

*Seamless Fare Integration Study
for the Detroit Region*

Final Report

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Introduction

The purpose of the *Seamless Fare Integration Study* was to document current conditions and identify issues and opportunities for fare integration between the four existing transit operators in the Detroit region: the Detroit Department of Transportation (DDOT), the Suburban Mobility Authority for Regional Transportation (SMART), the Ann Arbor Area Transportation Authority (AAATA) and Detroit Transportation Corporation (DTC). In addition, the study integrated consideration of another key future system for the area: the M-1 Streetcar, which is scheduled to begin operations in 2016.

Some impetus for conducting the study included:

- Transit provider interest in creating methods for customers to pay fares and transfer across agencies
- Agencies' need to reduce the high rate of cash fare payment, which slows down operations and creates additional handling costs
- Unrealized opportunities to increase transit pass partnerships with major employers and institutions
- Adoption of more advanced, scalable fare payment systems that provide greater utility to both customers and transit agencies

This report assembles the primary findings from the study, which were recorded in four technical memoranda:

- Existing Conditions of Current Transit Providers
- Comparable Transit System Survey
- Fare Integration Technologies and Contractors
- Options for a Seamless Regional Fare System

Based on this work, the project team worked alongside local agency representatives to determine short- and long-term approaches for creating an integrated, seamless fare system for transit customers in metro Detroit and Ann Arbor (see "Why Invest in Regionally Integrated Transit Fares?" on following page). This report includes an additional section on implementation gives an overview of necessary steps to operationalize recommendations over the next 5 years. Additional detail, including the technical memoranda and a draft Memorandum of Understanding for consideration by the regional transit agencies, can be found in the appendices to this report.

Why Invest in Regionally Integrated Transit Fares?

Agency Goals	Why is it Important?	Near-Term (Year 1 - 3) Action Items	Long-Term (3+ Year) Fully Integrated System
<p>Offer platform for seamless regional trip-making between transit providers</p>	<p>DDOT and SMART account for the vast majority of passenger transfers in the region, with thousands of customer transfers each day and more than 2 million per year. Currently, transfers between the agencies are complex due to mismatches in base fares and transfer policies. The People Mover, AAATA and the under-construction M-1 Rail streetcar also do not have policies or fare systems in place to facilitate transfers to other regional systems.</p>	<ul style="list-style-type: none"> Resolve DDOT-SMART differential in base fare and pass pricing, including consistent period passes. Establish transfer policies between M-1 and other regional providers. Expand upon existing DDOT-SMART regional pass by extending to People Mover and AAATA. 	<p>An integrated regional fare system would provide the ability to transfer between all regional systems seamlessly using one fare payment mechanism, and a shared centralized back-end accounting system would ensure that fare payment revenues are distributed equitably to all operating agencies.</p>
<p>Reduce reliance on cash fare payment</p>	<p>The systems in the Detroit region, and particularly DDOT and SMART, are heavily reliant on cash fares paid on vehicles. This situation has severe impacts on the quality of transit service (feeding bills and coins into fareboxes increases passenger loading times at busy stops) and also affects the cost of providing service (cash handling being a major expense). High cash usage reflects in part a lack of other convenient, consumer-oriented fare payment options.</p>	<ul style="list-style-type: none"> Expand fare pass distribution network to potentially include third-party retail partners. Simplify and further incentivize period pass usage. 	<p>An integrated regional fare system would improve upon the existing complex set of passes offered to customers, allowing customers to more easily pre-pay fares. Based on a review of peers, regional integrated systems have helped to eliminate over-reliance on cash fares in other regions, where cash payment now accounts for a small minority of trips.</p>
<p>Provide platform for working with employers and institutions on transit access</p>	<p>Nationally, the fastest growth markets for transit systems are places where they support active concentrations of employees and students. Peer transit networks in other regions have utilized online account-based fare payment systems to develop partnerships with employers and institutions. In addition to boosting ridership, these programs allow agencies to better understand customer usage patterns, develop responsive service structures and further incentivize the use of transit.</p>	<ul style="list-style-type: none"> Establish regional institutional / employer partnership program (providing discounted passes for large concentrations of commuters). Establish transit commuter benefits information and outreach program. 	<p>An integrated regional fare system would include an account-based option that would not only allow individual users to more easily set up and track their transit expenditures, but also serve as a platform for major employers and institutions to partner with agencies on transit access programs.</p>
<p>Capture benefits from emerging fare payment system options</p>	<p>That adoption of "open fare payment systems" refers to both the ability for customers to use multiple non-agency issued media (e.g., mobile phones, debit cards) to ride transit as well as an overall system design that does not lock public agencies into proprietary hardware or software solutions. Many agencies are moving away from these proprietary fare payment technologies, which are more expensive to maintain and difficult to change.</p>	<ul style="list-style-type: none"> Develop "concept of operations" and secure funding for regional integrated fare system. 	<p>An integrated regional fare system would potentially involve contracting with a system integrator that could develop, implement and help operate the "open" back-end system. This system could be set up to accept and/or add emerging payment mechanisms as they come available.</p>

Existing Conditions

Fare Equipment

The three bus system operators (DDOT, SMART and AAATA) all utilize *GFI Odyssey* fareboxes, installed within the past eight years. The DTC operates *GFI Transentry* turnstile equipment, installed between 1986 and 1988. And, the M-1 Streetcar has not yet selected or purchased fare equipment, but plans to have ticket vending machines at each station as well as on-board fareboxes.

Odyssey fareboxes can accept and process coins, bills, tokens, magnetic fare cards and 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 processor for *Odyssey* fareboxes.

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

Bus Fares, Fare Revenues & Recovery Ratio

Bus fares among the providers range from \$0.75 to \$2.00. DDOT and SMART are the only two agencies in the region that coordinate on fare products and currently have agreements in place

Agency Fare Comparison				
	DDOT	SMART	AAATA	DTC
Base Fare	\$1.50	\$2.00	\$1.50	\$0.75
Monthly Pass	\$47.00	\$66.00	\$58.00	\$10.00
Annual Revenue	\$21.9M	\$13.4M	\$5.9M	\$1.3M
Recovery Ratio	15%	13%	19%	11%

Sources: Agency fare information, 2013 National Transit Database

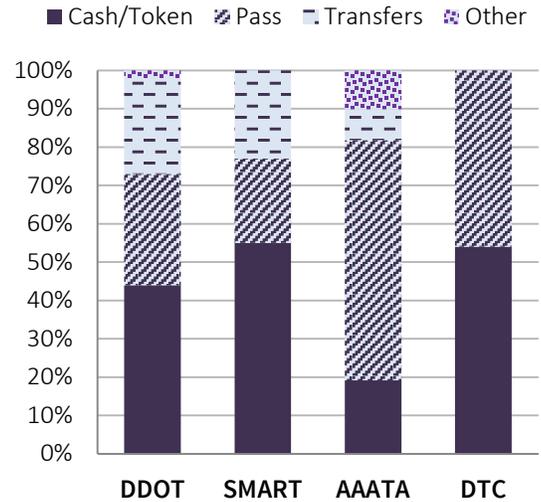
allowing for customers to pay for transfers between services. Although the farebox recovery ratio has fallen in recent years (concurrent with ridership), DDOT collects the most fare revenue of any agency in the region at more than \$20 million.

The fare recovery ratio in the Detroit region is generally below the national average (the average recovery ratio for all U.S. transit agencies in 2013 was 33%). Local bus agencies have typically recovered 15% to 20% via the farebox, and the People Mover has typically been nearer to 10%.

Fare Utilization

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.

Fare Utilization by Type



Sources: Agency information, 2013-2014

Issues & Opportunities for Fare Integration

Issues and opportunities for fare integration identified during the survey of existing conditions included:

- *Fare system inter-operability:* Due to the presence of a common farebox type among Detroit region providers, technology is not a major barrier to fare integration, and may make more short-term integration achievable.
- *Current inter-agency transfers:* Transfers between the DDOT and SMART systems make up nearly all existing transfer activity in the region, although planned changes, including the new M-1 Streetcar, should be expected to spur demand for transfers. In the near term, regional fare enhancement has the greatest potential benefit and impact for DDOT and SMART customers.
- *Cash vs. pass usage:* DDOT and SMART are also the regional transit agencies that are most reliant on cash payment. Shifting away from cash fares could have significant operational benefits for each of these agencies.
- *External partnerships:* System access agreements with major employers and institutions present an attractive way for transit agencies to build their market base. As the AAATA example demonstrates, there is great potential to obtain large shares of revenue through institutional pass agreements, even in advance of rolling-out regional smart card technology.
- *New fare technologies:* Advances in electronic fare payment, including contactless Smart Cards, have been explored by each of the agencies, who are attracted to their ability to reduce costs and increase customer convenience. AAATA and SMART have each piloted Smart Cards using current equipment.

The goals expressed by each agency throughout the fact-finding phase for Existing Conditions showed the desirability of more diverse customer payment options and a modern regional fare system.

Comparable Transit Systems

Six peer regions (see table below) were compared to review lessons learned about implementing automated fare collection systems involving multiple transit agencies. Like the Detroit region, the peer regions studied all had numerous transit service providers needing to coordinate on fares. In some cases, the regional fare collection system needed to accommodate ten or more individual agencies. The following pages contain an overview of the main findings from the survey of comparable systems.

Regional Fare Systems								
	System Name	Lead Agency	System Contractor	Other Suppliers	Agencies	Transit Modes ⁽¹⁾	Payment Methods	Year
Atlanta	Breeze	MARTA	Cubic	GFI Cents-a-Bill/ Odyssey	4	Bus, X-Bus, HRT, PT	Cash, Mag Card, Tickets	2005
Sacramento	Connect	SACOG	INIT	GFI Cents-a-bill/ Odyssey	7	Bus, X-Bus, LRT	Cash, Tickets	2014
Minn. -St. Paul	Go-To	Metro Transit	Cubic	GFI Cents-a-Bill	13	Bus, X-Bus, LRT, CR, PT (pilot)	Smart Card, Cash, Mag Card, Tickets	2007
Seattle	ORCA	King Co. Metro	ERG (Vix)	GFI Cents-a-Bill	6	Bus, X-Bus, BRT, LRT, CR, Ferry, PT	Cash, Tickets	2009
Philadelphia	Key	SEPTA	Xerox	GFI (rebuilt fareboxes)	TBD	Bus, TB, T, LRT, HR, CR, DR, PT	GPR Smart Cards, Magnetic cards, Cash, Drivers Licenses, ID cards	2015
Washington DC (two systems)	SmarTrip	WMATA	Cubic	GFI Cents-a-Bill	11	Bus, X-Bus, LRT, HRT	Cash, Mag Card, Tickets	1999
	NEEP	WMATA	Accenture	Scheidt-Bachman, Cubic	11+	Bus, X-Bus, SC, LRG, HRT, PT	Smart Card, Open Payments, Cash, ID Cards	2016

⁽¹⁾ X-Bus: express bus, BRT: bus rapid transit, LRT: light rail transit, HRT: heavy rail transit, CR: commuter rail, PT: paratransit, SC: street car

Seamless Fare Integration Study for the Detroit Region

Regional Demographics

When comparing the regional statistics, the Detroit region ranked very low in terms of transit trips per capita and particularly in the number of “choice” riders that use transit. The experience from other regions indicates that implementation of automated fare collection systems typically generates measurable ridership growth, particularly if linked with consumer-friendly fare policy refinements.

Fare Media and Equipment

All surveyed systems employed automated fare collection technology based on contactless smart cards. Most systems were closed-loop, card-based systems, but at least three agencies (in DC, Philadelphia and Sacramento) were in various stages of upgrading to newer technology employing open-loop and contactless bank card/mobile phone payment. Open-payment systems can accept a range of media, including employee ID cards, bank-issued credit/debit cards and mobile payments.

Public Acceptance

Market penetration of new fare programs is used as a proxy for program success, and each surveyed system in revenue service was reviewed for this measure of acceptance. The results of this review are visible in the table below, and show that the automated fare collection system accounts for more than half of the ridership for each of the peer regions. Most agencies considered fare re-structuring and developed a comprehensive plan to improve accessibility to discounted fares for existing riders and new customers. Differences in market penetration are likely due to a number of factors, such as demographics, trip type, trip frequency and continuation of legacy fare media.

Public Acceptance at Peer Regions					
	Annual Ridership	Daily Ridership	Daily Smart Card Trips	# of Card-Holders	Market Penetration
Atlanta	134,900,000	500,000	360,000	1,000,000	MARTA: 98%
Sacramento	27,100,000	96,000	TBD	TBD	Undetermined (new system)
Minn.-St. Paul	82,000,000	250,000	110,000	500,000	Overall: 52%
Seattle	151,620,000	570,000	373,000	1,700,000	Overall: 66%
Philadelphia	330,000,000	1,413,000	TBD	TBD	Expected: 90%
Washington DC	343,969,630	1,100,000	1,006,000	3,000,000	WMATA overall: 92%; All Bus: 90%; Metrorail: 85-91%

Governance & Procurement

Governance generally falls into one of two main categories, either collaborative or lead agency:

- Collaborative approaches typically involved a Memorandum of Understanding or Cooperation Agreement among participants in the region. Two of the regions studied preferred a collaborative governance approach. In Seattle, the agencies were organized into a joint governing body. Another system, Connect in Sacramento, has been organized and led by the MPO (SACOG) involving the participating agencies on a consensus basis.
- Lead agency arrangements allow the largest and most central agency in the region to work independently, followed later by agreements for new agencies to opt into the system once operational (not during design/procurement phase). In the majority of cases, a single agency – either the MPO or the largest carrier serving the urban core – led the design and procurement effort, either as a sole entity or as a representative of consortium of participating agencies.

No matter how the governance is structured, in recent years procurement of these regionally combined fare systems have increasingly moved away from proprietary, vendor-specific solutions to contracts with system integrators that can develop a tailored system utilizing a variety of hardware and software platforms.

Fare Policy Coordination

Although regions that collaborated on fare policy prior to adoption of an integrated system saw benefits as a result, one advantage of automated fare collection technology has been the ability to accommodate and process complex fare structures, including the unique policies of individual agencies in a regional system. This enables each agency to retain its own fare policy and structure if preferred. Transfer agreements and joint fares in place prior to regional system deployment can be included in the programming of the new system.

Lessons Learned

The experience of other regions that have adopted regionally integrated fare systems indicates that these systems can provide increased customer satisfaction, greater revenue accountability, improved ridership data, and a foundation for pass partnerships and other fare policy innovations.

Key lessons learned from these case studies can be organized into the following categories.

- System Design
 - Address policy issues during system design
 - Organize early to learn about specific needs or constraints
 - Organize to resolve conflict by creating a governance approach that addresses the interest of all agencies
 - Take steps to clearly define the functional requirements of the system

- System Procurement and Implementation
 - Structure the procurement process to maintain a level field during the competition
 - Protect the agency investment
 - Do not be schedule driven for system development
 - Be mindful of the system life cycle when scheduling multi-agency rollout

- Public Acceptance
 - Begin community outreach early
 - Provide incentives to encourage the use of the new smart card in place of cash
 - Move quickly and publicly to address and resolve design issues as they arise

Technology and Vendors

The survey of fare integration technologies and contractors indicated that the system, hardware and fare media options available to transit agencies are rapidly changing.

Systems

While the transit systems in the Detroit region currently offer fare pass products based on a proprietary, closed-loop model, for a variety of reasons, transit agencies in most major metropolitan areas are transitioning to account-based, open-payment and open-architecture systems. These reasons include:

- 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

For the purposes of long-term fare integration and compatibility, Detroit area providers should strongly consider these elements in planning for their future system.

Hardware

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 can still 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. Similarly, in many places fare vending machines are being quickly supplanted by alternative sales channels such as mobile ticketing. For each application, customer research will demonstrate the best mix of available hardware to meet operational needs.

Fare Media Types

Agency acceptance of multiple media forms will be commonplace in the future, as Near Field Communication faces off with other technologies. Magnetic media is increasingly seen as a shorter term bridging tool as new systems embrace more secure media forms.

System Options

Three system options were identified for consideration by regional stakeholders (see Options A, B, and C in the table below). These options were not exclusive of one another, but were developed to illustrate the range of choices available to the region.

System Options Overview		
	Description	Elements
Option A Enhanced Baseline	Use current fare technology and existing regional pass as basis for regional integration.	<ul style="list-style-type: none"> • Agreements on fare interoperability, policies and revenue sharing among all agencies. • Individual agencies advance policy and pricing changes to simplify fare offerings, reduce reliance on cash. All fare systems and data remain housed at operator agencies. • Expand usability to include M-1, People Mover and AAATA. • Could be seen as a temporary option as larger system integration plan moves ahead.
Option B Account-Based Smart Card	Regional agency collaboration on development of regionally branded transit smart card.	<ul style="list-style-type: none"> • RTA likely to lead effort to develop funding and interoperability agreements across all agencies in support of smart card. • Could be contracted through vendor as proprietary system or procured for open system architecture. • Functionality to include account-based system that allows for individuals and employers to manage accounts and track usage. • Potential introduction of mobile ticketing based on model adopted by M-1.
Option C Open Payment System	Regional contract with system integrator that develops comprehensive system based on accepting open payments for transit region-wide.	<ul style="list-style-type: none"> • RTA likely contracts with system integrator who leads integration of process, with individual technology elements procured separately. • Introduction of mobile ticketing and other payment methods (acceptance of credit/debit cards, student/employee IDs, other non-agency issued payment). • Likely includes development and utilization of a remotely hosted, shared backend system support open payments. • May require technology updates to vehicles to support on-vehicle transactions.

Evaluation of Options

The options for regional fare integration were evaluated based on how they impact customers, how they impact agency operations, and the ability to fund and implement them. The specific criteria for each are listed below:

- Customer Considerations
 - The *usability and acceptability* of the option, which describes the functionality of the system and also the need to accommodate the Detroit region's existing customer base, which is primarily low-income.
 - The *ridership impact* of the option, which particularly reflects the ability to grow ridership by attracting new or infrequent customers to use the system, or to partner with employers and institutions.
- Agency Considerations
 - The *conformance to agency goals*, which, according to feedback at meetings through the process included: reduction in reliance on cash fares; improved regional transfers and tripmaking between existing systems as well as planned systems (M-1, regional transit); simplification of fare types within agencies and across region, including validation process for reduced-fare customers; and acceptance of payments via mobile phones and other non-agency issued fare media, (especially for M-1 Rail system).
 - The *operational cost impact* of the option, which would largely be based on economies of scale from a regionally operated system as well as the increase in pre-paid fares and resulting lack of cash-handling.
- Funding & Implementation Considerations
 - The *capital/implementation cost* of the option, which includes not only investments in equipment needed to support the investment but also accompanying investments in support services and initiating the service.
 - The *implementation timeline* of the option, which tracks to the effort involved in conceiving, designing and implementing the system.

Selection of Preferred Option

Despite having the highest cost and longest timeframe, the regional agencies determined that Option C – Open Payments System best conforms to regional and agency goals for transit fare coordination, and is most likely to conform to RTA goals for improving regional transit trip options across systems. This option would embrace the most recent fare payment strategy being advanced by many regional transit systems in the United States by incorporating the advantages of open payments (via non-agency issued mechanisms) as well as open system architecture (allowing multiple vendors to bid on various hardware elements of the system).

Overview of Long-Term Preferred Option	
Elements	
Equipment	<ul style="list-style-type: none"> • Upgrade fareboxes & turnstiles with EMV/bar code reader, or install adjacent to existing fareboxes • Include CAD / AVL / internet systems for instant validation of open payment sources, and vehicle tracking for operational benefits and customer benefits (offer real-time information)
Fare Media	<ul style="list-style-type: none"> • RTA-issued, regionally branded contactless fare card accepted at all agencies • Mobile app and online portal for personal account management and fare payment • Customer portal for reloading, tracking trips, and managing account • Accept credit/debit cards, employee/student IDs, mobile ticketing and contactless media
Public Acceptance	<ul style="list-style-type: none"> • Third-party retail distribution network for purchase (and re-loading) of fare media at convenient locations (grocery, drugstore, etc.) • Regionally administered pass program for reduced-fare customers (disabled, senior, veteran, etc.) • Partnerships with social service agencies to distribute fare cards or consideration of reduced fares for low-income customers (may be coordinated with State’s Bridge Card program) • Customer-registered accounts offering loss-protection
Governance	<ul style="list-style-type: none"> • RTA to oversee system operations • Option for regional fare payment options to encourage regional tripmaking • Open payment technology determined or initiated on agency-by-agency basis
Procurement	<ul style="list-style-type: none"> • RTA contracts with system integrator to develop and operate back-end system • Open source system allows future non-proprietary components to be added without major system replacement (e.g., handheld inspection readers, iris scanners)
Capital & Operating Costs / Revenues	<ul style="list-style-type: none"> • Development of remotely-hosted, shared back-end system for regional electronic fare payment • Data tracking used to determine revenue flow to individual agencies • Agencies able to access system for financial and utilization data (agency firewalls)
Management & Operations	<ul style="list-style-type: none"> • New regional, web-based portals for customer management of fare media and accounts • Institutional portal for employers to manage own accounts and pass programs, including employer-sponsored commuter benefits
Fare Policy	<ul style="list-style-type: none"> • Pricing and policy alterations enacted to incentivize regional fare product and other non-cash payment options • Option for stored value, defined period pass or bonus • Phasing out of other agency-specific / value / period pass products (optional)

Implementation Plan

Based on the experience of other regions, full implementation of a regionally integrated fare payment system would require a significant amount of coordinated agency effort and funding, and could take up to five years. This section provides an overview of the likely funding and implementation plan for this long-term effort.

The project also identifies some near-term fare coordination efforts that could help advance regional fare integration goals as well as better prepare the region for capturing the benefits of a regionally integrated fare payment system.

As described in a proposed memorandum of understanding to be signed by each of the agencies (see Appendix A) it is recommended that a fare coordination working group be set up to meet on a regular basis to advance these near-term action items as well as continue progress toward the longer-term vision.

Near-Term Goals and Action Items

In the near term, the following actions could be taken to advance regional fare collection efforts. As there are more items than can reasonably be achieved in the next three years, the agencies must collaborate on determining the highest priorities from this list.

Near-Term Fare Coordination Action Items	
Goal	Potential Action Items
Offer a Platform for Regional Trip-Making	<ul style="list-style-type: none"> • <i>Resolve DDOT-SMART differential in base fare and pass pricing:</i> Given that most transfers currently occur between SMART and DDOT, creating a more consistent set of fares and period pass products for customers between these agencies would have the greatest near-term benefit for existing customers. • <i>Establish transfer policies and procedures between all regional providers:</i> While transfer policies have been established between DDOT and SMART, there are none in place for cross-system tripmaking on other systems. This includes the under-construction M-1 Rail system, which will conceivably have significant transfer opportunities for DDOT, SMART and the People Mover. • <i>Expand upon existing DDOT-SMART regional pass:</i> One potential mechanism for simplifying trips across all systems would be an expanded version of the current monthly regional pass offered by DDOT and SMART. By taking over administration of this pass and expanding its use to all systems in the region, RTA could offer an initial option for travelers needing to use multiple regional systems.
Reduce Reliance on Cash Fare Payment	<ul style="list-style-type: none"> • <i>Expand fare pass distribution network to potentially include third-party retail partners:</i> One barrier to expanded pass usage is the relative lack of places where customers can purchase passes. Other regions have had success in distributing passes via third-party retailers. • <i>Simplify and further incentivize period pass usage:</i> While fare passes for regional agencies currently offer value compared to paying cash, agencies could consider greater value incentives for use of passes, or possibly greater disincentives for use of cash.
Work with Employers and Institutions on Transit Access	<ul style="list-style-type: none"> • <i>Establish regional institutional/employer partnership program:</i> Agencies in the region could work to establish policies for how to work with major employers and institutions (e.g., universities, hospitals) to tailor services and provide system access for large concentrations of commuters. • <i>Establish transit commuter benefits information and outreach program:</i> Usage of the “tax-free transit” provision of the federal tax code is relatively low in the region. Experience from other regions indicates that a significant proportion of regular transit commuters purchasing passes are doing so via employer-sponsored programs that automatically deduct the funds from employee paychecks.
Capture Benefits of Emerging Fare Payment Options	<ul style="list-style-type: none"> • <i>Develop a “concept of operations” for the regionally integrated fare payment system:</i> Although this study has developed a high-level vision for the system, additional work is required in order to determine the technology and procedures for the system. This work would be a necessary precursor to putting a document out for vendor bids. • <i>Secure funding for a regional integrated fare system:</i> Funding for the regional fare system could be obtained via federal and state grant programs. The RTA and regional agencies could collaborate on a funding application.

Seamless Fare Integration Study for the Detroit Region

Implementation of Regional Integrated Fare System

As shown in the schedule on the following page, implementation of the regional integrated fare system could take four or more years. The schedule is divided into four main phases: Funding strategy and concept of operations; Develop system specifications and select integration partner; Design and pilot system; Activate system.

Overall, the preferred option – including various contingencies, agency labor contributions, procurement and development support – is estimated to cost the region between \$16.8 and \$22.7 million (see table below). The costliest item is the installation of new equipment onto AAATA, DDOT and SMART buses, at a maximum price of \$4.5 million. This price includes refurbishing existing *GFI Odyssey* fareboxes and adding on-board processors.

Total Cost of Implementation for Preferred Option

Item Description	Total Cost	
	Min	Max
Bus Equipment, with Installation	\$3,225,250	\$4,583,250
Rail Equipment, with Installation	\$1,013,600	\$1,646,400
Administration Equipment	\$120,000	\$180,000
Test Lab System	\$57,800	\$80,800
Spare Parts and Tools	\$460,900	\$676,000
Field Equipment Software	\$96,000	\$114,000
Central Software	\$635,000	\$877,500
Fare Media	\$119,250	\$155,500
Fixed Costs	\$800,700	\$1,024,552
Warranties	\$299,619	\$420,180
<i>Total Capital Costs</i>	<i>\$6,828,119</i>	<i>\$9,758,182</i>
Central Computer System Hosting (months)	\$1,260,000	\$1,500,000
Mobile Ticket Software Hosting	\$540,000	\$720,000
3rd Party Retailer (months)	\$900,000	\$1,200,000
<i>Total Software Service Costs</i>	<i>\$2,700,000</i>	<i>\$3,420,000</i>
Total Capital + Software Service Costs	\$9,528,119	\$13,178,182
15% Contingency	\$1,429,218	\$1,976,727
Development Support, Procurement & Implementation Elements	\$1,309,000	\$1,661,000
Agency labor and direct costs to project	\$2,400,000	\$3,000,000
Additional contingency for 2017/2018 installation, undefined legacy systems and customer service functions	\$2,199,950	\$2,972,387
Grand Total	\$16,866,287	\$22,788,296

Potential Implementation Schedule - Fare System Integration

Phase	Action	Year 1				Year 2				Year 3				Year 4+			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Fare Integration Step One: Funding & Concept of Operations	Review detailed existing conditions at each agency			■	■												
	Determine funding mechanism(s)		■	■	■	■											
	Develop detailed future Concept of Operations				■												
Fare Integration Step Two: Develop System Specifications & Select Integration Partner	Develop technical specifications				■	■											
	Develop bid package for System Integrator					■											
	Solicit Request for Proposals (may be multi-step process)					■	■										
	Select System Integrator (includes hardware, other system elements)						■										
Fare Integration Step Three: System Design & Piloting	SI develops detailed technical system design						■	■									
	Software development, limited hardware installation, integration tests								■	■	■						
	Installation of system - pilot application(s)										■	■	■				
	Testing of system - full pilot (friendly users)													■	■		
Fare Integration Step Four: System Activation	Full-scale operations of system elements															■	■
	Full system acceptance																■
	System activated region-wide																■

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Appendix A

Draft Memorandum of Understanding

November 2015

Memorandum of Understanding Concerning Integrated Regional Fare System for the Detroit Region

This Memorandum of Understanding (“MOU”) establishes guidelines and sets the foundation for an agreement regarding the development of an **Integrated Regional Fare System** among the transit operators in the Detroit region:

- Detroit Department of Transportation (DDOT),
- Suburban Mobility Authority for Regional Transportation (SMART),
- Ann Arbor Area Transportation Authority (AAATA),
- Detroit Transportation Corporation (DTC),
- M-1 Rail, and
- Regional Transit Authority (RTA).

Whereas, the Parties wish to cooperatively achieve an Integrated Regional Fare System for the benefit of:

- Improving the convenience of regional trip-making by customers using multiple transit providers;
- Reducing the over-reliance on in-vehicle cash payment for transit fares;
- Providing a platform for working with employers and institutions on transit access needs; and
- Expanding the options for customer fare payment to include not only a single, uniform fare medium that functions across the region but also emerging “open payment” systems relying on mobile devices and other methods for payment.

Whereas, the Parties understand that there are both near-term fare coordination actions and long-term shared technology investments needed to achieve these benefits.

Now, therefore, in mutual consideration of the benefits and obligations contained herein, the Parties agree as follows:

1. Regional Fare Collection Working Group Composition

The RTA shall establish a Regional Fare Collection Working Group comprised of the Parties named in this MOU. Until this group is formally established, the RTA Provider’s Advisory Council will initially serve as the interim Working Group.

2. Purpose and Scope

The Regional Fare Collection Working Group shall be established to:

- Provide a forum for joint collaboration regarding the development of regional fare policies and a shared Integrated Regional Fare System
- Consider and collaborate to implement a number of near-term action items, including (but not limited to):
 - Establishment of customer-oriented transfer policies and procedures between all regional transit providers, including M-1 Rail

Memorandum of Understanding (MOU) Concerning Integrated Regional Fare System for the Detroit Region

- A “demonstration project” relying on the existing pass technology used at DDOT, SMART, DTC and AAATA to create a monthly (or other period) pass that allows customers to utilize any of the four transit agencies fixed route systems to complete a trip with a single fare medium.
- Expanded regional distribution network for transit passes, potentially including partnerships with third-party retail providers
- Development of a regional program aimed at partnerships with employers and institutions and leveraging the use of transit commuter benefits
- Work collaboratively toward implementation of an Integrated Regional Fare System, which would likely involve contracting with a system integrator that can develop a comprehensive system based on the desire to incorporate a regional account-based smart card as well as acceptance of open payments. Contingent upon regional funding, the Working Group would work toward this shared goal according to the following schedule:
 - Year 1 - Development of a “concept of operations” for the system and determination of funding
 - Year 2 - Create a phased plan and specifications for universal transit fare media usage and invite proposals from Fare System Integrators to design, build and operate a single, shared back-end processing system for support of each Parties fare payment requirements, individual pricing and policy fulfillment.
 - Years 3 and 4 – Acquisition of the appropriate equipment to support each Parties fare payment requirements, followed by piloting and activation of Integrated Regional Fare System for the Detroit Region

3. Criteria

The Parties agree to the following criteria in developing an implementation program for an Integrated Regional Fare Payment System:

- Each agency will determine an initial pilot phase and additional phases appropriate for their own system.
- Each agency will agree to each phase or sub/partial phase of implementation as funds are available.
- Each agency will meet with the Working Group regularly to revise the Regional Fare Payment Requirements and Cost Table to reflect changes in funding availability, phase advancement or delay, unit cost adjustments and agency needs.
- Each agency will include this project and description of regional collaboration in their adopted financial and service planning documents.
- The Parties will identify and share certain information about on-going system operating costs of the Regional Fare Payment System, according to jointly-developed and agreed-upon processes (e.g., centralized clearing house vs. direct payment) and disbursement formula(s).

4. Rules of Order and Term

- The activities of the Regional Fare Payment Working Group shall be conducted with the involvement of, and in cooperation with, each Party at each stage.
- The Parties will work cooperatively to determine, pursue and accept grant opportunities appropriate for this regional project.
- This MOU shall take effect when approved by all Parties on the last date shown below and remain in effect until the all phases of the project are complete or June 30, 2020, whichever is first.

5. Signatures

By the signatures below, representatives of each of the Parties agree to assign staff support and cooperatively work toward development of an Integrated Regional Fare System for the Detroit Region.

Regional Transit Authority

Name: _____

Signature: _____

Date: _____

Detroit Transportation Corporation

Name: _____

Signature: _____

Date: _____

Detroit Department of Transportation

Name: _____

Signature: _____

Date: _____

Suburban Mobility Authority for Regional Transportation

Name: _____

Signature: _____

Date: _____

Ann Arbor Area Transportation Authority

Name: _____

Signature: _____

Date: _____

M-1 Rail

Name: _____

Signature: _____

Date: _____

Appendix B

Existing Conditions of Current Transit Providers

November 2014

Existing Conditions of Current Transit Providers

The purpose of this memorandum is to document current conditions and identify issues and opportunities for fare integration between the four existing transit operators in the Detroit region: the Detroit Department of Transportation (DDOT), Suburban Mobility Authority for Regional Transportation (SMART), Ann Arbor Area Transportation Authority (AAATA), and Detroit Transportation Corporation (DTC). The memorandum includes discussion of likely technological or customer base considerations as well as potential size of the “regional fares” market.

In addition to these existing service providers, another key future service that is considered in the discussion is M-1 Streetcar, which will be operated by a separate private entity and is scheduled to begin operations in 2016.

This report is supplemented by a series of Fare Profile Sheets (see Appendix B.1), one for each of the four current agencies, which outlines current fare equipment; fare structure and policies; fare utilization; pass sales; and fare revenue data.

Fare Equipment

The three bus system operators all utilize the *GFI Odyssey* fareboxes on their fleets of fixed-route buses, with all having installed them in the past eight years (DDOT in 2007, SMART and AAATA in 2009). These fareboxes can accept and process coins, bills, tokens, magnetic fare cards and smart cards (none of the agencies offer smart-card passes for general use).

Agency Fare Comparison				
	DDOT	SMART	AAATA	DTC
Base Fare	\$1.50	\$2.00	\$1.50	\$0.75
Monthly Pass	\$47.00	\$66.00	\$58.00	\$10.00
Annual Revenue	\$21.9M	\$13.4M	\$5.9M	\$1.3M
Recovery Ratio	15%	13%	19%	11%

Sources: Agency fare information, 2013 National Transit Database

DTC operates *GFI Transentry* turnstile equipment, installed during the system’s inaugural years between 1986 and 1988. The equipment is notably more limited in features than the equipment utilized by the other three agencies. For example, DTC cannot accept transfers from other agencies without initiating equipment upgrades, and DTC’s fare gate system cannot be networked, which requires personnel to travel to individual fare gates to gather data.

The M-1 Streetcar has not yet selected or purchased fare equipment, but plans to have ticket vending machines at each station to allow for purchase and validation of tickets for a “proof-of-payment” system. M-1 also plans to have on-board fareboxes for collecting fares from cash-paying customers.

Seamless Fare Integration Study for the Detroit Region

Base Fares & Policies

The base fare among the providers ranges from \$0.75 to \$2.00; M-1 has also set its base fare at \$1.50. Three of the agencies have revised their fare pricing structure in the past five years:

- SMART initiated a fare increase in 2009, raising its base fare from \$1.50 to \$2.00.
- AAATA completed a two-step increase of its base fare in 2009 and 2010, increasing from a \$1.00 fare to \$1.25 and then the current \$1.50.
- DTC raised the base fare for the People Mover from \$0.50 to the current price of \$0.75 in 2011, the first fare increase since opening in 1987.

DDOT has not revised its fare pricing in more than a decade, although the agency did consider increasing fares in 2009 to match SMART. As part of the post-bankruptcy financial plan for the City of Detroit, an increase in DDOT fares is under consideration for 2015. This increase would potentially resolve the current mismatch in fare pricing between DDOT and SMART, which are the only two agencies in the region that coordinate on fare products and currently have agreements in place allowing for customers to pay for transfers between their services.

Fare Revenues & Recovery Ratio

Although it has fallen in recent years (concurrent with ridership), DDOT collects the most fare revenue of any agency in the region. In fact, with an average annual amount of more than \$20 million, DDOT collects approximately as much as all three of the other agencies combined.

None of the Detroit area agencies have set official goals or policies in terms of a farebox recovery ratio. Farebox recovery varies among providers and from year to year, but while the bus agencies have typically recovered between 15% - 20% via the farebox, the People Mover has typically been nearer to 10%. Each of the agencies that increased fares in recent years have seen a resulting increase in revenues and recovery ratio, and AAATA in particular has seen a significant increase in both. At the same time, each of the agencies in the Detroit region is generally below the national average (the average recovery ratio for all U.S. transit agencies in 2013 was 33%).



DDOT-SMART Regional Pass

The only integrated fare product currently available for the Detroit region is the Regional Pass offered jointly by DDOT and SMART. Each pass is offered on a monthly basis, and is valid for that calendar month. Due to the mismatched fare pricing structure (since 2009) between DDOT and SMART, there are two pricing options for Regional Pass holders:

- **Regional Pass (\$49.50)** allows unlimited rides on all DDOT bus services, but requires customers to pay an additional \$0.50 for SMART transfers or trips.
- **Regional Plus Pass (\$69.50)** allows unlimited rides on all DDOT and SMART bus services for the month.

The Regional Pass is the most frequently used pass on both DDOT and SMART, and the agencies sold approximately 4,000 per month during 2013-2014. The agencies share revenues from the pass sales equally, regardless of the usage of the passes on the two systems.

Seamless Fare Integration Study for the Detroit Region

AAATA also differentiates itself in terms of the source of its revenues (see chart at right). While each of the other agencies rely primarily on cash farebox receipts and pass sales for fare revenue, AAATA primarily obtains fare revenue via “other” means including service and ridership agreements with local institutions such as the University of Michigan, Eastern Michigan University and the Ann Arbor Downtown Development Authority. DDOT also obtains a significant proportion of its revenue through other sources such as tickets purchased by government and not-for-profit agencies to distribute to their patrons. Overall, each of the agencies currently gets a minority of its fare revenue via sales of pass products.

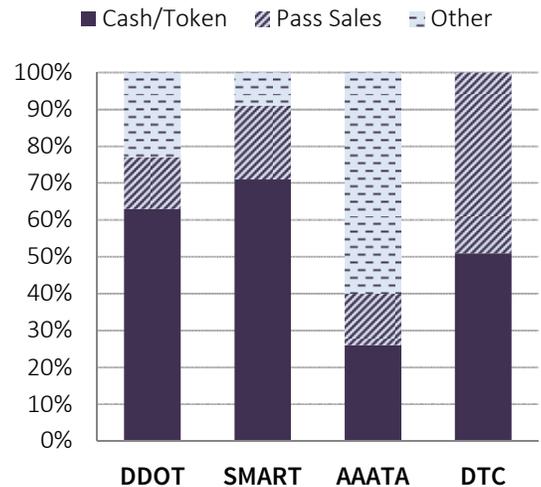
Fare Utilization

The customers of the agencies have different utilization patterns of the fare types offered them:

- DDOT and SMART are very similar, with the large majority (60% - 70%) of their trips paid for via cash fare or transfer (nearly all transfers on these systems are purchased on the bus using cash). DDOT has a somewhat higher proportion of pass usage, but this represents less than 30% of the rides on each system.
- Customers on the People Mover utilize a relatively even mix of cash and passes (because each station has both change and token machines as well as fareboxes that accept coins, tokens are categorized with cash in the chart at right). Customer dynamics on the People Mover can vary widely from week-to-week depending on sporting events and conventions.
- AAATA has the largest majority of pass users, which can be linked to the fact that nearly half (44%) of their ridership activity is accounted for by University of Michigan MCard holders.

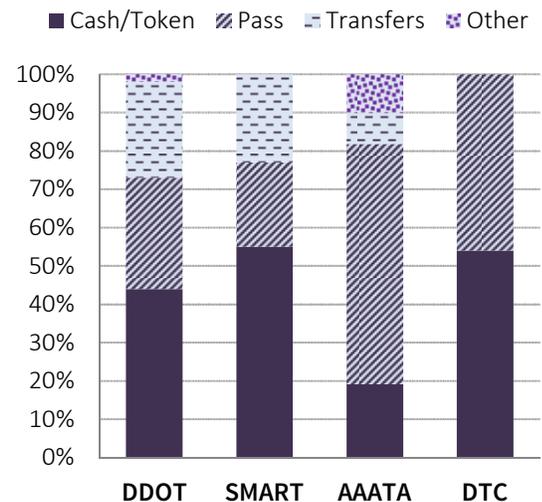
Only DDOT and SMART currently have significant levels of transfer activity between services, and the amount of this activity can be estimated based on fare usage reports from each agency. Fare utilization statistics indicate that approximately 10% - 12% of SMART customers transfer from a DDOT bus, while 5%-7% of DDOT customers are transferring from SMART. This means that, during the most recent fiscal year for both agencies, there were an estimated 2 to 3 million such transfers between the systems.

Fare Revenue by Type



Sources: Agency information, 2013-2014

Fare Utilization by Type



Sources: Agency information, 2013-2014

Issues & Opportunities for Fare Integration

Based on interviews with agency staff, a review of data and understanding of regional fare issues, the following issues and opportunities have been identified as factors to consider during follow-on phases of the study.

1) Fare System Inter-operability

Current farebox technology in the Detroit region should not be a barrier to fare integration and in fact may make implementation of a regional fare product more achievable in the near-term. SMART, DDOT and AAATA already have the same fare payment technology, and both DDOT and SMART coordinate on a fare pass product utilized on both systems. DTC also utilizes the same vendor, although their equipment is now dated and not currently interoperable with other providers. Conceivable near-term fixes involve producing transfers, regional passes and other fare media readable by the three bus agencies, with opportunity to determine options for interoperability for the People Mover and M-1 Streetcar.

2) Current Inter-agency Transfers

The only significant inter-agency transfer activity in the region is between DDOT and SMART. Yet despite the significant numbers of current transfers, cooperation on fares, and an overriding transportation need to connect the City of Detroit to its suburbs (and vice versa), there are many indications that there are opportunities to improve the convenience of transferring between services from each agency. One fare-related issue is that the difference in base fares and pass types between the agencies complicates transferring for non-veteran riders. Although a regional fare card exists, riders must purchase a separate "Regional Plus Pass" to avoid paying an additional \$0.50 when boarding SMART vehicles. Customers utilizing bus-issued transfers from DDOT to board SMART must also pay an extra \$0.50 to ride. Another issue is that substantial service reductions by both agencies in recent years have likely reduced the amount of transfer opportunities compared to what previously existed. Fortunately DDOT and SMART have an existing transfer and revenue sharing agreement, and the agencies could work together on near-term fixes such as enhanced marketing of the regional pass, or timed transfers.

The current lack of transfers between the other agencies in the region is likely more a function of geography and convenience than fare policy. This is particularly true for AAATA, which does not have services that connect to any of the other three operators. But even for the People Mover, which physically overlaps with DDOT and SMART in downtown Detroit, there are not convenient facilities for accommodating transfers from DDOT or SMART bus stop locations. But although nearly all initial activity associated with any type of regional fare product would certainly be for DDOT and SMART, the Regional Transit Authority will be working to develop service

Seamless Fare Integration Study for the Detroit Region

plans that “bridge the gap” between agencies, including service connecting Detroit and Ann Arbor. Fare integration options considered for this study should recognize the likely current user base, but also provide a platform for this improved regional transit tripmaking.

3) *Cash vs. Pass Usage*

The two largest transit agencies in the region, and the only two with measurable levels of transfer activity between them, currently rely primarily on fares paid on-board with cash. This may have implications for the potential success of an integrated fare product. Both DDOT and SMART have expressed an interest in lowering the proportion of cash fares, which tend to decrease the quality of service (by increasing dwell time at bus stops) and increase costs and administrative duties compared to pre-paid fare mechanisms. Although for many patrons passes will always introduce an economic barrier, there are methods DDOT and SMART could employ to encourage greater pass usage among both current and prospective new customers. One method used by many agencies, sometimes in concert with new fare technologies or programs, is to offer customers more of an economic incentive to pre-pay for fares. Other strategies could include greater pass distribution/availability, marketing, movement from period passes to rolling passes and modification of current pass structure.

4) *External Partnerships*

External partnerships with employers, institutions and other agencies are an important way that transit agencies can diversify and build on their market base. One agency in the region (AAATA) has taken advantage of this, and now obtains a majority of its fare revenue and ridership via passes purchased or distributed through such programs. There are numerous anchor institutions within the Detroit metropolitan area that might consider similar pass agreements, and an advanced, integrated fare product could serve as a key element of those agreements. Experiences from other regions suggests that linking fare passes to individual institutional user groups also allow for improved data analysis and service planning that can respond to the needs of those groups.

5) *New Fare Technologies*

Examples of emerging fare technologies (smart cards, open source payments, mobile payments) from other regions are of interest here in the Detroit region. Two agencies (AAATA and SMART) have already begun piloting smart card technology, while M-1 has expressed interest in mobile payment options. Through interviews with each agency it became apparent that they want to provide more diverse customer payment options to bring their practices in line with modern regional transit systems.

Appendix B.1

Fare Profile Sheets

Ann Arbor Area Transportation Authority (AAATA) Fare Profile Sheet

System Overview

The AAATA/TheRide is a not-for-profit unit of government that operates the local transit system for the greater Ann Arbor-Ypsilanti area. In addition to fixed route buses, AAATA offers many other services such as door-to-door accessible service, vanpools, express buses, and more. The table below provides a basic overview of the system as of 2012 (note: the agency has expanded overall bus service in fall of 2014 following a successful millage expanding local funding for transit).

	Bus / Commuter Bus	Demand Response
Annual Ridership	6,524,815	236,066
Annual Vehicle Revenue Miles	2,857,564	1,591,213
Annual Vehicle Revenue Hours	208,069	101,304
Operating Expenses	\$25,107,894	\$5,033,511

Source: National Transit Database, 2013 data

Current Fare Equipment

AAATA uses GFI Odyssey Fareboxes which were installed in February 2009.

The AAATA has implemented Smart Cards as a pilot project. It is utilizing first generation Smart Cards that are time limited. Fareboxes have been programmed to accept the cards.

The AAATA reports no problems with the current fareboxes or media, except that it would like to develop an economical solution to phasing out the two different tokens that it accepts, or at least reduce the use of tokens.

The AAATA plans to move toward smart cards and the next phases of technology. It hopes to reduce the driver/fare interaction and make the boarding process easier.

Fare Structure & Policies

The agency last changed its fare structure and policies in 2009 and 2010, increasing the base fare that was previously \$1.00 to the current base fare of \$1.50.

Cash Fares	Price
Base Fare	\$1.50
Youth Fare (Student ID)	\$0.75
Senior (60-64), Income Eligible, Disabled, Medicare/Medicaid	\$0.75
Children (5 & Younger) and Senior (65+)	Free
Transfers (within 90 minutes)	Free
Pass Types	Price
30-Day Flex Pass	\$58.00
30-Day Value Pass (Senior/Income/Disability)	\$29.00
30-Day Value Pass (Youth)	\$29.00
1-Day Pass	\$4.50
Subsidized & Specialized Passes	Price
getDowntown/go!pass*	Free
EMU 30-Day Bus Pass	\$40.00
MRide (Yellow M-Card)*	Free
Holiday and Late Night Fares	Price
Cash Fare	\$5.00
Seniors	\$2.50
ADA	\$2.50
Go!pass	\$3.00

Source: AAATA Website, August 2014

*Passes can be used for unlimited rides on system, but are paid for via University of Michigan and Downtown Development Authority.

Fare Utilization

Fare usage on TheRide’s system is heavily weighted toward passes, in large part due to use of the passes from the University of Michigan, Eastern Michigan University, and Washtenaw Community College. Use of these passes made up approximately 44% of the system ridership as of 2013.

Fare Type	Proportional Use
Cash Fares	18%
Transfers	8%
Tokens	1%
Passes	62%
30-Day (Flex/Value) Pass	8%
University Pass	44%
Go!Pass	10%
Other (Senior/ADA/Free)	10%

Source: AAATA FY 2013 Data

Pass Sales by Type

Data from AAATA indicates that they sold or distributed the following number of passes on an average monthly basis.

Pass Type	Average Monthly Sales
30-Day Flex Pass	267
30-Day Value Pass	576
Day Pass	142

Source: AAATA FY 2013 Data

Fare Revenues

The table below illustrates a five-year trend for fare revenues and farebox recovery ratio as reported in the National Transit Database. AAATA does not have an established fare recovery ratio goal, but has seen a significant increase in fare revenue and recovery ratio since 2008.

	2008	2009	2010	2011	2012	2013
Fare Revenue	\$3.3M	\$3.7M	\$4.3M	\$5.0M	\$5.7M	\$5.9M
Recovery Ratio	14%	15%	17%	19%	20%	19%

Source: National Transit Database, 2008-2013 data

Due in large part to its agreements with institutional partners such as the University of Michigan, the primary source of revenues for the agency are not cash or pass sales, a significant difference from the other agencies in the region.

Source	Proportional Revenue
Cash Fares	26%
Pass Sales	14%
Other*	60%

*includes subcontracted services, special fare sales

Source: AAATA FY 2013 Data

Detroit Department of Transportation Fare Profile Sheet

System Overview

The Detroit Department of Transportation (DDOT) is the major bus transit carrier in Southeastern Michigan as well as the largest transit carrier in the State of Michigan. DDOT operates 36 fixed routes and ADA paratransit service.

	Bus	Demand Response
Annual Ridership	30,898,942	282,343
Annual Vehicle Revenue Miles	9,660,800	1,862,764
Annual Vehicle Revenue Hours	744,817	705,109
Operating Expenses	\$113,804,117	\$5,243,309

Source: National Transit Database, 2013 data

Current Fare Equipment

DDOT uses GFI Odyssey fareboxes, which were installed in 2007.

Fareboxes are equipped with Smart Card readers but the readers are not enabled. DDOT fareboxes breakdown often and are constantly in stages of repair. DDOT staff reported that there are failures with the tickets jamming in the fareboxes.

Fare Structure & Policies

The current fare structure has been in place with no price increase in the base fare for at least 10 years. In 2008, DDOT added the Value Cards to its structure.

General / Cash Fares	Price
Base Fare	\$1.50
Student (with DDOT student ID)	\$0.75
Senior & Disabled (with ID Card)	\$0.50
Medicare Cardholder	\$0.75
Children (Under 44" with adult)	Free
General Transfers (within four hours)	\$0.25
Senior/Disabled Transfers	\$0.10
Pass Types	Price
Monthly GoPass	\$47.00
Biweekly GoPass	\$27.50
Weekly GoPass	\$14.40
Value Card	\$10.00
5-Day Pass	\$15.00
DDOT/SMART Regional Monthly Pass	\$49.50
DDOT Senior & Disabled Monthly GoPass	\$17.00
Go!pass	\$3.00

Source: DDOT Website, August 2014

Fare Utilization

Cash fares and transfers comprise the majority of rides on the DDOT system.

Fare Type	Proportional Use
Cash Fares	44%
Transfers	25%
DDOT	22%
SMART	3%
Passes/Tickets	29%
Regional Passes	10%
Monthly	5%
Weekly/Bi-Weekly	3%
Other / Free	2%

Source: DDOT FY 2014

Based on utilization by fare type, it is estimated that approximately 7% of DDOT's fixed route customers are transferring from a SMART route (all SMART transfers plus half of Regional Pass trips).

Pass Sales by Type

Data from DDOT indicates that the regional pass is the most popular sold by DDOT on a month-to-month basis.

Pass Type	Average Monthly Sales
Regional	2,346
Monthly	1,443
Bi-Weekly	1,100
Weekly	1,533
Disabled	184
Senior	143

Source: DDOT FY 2014

Fare Revenues

The table below illustrates a five-year trend for fare revenues and farebox recovery ratio as reported in the National Transit Database. DDOT does not have an established fare recovery ratio goal, and has seen overall fare revenues decrease (along with ridership) in recent years.

	2008	2009	2010	2011	2012	2013
Fare Revenue	\$28.0M	\$27.9M	\$25.2	\$26.8M	\$23.9M	\$21.9M
Recovery Ratio	16%	16%	15%	17%	14%	15%

Source: National Transit Database, 2008-2013 data

The primary source of revenues for the agency is cash fares taken in via the farebox.

Source	Proportional Revenue
Cash Fares	63%
Pass Sales	14%
Other*	23%

*includes social agency tickets, advertising, etc.

Source: DDOT FY 2014 estimate

Detroit Transportation Corporation Fare Profile Sheet

System Overview

The Detroit Transportation Corporation (DTC) operates the Detroit People Mover, a fully automated monorail system that operates on an elevated single track loop in Detroit's central business district.

	Rail
Annual Ridership	2,331,655
Annual Vehicle Revenue Miles	586,382
Annual Vehicle Revenue Hours	50,373
Operating Expenses	\$11,729,550

Source: National Transit Database, 2013 data

Current Fare Equipment

DTC uses its original GFI fare technology, implemented 1986-88.

DPM collects coins, tokens, and magnetic stripe cards. Fareboxes are located at each station. Each station has three gates plus an elderly and handicap entrance.

The fare gate system is localized, not networked, meaning that the agency needs to probe each individual fare gate to gather data on ridership and usage.

Fare Structure & Policies

The base fare for the People Mover was increased in 2011, raising it from the \$0.50 fare the system had in place since its inception. Tokens and passes are available at a 50% discount for seniors and people with disabilities. There is no transfer pass or agreements in place with other transit providers.

General / Cash Fares	Price
Base Fare	\$0.75
Senior/Disabled/Medicare Fare	\$0.35
Children (5 or under)	Free
Pass Types	Price
5-Day Fast Pass	\$6.00
Monthly Pass	\$10.00
Annual Pass	\$100.00

Source: DTC Website, August 2014

Fare Utilization

Cash fares and tokens comprise the majority of rides on the People Mover, although a significant portion of the usage is from pass holders.

Fare Type	Proportional Use
Cash	24%
Tokens	30%
Passes	46%
<i>Annual</i>	27%
<i>Monthly</i>	16%
<i>Convention</i>	3%

Source: DTC FY 2013

Pass Sales by Type

During 2013-2014, DTC sold nearly 5,000 annual passes and had another 300 or so monthly passes in use in an average month.

Pass Type	Total Annual Sales	Average Monthly
Monthly Pass	3,609	300
Annual Pass	4,718	393
Convention Passes	17,359	1,447

Source: DTC FY 2013

Fare Revenues

The table below illustrates a five-year trend for fare revenues and farebox recovery ratio as reported in the National Transit Database. DTC does not have an established fare recovery ratio goal, but saw a significant increase in fare revenues following its fare increase near the end of 2011.

	2008	2009	2010	2011	2012	2013
Fare Revenue	\$1.1M	\$0.8M	\$0.9M	\$0.9M	\$1.2M	\$1.3M
Recovery Ratio	8%	7%	7%	9%	11%	11%

Source: National Transit Database, 2008-2013 data

DTC obtains a relatively even mixture of cash fares and pass sales. Many passes are sold and distributed on behalf of convention goers.

Source	Proportional Revenue
Cash Fares / Tokens	51%
Pass Sales	49%
Other	n/a

Source: DTC FY 2013

Suburban Mobility Authority for Regional Transportation (SMART) Fare Profile Sheet

System Overview

SMART offers bus and paratransit service in areas of suburban Wayne, Oakland and Macomb Counties, including 37 different fixed routes.

	Bus	Demand Response
Annual Ridership	9,464,558	650,236
Annual Vehicle Revenue Miles	8,624,774	3,748,475
Annual Vehicle Revenue Hours	519,534	220,579
Operating Expenses	\$74,605,079	\$20,261,731

Source: National Transit Database, 2013 data

Current Fare Equipment

SMART has GFI Odyssey fare boxes, which were installed in early 2010 (replacing the GFI Cents-a-Bill).

Fareboxes are equipped to read magnetic cards and also accept transfers and passes.

SMART integrated AVL, farebox, and illuminator signs on all large buses.

No other considerations of farebox upgrades are currently underway.

Fare Structure & Policies

SMART raised their base fares in 2009 from \$1.50 to the current \$2.00. The cost of passes was also adjusted, although there was no change in fares for older adults and people with disabilities. There is a premium for SMART's "park and ride" routes, which are typically express-bus services into Detroit.

General / Cash Fares	Price
Base Fare (regular service)	\$2.00
Youth (6-18)	\$1.00
Senior & Disabled	\$0.50
Children (5 and under)	Free
General Transfers (within four hours)	\$0.25
Senior/Disabled Transfers	Free
Park & Ride Service	Price
Base Fare	\$2.50
Youth (6-18 Years)	\$1.50
Senior & Disabled (with ID Card)	\$1.00
Pass Types	Price
31-Day Pass (Regular)	\$66.00
31-Day Pass (Park and Ride)	\$82.00
31-Day Pass (Student/Youth)	\$33.00
31-Day Pass (Senior/Disabled)	\$17.00
Regional Pass (DDOT)	\$49.50
Regional / Regional Plus Pass	\$69.50
\$11 / \$22 Value Pass	\$10 / \$20

Source: SMART Website, August 2014

Passengers may use both SMART and DDOT using the monthly Regional Plus Pass (\$69.50). A \$49.50 Regional Pass is also available for purchase from DDOT, but requires the customer pay additional fares for transfers to SMART.

Fare Utilization

Cash fares and transfers comprise the majority of rides on the SMART fixed-route system, while 24% of the customers utilize some type of pre-paid fare media.

Fare Type	Proportional Use
Cash Fares	51%
Transfers	25%
<i>SMART</i>	16%
<i>DDOT</i>	8%
Passes/Tickets	24%
<i>31-Day Passes</i>	7%
<i>Value Passes</i>	4%
<i>Regional Passes</i>	5%
<i>Regional Plus Passes</i>	3%
<i>Other (Tickets, etc.)</i>	6%

Source: SMART, August 2013 – July 2014 data

Based on utilization by fare type, it can be estimated that approximately 10% - 12% of SMART’s fixed route customers are likely to be transferring from a DDOT route (estimated based on the proportion of DDOT transfers in addition to use of the Regional and Regional Plus passes).

Pass Sales by Type

SMART does not aggregate and track overall sales of its various pass types, as they are sold at a number of different locations including online.

Fare Revenues

The table below illustrates a five-year trend for fare revenues and farebox recovery ratio as reported in the National Transit Database. SMART does not have an established fare recovery ratio goal, but has seen a significant increase in fare revenue and recovery ratio since raising fares in 2009.

	2008	2009	2010	2011	2012	2013
Fare Revenue	\$12.3M	\$12.9M	\$13.8M	\$15.3M	\$15.2M	\$13.4M
Recovery Ratio	10%	12%	13%	14%	15%	13%

Source: National Transit Database, 2008-2013 data

Similar to fare usage levels, the bulk of fare revenues at SMART are obtained via on-vehicle cash fares.

Source	Proportional Revenue
Cash Fares	71%
Pass Sales	20%
Other*	9%

*includes contract fares, advertising

Source: SMART 2013 budget, estimate

Appendix C

Comparable Transit System Survey

January 2015

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Introduction

This memorandum reports on the decisions and experiences of six peer regions that have implemented, or that are in the final stages of implementing, automated fare collection (AFC) systems involving multiple transit agencies. The purpose is to inform Detroit’s regional agencies on best practices, strategies available and lessons learned as they consider creation of their own regional AFC system. The report is aimed at providing the Detroit area transit providers with a clear and comprehensive view of peer regions’ experience concerning planning, implementation and governance of multi-agency regional fare collection systems.

This report addresses issues of governance and coordination during the phases of system development, procurement, implementation and operation, including:

- Demographics
- Public Acceptance
- Governance
- Procurement
- Capital and Operating Costs
- Farebox Recovery
- Management and Operations
- Fare Policy Coordination
- Fare Media and Equipment
- Lessons Learned

Peer Regions and Regional AFC Systems

The population, demographics and transit utilization measures of the chosen six peer agencies were compared with the Detroit region. When comparing the regional statistics on Table 1, it is important to point out the very low use of transit in the Detroit region, both in terms of transit trips per capita and percentage of the population that uses transit. Implementation of AFC systems typically generates measurable ridership growth, particularly when linked with consumer-friendly fare policy refinements

Table 1: Demographics						
	Total Population	Annual Transit Trips Per Capita	% Public Transportation Users	Total Employment	Poverty Rate	Unemployment Rate
Detroit	4,038,245	11.3	2.2%	1,803,510	18.0%	10.6%
Atlanta	4,740,405	29.9	3.5%	2,245,257	15.9%	9.8%
Sacramento	1,790,826	17.0	2.9%	767,280	16.6%	11.7%
Minn.-St. Paul	2,748,353	34.9	5.7%	1,465,018	11.2%	5.9%
Seattle	3,231,111	63.6	10.0%	1,615,716	12.9%	7.3%
Philadelphia	5,512,166	67.8	10.8%	2,603,554	14.0%	9.7%
Washington DC	4,860,914	99.6	16.5%	2,593,739	8.7%	6.7%

Source: <http://www.bls.gov/news.release/cesan.nr0.htm>

and improved access to discounted fares. Detroit’s Poverty Rate is the highest of the peer regions, while unemployment ranks second. Information presented for Detroit includes Detroit and Ann Arbor urbanized areas, and the peer regions also include the urbanized area.

Table 2 offers a more detailed examination of transit commuting share by personal income level. For the Detroit region, it is important to point out the high levels of transit trips represented by those with annual income levels below \$25,000 and the extraordinarily high levels of transit trips represented by the lowest income level, below \$9,999 per year. Transit use among those with higher incomes is significantly below that of all peer regions examined. These findings suggest the transit systems in the Detroit region have the opportunity to gain significant market share among those with higher incomes.

Table 2: Transit Commuting Share by Personal Income Level								
	\$1 to \$10k	\$10k to \$15k	\$15k to \$25k	\$25k to \$35k	\$35k to \$50k	\$50k to \$65k	\$65k to \$75k	\$75k or more
Detroit*	32.3%	11.8%	22.7%	11.3%	6.6%	6.8%	1.0%	7.6%
Atlanta	18.7%	13.9%	22.2%	14.8%	8.9%	6.0%	3.5%	12.0%
Sacramento	24.1%	4.2%	18.8%	9.5%	14.7%	11.5%	4.2%	13.1%
Minn.-St. Paul	19.0%	9.5%	14.1%	12.4%	15.0%	9.8%	4.8%	15.4%
Seattle	13.3%	6.1%	13.5%	11.2%	14.3%	11.6%	6.1%	24.0%
Philadelphia	16.3%	8.9%	16.0%	12.6%	16.0%	10.2%	4.1%	15.7%
Washington DC	10.6%	5.4%	10.8%	9.7%	12.7%	11.4%	6.3%	33.2%

Source: 2013 ACS 1-Year Estimates

The peer agencies along with their respective regional partner agencies are listed in Appendix C.1.

Overview of Regional Fare Systems

Selection of these regional systems provided an opportunity to report on a broad array of approaches in several areas of interest: governance during each phase of the project; agency coordination during project development, procurement and ongoing management and administration; and the strategies for allocating payment among agencies for both the initial investment and on-going operating costs.

All of the selected systems have employed automated fare collection technology based on the contactless smart card. While most of the systems are closed-loop, card-based systems, newer systems being deployed at SEPTA and WMATA, for example, are open-loop and will accept contactless bank cards and mobile phones for payment once fully deployed. Closed-loop refers to the use of a transit-specific, agency-branded smart card as the fare payment medium. Card-based refers to a system which processes transactions locally using logic programmed in the card reader on the bus or rail platform. These systems read and store data on the smart card itself. Refer to Section 3 for a discussion of technical terms.

The open-payments systems accept more than just agency specific smart cards. These systems can accept other cards such as employee ID cards and bank-issued credit/debit cards as well as mobile payments. In contrast to a card-based system, an account-based system does not encode new

Seamless Fare Integration Study for the Detroit Region

information onto the card; rather all transactions are processed and stored by the central computer system. The card acts as a credential identifying the account within which to process payment.

Table 3: Regional Fare Systems

	System Name	Lead Agency	System Contractor	Other Suppliers	Agencies	Transit Modes ⁽¹⁾	Payment Methods	Year
Atlanta	Breeze	MARTA	Cubic	GFI Cents-a-Bill/ Odyssey	4	Bus, X-Bus, HRT, PT	Cash, Mag Card, Tickets	2005
Sacramento	Connect	SACOG	INIT	GFI Cents-a-bill/ Odyssey	7	Bus, X-Bus, LRT	Cash, Tickets	2014
Minn. -St. Paul	Go-To	Metro Transit	Cubic	GFI Cents-a-Bill	13	Bus, X-Bus, LRT, CR, PT (pilot)	Smart Card, Cash, Mag Card, Tickets	2007
Seattle	ORCA	King Co. Metro	ERG (Vix)	GFI Cents-a-Bill	6	Bus, X-Bus, BRT, LRT, CR, Ferry, PT	Cash, Tickets	2009
Philadelphia	Key	SEPTA	Xerox	GFI (rebuilt fareboxes)	TBD	Bus, TB, T, LRT, HR, CR, DR, PT	GPR Smart Cards, Magnetic cards, Cash, Drivers Licenses, ID cards	2015
Washington DC	SmarTrip	WMATA	Cubic	GFI Cents-a-Bill	11	Bus, X-Bus, LRT, HRT	Cash, Mag Card, Tickets	1999
Washington DC	NEEP	WMATA	Accenture	Scheidt-Bachman, Cubic	11+	Bus, X-Bus, SC, LRG, HRT, PT	Smart Card, Open Payments, Cash, ID Cards	2016

⁽¹⁾ X-Bus: express bus, BRT: bus rapid transit, LRT: light rail transit, HRT: heavy rail transit, CR: commuter rail, PT: paratransit, SC: street car

Fare Media and Equipment

Each agency has a different selection of fare equipment. Some agencies have open-loop fare card systems, some have closed-loop card systems, while agencies with newer systems (i.e. SEPTA and WMATA – NEEP) have newer equipment that provides for “open payments.” Larger systems with rail typically employ fare gates, which have a significant impact on fare evasion.

Table 4: Fare Media & Equipment	
Fare Media & Equipment	
Atlanta	<ul style="list-style-type: none"> • Closed-loop contactless Breeze card and limited use passes • Devices include: faregates, vending machines, ticket office machines, encoding equipment, fareboxes, light validators, and driver control units (DCU) • Central data system is called NextFare • Other applications that support Breeze include: parking, system monitoring (Hewlett Packard Open View HPOV), reports (Hummingbird), and web portals (breezecard.com) • Paratransit included
Sacramento	<ul style="list-style-type: none"> • Closed-loop contactless Connect card • Deliverables include: smartcard passenger terminals, add fare machines, GPS enabled onboard computers, customer service workstations, retail sales terminals, and a back-office fare management system for the new Connect Transit Card System
Minn.- St. Paul	<ul style="list-style-type: none"> • Closed-loop contactless Go-To card • Features include: vending machines, bus validators, platform validators, website • Paratransit currently in pilot
Seattle	<ul style="list-style-type: none"> • Closed-loop contactless ORCA card • Features include: vending machines, bus validators, platform validators, website • Paratransit included
Philadelphia	<ul style="list-style-type: none"> • Open-loop contactless Key card, branded general-purpose smart cards • Deliverables include: central system, on-board readers integrated with CAD/AVL, turnstiles and faregates, TVMs, platform validators, parking pay-stations, hand-held units, retail sales devices, e-commerce web-portals, third party retail/reload network, and customer mobile application • Paratransit to be included in second phase
Washington DC (SmarTrip)	<ul style="list-style-type: none"> • Closed-loop SmarTrip card • Proprietary Cubic magnetic system updated with additional on-board and at station equipment, updated central back-end processing system • Paratransit included
Washington DC (NEEP)	<ul style="list-style-type: none"> • Open-loop NEEP system will allow payment with smartphones, credit cards, etc. • Will work throughout system except for certain TVMs, does not replace SmarTrip or cash fares – which will still be accepted • Investments include: new fare gates and vending machines • Paratransit included

Public Acceptance

Each of the selected systems is in revenue service, with three exceptions: the Connect Transit Card in Sacramento, which is in the test phase and expects to deploy early in 2015; SEPTA, which is scheduled to deploy in 2015; and WMATA, which is initiating an open-payment pilot that will lead to full deployment in 2017 if successful. Table 5 provides details about use of each system. The table identifies the market penetration of the program, i.e. the percentage of fares that are paid using the smart card. Market penetration is a measure of public acceptance and system success. In general, the smart card is most popular with frequent customers like commuters. Riders who have been purchasing high-value products – monthly or annual passes – have continued to do so as those products migrated to the smart card. Occasional riders and those unable to pay for a calendar monthly pass are more likely to pay cash and are less likely to carry a smart card for the sole purpose of paying with an e-purse. The differences in market penetration are likely due to a number of characteristics, including demographics, trip type, trip frequency as well as continuation of legacy fare media.

As part of the implementation process most agencies consider fare restructuring and develop a comprehensive plan to improve the accessibility to discounted fares for existing riders and as mechanism to attract new customers. Fare restructuring provides the opportunity to assess and consider potential improvements in fulfilling Title VI Goals, as required by the Federal Transit Administration.

Table 5: Public Acceptance					
	Annual Ridership	Daily Ridership	Daily Smart Card Trips	# of Card-Holders	Market Penetration
Atlanta	134,900,000	500,000	360,000	1,000,000	MARTA: 98%
Sacramento	27,100,000	96,000	-	-	n/a
Minn.-St. Paul	82,000,000	250,000	110,000	500,000	Overall: 52%
Seattle	151,620,000	570,000	373,000	1,700,000	Overall: 66% Range: 37% (WS Ferry)- 93% (ST commuter rail);
Philadelphia	330,000,000	1,413,000	-	-	Expected: 90%
Washington DC	343,969,630	1,100,000	1,006,000	3,000,000	WMATA overall: 92%; All Bus: 90%; Metrorail: 85-91%

Governance

The method of governance adopted in each of the six peer regional systems is described in Table 6. The type of governance approach established was often influenced by the degree of cooperation established during the system design and procurement phases. The approach generally falls into one of two main categories: collaborative or lead central agency. Each are described in more detail below the table.

Table 6: Governance	
Structure	
Atlanta	<ul style="list-style-type: none"> • Lead Agency - MARTA • Governance structure currently under review as part of ARC regional fare study • Existing structure based on reciprocal fare policy agreements and Breeze card participation agreements from 2006
Sacramento	<ul style="list-style-type: none"> • Collaborative • Memorandum of Understanding executed in 2011 by SACOG and each charter member transit operating agency of Connect Card consortium; MOU defines governance for the procurement phase and an amendment will define governance during revenue operations
Minn.-St. Paul	<ul style="list-style-type: none"> • Lead Agency – Metropolitan Council • Metropolitan Council works with each provider to ensure delivery of an integrated, cohesive transit system to meet and enhance the region’s mobility needs
Seattle	<ul style="list-style-type: none"> • Collaborative • Very detailed Interlocal Cooperation Agreement from 2009 • Decisions made by unanimous consent of General Managers of all participating agencies, which entered into agreement in 2000 to establish framework for designing / procuring the regional fare collection system • Agreement was revised / expanded in 2003 to focus on development and operation of the regional system; In 2009, as the development stage was concluding, the agencies revised the agreement with more specificity regarding final deployment and operation
Philadelphia	<ul style="list-style-type: none"> • Lead Agency – SEPTA • Independent operation, pricing, policies and governance • SEPTA provides 95% of regional transit travel
Washington DC	<ul style="list-style-type: none"> • Lead Agency - WMATA • SmarTrip: Working group inter-agency cooperation with no formal agreement
Washington DC	<ul style="list-style-type: none"> • Lead Agency - WMATA • NEEP: New, formal interagency agreements will be developed to govern equipment purchase and maintenance, back-end operational and transaction processing costs

Category 1: Collaborative Governance

In those cases where design and procurement were a collaborative effort, a Memorandum of Understanding (MOU) or Cooperation Agreement was executed by the participating agencies.

Agencies participating in the Connect Transit Card system in Sacramento executed an MOU as a more loosely defined consensus alternative to the joint powers agreement originally proposed by the administering agency, Sacramento Council of Governments (SACOG). An amendment to the MOU will expand the agreement to include the revenue operations phase.

Agencies in the Seattle/Puget Sound area organized early in the process. They negotiated and executed an Interlocal Cooperation Agreement, similar to the Clipper Agreement in the San Francisco Bay Area, which formally defined the method for participation and decision-making first during design and procurement and then, via amendment, the revenue service phase. The Agreement established a joint board of the General Managers with oversight responsibilities. A staff person is assigned to the joint board to manage the system and associated service contracts.

Category 2: Lead Central Agency

In other cases, design and procurement proceeded with one agency, typically the largest and most central in the region, working independently. In these instances, formal agreements defining the terms for new agencies opting into the system were executed after the system became operational, and not during design and procurement. In most but not all cases, agreements have subsequently been executed with agencies wishing to become part of the new system.

In some instances the lead agency is involved in financing the other agencies. For example, when MARTA implemented their Breeze smart card system in 2006, a regional system was envisioned that included Cobb Community Transit (CCT), Gwinnett Community Transit (GCT) and Georgia Regional Transportation Authority (GRTA) as transit partners. The relationship was formalized through the Breeze Card Participation Agreement. MARTA has had reciprocal fare transfer agreements with various regional suburban operators for over 20 years. The term of the Breeze Card Participation Agreements was 3 years, and included a number of provisions by which MARTA would provide equipment, technology infrastructure, clearinghouse/enterprise applications and other support to each operator for a fee of \$3,000 per month, plus a share of proportional costs, but no more than \$4,000 per month. The initial Breeze Card Participation Agreements expired in 2009 for the regional operators; however, MARTA and the regional operators are continuing to function under the initial contract provisions until such time a full renegotiation process is complete.

In other cases, the lead agency provides a facility for other agencies to piggyback on their existing system, but the agencies otherwise remain autonomous. For example, in both Washington, D.C. and Philadelphia, the lead agency financed the investment for the back-end system and equipment required for operation of their own service. As partners join these programs the partner agencies are expected to purchase the equipment they require as well as cover on-going costs associated with processing their transactions.

Procurement

Table 7 describes the approach taken in each of the six regions to design and procure the smart card system and equip the participating transit operators. It identifies the agency or agencies executing contracts with the system supplier and the process by which all participating agencies were equipped for the system. In the majority of cases, a single agency – either the MPO or the largest carrier serving the urban core – led the design and procurement effort, either as a sole entity or as a representative of consortium of participating agencies. One system, ORCA, organized the agencies into a joint governing body. Another system, Connect in Sacramento, has been organized and led by the MPO, SACOG, involving the participating agencies on a consensus basis. For those systems in which a single operating agency contracted for the system, other operators would opt in through separate contracts with the system supplier which referenced the specifications and pricing of the base contract.

Table 7: Procurement	
Approach to Procurement	
Atlanta	<ul style="list-style-type: none"> • MARTA procured the Breeze program through Cubic • The program was then extended to other agencies by MARTA through agreements to allow smart card usage among all their transit services • Term of the Breeze Card Participation Agreements was 3 years, and included a number of provisions by which MARTA provided equipment, technology infrastructure, clearinghouse/enterprise applications and other support to each agency
Sacramento	<ul style="list-style-type: none"> • SACOG executed a contract with INIT to supply the Connect Transit Card system and equip six transit systems; an option has since been executed to add a seventh agency • SACOG continues to manage the procurement with continued participation by the consortium of agencies working within committees to prepare for testing and start-up • Following a Phase 1 feasibility study for SACOG with 14 transit service providers, six operating agencies participated with SACOG in the design and procurement phases; A seventh opted in following contractor selection • An emphasis on quality, reliability and readiness has delayed the original schedule
Minneapolis-St. Paul	<ul style="list-style-type: none"> • Metro Council executed a contract with Cubic to supply a new smart card system and equip buses and light rail stations of its transit division, Metro Transit, and other regional bus services • Metro Council continues to manage the contract and execute options to equip other service providers, including the new MinnDOT Northstar commuter rail service • All operator fare systems were purchased using a single specification that covered multiple components - equipment on buses, TVMs, validators for rail platforms, Hiawatha light rail equipment, options for equipment on bus corridor and Northstar commuter rail, and a web portal
Seattle	<ul style="list-style-type: none"> • Seven transit agencies cooperated in a joint procurement process under an Interlocal Cooperation Agreement (ILA); all seven agencies were represented during the design, contractor selection, test, and implementation phases

Table 7: Procurement	
Approach to Procurement	
Philadelphia	<ul style="list-style-type: none"> • Motorola was the prime contractor for the initial proposal, but dropped out prior to Best And Final Offer phase placing ERG as prime; Contract was awarded in 2003 • In 2009, ERG pulled out of most US projects, but remains on the ORCA project due to an inability to reach satisfactory terms in negotiations with the ORCA agencies for a transfer of the contract to Cubic for hosting and managing the system
Washington DC (SmarTrip)	<ul style="list-style-type: none"> • SEPTA executed Design Build Operate Manage contract with Xerox to supply comprehensive open payment, open source payment solution in 2011 • Post-warranty services portion of contract may be awarded at SEPTA’s pleasure prior to full system acceptance • System is licensed and sized to support all agencies physically touching SEPTA as well as all agencies within Pennsylvania • SEPTA awarded a separate contract to GenFare to upgrade and integrate legacy fareboxes
Washington DC (NEEP)	<ul style="list-style-type: none"> • WMATA contracted with Cubic to supply its fare collection system since opening of initial Metrorail line; Cubic has continued to equip Metrorail extensions and provide upgrades • WMATA executed two separate contracts with Cubic to upgrade the Metrorail & Metrobus fare collection systems to accept SmarTrip cards, the first smart card fare collection application; Cubic also received a separate contract and subsequent change order from WMATA to upgrade the original central data collection system with Cubic’s latest NextFare management system with additional functionality • Cubic executed a separate contract with the State of Maryland for MTA to install CharmCard fare collection equipment (compatible with SmarTrip) on the Baltimore transit system, and to fund SmarTrip equipment for the bus agencies in Maryland’s two counties in the WMATA service area • Commonwealth of Virginia executed a separate contract with Cubic via the Northern Virginia Transportation Commission to upgrade six Northern Virginia bus agencies (ART, DASH, CUE, Fairfax Connector, Loudoun County Transit, Omniride) with SmarTrip-capable fareboxes and other equipment
Washington DC (NEEP)	<ul style="list-style-type: none"> • WMATA contracted with Accenture for delivery of a comprehensive open payment / open source fare payment system, replacing most legacy components; fareboxes have been upgraded to the latest available software and will not be replaced • Accenture must successfully complete a 90 day pilot of functional field-installed turnstiles, payment stations and on-board readers before full contract will be awarded. • WMATA is undertaking to implement a solution that is scalable and expandable, allowing for the continued fare interoperability such as that in place for the regional SmarTrip program; area transit operators will be able to utilize the NEEP contract to procure NEEP equipment and services, controlling their own implementation based on their individual business and customer needs

Capital and Operating Costs

Capital costs include system investment costs as defined by FTA best practices and are generally impacted by system complexity, types and quantities of equipment, legacy system interfaces and risk. Operating costs are uniquely defined by each agency and are generally in the range of \$.12 to \$.18 per dollar of fare collected. Agencies with heavy rail generally experience higher costs due to station equipment, cashiers or station personnel primarily supporting fare collection.

Table 8: Capital & Operating Costs						
	Capital Costs			Operating Costs		
	Total Cost	Cost Sharing	Useful Life	Total Annual Cost	Cost of Participation	Cost per Transaction
Atlanta	\$72.5	n/a	12 yrs	\$835,000	\$3,000-\$4,000 per agency/mo	n/a
Sacramento	\$10M incl. support work	MPO grant funded	15 yrs	Operation begins 2014	Ridership (taps)	n/a
Minn.-St. Paul	\$20M	n/a	15 yrs	n/a	Detailed estimate based on projected activity (taps, reloads, etc.)	n/a
Seattle	\$42M Allocated based on agency equip costs	Allocated based on agency equip costs	12-15 yrs	\$9M	Ridership (taps)	\$0.09
Philadelphia	\$129M	Each agency pays its own way	15 years	Less than legacy system due to labor efficiencies	n/a	Detailed estimate based on projected activity (taps, reloads, etc.)
Washington DC	~\$177M incl. Baltimore & others	Each agency pays its own way	12-15 yrs	WMATA AFC line item budget	n/a	n/a

Management and Operations

Table 9 below summarizes how each of the regional systems in the case studies is organized. In general, systems procured by a single large transit agency are managed by that agency. In cases with no clear dominant agency, a contract will be let for a managed service, typically by the system supplier.

In some cases, the system supplier has supported or managed system start-up and provided the staffing levels necessary for an initial contract period. This has ensured a smoother rollout when a high level of customer support is necessary and agency personnel are still becoming familiar with the system. For ORCA, initial plans to have the contractor provide call center customer service were revised as the agencies determined that they could handle customer questions and provide a superior level of service.

Table 9: Management and Operations					
	System Name	System Administrator	Customer Service	Web Hosting	Equipment Maintenance
Atlanta	Breeze	MARTA	MARTA	MARTA	Cubic
Sacramento	Connect	RT	RT	RT	RT
Minn.-St. Paul	Go-To	Metro Transit	Metro Transit	Metro Transit; Cubic hosts site	Metro Transit
Seattle	Orca	ERG (now Vix)	Agencies: 1 st call; KC Metro: call center for forwarded calls	KC Metro	Agencies: field; ERG: repair
Philadelphia	Key	Xerox through warranty	Xerox	Xerox	Xerox through warranty
Washington DC	SmarTrip	WMATA	WMATA/Cubic	WMATA	WMATA
Washington DC	SmarTrip	WMATA	WMATA/Accenture	WMATA	TBD

Fare Policy Coordination

One advantage of smart card technology has been its ability to accommodate and process complex fare structures, including the unique policies of individual agencies in a regional system. This has enabled each agency to retain its own fare policy and structure. Transfer agreements and joint fares in place prior to regional system deployment are included in the programming of the new system. However, rarely have the participating agencies cooperated to develop regional fares and regional products for the new regional fare system.

A description of the general strategies applied to fares in each case study is provided in Table 10 below. It identifies the interagency fares in place and any effort to rationalize fares into a more regional structure. As the table shows, in each case the agencies have maintained control of their own fare policies and fare levels. Interagency fare products already in place have migrated to the new fare system.

Of the six case studies, one consortium of agencies was successful in developing a set of regional pass products. The agencies participating in what became the ORCA system in the Seattle area, cooperated to develop the Puget Pass, a monthly pass accepted on all participating transit agencies (Washington State Ferry system does not accept the Puget Pass). Each agency retains the ability to set fare levels. Developing the Puget Pass required agreement on the monthly fare multiplier on the single ride fare (36x), and the method for estimating and distributing revenue for the product. This distribution is based on the proportion of taps on each agency service and the associated fare. The Puget Pass is a considerable convenience to riders who have a choice of services, typically between a county agency and Sound Transit, which provides service covering parts of three counties.

Table 10: Fare Policy Coordination	
Fare Policy Coordination	
Atlanta	<ul style="list-style-type: none"> • Each agency retains its own fare structure • Reciprocal fare transfer agreements determine transfer rules and revenue agreements between the agencies
Sacramento	<ul style="list-style-type: none"> • Each agency retains its legacy fare structure, with one exception: Agency capped daily fare replaces day passes • No regional fares • Existing bi-agency transfer agreements and revenue agreements remain in place
Minn.-St. Paul	<ul style="list-style-type: none"> • Metro Council (parent agency of Metro Transit) coordinates fare policy and fare levels for the agencies
Seattle	<ul style="list-style-type: none"> • In 1999, five agencies (KC Metro, ST, PT, CT, Everett) developed a common fare product - Puget Pass - years in advance of ORCA procurement • Each agency sets the single-ride fares for its services • Regional monthly passes (Puget Passes) are available in values of 36x the single-ride fare. A pass is valid for any agency's service for which the pass value equals or exceeds the fare; Stored value is valid on all service • An agency may have its own fare products (passes, cash-fare transfers, etc.); however, these are not part of ORCA • Agencies not part of Puget Pass require payment from the ORCA e-purse
Philadelphia	<ul style="list-style-type: none"> • Independent policies and pricing • In preparation for launch, SEPTA conducted extensive customer research, instituted a new regional fare policy task force and sought public input on proposed streamlined policies and pricing prior to adoption by the SEPTA Board • Legacy transfer agreements revisited and adjusted to conform to new system • Universal smart cards will fully support all operators and modes; new ID cards issued to qualified Demand Response customers to support travel on both scheduled and demand-responsive services
Washington DC	<ul style="list-style-type: none"> • SmarTrip: Consortium of agencies in 2009 engaged in fare simplification in advance of SmarTrip rollout. Set interagency agreements, 7-day regional bus pass, transfer agreements • Migrated to SmarTrip following deployment • Each agency continues to establish its own fares and fare products for SmarTrip
Washington DC	<ul style="list-style-type: none"> • NEEP: Potential future consideration

Lessons Learned

The previous sections reported primarily on methods, approaches taken and resulting experiences. This section contains a number of tables presenting the lessons learned by the agencies pertaining to: System Design, Design Phase, Procurement Phase, Public Acceptance, and Service Quality and Reliability. The responses step beyond the approaches taken to rollout each system; instead they are the reflections of agency representatives on how to do things better next time. The lessons learned are based on discussions with agency contacts. Agency contacts are listed in Appendix C.1.

1) System Design

Table 11 provides an overview of System Design lessons learned. System Design refers to the overall technical and functional aspects of the AFC system. This covers a broad cross section of elements from the fare media to the customer service support software.

The agency commentary on system design points to the following observations:

- Address policy issues in advance of or during system design. Policy is more challenging, but is more effective in regionalizing and attracting riders.
- Organize early. Agencies that get involved in system design are more likely to have their specific needs and constraints addressed, reducing the likelihood of future conflict and improving agency acceptance.
- Organize to resolve conflict. Understand that disagreements will occur when a number of agencies are working together. Create a governance approach that addresses the interests of all agencies without impeding project progress.
- Takes steps to clearly define the functional requirements of the system and the scope of services of the system contractor, including interfaces with other systems, customer use, and agency responsibilities. Focus on functional requirements. Avoid proprietary design, where practicable.

Table 11. Lessons Learned – System Design	
Agency Commentary	
Atlanta	<ul style="list-style-type: none"> • Reciprocal fare transfer agreements have issues: inequitable revenue distribution resulting from pass-through trips, whereby riders enter a MARTA station, tap their Breeze card, but do not enter through the faregates, then board regional agency’s bus service • Compliance issues with requirements of ADA complementary paratransit services. The agreements only cover fixed route services with the exception of CCT. • Regional fare rules have created “fare leakage” for MARTA and other regional agencies: A regional agency explained that fare leakage on their system stems from customers purchasing discounted MARTA passes instead of higher priced local agency period passes. At transfer points and park and ride lots where MARTA and partner agency buses stop, customers board MARTA buses, tap their card to receive the free transfer, immediately exit the bus and then board another agency’s bus.

Table 11. Lessons Learned – System Design	
Agency Commentary	
Sacramento	<ul style="list-style-type: none"> • Address policy issues in advance of or during system design. These are more challenging, but the result can be more effective in regionalizing transit services and attracting riders. • Organize participating agencies at the beginning, be transparent in your efforts and press for active participation to retain cooperation and buy-in of the system.
Minn.-St. Paul	<ul style="list-style-type: none"> • Suffered due to acceptance of a very mature design (platform validators) - budget constraints would not allow them to ask for updated technology (last installations of that Cubic technology). • Program/Project Manager specifically didn't understand the Central Data System as fully as necessary when developing specification. • Focus more on performance and functionality and not just the architecture; most important are reports and monitoring tools. • Integration with vehicle systems: focus on operator interface and involve them; didn't start early enough; didn't have enough attention on the robustness of software update process (delayed rollout at least 9 months). • When platforms were laid out for LRT system validators placed in the middle, near the TVMs, passenger flow was not optimal. Validators should have been placed near entrances.
Seattle	<ul style="list-style-type: none"> • Development of the project finance plan involved multiple federal grants, which were shared by the region in the same proportion as the sharing of capital costs including planning and design costs. • Selecting established technology that has been implemented elsewhere minimizes risks, although some customizations especially with regard to software may be required in order to accommodate different legacy equipment and systems. • Legal issues have been greater than anticipated, both with regard to the vendor and balancing the needs of all of the partner agencies.
Philadelphia	<ul style="list-style-type: none"> • SEPTA was the first major U.S. agency to envision an open payments approach based on Near Field Communications (NFC). • To execute a key initiative at a time of weak capital funding, SEPTA leveraged the Welcome Fund, a U.S. Department of Immigration licensed financing instrument. SEPTA utilized a comprehensive Technical Specification, strict, performance-based milestone payments and a tight, non-negotiable contract which has resulted in few Change Orders to-date.
Washington	<ul style="list-style-type: none"> • A very interactive design phase between Cubic and WMATA helped to define the details behind some of the more complex system requirements and design. • Moving the MetroRail and MetroBus to a common fare collection platform, NextFare, eliminated the need for WMATA to support two systems, one being an outdated mainframe.

2) System Procurement & Implementation

Table 12 presents agency observations of lessons learned from their procurement and implementation of the system. The observations are of the contractor selection process, and design and deployment timing, as are summarized below:

- Structure the procurement process to maintain a level field during the competition.
- Protect the agency investment against potential contractor default by requiring corporate financial security and up-to-date software escrow.
- Do not be schedule driven for system deployment; rollout only when testing and drilling demonstrates system readiness.
- Be mindful of the system life cycle when scheduling multi-agency rollouts. Future-proof system design where practical to maximize return on investment for deployments late in the cycle.

Table 12. Agency Commentary – Procurement and Implementation	
Agency Commentary	
Atlanta	<ul style="list-style-type: none"> • Did not consider regionalization at the time of system procurement, making the process difficult to implement later on.
Sacramento	<ul style="list-style-type: none"> • Emphasize agency preparation for transitioning to the new system, pressing for business processes that use electronic data systems to advantage. • Do not publicize a rollout date – do not be schedule driven; rollout only when the system is fully tested and personnel are properly trained and drilled. • Rigorous pilot testing is critical to analyzing customer use and ease of understanding.
Minn.-St. Paul	<ul style="list-style-type: none"> • Complicated procurement because of the multiple budgets involved. No agreement on proper sharing of the fixed costs.
Seattle	<ul style="list-style-type: none"> • Establish a sufficiently large performance security requirement to assure that only financially secure firms are likely to respond. • Establish an Intellectual Property escrow containing up-to-date proprietary source code and build documents to protect against the risk of vendor default.
Philadelphia	<ul style="list-style-type: none"> • Design and implementation of the first large scale open-payment system has suffered from significant schedule delays. • The system has been designed to accommodate an unlimited number of regional partners.
Washington DC	<ul style="list-style-type: none"> • The current SmarTrip system for MetroRail and MetroBus with all current functionality was implemented with multiple contracts, each with their own procurement processes and timelines, with WMATA from the 90s to the present instead of a single contract.

3) Public Acceptance

In Table 13, the respondents shared their lessons learned with respect to public acceptance of the new system. Agency observations included those on market penetration rate and customer satisfaction. Outreach and education are highlighted as key to ensuring a positive customer experience during the transition to the new system.

- Begin community outreach early to give sufficient time to educate the public on the pending changes. Outreach materials should be in all primary languages of the riding public.
- Provide incentives to encourage use of the new smart card in place of cash. Transition fare products from paper and magnetic fare media to the smart card over a fairly short transition period.
- Move quickly and publicly to address and resolve design issues as they arise. All agencies reported ridership growth during the period following implementation but were sometimes unable to directly associate with the new system due to corresponding service enhancements, regional economic growth and other factors. Critical goals of any fare improvement project is to improve revenue and data collection processes and new systems typically successfully achieve these during the period following full system acceptance.

Table 13: Lessons Learned – Public Acceptance	
Agency Commentary	
Atlanta	<ul style="list-style-type: none"> • High rate of public acceptance of Breeze program was directly related to the elimination of all legacy fare instruments. • Public confidence in the system somewhat derailed by issues arising from the regional fare structure agreements.
Sacramento	<ul style="list-style-type: none"> • Not yet known.
Minn.-St. Paul	<ul style="list-style-type: none"> • One of the first adopters of technology, so they did quite a bit of outreach to incorporate the community. • PVC cards initially distributed were brittle and prone to fracturing particularly in cold weather. The switch to triplex stock has demonstrated improved durability. Retaining a complex fare policy makes the card validation process difficult.
Seattle	<ul style="list-style-type: none"> • While ORCA card use is substantial, additional emphasis is required in ensuring that TVMs and ORCA readers are easier and faster to use.
Philadelphia	<ul style="list-style-type: none"> • Complete fare policy review and seek Board approval for fare structure changes as early as possible as this will minimize both vendor and public confusion. • Identify a project champion who has the support of Executive Management to make decisions and keep the project moving.
Washington DC	<ul style="list-style-type: none"> • There are currently approximately 3 million active SmarTrip cards in circulation; “active” is defined as having been used at least once in the past 6 months. • SmarTrip usage on Metrorail is about 85%, on Metrobus is about 90%.

Appendix C.1

Agencies and Agency Contacts

Participating Agencies in Regional Systems

Region	Agencies	
Atlanta	Metropolitan Atlanta Rapid Transit Authority (MARTA), Cobb Community Transit, Atlanta Streetcar	Gwinnet County Transit, Georgia Regional Transportation Authority (GRTA Express),
Minn.-St. Paul	Metro Transit, Northstar (commuter rail), Maple Grove, Minnesota Valley Transit Authority (MVTA), Plymouth Metrolink, Shakopee	Southwest Transit Authority, University of Minnesota Campus Connector, Ramsey Star Service, Rush Line Service, Metropolitan Transportation Services
Philadelphia	Southeastern Pennsylvania Transportation Authority (SEPTA) Future Consideration: Port Authority Transit Corporation (PATCO)	Delaware Transit Corporation (DART – First State) All agencies within Pennsylvania
Sacramento	Sacramento Area Council of Gov'ts (SACOG), Regional Transit (RT), Elk Grove Transit (e-tran) , Yolo County Transit District (Yolobus)	El Dorado Transit Authority (EDTA), Folsom Stage Line , Yuba-Sutter Transit (YST), Roseville Transit
Seattle	King County (KC) Metro, Sound Transit (ST), Pierce Transit (PT), Community Transit (CT)	WS Ferry (WSF), Kitsap Transit (KT), Everett Transit, King County Ferry District (Water Taxi)
Washington DC	Washington Metro Area Transit Authority (WMATA), DASH (Alexandria, VA), Ride On (Montgomery County MD), Fairfax Connector (Fairfax County), Arlington Regional Transit (ART), CUE (Fairfax City)	The Bus (Prince Georges County), Loudoun County Transit (VA), Potomac & Rappahannock Transportation Commission (Omniride/Omnilink), DC Circulator, CharmCard(Interchangeable with SmarTrip: Maryland Transit Administration (MTA)

Agency Contacts

Region	Name, Title and Agency	Contact Information
Atlanta	Cain Williamson Division Manager Atlanta Regional Commission	Office: 404-463-3281 Email: cwilliamson@atlantaregional.com
Minn.-St. Paul	James Alexander Project Manager Metropolitan Council	Office: (651) 602-1937 Email: jim.alexander@metc.state.mn.us
Philadelphia	Kevin O'Brien Senior Director – New Payment Technologies Southeastern Pennsylvania Transportation Authority (SEPTA)	Office: 215-580-7931 Email: kobrien@septa.org
Sacramento	Robert McCrary Project Manager Sacramento Area Council of Governments	Office: 916-340-6228 Email: rmccrary@sacog.org
Seattle	Brian Brooke Project Manager Sound Transit	Office: 206-398-5229 Email: brookeb@soundtransit.org
Washington DC	Thomas Randall Director of Payment Systems Washington Metro Area Transit Authority	Office: 202-962-2294 Email: trandall@wmata.com

Appendix C.2

Demographic Information

Population by Race (Total Number)

Region	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some other race	Two or more races	Hispanic or Latino
Detroit	2,578,003	990,449	9,779	185,466	548	5,900	92,432	175,668
Atlanta	2,133,432	1,655,663	9,751	281,959	1,644	18,962	93,056	545,938
Sacramento	924,267	146,139	7,629	244,499	14,818	2,777	87,410	363,287
Minn.-St. Paul	2,015,966	251,377	13,640	203,126	914	6,673	83,795	172,862
Seattle	2,073,916	193,637	22,291	426,676	30,457	5,708	165,045	313,381
Philadelphia	3,412,373	1,178,718	5,814	311,039	400	14,044	102,798	486,980
Washington DC	2,079,940	1,290,530	8,913	526,394	1,754	14,562	141,573	797,248

Population by Race (Percentage)

Region	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some other race	Two or more races	Hispanic or Latino
Detroit	63.8%	24.5%	0.2%	4.6%	0.0%	0.1%	2.3%	4.4%
Atlanta	45.0%	34.9%	0.2%	5.9%	0.0%	0.4%	2.0%	11.5%
Sacramento	51.6%	8.2%	0.4%	13.7%	0.8%	0.2%	4.9%	20.3%
Minn.-St. Paul	73.4%	9.1%	0.5%	7.4%	0.0%	0.2%	3.0%	6.3%
Seattle	64.2%	6.0%	0.7%	13.2%	0.9%	0.2%	5.1%	9.7%
Philadelphia	61.9%	21.4%	0.1%	5.6%	0.0%	0.3%	1.9%	8.8%
Washington DC	42.8%	26.5%	0.2%	10.8%	0.0%	0.3%	2.9%	16.4%

Source: 2013 ACS 1-Year Estimates

Household Income Levels (Total Number)

Region	Less than \$10,000	\$10,000 to \$14,999	\$15,000 to \$24,999	\$25,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$74,999	\$75,000 to \$99,999	\$100,000 to \$149,999	\$150,000 to \$199,999	\$200,000 or more
Detroit	148,910	86,222	169,847	154,557	210,815	266,661	182,995	201,707	75,342	70,685
Atlanta	114,203	73,896	154,511	172,985	226,728	305,662	208,253	230,086	92,370	97,409
Sacramento	40,773	34,402	62,434	59,248	84,731	114,037	79,635	91,102	39,499	31,217
Minn.-St. Paul	59,027	39,709	92,297	88,004	125,567	193,179	149,177	186,740	71,906	68,686
Seattle	77,618	46,320	97,648	102,656	143,968	219,082	165,251	206,563	97,648	96,396
Philadelphia	158,501	95,507	195,078	178,821	245,879	343,418	243,847	302,777	132,084	136,148
Washington DC	78,719	36,736	85,717	92,714	152,191	267,646	229,161	348,115	199,422	258,899

Source: 2013 ACS 1-Year Estimates

Household Income Levels (Percentage)

Region	Less than \$10,000	\$10,000 to \$14,999	\$15,000 to \$24,999	\$25,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$74,999	\$75,000 to \$99,999	\$100,000 to \$149,999	\$150,000 to \$199,999	\$200,000 or more
Detroit	9.5%	5.5%	10.8%	9.9%	13.5%	17.0%	11.7%	12.9%	4.8%	4.5%
Atlanta	6.8%	4.4%	9.2%	10.3%	13.5%	18.2%	12.4%	13.7%	5.5%	5.8%
Sacramento	6.4%	5.4%	9.8%	9.3%	13.3%	17.9%	12.5%	14.3%	6.2%	4.9%
Minn.-St. Paul	5.5%	3.7%	8.6%	8.2%	11.7%	18.0%	13.9%	17.4%	6.7%	6.4%
Seattle	6.2%	4.7%	7.8%	8.2%	11.5%	17.5%	13.2%	16.5%	7.8%	7.7%
Philadelphia	7.8%	2.1%	9.6%	8.8%	12.1%	16.9%	12.0%	14.9%	6.5%	6.7%
Washington DC	4.5%	2.1%	4.9%	5.3%	8.7%	15.3%	13.1%	19.9%	11.4%	14.8%

Source: 2013 ACS 1-Year Estimates

Transit Commuting Share by Personal Income Level (Total Number)

Region	Less than \$10,000	\$10,000 to \$14,999	\$15,000 to \$24,999	\$25,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$74,999	\$65,000 to \$74,999	\$75,000 or more
Detroit	12,715	4,636	8,913	4,429	2,585	2,663	397	2,990
Atlanta	14,296	10,640	16,968	11,372	6,836	4,614	2,694	9,163
Sacramento	5,163	893	4,013	2,026	3,143	2,468	894	2,802
Minn.-St. Paul	15,449	7,750	11,532	10,131	12,202	7,979	3,883	12,579
Seattle	21,257	9,820	21,599	17,932	22,869	18,570	9,858	38,423
Philadelphia	44,870	24,525	44,094	34,720	44,094	28,020	11,330	43,276
Washington DC	44,863	23,049	45,656	40,992	53,699	48,328	26,815	140,845

Source: 2013 ACS 1-Year Estimates

Transit Commuting Share by Personal Income Level (Percentage)

Region	Less than \$10,000	\$10,000 to \$14,999	\$15,000 to \$24,999	\$25,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$74,999	\$65,000 to \$74,999	\$75,000 or more
Detroit	32.3%	11.8%	22.7%	11.3%	6.6%	6.8%	1.0%	7.6%
Atlanta	18.7%	13.9%	22.2%	14.8%	8.9%	6.0%	3.5%	12.0%
Sacramento	24.1%	4.2%	18.8%	9.5%	14.7%	11.5%	4.2%	13.1%
Minn.-St. Paul	19.0%	9.5%	14.1%	12.4%	15.0%	9.8%	4.8%	15.4%
Seattle	13.3%	6.1%	13.5%	11.2%	14.3%	11.6%	6.1%	24.0%
Philadelphia	16.3%	8.9%	16.0%	12.6%	16.0%	10.2%	4.1%	15.7%
Washington DC	10.6%	5.4%	10.8%	9.7%	12.7%	11.4%	6.3%	33.2%

Source: 2013 ACS 1-Year Estimates

Appendix C.3

Agency Fare Revenues and Recovery Ratio

Peer Agency Fares and Recovery Ratios

Region/Agency	Fare Revenues Earned	Total Operating Expenses	Recovery Ratio
Atlanta			
MARTA	\$130,642,970	\$411,314,379	31.8%
Cob Community Transit	\$6,187,175	\$17,440,692	35.5%
Gwinnett County Board of Commissioners	\$4,696,038	\$14,176,806	33.1%
GRTC Express	\$11,218,788	\$24,531,401	45.7%
Sacramento			
Sacramento Regional Transit District	\$28,967,228	\$111,102,427	26.1%
Yolo County Transportation District	\$2,468,207	\$10,079,997	24.5%
City of Elk Grove	\$1,384,202	\$6,518,893	21.2%
Yuba-Sutter Transit Authority	\$1,316,867	\$5,693,779	23.1%
Roseville Transit	\$799,298	\$4,475,664	17.9%
City of Folsom	\$75,419	\$2,621,095	2.9%
Minneapolis – St. Paul			
Metro Transit	\$89,919,538	\$284,697,538	31.6%
Metropolitan Council	\$12,237,820	\$60,968,839	20.1%
Seattle			
King County Metro Transit	\$139,668,000	\$528,645,842	26.4%
Sound Transit	\$46,116,593	\$175,166,744	26.3%
Snohomish County Community Transit	\$25,141,210	\$89,339,360	28.1%
Pierce Transit	\$13,502,384	\$90,403,858	14.9%
Everett Transit	\$1,291,027	\$18,329,845	7.0%
King County Ferry District	\$1,100,484	\$4,163,312	26.4%
Philadelphia			
SEPTA	\$524,258,000	\$1,270,436,000	41.3%
Washington			
Washington Metropolitan Area Transit Authority	\$710,601,594	\$1,497,170,206	47.5%
Ride-On Montgomery County Transit	\$19,780,939	\$104,782,723	18.9%
Fairfax Connector Bus System	\$5,203,778	\$62,730,890	8.3%
Prince George's County Transit	\$1,569,806	\$25,582,055	6.1%

Source: U.S. Transit Agency Data: Federal Transit Administration, National Transit Database, 2011

Appendix D

Fare Integration Technologies and Contractors

January 2015

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Introduction

This memorandum provides a current overview of fare collection system technologies and contractors. The information is broken down into four sections:

- The *Systems* section explains types of systems that are common in the industry, and terminology that is typically used to describe fare collection systems. The section is broken down into system types, system components, and system options.
- The *Hardware* section outlines the different types of equipment that are typically supplied with fare collection systems.
- The *Media* section defines the different types of media that are used in fare collection systems.
- Contractors and equipment suppliers are outlined in the *Vendors* section. This list includes the areas that each company specializes in.

Wherever appropriate, high level recommendations have been included within each of the sections. The information presented will assist in understanding fare collection systems for the purpose of this study, for future studies and for future procurements for fare collection.

Systems

Recent technological advances have significantly altered the number of options available to transit agencies for fare payment, and the current set of system types and options provide important considerations for regional fare integration.

System Types

Proprietary/Closed

A proprietary fare collection system implies that only fare instruments issued by the agency will be accepted. This type of system is also referred to as a “closed” payment system. A closed system most closely resembles a gift-card model, where funds/products are loaded onto the branded card which can only be used at the retail establishment from which the card was issued.

Equipment associated with a proprietary fare system will typically only recognize a very limited number of agency-distributed fare media types, in some case only one. The early automated fare collection systems were all developed with proprietary system design, equipment and media. The majority of new fare systems in development are non-proprietary, open systems.

The systems currently in place in the Detroit area are best defined as proprietary and closed.

Card-Based

A card-based system stores transit funds and/or fare products on the card. A card-based system is always closed-loop/proprietary.

In card-based systems, the value resides on the transit card which, if lost, can mean the loss of funds or fare products for the patron. Further, card-based systems require both reading and writing at the validator/fare box, which can cause delays of up to 24-hours when loading value or fare products from a website or via telephone. Fare systems currently in place in the Detroit area are card-based.

Account-Based

An account-based system stores a user profile with funds and/or fare products on a back-end system. Account-based systems can allow for, but do not necessitate, open payments.

Account-based systems offer a more-secure environment for both consumers and the agency. One advantage of account-based systems is the ability to deal with lost or stolen fare cards by issuing replacement cards, usually at a cost to the customer but without a loss of the fare value or product.

Account-based systems can also be integrated with non-transit cards, such as student cards or building access cards. For integrated non-transit cards, a business agreement must be made with the transit agency, and a specific interface needs to be developed to accept and track foreign card usage.

Open Payments

Open payments is a consumer-driven response to the challenges of maintaining, distributing and reconciling agency-branded fare media. An open payments system will accept media from a variety of sources in addition to an agency-branded card. In these systems, payments can be made from media issued by a financial institution, or through other payment sources (e.g., Google Wallet, Apple Pay). In Open Payment systems, the agency can issue agency-branded media, but has the option not to.

Over the last several years there has been an increasing move to open systems, which includes open design elements, and interchangeable equipment capable of interacting with a variety of media types. An open fare system offers very long life, the ability to interact with a variety of payment sources and the opportunity to replace equipment available from a number of suppliers.

Open payments platforms are in place in Salt Lake City, Chicago and Philadelphia as well as in development in a number of markets. It is clearly the “new normal” for fare systems worldwide.

Open Architecture

An open architecture system is a fare collection system that does not rely on a single vendor for parts. Rather than relying on a single vendor, an open architecture system is required to accept and support devices from other vendors. For example, one vendor may provide the central system, while other vendors provide validators.

Although this is a new concept in the fare collection industry, open architecture procurement has been implemented in Ontario, Canada, with the PRESTO system, and with the NEEP system currently going to pilot in Washington, DC. In both of these examples, the central data system is from a different supplier than the fare equipment.

An Open Architecture system provides certain advantages, such as allowing for competitive procurement for additional equipment after the system is deployed. The systems also have drawbacks. These systems tend to be more difficult to procure and are not proven in the industry. As well, the initial cost of these systems can be prohibitive as they are more difficult for vendors to develop and implement. These types of procurements may also limit competitiveness as the systems are less attractive to vendors as they are not guaranteed any on-going revenues.

System Components

Central Data System

A central data system is included with every fare collection system, and is comprised of one or more servers and supporting software to operate and manage the payment processes. Central data system functions include: maintaining/calculating fare rules, processing and recording transactions, maintaining card inventories as well as lists of valid and invalid media, interacting with other agency systems such as CAD/AVL and tracking equipment health. Account-based systems have more sophisticated and complex central systems which centrally manage account information. Card-based systems are more dependent on devices, whereas central data systems send updates to more complex validating devices.

Customer Service

Fare collection systems include a customer service interface, which provides tools and information for managing and resolving customer service issues. The Customer Service interface may be web-based, and is used by call center staff to quickly retrieve and resolve customer account issues.

E-Commerce and Web Portals

Web portals are typically included in fare collection systems, and provide a convenient interface for consumers to purchase fare products and manage account information, employers to generate transportation benefits and social service agencies/schools to provide travel benefits.

System Options

Managed Services

Rather than self-maintain equipment, central data systems, and/or web portals and e-commerce, these services can be contracted to an outside provider, either through the system integrator that provides the fare collection system, or competitively bid in the market-place.

Remote Hosting

Remote hosting is offered by many fare collection vendors, and provides a remote backend system, where servers, central data system, and databases are managed by the vendor. Remote hosting significantly reduces requirements for internal technical resources, and is especially attractive to smaller agencies that have limited access to IT resources. Hosting typically includes levels of redundancy and security and can be provided in centralized locations or “in the cloud.”

Mobile Ticketing Systems

Mobile ticketing involves customers using mobile phones for the purchase of fares for fare payment. Mobile ticketing can be deployed using contactless technology in some phones or through barcodes displayed on the phone. Customers are typically required to download an application to their phone, identify a funding source, select a fare for purchase and present their phone to the validator or inspector.

Third Party Retail Sales Networks

Third party retail sales networks provide retail outlets for sale of transit smartcards, fare products, or transit funds. These retail networks can be provided with POS devices, or can simply utilize a web portal for managing sales. Third Party Retail Sales Networks are sometimes garnered as part of fare collection procurement, or may already be established by the transit agency.

System-Related Considerations for Detroit Region

Transit systems in the Detroit region currently offer fare pass products based on a proprietary, closed-loop model. For a variety of reasons, transit agencies in most major metropolitan areas are transitioning to account-based, open-payment and open-architecture systems:

- Account-based systems offer greater security and flexibility for agencies as well as customers, and provide forward-compatibility with developing technology.
- An open fare system offers very long life, the ability to interact with a variety of payment sources and the opportunity to replace equipment available from a number of suppliers.
- Open architecture offers benefits concerning lower life cycle costs and forward-compatibility, and can also be designed to comply with open payments requirements.

For the purposes of long-term fare integration and compatibility, Detroit area providers should consider these elements in planning for their future system. The region should also prioritize shared system components and options that have the greatest shared value. For example, a shared, regional backend may be an attractive solution.

Hardware

Fare collection systems include a variety of customer-facing hardware and devices. All hardware must meet federal, state and local ADA requirements, typically including braille, audible tones and voice instructions for visually impaired and other passengers with special needs. The selection of hardware varies from agency to agency, depending on the specific characteristics of the system.

Fareboxes

A farebox is an electromechanical device normally installed on a bus or transit vehicle that is used by customers for fare payment. Fareboxes are provided in secure drop, registering and validating configurations.

- *Drop boxes* offer a secure container for collection of funds.
- The *registering farebox* verifies coins and the number of bill-sized paper currency inserted and associates the correct fare to a passenger trip.
- *Validating fareboxes* use electronic means to very accurately verify and authenticate both bill and coin denominations.

Fareboxes may also contain various fare media readers as described below.

Smart Media Readers (Validators)

Contactless smart media readers use radio waves to communicate with contactless smart media. Contactless smart media readers can both read and write data on a smart card, and can read a variety of contactless media, such as contactless cards and Near Field Communication (NFC)-enabled mobile devices.

In card-based systems, these devices need to perform robust fare calculations to read and update the smart media. In account-based systems, the smart media readers are required to do fewer calculations, and do not need to update the media, as the bulk of the processing is shifted to the fare collection central servers. The move to account-based systems allows for more “off the shelf” smart media readers, rather than the proprietary customized readers that are required for card-based systems.

Newer readers are often certified to meet all applicable standards to process bank cards.

Onboard validators

Smart media readers are installed on board buses, light rail vehicles, street cars and similar vehicles. They are often a standalone smart media reader installed alongside a farebox or can be integrated into the farebox. On-board smart media readers collect payment for the passenger trip, either with an available fare product or

stored transit value. When distance-based fares are in use, a vehicle may have validators at every exit on a vehicle, allowing for the tap-in and tap-out required for distance-based fare calculations.

Fare Vending Machines

The Fare Vending Machine (FVM) is a customer-operated device installed at a rail station, bus terminal or any other location convenient to transit services. FVMs can dispense smart cards, prepaid cards, proof of payment receipts, and limited use media. They can be used to purchase fare media and fare products, check balances, and to load value. New FVMs include touchscreens that allow customers to register and manage accounts.

FVMs typically accept cash and credit/debit. Cashless FVMs are less common, and are much smaller and less complex than their counterparts as there is no need to accept, store, and distribute cash. FVMs that accept credit/debit must conform to Payment Card Industry (PCI) standards.

FVMs can be used to provide information and advertising to the transit patron.

Faregates/Turnstiles

Faregates and turnstiles provide a barrier between the paid and unpaid areas of a transit location, and, when added, can significantly reduce fare evasion. There are different styles of gates available, with three basic types: retractable barrier, paddle gates, and turnstile. Faregates must be ADA accessible, or additional ADA gates will need to be included as required by ADA regulations. Faregates are typically reversible, or can be set to two-way – allowing for both entry and exit. The faregates contain a smart media reader and/or a barcode scanner to read the media, tag the user into or out of the paid area, calculate fare, validate available fare product or transit balance, and open the gate.

Platform Validators

Platform validators are smart media readers which are installed on platforms and station locations. A transit patron will present fare media at the platform validator to pay fare before boarding a vehicle. Platform validators can also be used to check balances. These validators may also be used for tap-on and tap-off for distance based fares. Platform validators are typically used when a system is not gated, and relies instead on proof-of-payment.

Handheld Devices

Handheld devices are compact devices used by transit personnel to perform a variety of functions, from fare enforcement to sales, depending on the operational needs of the agency. Handheld devices are also an option for paratransit fare collection. Traditionally, the devices have been heavily ruggedized non-consumer devices, but more recently transit agencies have been using readily available smartphones due to the operational convenience and lower cost.

Point of Sale/Administrative Terminals

Point of sale (POS) devices are devices used to add transit fare products and add value to fare media. Retail POS devices can also be distributed to retailers. Point of sale terminals are often used at internal sales locations as well. Administrative terminals have additional functionality, and are used by back office administrative personnel. With the migration to account-based systems, the functionality required is often available through web portals, eliminating the need for the transit-specific POS devices.

Hardware-Related Considerations for Detroit Region

In a system developed with open architecture, components can be added over time. One increasingly popular approach is supplementing existing fareboxes with new onboard validators. The validators become the customer interface for new media. The usefulness of FVMs is being quickly supplanted by alternative sales channels such as mobile ticketing. Customer research will demonstrate the best mix of available hardware to meet operational needs.

Fare Media Types

Changes in fare payment systems and technology have added a variety of new considerations for fare media types.

Near-Field Communication

Near-Field Communication (NFC) is a technology that is embedded in transit smart cards and contactless credit cards, and provides the ability for close proximity interaction between the NFC chip in the device and a contactless reader. A device that is NFC-enabled is considered “contactless”.

Smart cards

Agency smart cards are transit-use only contactless cards issued by transit agencies. Agencies produce and distribute branded cards and may or may not collect a fee for the card from customers. The agency branded smart card is the most common and recognizable feature of fare collection systems today.

Partner-issued (third-party) smart cards

Third-party, compatible smart cards are produced and distributed by a third-party for non-transit purposes (e.g. student cards produced by a college or university). A business agreement is put into place to integrate these third-party contactless smart cards into the fare collection system.

Contactless bank cards (credit/debit)

Contactless bank cards are branded cards (i.e. Visa/MasterCard) issued by financial institutions. These cards are accepted in Open Payment transit fare collection systems, where a contactless credit/debit card can be used at point-of-entry for a single transit fare that is processed as a standard credit/debit transaction. In account-based systems, a credit/debit card can be associated with an account, and when used in transit, can access fare products and transit funds associated with the account. Bank cards and transactions processed through the banking industry require adherence to Payment Card Industry Data Security Standards (PCI) – The definitive security standards and regulations for merchant processing of bankcards.

Prepaid Card/General Purpose Reloadable (GPR) Card

Prepaid cards are private label cards that have traditionally been used in the gift card industry, and can be made available for purchase in retail outlets. These cards are agency branded and can typically only be used for transit. When sold by an external retailer there are typically commissions or fees paid to the retailer.

General Purpose Reloadable cards are branded cards (i.e. Visa/MasterCard) that can be co-branded by the agency. GPR cards are similar to prepaid cards, but can be used wherever the Visa/MasterCard brand is accepted and also have the capability

for the reload of funds. GPR cards typically have high user fees and are heavily regulated.

Prepaid and GPR cards are often considered in order to address unbanked patrons in Open Payment systems. Prepaid and GPR cards for use in fare collection must be contactless. Philadelphia and Chicago systems utilize GPR cards.

NFC Mobile Payments

Long heralded as the payment method of choice for fare collection, the limitation for NFC mobile payments has been the lack of NFC-enabled mobile phones available in the marketplace. NFC-enabled mobile phones interact with the same readers as smart cards and contactless bank cards, making the addition of NFC mobile payments to an existing fare collection system relatively straightforward.

NFC Mobile Payments are becoming a more realistic option for payments based on the introduction of Apple's NFC-enabled iPhone 6. Apps, like Apple Pay, can be used for NFC payments, but a custom agency app can also be deployed for transit-specific use. The most significant factor in NFC mobile payments is the proliferation of NFC-enabled mobile phones.

Barcode Mobile Payments

Barcode mobile payments provide two-dimensional bar-codes and QR codes that are displayed on a mobile phone that can be used for proof-of-payment or can be verified with a bar-code scanner. When used for proof-of-payment, barcodes can include animation, ensuring an additional level of security for visual inspection. Barcode scanners are required for scanning barcodes on paper or on a mobile device.

Limited-use disposable smart cards

Limited-use disposable smart cards are disposable paper tickets with an embedded NFC chip. Limited-use disposable media provide an alternative payment method to the more expensive smart card media, and are meant to be used only a limited number of times. Limited-use media are validated with the same readers as smart cards, but are currently an expensive alternative for managing payments from short-term or one-time patrons.

Other Contactless Devices

Although NFC technology is available in smart cards, credit cards, many building access cards, student identification cards and some mobile phones, it can also be embedded in other devices such as key fobs, wrist bands and watches.

Magnetic cards

Magnetic cards pre-date NFC technology, and rely on data written to a magnetic stripe on the card. When a card is swiped through a reader, the readers read and write data to the magnetic stripe. Magnetic fare cards are proprietary, and are maintained and distributed by the agency. These cards have inherent security issues, so are best suited for single or limited use where they are unlikely to be compromised through hacking.

Media-Related Considerations for Detroit Region

Agency acceptance of multiple media forms will be commonplace in the future as NFC faces off with other technologies. Magnetic media is increasingly seen as a shorter term bridging tool as new systems embrace more secure media forms.

Fare System and Technology Vendors

The tables below provide an overview of the vendors actively participating in fare technology and system integration.

Table 1: System Suppliers / Integrators			
	System Supplier	System Integrator	Web Site
Cubic Transportation Systems	✓	✓	http://cts.cubic.com
SPX/Genfare	✓	✓	http://www.spx.com/genfare
Thales Transportation	✓		http://www.thalesgroup.com/transportation
INIT	✓	✓	http://www.initusa.com
Trapeze	✓	✓	http://www.trapezegrup.com/
Xerox Transport Solutions	✓	✓	http://services.xerox.com/transportation-solutions
Scheidt & Bachmann	✓		http://www.scheidt-bachmann.com/en/fare-collection-systems/
Parkeon	✓		http://www.parkeon.us/
Lecip	✓		http://www.lecip.com/
Vix Technology	✓	✓	http://vixtechnology.com/
Avail Technologies	✓		http://www.availtec.com/
BEA Transit Technologies	✓		http://www.beatransit.com/
Accenture (System Integrator only)		✓	http://www.accenture.com/us-en/Pages/service-public-transportation-overview-summary.aspx

Table 2: Mobile Payment Vendors	
	Web Site
Globesherpa	http://www.globesherpa.com
Blackhawk Network	http://blackhawknetwork.com
CooCoo	https://www.coocoo.com/
Bytemark	https://www.bytemark.co/
Unwire	http://www.unwire.com/
Incomm	http://www.incomm.com/
Masabi	http://www.masabi.com/

Table 3: Fare Media Suppliers		
	Products	Web Site
Giesecke & Devrient	smart cards, limited use smart cards	http://www.gi-de.com
Smartrac Technology	cards, tickets, tokens, key rings, phone tags and other creative form factors	https://www.smartrac-group.com/public-transport.html

Appendix E

Options for a Seamless Regional Fare System

April 2015

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Introduction

This memorandum, the fourth produced for this study, presents and evaluates a set of options for consideration by the Detroit region. The information is broken down into three sections:

- The *System Options* section describes the range of reasonable options for the Detroit Region to consider based on current conditions as well as peer examples.
- The *Evaluation of Options* section presents a comparison of the options based on a variety of factors, including agency, cost, and customer considerations.
- The *Preferred Option* section describes the best option for implementation within the Region based on the evaluation of factors as well as input from agency stakeholders.

Previous phases of this study have established the potential benefits of a more coordinated and technologically advanced fare collection system within the Detroit Region. Experience from other regions suggests that a well-designed and implemented system based on electronic fare payments can provide:

- Increased customer satisfaction
- Greater revenue accountability
- Improved data for service planning and operations
- Enhanced service, especially when transitioning away from on-vehicle cash collections

Each of the above areas has also been identified as potential benefits by the individual service providers in the Detroit region as well. The regional bus agencies (DDOT, SMART and AAATA) currently utilize the same fareboxes (GFI Odyssey), but vary widely in how they collect their fares. DDOT and SMART, which have the vast majority of inter-agency transfers and allow for transfers, rely primarily on cash payments on vehicles, while AAATA primarily has pass users. The Detroit People Mover does not coordinate fares with the other agencies, and also relies on cash fares and tokens for most payments.

In addition, with the establishment of the Regional Transit Authority, the construction of M-1 Rail streetcar, and plans for additional services that better link regional locations and systems, there is an anticipated greater future need for customers to use multiple transit systems.

System Options

Based on a review of the current fare systems in the region and an understanding of the current state of fare technology, three technology options were identified for consideration by regional stakeholders (labeled A, B and C in the table below).

These options are not exclusive of one another, but were developed to illustrate the range of choices available to the region. Each can be thought of as building upon the previous option, so that Option B contains many of the elements of Option A, and Option C encompasses some of the elements of both A and B.

Each option assumes greater cooperation and coordination on fare policies and payment acceptance across the regional transit agencies, while seeking to preserve individual agency control over pricing and policies.

Table 1: System Options Overview		
	Description	Elements
Option A <i>Enhanced Baseline</i>	Use current fare technology and existing regional pass as basis for regional integration.	<ul style="list-style-type: none"> • Agreements on fare interoperability, policies and revenue sharing among all agencies. • Individual agencies advance policy and pricing changes to simplify fare offerings, reduce reliance on cash. All fare systems and data remain housed at operator agencies. • Expand usability to include M-1, People Mover and AAATA. • Could be seen as a temporary option as larger system integration plan moves ahead.
Option B <i>Account-Based Smart Card</i>	Regional agency collaboration on development of regionally branded transit smart card.	<ul style="list-style-type: none"> • RTA likely to lead effort to develop funding and interoperability agreements across all agencies in support of smart card. • Could be contracted through vendor as proprietary system or procured for open system architecture. • Functionality to include account-based system that allows for individuals and employers to manage accounts and track usage. • Potential introduction of mobile ticketing based on model adopted by M-1.
Option C <i>Open Payment System</i>	Regional contract with system integrator that develops comprehensive system based on accepting open payments for transit region-wide.	<ul style="list-style-type: none"> • RTA likely contracts with system integrator who leads integration of process, with individual technology elements procured separately. • Introduction of mobile ticketing and other payment methods (acceptance of credit/debit cards, student/employee IDs, other non-agency issued payment). • Likely includes development and utilization of a remotely hosted, shared backend system support open payments. • May require technology updates to vehicles to support on-vehicle transactions.

Option A – Enhanced Baseline

This option focuses on potential improvements with improved fare policy coordination between the regional transit agencies, but would also likely require some capital system investments to improve functionality and interoperability.

These efforts could build from the interoperability of the existing GFI fare equipment, which is currently set-up to read the fare media from DDOT and SMART but has the capability to incorporate all agencies (with some caveats in the case of M-1). The M-1 Rail, People Mover and AAATA systems could coordinate to accept payment or transfers from these same fare mechanisms.

The potential implementation steps for this option could include:

- DDOT and SMART coordinate fare policies and pricing for their existing monthly pass product as well as value passes, including incentivizing use of passes over on-vehicle cash payment.
- Existing magnetic-stripe fare media is used on near-term basis, with consideration to adopt faster and more durable smart-card product in long-term (would require fare equipment upgrades).
- DTC and AAATA coordinate with DDOT and SMART to accept passes using their GFI-manufactured equipment, including determination of equitable mechanism for reimbursement.
- M-1 coordinates transfer policy with DDOT, SMART and DTC to seamlessly blend in with other systems and accept other agency passes at ticket vending machines or on-vehicle fareboxes.

Essentially, this option sustains the status quo for fare payment in the region, although it does not prevent agencies from coordinating on fare technology standards to ensure future compatibility.

Option B – Account-Based Regional Smart Card

This option would advance the model utilized by most regional “universal fare card” efforts over the past 10 – 15 years, which have been built around a coordinated smart card that is accepted across all agencies.

This option would require significant planning and coordination as well as investment in upgraded fare equipment region-wide, and would likely need to be led by the RTA.

The potential implementation steps for this option could include:

- RTA develops account-based smart card that can be loaded with value or defined period passes.
- RTA works with existing agencies to estimate cost for accepting regional fare card on their systems, either via upgrades to the fareboxes or

Seamless Fare Integration Study for the Detroit Region

procurement and installation of stand-aside readers/validators. Depending on implementation and funding, individual agencies could develop their own approach for accepting smart card fares.

- Work with M-1 Rail to ensure compatibility with ticket vending machines and/or validators on their system.
- Coordinate roll-out of regional fare card across all systems and operators during same time frame to promote seamless travel options.

This option would provide a technological advancement in fare payment for all agencies, and represents a significant cooperative effort. Individual regional agencies, particularly AAATA, are likely to advance to this technology individually in the near future, even without regional coordination. Further adoption of open payments via other mechanisms could be part of the package or advanced on an agency-by-agency basis.

Option C – Open Payments System

This option would embrace the most recent fare payment strategy being advanced by larger regional transit systems by incorporating the advantages of open payments (via non-agency issued mechanisms) as well as open system architecture (allowing multiple vendors to bid on various hardware elements of the system).

One potential option for this approach would be the ability to contract with one of a set of vendors offering non-proprietary “system integration” services, which could include not only setting up the regional system but also ongoing operational support for shared elements such as a back-end system for all financial and ridership data. The fare policy coordination and account-based regional fare card could be integrated as part of the overall system.

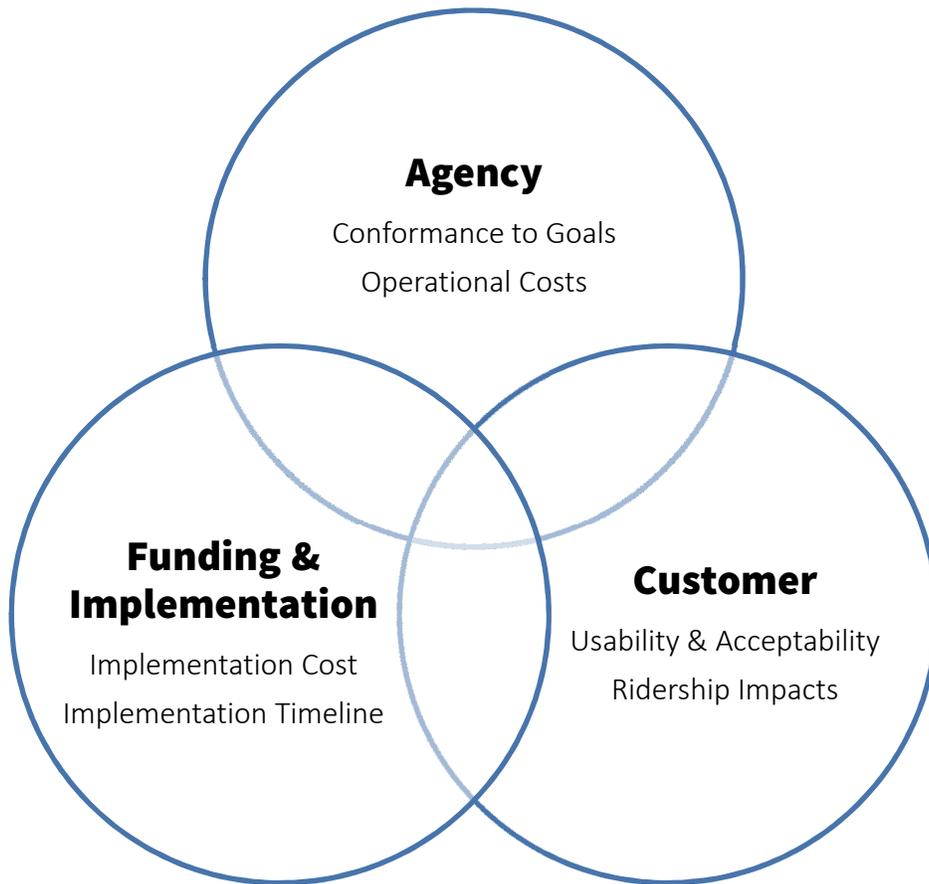
The potential implementation steps for this option could include:

- RTA and regional agencies develop procurement package to contract with fare “system integrator” to help create overhauled regional fare system, with details of package to likely include development of regional fare card as well as integration of open payments from other sources.
- The system integrator would also set up a hosted back-end system that validates all financial and travel information for region, making it accessible to individual agencies for reporting purposes.
- Initial system roll-out would occur as coordinated process, but certain elements (such as open payment types) may still be advanced on agency-by-agency basis.

This option would be the most complex undertaking, and would likely thus have greater costs and a longer timeline for implementation. On the other hand, this option could best position the region for future technology advancement in fare payment.

Evaluation of Options

The options for regional fare integration can be evaluated based on how they impact customers, how they impact agency operations, and the ability to fund and implement them.



Customer Considerations

Key customer considerations for the evaluation include:

- The *usability and acceptability* of the option, which describes the functionality of the system and also the need to accommodate the Detroit region’s existing customer base, which is primarily low-income.
- The *ridership impact* of the option, which particularly reflects the ability to grow ridership by attracting new or infrequent customers to use the system, or to partner with employers and institutions on workplace transportation initiatives.

The table below provides a qualitative discussion comparing the options’ performance in these categories.

Table 2: Customer Considerations		
	Usability & Acceptability	Ridership Impacts
Option A <i>Enhanced Baseline</i>	Moderate - Incremental improvements likely to maintain familiarity for existing customer base but not significantly improve functionality.	Low - Improved fare coordination will benefit existing customers, but likely not provide platform for greater regional interest or ability to coordinate with key external partners.
Option B <i>Account-Based Smart Card</i>	Moderate – Option will expand upon fare payment options, provide existing and new customers with ability to plan transit expenditures. Would require consideration of pricing and distribution network to ensure access for all, adoption by lower-income customers.	Moderate - New regional fare product will allow for uniform marketing and focus, account-based system leads to more coordinated fare.
Option C <i>Open Payment System</i>	High - System will accept whatever payment source is presented, will provide the greatest options for customer base. Introduction of new options would require pricing and distribution network to ensure access to benefits of advanced system.	Moderate to High - Acceptance of any payment source likely to increase potential ridership base, particularly if combined with significant regional service improvements.

Agency Considerations

Key agency considerations for the evaluation include:

- The *conformance to agency goals*, which, according to feedback at meetings through the process included:
 - Reduction in reliance on cash fares.
 - Improved regional transfers and tripmaking between existing systems as well as planned systems (M-1, regional transit).
 - Simplification of fare types within agencies and across region, including validation process for reduced-fare customers.
 - Acceptance of payments via mobile phones and other non-agency issued fare media, (especially for M-1 Rail system).
- The *operational cost impact* of the option, which would largely be based on economies of scale from a regionally operated system as well as the increase in pre-paid fares and resulting lack of cash-handling.

The table below provides a qualitative discussion comparing the options' performance in these categories.

Table 3: Agency Considerations		
	Conformance to Goals	Operational Costs
Option A <i>Enhanced Baseline</i>	Low - Unlikely to drive attraction of new customer base or reductions in cash payment, and also unlikely to be easily compatible with plans for M-1 Rail system.	Low - Individual agencies make fare system investments based on economics of each, however little related benefits from reductions in cash-paying customers.
Option B <i>Account-Based Smart Card</i>	Moderate - Could lead to significant operational improvements due to faster boarding times. Adoption of regional fare would provide improved usage and customer data for agencies to utilize for planning service.	Moderate - Creates new sales channels, potential to shift costs from cash collection to financial settlement. Account-based option could be platform for improved institutional and employer partnerships around system access.
Option C <i>Open Payment System</i>	High - Interagency agreement for entire system procurement and multi-year system operation. Opportunity for significant changes in policies, pricing. Provides opportunity to upgrade to latest technology being adopted by large-Metro transit agencies	Moderate - Creates new sales channels, potential to shift costs from cash collection to financial settlement. Account-based option could be platform for improved institutional and employer partnerships around system access. Shift to non-agency issued payment options reduces agency costs related to pass production.

Funding & Implementation Considerations

Key funding and implementation considerations for the evaluation include:

- The *capital/implementation cost* of the option, which includes not only investments in equipment needed to support the investment but also accompanying investments in support services and initiating the service.
- The *implementation timeline* of the option, which tracks to the amount of likely effort involved in conceiving, designing and implementing the system.

The table below provides a qualitative discussion comparing the options’ performance in these categories.

Table 4: Funding & Implementation Considerations		
	Capital/Implementation Cost	Implementation Timeline
Option A <i>Enhanced Baseline</i>	Low - Likely low initial investments for RTA or individual agencies, future costs of fare upgrades likely to be taken on at agency level.	Immediate - The regional agencies could begin cooperation efforts immediately on fare policy coordination and interoperability of existing systems.
Option B <i>Account-Based Smart Card</i>	Moderate - On-board readers or farebox upgrade, card distribution and reload network, backend processing, mobile application. Initial capital cost could be regional cost or shared across agencies.	Moderate - System could be implemented within a 2 - 4 year timeframe, with initial year spent specifying preferred system and procuring technology vendor, and 1 – 3 years in system design, installation, and piloting.
Option C <i>Open Payment System</i>	High - System integrator/others provide centralized system, compliant on-board readers or farebox upgrade; card distribution and reload network, mobile application, payments processing. Likely to require highest level of investment in fare system upgrades, but contracting with system integrator allows for cost and risk sharing that can offer savings.	Moderate - Long – System could be implemented in 3 – 5 year timeframe, with additional time compared to Option B included for development of shared back-end system.

Evaluation Summary

The evaluation of options indicates that, despite likely having the most cost and longest timeframe, Option C best conforms to regional and agency goals for transit fare coordination, and would be most likely to conform to RTA goals for improving options for regional tripmaking using transit.

Individual elements of that system require further discussions, but in the meantime there are fare policy and coordination objectives (Option A) that would not require significant objectives and could lay the groundwork for maximizing benefits from a regional fare collection system.

Description of Preferred Option

The evaluation of options, combined with agency consultation and input received at the February 2015 meeting of the Providers Advisory Council, support the direction for the region to coordinate and cooperate in developing a long-term plan to implement a regional electronic fare payment system that incorporates both account-based fare payment as well as open payment technologies (Option C).

A summary of the preferred elements of that system are summarized in the table on the following page. This format generally follows the organization of comparable systems presented in the previous memorandum. Further definition of the costs, benefits and implementation steps will be developed in a subsequent memorandum.

Seamless Fare Integration Study for the Detroit Region

DESCRIPTION OF PREFERRED OPTION

Equipment	Fare Media	Public Acceptance	Governance	Procurement	Capital, Operating Costs & Revenues	Management & Operations	Fare Policy Coordination
<p>Upgrade fareboxes & turnstiles with EMV / bar code reader, or install adjacent to existing fareboxes</p> <p>Include CAD / AVL / internet systems for instant validation of open payment sources, & vehicle tracking for operational benefits and customer benefits (offer real time information)</p>	<p>RTA-issued, regionally branded contactless fare card accepted at all agencies</p> <p>Mobile app + online portal for personal account management and fare payment</p> <p>Option for stored value, defined period pass or bonus</p> <p>Customer portal for reloading, tracking trips, managing account</p> <p>Accept credit/debit cards, employee/student IDs, mobile ticketing and contactless media</p>	<p>Third party retail distribution network; Purchase and re-loading of RTA fare media at convenient locations (grocery/drugstore etc.)</p> <p>Develop regionally valid pass program for reduced-fare customers</p> <p>Partner with social service agencies to distribute fare cards or consider reduced fares for low-income customers (may be coordinated with State Bridge Card program)</p> <p>Customer-registered accounts offer loss protection</p>	<p>RTA to oversee system operations</p> <p>Individual agencies decide when and how to limit cash fares</p> <p>Option for regional fares to enhance regional travel</p> <p>Open payments determined or initiated agency-by-agency</p>	<p>RTA contracts with system integrator to develop and operate back end system</p> <p>Open source system allows future, non-proprietary components to be added over time without major system replacement, i.e. handheld inspection readers, iris scanners</p>	<p>Development of remotely hosted, shared back-end system for regional electronic fare payment.</p> <p>Data tracking used to determine revenue flow to individual agencies, e.g. # trips/agency, point of sale</p> <p>Agencies able to access system for financial and utilization data (agency firewalls)</p>	<p>New regional, web-based portals for management of fare media and accounts</p> <p>Institutional portal for institutions and employers to manage own accounts/pass programs, including employer-sponsored commuter benefits</p>	<p>Pricing / policy alterations to incentivize regional fare product and other non-cash payment options</p> <p>Possibility to allow cash pmt option on vehicles with current farebox (determined by individual agency)</p> <p>Partner with social service agencies and Bridge Card program to distribute cards</p> <p>Phase out legacy magnetic & other regional / value / period pass products (optional)</p>

Appendix F

Automated Guideway Peer Comparison

June 2015

MONORAIL/AUTOMATED GUIDEWAY PEER COMPARISON

Overview

This memorandum describes operating comparisons for Detroit People Mover peers. The People Mover is an automated light rail system that is part of the Detroit regional transit system. The single track loop runs 2.9 miles around Detroit’s central business district. The operator of the People Mover, the Detroit Transportation Corporation, currently spends over half a million dollars annually on fare collection. This includes staff time and resources as well as the costs of equipment maintenance and an armored car contract.

The Seamless Fare Integration Study for the Detroit Region has estimated the cost of upgrading People Mover fare collection equipment to be between \$1M and \$1.6M. Other agencies with similar systems, notably Jacksonville’s Skyway and Miami-Dade’s Metromover, have decided to move to a fare-free model in recent years. In the case of Jacksonville, the agency specifically adopted a fare-free model in 2012 in order to avoid fare collection equipment upgrades. In 2002 the Miami-Dade Metromover also went fare-free, citing minimal net revenue after collection costs were accounted for.

Operating Comparison Overview

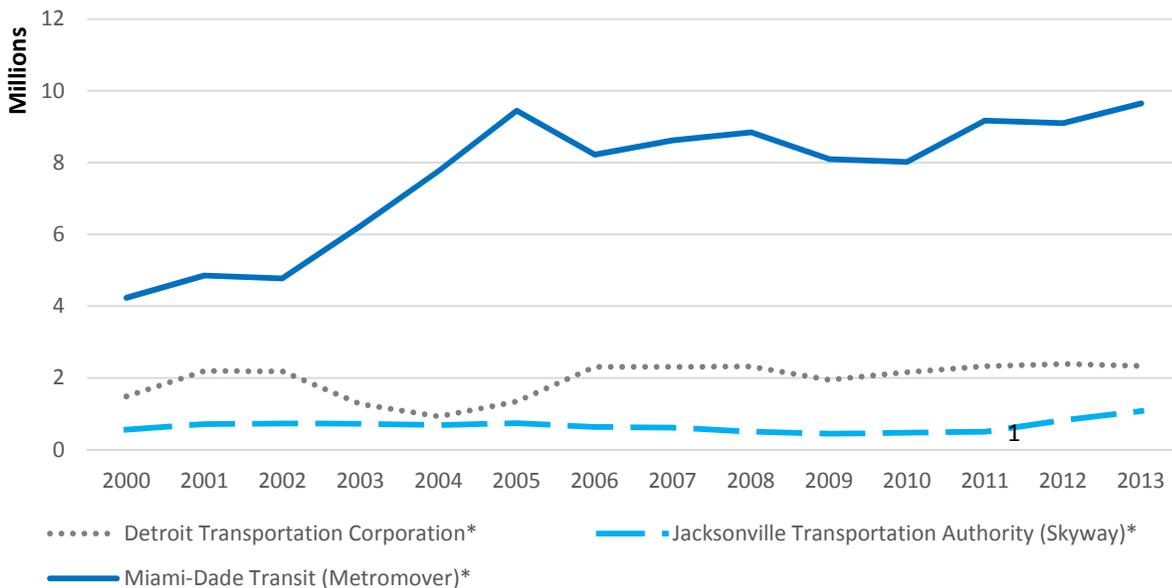
	Jacksonville Skyway	Miami-Dade Metromover	Detroit People Mover
Fare	-	-	\$0.75
Directional Route Miles	5.4	8.5	2.9
Vehicles Operated in Max Service*	5	21	10
Weekday Operating Hours	6AM - 9PM	5AM - 12AM	6:30AM-12AM**
Days of Operation	Mon-Fri	Mon-Sun	Mon-Sun
~Wait	3-6 min	5-10 min	3-4 min
~Ridership*	1.1M	9.6M	2.3M
~Annual Operating Cost*	\$6.5M	\$22.5M	\$11.7M

* Figures based on 2013 National Transit Database Profiles

** Friday service extended to 2AM

Ridership increased dramatically on the Miami-Dade system after moving to a fare-free model. From November 2001 to November 2002, weekday ridership on the Metromover increased 52%. During the same period, weekend ridership increased by 80% (see “Annual Ridership” figure).

Annual Ridership



Source: National Transit Database

Below is an introduction to the Jacksonville Skyway and Miami-Dade Metromover, with information on ridership, recent fare history, struggles and funding.

JACKSONVILLE TRANSPORTATION AUTHORITY

Overview

Jacksonville Transportation Authority’s (JTA) Skyway is a 2.5 mile automated monorail system that connects Jacksonville’s downtown core and Southbank to the rest of JTA’s bus, Bus Rapid Transit (BRT), and trolley system. Skyway is intended to complement the downtown trolley service which offers weekday lunchtime trips between the Five Points Historic District in Riverside and The Landing in Downtown Jacksonville. Skyway is operated from 6:00 AM to 9:00 PM Monday through Friday. Saturday and Sunday service is only available during special events. Peak hour frequency for Skyway is every three

minutes (6:00 AM to 9:00 AM and 4:00 PM to 6:30 PM), while off peak frequency is between three and six minutes.

Currently, the Skyway is fare-free. In 2012, the Skyway was temporarily made free to ride (before 2012, the fare was \$0.50). The fare-free approach was implemented as a way to avoid upgrading the payment method system on the Skyway (STAR Card Readers). It continues to be fare-free as a way to consolidate downtown bus routes, eliminate trolleys, truncating bus routes, and to link more bus routes to the Skyway. The fare-free approach spurred a huge jump in ridership in the six months after implementation as compared to the same six months the previous year (February-July 2012 showed a

62.7% increase in ridership over February-July 2011) (Davis, 2012). Fare-free rides will continue until at least September 2015 when it is expected that the results of the Skyway System Plan and Technology Assessment will be released.

JTA expected to lose \$130,000 in 2012/2013 as a result of free fares, but would save \$200,000 by not installing the new fare card readers. JTA also realized that it was only recovering close to 4% of the operating costs through fares (Hannan, 2012). More recently, JTA has started to lose \$500,000 a year in fare revenues but believe the tradeoffs have been worth it (increased ridership, and fare collection savings). In 2014, JTA looked to reinstate a fare, but there was no support from local stakeholders for doing so. Most of the local stakeholders believe that the fare-free policy for the Skyway is an asset to the City.

Ridership

Ridership on the Skyway has always fallen short of projected numbers. One major factor for the underperformance was a loss of employees in the Central Business District at the same time that the Skyway was built.

Ridership for the Skyway is mostly workers, or the “lunch crowd”. Smaller demographics that use Skyway are Florida State College at Jacksonville students, tourists, and people experiencing homelessness, typically when it is very hot.

Most of the riders are accessing the system by walking. About 25% of ridership comes from bus transfers, primarily at the two end stations. Another 5% comes from park-and-ride lot transfers at the two end stations. A few riders bike to the stations, although bikes are not allowed on the vehicles during peak hours.

Ridership was previously calculated using automated passenger counters (APC), but JTA found that they

Skyway Map



Source: jacksonville.com

were undercounting by about 30%. This led to the installation of turnstiles to improve accuracy. JTA is currently going out for bid for a new type of APC that will be more accurate. The switch to turnstiles, and now better APCs, will allow JTA to secure more State of Good Repair funding which depends, in part, on ridership.

Struggles

An article on the website www.metrojacksonville.com discussed some of the struggles Skyway has experienced since it first started to operate in 1989. Originally, Jacksonville envisioned a 42-mile rapid transit system to feed the Skyway with riders from other areas of the region. The rapid transit system is just now in Phase I, planning and construction of downtown enhancements (Pickrell, 2014).

Seamless Fare Integration Study for the Detroit Region

It also did not help that, for years, JTA's bus/trolley routes duplicated the Skyway route, causing them to compete for a limited pool of riders.

Ennis Davis, a transportation planner at Ghyabi & Associates and co-founder of metrojacksonville.com, talks about the success and failures of People Mover systems in Jacksonville, Detroit, and Miami:

Both the JTA Skyway (4,100 daily riders) and Detroit People Mover (5,300 daily riders) have struggled partially because the downtowns they were meant to serve have dramatically declined over the last 30 years. However, they have also struggled because they are representative of incomplete and poorly integrated transit networks. On the other hand, Miami's Metromover has seen much higher ridership (+35,000 daily riders) and is a catalyst for infill transit-oriented development because that community has heavy rail and commuter rail lines feeding the system with riders and support land use policies that encourage dense infill development around its stations (Pickrell, 2014).

Riders experiencing homelessness have increased since Skyway implemented its fare-free policy. Crime has not increased, but JTA and the local police have decided to monitor the homeless riders and ask them to leave after a few roundtrips.

Funding

JTA has a sales tax and a city gasoline tax that help fund operations of the Skyway. JTA also receives State of Good Repair funds which is the largest funding source for operations of the Skyway. JTA is currently exploring selling naming rights to the stations to increase revenues.

Sources

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MIAMI-DADE TRANSIT (MDT) (METROMOVER)

Overview

Miami-Dade Transit’s (MDT) Metromover is a 4.4 mile electrically-powered, fully automated people mover that connects with Metrorail and Metrobus at various stations downtown. Major destinations of Metromover include American Airlines Arena, Bayside Market Place, Miami-Dade College, and Miami-Dade County School Board. Metromover is operated from 5:00 AM to 12:00 AM Monday through Sunday. Peak hour frequency is every 90 seconds, while off peak frequency is three minutes.

Metromover has been fare-free since 2002. Before 2002, the cost to ride was \$0.25. It was determined at that time that the revenues generated from fares barely exceeded the cost of collecting them. It was, therefore, proposed that a free Metromover would increase ridership on Metromover and Metrorail while resulting in a minimum loss of revenue. When the 2002 referendum for a half-penny sales tax passed, the fare for Metromover was eliminated.

Ridership

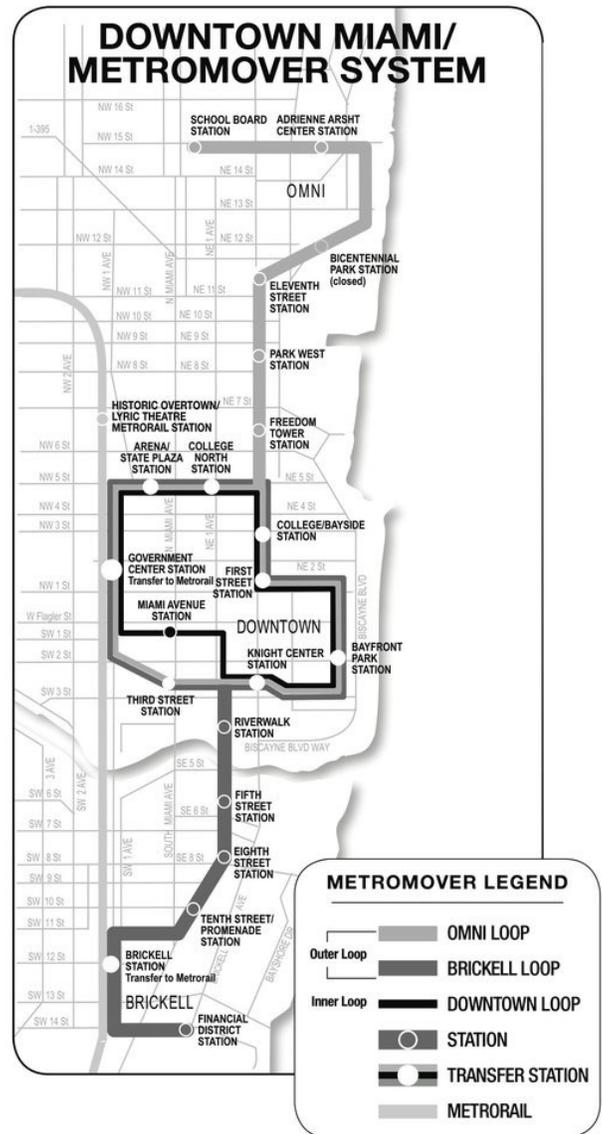
When Metromover went fare-free, weekday ridership increased about 52% from November 2001 compared to November 2002. Weekend ridership compared during the same time period increased by 80% (Dinkova, 2015).

Automated Passenger Counters (APCs) are used at entrances to Metromover stations to count riders.

Struggles

Based on recent research, Miami-Dade Transit (MDT) considered a fare for its Metromover. A Commissioner said “charging a fare is a way to transfer the cost of public transportation to people who can more afford it, such as those living and working downtown, from those who can least afford

Metromover Map



Source: mobilemaplets.com

it, meaning people who don’t qualify for a county subsidy to use mass transit in other parts of the county” (Dinkova, 2015).

If a \$0.50 fare is charged, it would take the county five to ten years to recover the initial capital expense of a fare collection system, which would cost the county \$475,000 a year to operate and maintain (Dinkova, 2015).

During public hearings on the topic, feedback from area businesses was in support of Metromover

Seamless Fare Integration Study for the Detroit Region

remaining free for passengers because fares could deter people from shopping and doing business in the local area.

In an article posted by *The Next Miami*, their source estimated that it would cost between \$2.4 million and \$9 million to install a fare collection system. This source also estimated the yearly operating and maintenance to be \$525,000. If ridership figures remain close to current levels, and Metromover charged a \$1 fare, it would generate between \$1.8 and \$2.7 million, annually. The revenue would not only go towards operating Metromover but also towards other transit projects and free senior transportation (TNM Staff, 2015).

It was ultimately decided not to introduce a fare to Metromover (by County Commissioners' vote). MDT and the County Commissioners determined that the return on investment would take close to ten years and was not worth the effort.

Funding

Among other funding sources, MDT receives funds through a sales tax, property tax, and a gasoline tax for the Metromover.

Sources

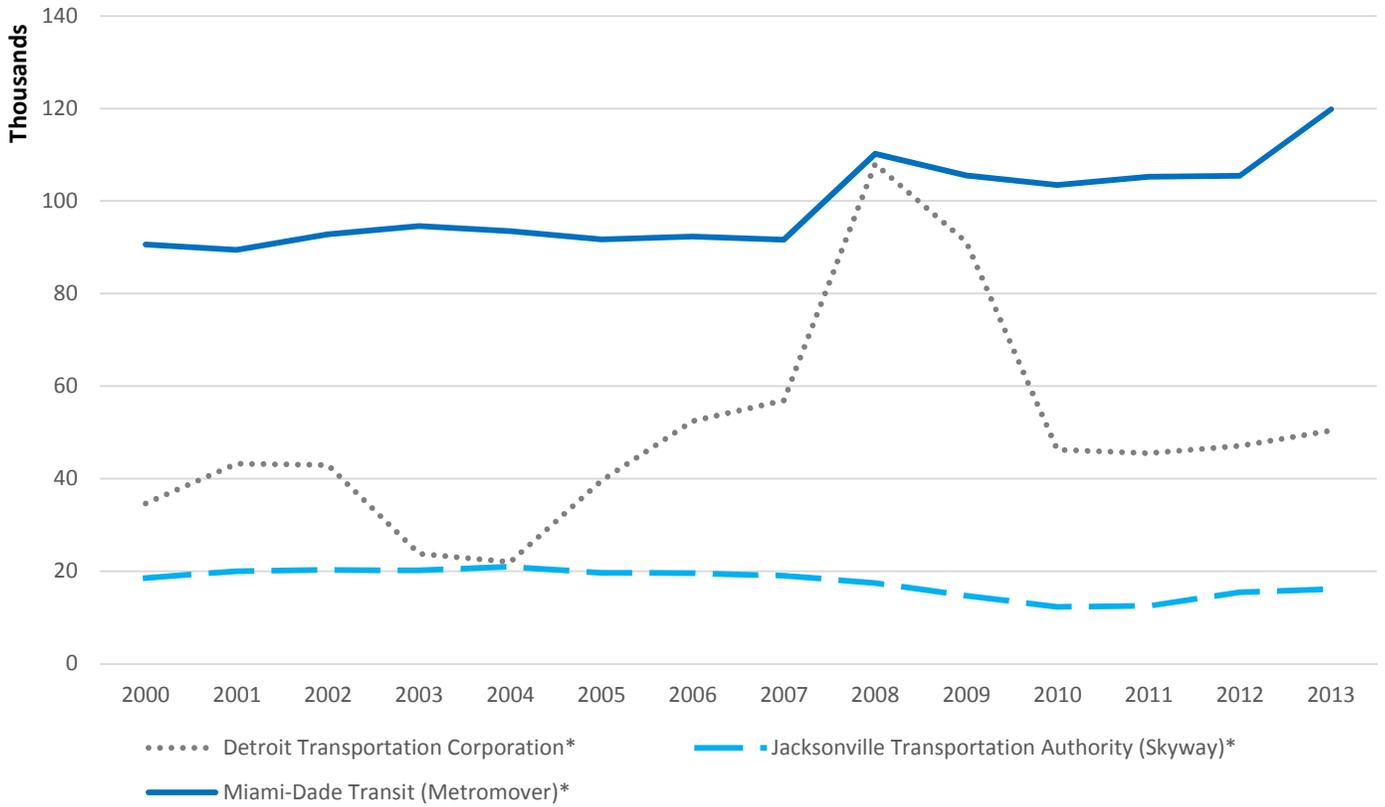
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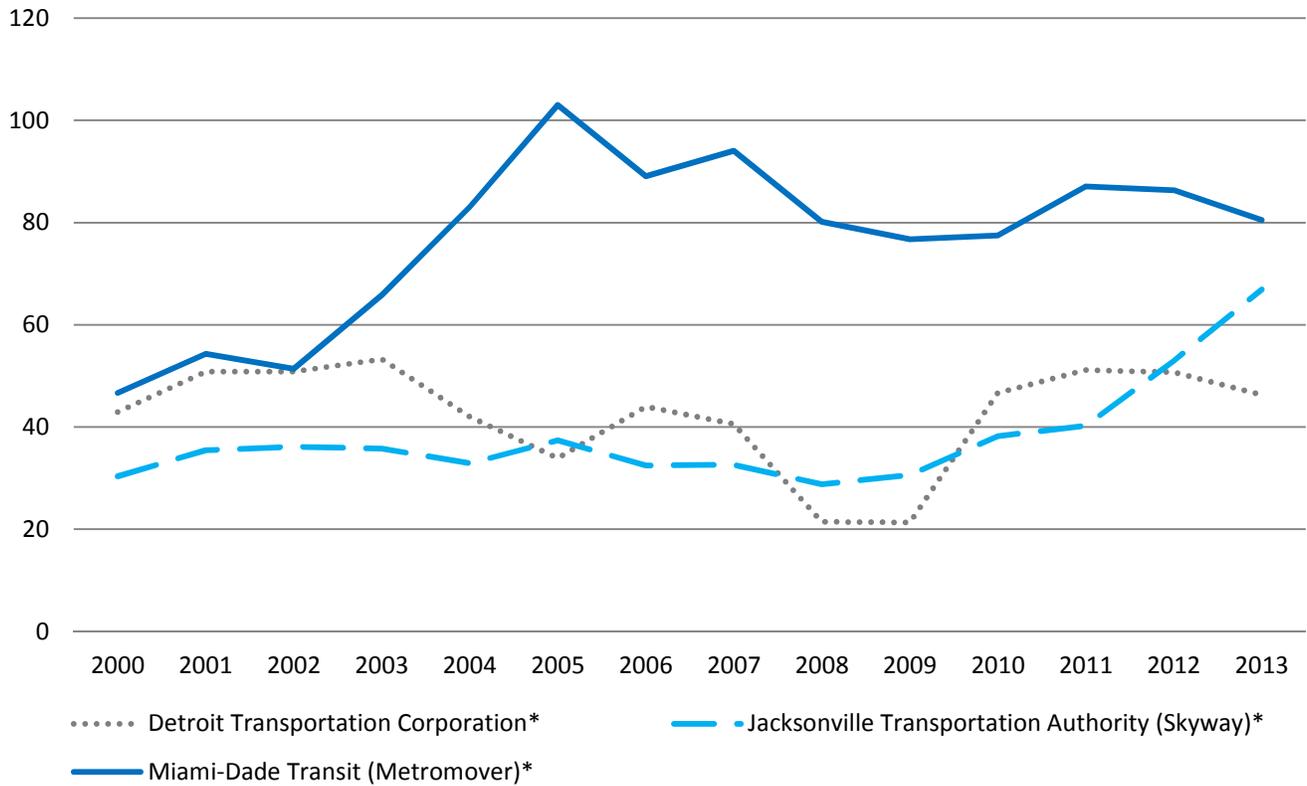
OPERATIONS COMPARISON

National Transit Database (NTD) data was collected for each of the three people mover systems. Graphs were created to compare ridership, revenue hours, and riders per hour from 2000 to 2013. Tables were also provided that compares 2013 NTD data for Detroit’s People Mover with Jacksonville Transportation Authority’s Skyway and Miami-Dade Transit.

Revenue Hours



Riders Per Revenue Hour



Operating Data, NTD 2013

	Ridership	Revenue Miles	Revenue Hours	Uses of Capital Funds
Detroit People Mover	2.3M	600K	50K	\$2M
Jacksonville Skyway	1M	180K	16K	\$2.1M
Miami-Dade Metromover	9.6M	1.2M	120K	\$5.1M

	Operating Expenses				
	Vehicle Operations	Vehicle Maintenance	Non-Vehicle Maintenance	General Administration	Total
Detroit People Mover	\$3.9M	\$3.6M	\$530K	\$3.6M	\$11.7M
Jacksonville Skyway	\$1.1M	\$2.7M	\$880K	\$1.6M	\$6.5M
Miami-Dade Metromover	\$6.7M	\$7.3M	\$4.9M	\$3.4M	\$22.5M

	Operating Statistics				
	Operating Expense Per Revenue Mile	Operating Expense Per Revenue Hour	Operating Expense Per Trip	Trips Per Revenue Mile	Trips Per Revenue Hour
Detroit People Mover	\$20	\$233	\$5.03	3.98	46.29
Jacksonville Skyway	\$35	\$400	\$5.98	5.89	66.92
Miami-Dade Metromover	\$18	\$188	\$2.33	7.89	80.47

Source: NTD 2013 Data. Data rounded for legibility

*Monorail/Automated Guideway Only