny" lists and store the regional system's fare tables, ensuring that the appropriate fare is calculated.
- Device and network configuration, management and monitoring – primary purpose to manage field devices and applicable communications links.
- Data warehouse – primary purposes is to provide robust business analytics and intelligence capabilities through data integration of various systems.

Hosting

The regional back-end system will be a remotely hosted solution, potentially residing within the "cloud". This solution shall be hosted and maintained by the fare collection vendor.

This system will:

- Incorporate all required and appropriate measures to ensure security for transactions and data within the system;
- Maintain high availability and redundancy;
- Ensure access to all appropriate data to each of the regional partners.

At no point shall any of the participating agencies be responsible for maintenance of the system. Additionally no agency shall be required to interact through another agency to access data or services within the back-end system.

Web Portals

The system will include a customer service center and centralized website. The customer portal will provide a comprehensive means for customers to perform all necessary self-service and assisted customer support functions, including adding value, making purchases, setting up auto-load, reviewing trip history, card replacement.

Organizational portals will be included to support funding and management of transportation benefits, student travel and social service agencies. These portals will provide a comprehensive means for administrator to add value for participants, handle card replacement, enable benefits for eligible participants and cancel benefits for those no longer entitled.

Agency portals will be included for monitoring system health, transactional reporting and data access.

Commercial Infrastructure

The Processing System will also interact with various external entities (acquirers, issuers, card networks, etc.) for processing of credit and debit card transactions.

5.12 Wireless Communications

Each participating agency will be responsible for providing wireless, or were appropriate wired, connectivity to support secure, real-time transactional processing. During transition certain agencies may be unable to support real-time transactions. Transactions at those agencies will be processed on a "store and forward" basis from the devices.

5.13 Data Security

At a minimum, the system shall be capable of accepting credit, debit and account-based prepaid media as forms of payment. The entire system, all devices that process credit or debit cards, all communications and computer systems comprising the entire system and all interfaces with any existing system components shall be in full compliance with all required security standards statements, and guidelines, including those from the principal credit and debit card issuers. System design will aim to limit agency exposure for financial transactions, including through secure connection of buses to the financial network in order to rapidly validate cards and maintaining a list of recently used smart cards (and if open payments is implemented of credit/debit cards) that were previously identified as invalid.

The system shall aim to exceed the minimum requirements of these standards where applicable, especially with regards to the use of encryption and/or tokenization to minimize the number of systems and processes considered in-scope for compliance purposes. The system will minimize the risk of any data security incidents, and the annual capital and operating costs to maintain compliance, by eliminating, to the extent possible, the processing or storage of sensitive data by the system, and by instead using third party payment channels. This will result in transferring much of the responsibility for security, and the risk of loss for security breaches, to these third parties.

5.14 Paratransit

The operating scenarios for On-Call and Paratransit services will be identified later on once an ongoing procurement process has been completed.

5.15 Special Events Ticketing

The system will support a variety of joint-ticketing partnerships that will enable event tickets to be purchased along with transit fares.

Agencies would also have the ability to co-brand media with corporate or regional sponsors. One example would be incorporation of a QR Code use on baseball tickets for transit travel the day of weekend tiger home games.

6 PROCUREMENT AND IMPLEMENTATION APPROACH

6.1 Implementation Plan

Initial Scoping

Each agency shall determine if they will participate in the initial scoping effort. The participating agencies will determine the lead agency or agencies for this effort and its organizational structure. The participating agencies will investigate existing regional fare collection systems, including site visits. The participating agencies will then cooperate to develop an RFI or Draft RFP, building on this document and the draft system specifications, and in discussions with potential vendors of the regional fare collection system.

From a regional perspective, it is most important to take advantage of the economic benefits of a single back-end system with a single transactional public web portal. Not every agency needs to implement hardware improvements at the same time or adopt a similar fare structure. The long-term shared vision should include the elements discussed in Section 4.1, tempered by individual Fare Policy goals.

A single, regional "Brand" offers an effective way to gain visibility and uniform messaging about regional benefits.

Each agency shall determine if they will participate in the project.

Part A – Phase I

Phase I shall include the procurement of Smart Card reading technology, consisting of the OMP and the regional back-office including web-portal systems. Following installation and testing of the OMPs and the regional back-office, the agencies will initially distribute the smart cards directly to bulk purchasers, such as universities, other schools, major employers, and social service agencies, together with making available web portals designed specifically for each of these groups. Once these groups are functioning properly, the agencies will then begin distributing smart cards through their existing distribution channels.

Part A - Phase II (may be contained as an "Option" within Phase 1)

Phase II will be procurement of the Third-Party External Sales network. This network will designed to build off of the system developed in Part A – Phase I and expand its reach by making smart cards more available and by making it easier for individuals to add value to their accounts. By ensuring that this network reaches into low income and minority neighborhoods, the transit agencies will be better

meeting the needs of their customers and meeting their own requirements under Title VI and Environmental Justice.

Phase II generally will also include the implementation of new fare policies, since it is important that all new fare products be available to all of the agencies' customers.

Part B (may be contained as an "Option" within Phase 1)

Part B shall be the procurement of a Mobile Ticketing application. Mobile Ticketing is not reliant on the Regional back-office, although it should be designed to be compatible with it. As a result, some agencies begin by procuring a Mobile Ticketing application which accommodates visual inspection of tickets by bus operators, as it can be implemented more quickly than installing new fare equipment. The Mobile Ticketing application will also incorporate bar codes or NFC so that validation can be switched to the OMP after it is installed.

6.2 Procurement Approach and Schedule

- Spring, 2020 – Investigation of Existing Regional Fare Collection Systems including site visits and determination of lead agencies and organizational structure
- July, 2020 – Issuance of RFI with potential on-site vendor visits
    - The RFI will address all Phases of the Project
    - RFI responses due 4 weeks after release
- November, 2020 – potential vote on regional transit funding
- January, 2021 – Potential release of Part A - Phase I RFP
- March, 2021 – Potential Part A - Phase I Bids Due