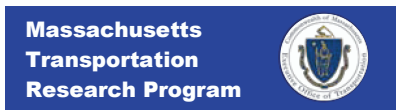
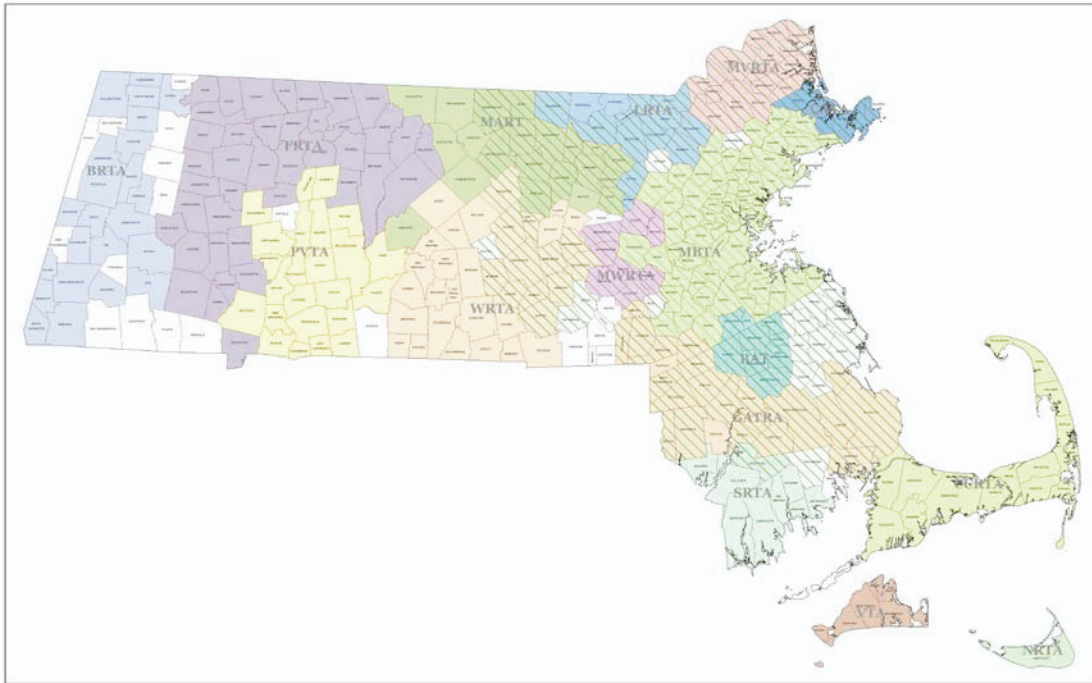




University of Massachusetts
Transportation Center

Integrated Fare Card System Synthesis Report



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16. Abstract <p>The Massachusetts Bay Transportation Authority has developed a contactless fare card system to automate the collection of fares along its rail and bus route services. At the same time, there are indications that other regional transit authorities as well as other transportation providers in the Commonwealth are considering new technologies to streamline their payment collection and processing activities. A major question being raised is: "Are there merits to the development of an integrated system so that multiple fare payments could be collected in a coordinated manner by two or more regional transit authorities with a single card or other medium?" An objective of this research project is to address this question by identifying the benefits and challenges associated with the development and deployment of such an integrated fare card and payment system. The anticipated benefits of an integrated fare card system include user convenience; equity and fairness; improved data collection; cost sharing; and reductions in operating costs and increases in revenue. Challenges identified include personal identification security; administrative issues; technology concerns; service coordination issues; and system affordability. Based on the results and conclusions of this synthesis, recommendations have been developed and proposed to serve as a set of guidelines in assisting integrated fare card stakeholders as they move forward with consideration of an integrated fare card system.</p>			
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Integrated Fare Card System Synthesis Report

**Final Report
Task Order #8
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DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Executive Office of Transportation and Public Works, or the Federal Highway Administration and the report does not constitute a standard, specification, or regulation.

EXECUTIVE SUMMARY

This research synthesis project, Integrated Fare Card System, was undertaken as part of the Executive Office of Transportation and Public Works (EOT) Research Program. The program is funded with Federal Highway Administration (FHWA) Statewide Planning and Research (SPR) funds. Through this program, applied research is conducted on topics of importance to the Commonwealth of Massachusetts.

Purpose of Project

The Massachusetts Bay Transportation Authority (MBTA) has recently developed and is currently deploying a contactless fare card system to automate the collection of fares along its rail and bus route services. At the same time, there are indications that other regional transit authorities (RTAs) as well as other transportation providers in the Commonwealth are considering new technologies to streamline their payment collection and processing activities. The purpose of the project is to develop guidelines for transportation decision-makers and other members of the transportation community who may be involved in the planning, design, and deployment of innovative payment systems. Central to the scope of work in the project was an examination of the issues, challenges, benefits, costs, risks, and opportunities associated with the development of an integrated fare card system that enables multiple fare payments to be processed in a coordinated manner by two or more transit authorities with a single card or other medium. The scope of work included three tasks which are described below, along with the findings, results, conclusions, and recommendations.

Findings and Results

Task 1 was a literature review that focused on the identification of major issues, challenges, benefits, risks, costs, and opportunities associated with the planning and deployment of an integrated fare card system. The major findings and results in Task 1 are as follows:

- The major issues identified in the literature synthesis relate to institutional and technological concerns. Institutional issues pertain to strategic planning and fare policy; the payment process including billing and reconciliation; partnering agreements and governance; user acceptance; and privacy. Technological concerns pertain to hardware, software, and other equipment-related decisions and potential interoperability features.
- Potential challenges relate to labor relations; funding; equity and fairness; and coordination and organizational issues.
- Anticipated benefits include increases in revenue; reductions in operating expenses; enhanced customer convenience; better security; and greater equity.
- Possible risks include unexpected technology problems during implementation; potential of unmet traveler expectations; possible cost overruns and limited (if any) cost savings.

- Opportunities could include the development of innovative pricing strategies; creation of partnerships among transit operators, the financial industry, and local business community to share costs, benefits, and risks; the establishment of a single, integrated payment system to improve the delivery and overall image and utility of public transportation and other transportation services.

Task 2 included conducting a survey to determine views of selected transportation professionals and industry representatives in Massachusetts involved in electronic payment system planning and deployment. The survey focused on the benefits and challenges of planning and deploying an integrated fare card system Statewide.

Individuals interviewed were employed with a regional transit authority, a regional planning agency, a private bus operator, or a credit card company. These individuals were interviewed and also participated in a conference panel discussion. Major benefits and challenges identified through the survey and panel discussion are:

- The anticipated benefits of an integrated fare card system as viewed by these individuals include user convenience; equity and fairness; improved data collection; cost sharing; and reductions in costs and increases in revenue.
- The expected challenges identified through the interviews and panel discussion include personal information and identification security; administrative issues; technology concerns; service coordination issues; and system affordability.

Task 3 included the preparation of a Final Report including the presentation of conclusions and recommendations. This document constitutes the Final Report on the project.

Conclusions and Recommendations

While the results of Task 1 and Task 2 indicate that selected individuals in Massachusetts as well as California, Florida, Virginia, and other states anticipate integrated fare card system benefits, the results also suggest that there will be administrative and technological challenges encountered in integrated fare card system planning and deployment. Based on these results, conclusions and recommendations were developed and proposed to serve as a set of guidelines to assist the transportation agencies and other stakeholders as integrated fare card and payment systems are being considered. These conclusions and recommendations are as follows:

- Given that the MBTA Charlie Card has been deployed, this medium should be reviewed as a possible statewide integrated fare card.
- An institutional structure needs to be established in order to seek and obtain input and feedback from important stakeholder agencies and individuals. Such a structure would lead to the determination of the current level of interest,

expectations, merits, and challenges associated with the deployment of an integrated electronic payment system for transportation services in the Commonwealth. While the Task 2 survey results suggest that there is interest among some stakeholders in integrated payment systems in Massachusetts, experiences in New York, Washington D.C., Chicago and San Francisco, for example, suggest that such an institutional structure is essential in the planning stages to provide all stakeholders an opportunity to participate and voice their interests and concerns effectively. Examples of stakeholder agencies and organizations that have been involved in experiences elsewhere include regional transit authorities; public and private transit operators; toll road, bridge, and tunnel agencies; parking authorities and operators, major public and private sector employers; representatives from the credit card and technology industries; and university transportation centers. Input from these and other stakeholders will be critical to address the coordination, funding, and technology challenges as identified in the Task 1 literature review and the Task 2 survey.

- As part of the planning process, consideration should be given to preparing an agreement outlining the mission and goals of an integrated payment system involving multiple regional transit authorities. Based on expert judgment and experiences elsewhere, a special effort should be made in the mission and goals statement to identify the transportation markets to be served with the payment system and the technologies available to deploy such systems. To the maximum extent possible, such an agreement should be simple and informal, similar to the agreement established by the Interagency Advisory Group (IAG) in the initial planning and deployment of the EZ Pass system. Consistent with the integrated payment system mission and goals, the agreement would propose that a Strategic Plan be developed consisting of an integrated payment system vision statement, system objectives, a system concept of operations, and a financial implementation strategy.
- In the development of the agreement consideration should also be given to establishing a stakeholder organization as the “lead agency”. The “lead agency” would have the major responsibility of working directly with all stakeholders and ensuring that the agreement is used as a guide in the planning process and that the Strategic Plan is employed consistent with the Plan’s vision and objectives and in concert with the views and desires of all stakeholders. Integrated payment systems experiences in California, Illinois, and Florida show that the “lead agency” varies by geographic location and that the “one size fits all” concept does not necessarily apply. For example, in some experiences the “lead agency” was the major transit authority in the State or metropolitan area, while in other areas “lead agencies” included the metropolitan transportation organization (MPO), a toll road agency, and a State Department of Transportation.

It is also noted that the conclusions and recommendations outlined above could provide guidance in the planning, design, and deployment of a statewide integrated payment system consistent with Governor Deval Patrick’s current transportation

policy, as presented in the Massachusetts Executive Order, No. 488, establishing the Massachusetts Mobility Compact.

TABLE OF CONTENTS

TECHNICAL REPORT DOCUMENT PAGE	i
ACKNOWLEDGEMENTS	iii
DISCLAIMER	v
EXECUTIVE SUMMARY	vii
TABLE OF CONTENTS	xi
1.0 INTRODUCTION	1
1.1 Background	1
1.2 Objective of Synthesis.....	1
1.3 Scope of Work.....	2
2.0 RESULTS	3
2.1 Literature Synthesis	3
2.1.1 Findings	3
<i>Major Issues</i>	3
<i>Benefits</i>	5
<i>Challenges</i>	7
<i>Privacy</i>	7
<i>Technology</i>	7
<i>Labor Relations</i>	8
<i>Funding</i>	8
<i>Organizational</i>	8
<i>Risks</i>	9
<i>Opportunities</i>	10
2.1.2 Summary and Conclusions.....	11
2.2 Survey of Individuals.....	11
2.2.1 Findings	12
<i>Benefits</i>	12
<i>User Convenience</i>	12
<i>Equity and Fairness</i>	13
<i>Improved Data Collection</i>	13
<i>Cost Sharing</i>	14
<i>Reductions in Costs and Increases in Revenue</i>	14
<i>Challenges</i>	15
<i>Personal Identification Security</i>	15
<i>Administrative Issues</i>	16
<i>Technology Issues</i>	17
<i>Service Coordination Issues</i>	18
<i>System Affordability</i>	18
2.2.2 Summary and Conclusions.....	19
3.0 CONCLUSIONS AND RECOMMENDATIONS	21
4.0 REFERENCES	23
5.0 APPENDICES	25
APPENDIX A ANNOTATED BIBLIOGRAPHY	25
APPENDIX B SAMPLE EMAIL TO INDIVIDUALS SURVEYED.....	49

1.0 INTRODUCTION

This research synthesis project, Integrated Fare Card System, was undertaken as part of the Executive Office of Transportation and Public Works (EOT) Research Program. This program is funded with Federal Highway Administration (FHWA) Statewide Planning and Research (SPR) funds. Through this program, applied research is conducted on topics of importance to the Commonwealth of Massachusetts.

1.1 Background

The MBTA has developed and is deploying a contactless fare card system to automate the collection of fares along its rail and bus route services and at its parking facilities. Additionally, there are indications that other regional transit authorities as well as other transportation providers in the Commonwealth are considering new technologies to streamline their fare payment collection and processing activities. The purpose of the project is to develop guidelines for transportation decision-makers and other members of the transportation community who may be involved in the planning, design, and deployment of innovative payment systems. Central to the scope of work in the project was an examination of the issues, challenges, benefits, costs, risks, and opportunities associated with the development of an integrated fare card system that enables multiple fare payments to be processed in a coordinated manner by two or more transit authorities with a single card or other medium. Consistent with the intent of Governor Patrick's Executive Order No. 488 to direct the Executive Office of Transportation and Public Works (EOTPW) to establish a Mobility Compact, such an integrated payment system has the potential to "..... (1) to improve administrative efficiencies and program effectiveness; and (2) to assure the coordination and quality of roadway, transit, airport, and port infrastructure and security, between and among the several agencies and authorities.....".

1.2 Objectives of Synthesis

The main objective of this project has been to identify the major issues, challenges, benefits, costs, risks, and opportunities associated with the development of a statewide integrated fare card and payment system for transit services.

A secondary objective of the project was to assist selected members of the transportation community in Massachusetts who are considering the possibility of developing a statewide integrated fare card system. The conclusions and recommendations of this synthesis are intended to serve as guidelines to provide technical assistance and policy

guidance for transportation decision-makers and other members of the transportation community who may eventually be involved in the planning, design, and deployment of an integrated fare card and payment systems.

To accomplish these objectives, the project scope of work consisted of three tasks as described in Section 1.3.

1.3 Scope of Work

TASK 1. Synthesize the Literature. Technical reports, journal articles, and other written documents as well as internet based sources were reviewed and synthesized for the purposes of identifying the major issues, challenges, benefits, risks, and opportunities associated with the planning, design, and deployment of integrated fare card systems and other types of electronic payment systems for transportation and other services.

TASK 2. Survey of Individuals. A small group of individuals were identified and surveyed to determine their expectations related to the benefits and challenges associated with the deployment of a statewide, integrated fare card payment system. An effort was made to survey a representative cross-section of individuals across the Commonwealth in public and private transportation organizations. Personal interviews were conducted either face to face and/or through teleconference calls.

TASK 3. Prepare a Final Report. The final report presents the results of Tasks 1 and 2 as well as conclusions and recommendations which serve as a set of guidelines to provide technical assistance and policy guidance to decision-makers and other members of the transportation community in Massachusetts as they move forward in the planning, design, and deployment of an integrated fare card payment system.

2.0 RESULTS

This section of the report presents the major results of Task 1: The Literature Synthesis and Task 2: The Survey of Individuals.

2.1 Literature Synthesis

This section of the report presents the major results of Task 1: The literature Synthesis and Task 2: The Survey of Individuals. The literature synthesis provides a review of technical reports, journal articles, and other written and internet based documents that pertain to the planning, design, and deployment of integrated fare card applications and other electronic payment systems for transportation and other services. Reports and articles were drawn largely from documents published by the Transportation Research Board, the Intelligent Transportation Society of America, and the U.S. Department of Transportation. The literature synthesis focused on the major issues, challenges, benefits, risks, and opportunities associated with the deployment of integrated fare card applications and other electronic payment systems. The major findings of the literature synthesis are summarized below and an annotated bibliography with further details is included in Appendix A.

2.1.1 Findings

Major Issues

There are many issues associated with planning, designing, and implementing integrated fare card applications and electronic payment systems in general. A report by Easley, Plotnikov, and Easley (2001) describes two basic types of issues that must be addressed at the start of an electronic payment system project. They include: 1) institutional issues (e.g. who are the partners in the project and what will be their respective roles; and 2) technological issues (e.g. what medium will be used, what hardware and software will be procured). Fleishman, Schweiger, Lott, and Pierlott (1998) suggest that such electronic fare projects require that a clear institutional structure be put in place that defines the roles and responsibilities of the participating transit agencies. The institutional structure should attempt to identify the major costs, benefits, and risks to each agency before the project begins.

Based on a review of six case studies, Collura and Dinning (1996) identify the following key institutional issues that need to be addressed. These issues center on: 1) strategic planning and fare policy, 2) technology used, 3) the payment process, 4) partnering agreements and governance, 5) user acceptance, and 6) privacy. Collura and Dinning (1996) also recommend building a “business case” for the project in order to demonstrate the benefits and costs to potential partners and stakeholders.

The Ventura County demonstration project (USDOT, 2001) illustrates the need to have a strong leadership team with the ability to effectively manage the implementation of an electronic payment system. The Ventura County experience attributes many problems

they encountered to an undersized staff that was not equipped with the technical and leadership skills needed to manage the complex project. Despite these initial problems, the matters improved when a project manager was hired.

The need for careful planning and communication among the various stakeholders and transit agencies involved is also reiterated in other studies. In one study, Booz-Allen & Hamilton, Inc. (2000) recommends implementing a strategic plan at the beginning of electronic payment system projects. In addition, Fleishman, Schweiger, Lott, and Pierlott (1998) also indicate that each participating transit agency should have a dedicated project “champion” with the interest and initiative to move the project forward. This suggestion was also recommended by the Ventura County case study (USDOT, 2001).

Collura and Plotnikov (2001) suggest that transit professionals need more information to better evaluate alternative electronic payment system applications during the planning phase and that planning requires a “broad based view of the transit system environment” considering many factors including the concerns of all stakeholders and the various technologies that are available. They claim further that project objectives must be established with input and guidance from all project participants and stakeholders.

Similarly, a report by Turban and Brahm (2000) advises assessing the complete costs and benefits to both transit providers and users before planning the implementation. Specifically, transportation managers need to evaluate their respective markets and products to determine the most appropriate system and technology strategy.

The Georgia Regional Transportation Authority (GRTA) report (Manuel Pardon & Associates, 2003) suggests that issues such as fare policies, fare structures, fare strategy, and fare payment technology should all be included in an Interagency Fare Policy Agreement signed by all regional partners before a project begins. The report also suggests that a “project planning team” be created to address the most critical questions - especially those pertaining to fare policy - early on, as part of the project planning phase.

Fleishman, Schweiger, Lott, and Pierlott (1998) emphasize the necessity of carefully outlining the expected costs and benefits to the various participants. These include estimates of project costs (and how they will be shared among regional partners) and any legal or jurisdictional issues that may relate to the effort. The report suggests that participating transit agencies should identify goals that they intend to achieve and any anticipated constraints. In addition, the report proposes that steps should be taken to articulate the roles and responsibilities of the different participating agencies.

Fleishman, Schweiger, Lott, and Pierlott (1998) highlight another important issue related to user acceptance. The report concludes that the “ultimate success of electronic payment systems will depend on the degree of acceptance of electronic payment systems by issuers, merchants, and consumers.” An innovative method of achieving user acceptance was illustrated in the Orlando Field Test (Goeddel, 2000) with a “cardholder recruitment plan.” This included a user education component that showcased the benefits of the smart card system. This was seen as an important way to ensure high user involvement

and loyalty. Incentive schemes that included preloaded smart cards were also seen as important to attracting card users.

Collura and Dinning (1996) highlight privacy concerns. These concerns emanate from the fact that electronic payment systems often generate a record of user transactions and travel which some users may consider personally intrusive. To address this issue, some transit agencies give users the option of not having personal identification numbers on smart cards in order to remain anonymous. They recommend that transit agencies implement stringent privacy policies to protect users.

Turban and Brahm (2000) point to card security as a major issue that must be addressed in order to attract users. Users must be assured that the money stored on transit cards is safe and that the clearinghouse will bill them properly. Microprocessor-based cards - as opposed to magnetic strip cards - have proved to be very accurate and allow users to cancel cards if they are lost or stolen. Successful demonstration projects can help address these types of user concerns.

Equity issues that must be addressed are highlighted by McDonald (2000). Underscoring the need to respond to equity and fairness issues, is the fact that federal law requires that public transportation be accessible to all, therefore, transit agencies must meet the needs of users that may not have access to smart cards, credit cards, cell phones, and other technologies. In light of this, most systems still provide the opportunity for users to purchase some form of payment (prepaid card or other media) with cash. This approach also addresses the needs of the casual user.

Benefits

The literature describes a range of benefits expected with the introduction of electronic payment systems. Collura and Dinning (1996) highlight the following potential benefits: increased revenue, reductions in operating expenses, and enhancements in security, equity and quality of transit service.

Electronic payment systems can also increase revenues by reducing fare evasion, and allowing agencies to collect the interest earned on card balances (float). Some transit agencies even sell advertising space on smart cards as another revenue source. According to Easley, Plotnikov, and Easley (2001), a pivotal way in which transit agencies can reduce costs is by getting out of the “payments and settlements” business and transferring responsibility over to banks or other financial institutions.

Another potential benefit to transit agencies is reduced operating costs achieved by reducing the amount of labor required to process cash. A report for the Federal Transit Administration (Goeddel, 2000) shows that for every dollar, a transit agency receives in passenger revenue (cash and/or tokens), it spends approximately six cents on fare collection and processing; some systems spent as much as 20% of collected fare revenue on fare collection and processing. Along with the above mentioned savings, the report also notes that electronic payment systems may reduce lost revenues due to fare evasion.

Electronic payment systems are also less prone to malfunctions and require fewer repairs compared to traditional turnstile systems, thus reducing maintenance costs and increasing revenues for transit operators. These anticipated improvements in system reliability, maintenance, and revenue generation have the potential to improve overall transit efficiency and the quality of transit service as perceived by the riders.

Heaslip, Collura, McQueen, and Irwin (2005) and Fleishman, Schweiger, Lott, and Pierlott (1998) indicate that another major benefit of electronic payment systems is the unlimited degree of flexibility it offers transit operators in establishing fare policies. For instance, fare structures can be created to reflect a range of diverse users and changes can be made quickly and easily, benefiting both operators and users. Easley, Plotnikov, and Easley (2001) demonstrate this flexibility by showing that with electronic payment systems individual transit operators can maintain their unique fare structures, even when they become part of a regional system.

Electronic payment systems also have the potential to provide transit operators a range of travel data that can help transit agencies better manage their transit systems. San Antonio (PBS&J, 2004), for example, adjusts the number of buses it dispatches each day depending on the ridership information it receives at its payment system command center each morning.

Fares can also be made more equitable for persons with special needs due to the wide range of fare structures the payment system can accommodate. The Easley, Plotnikov, and Easley (2001) report shows that discounts for elderly or persons with special needs can be adjusted automatically. Collura and Dinning (1996) suggest that contactless smart cards that do not have to be swiped benefit users with mobility problems, especially the elderly and persons with disabilities. Also, a Federal Transit Administration report (Goeddel, 2000) suggests that distance-based fares, made possible with electronic payment systems, are more equitable and allow for better regional coordinated transit services and inter-modal connections.

Collura and Dinning (1996) point to many other benefits that improve the quality of transit service for travelers. These benefits include the convenience associated with interregional system and mode transfers. Users no longer have to carry cash or worry about having the exact change. Passengers can board buses and trains more quickly, allowing for faster “throughput”.

Electronic payment systems also improve security for both card users and transit agencies. Lost or stolen cards can be replaced. Smart cards cannot be duplicated as easily as magnetic stripe cards, reducing losses to transit agencies due to fraud (Easley, Plotnikov, and Easley, 2001).

Challenges

While there are many potential benefits that may accrue to travelers and transit operators, the literature also identifies many challenges related to implementing electronic payment systems especially those that are integrated involving multiple operators and jurisdictions. Heaslip, Collura, McQueen, and Irwin (2005) explain that several major challenges facing electronic payment systems in transit are privacy, technology, labor relations, funding, and organizational.

Privacy

As mentioned above, electronic payment systems must assure travelers of confidentiality and must address issues related to user privacy. According to Heaslip, Collura, McQueen, and Irwin (2005), user concerns related to the collection of personal data and travel habits of transit users must be addressed in order to make smart cards attractive. Some agencies address privacy concerns by allowing passengers to register for cards anonymously. Others have strict rules in place that limit the sharing of passenger data.

Technology

In addition, a report by Turban and Brahm (2000) suggests that some users may not be attracted to smart cards because of concerns related to using a new technology. For example, the report indicates that the electronic payment systems card technology selected must assure users that their money is safe and that they will be billed properly. At the same time, merchants must have a means of validating electronic payment systems cards.

Other challenges as pointed out by Turban and Brahm (2000) and Easley, Plotnikov, and Easley (2001) cite the lack of national standards for electronic payment systems in transit as a significant impediment to statewide and nationwide interoperability. This currently limits the ability for smart cards to be used for applications beyond one jurisdiction. A major challenge for the transportation industry is to develop a nationwide infrastructure that can support a range of various kinds of financial transactions. The type of media selected may eventually be capable of working with transponders and other equipment including cell phones.

The Washington D.C. Metro, Smart Access Demonstration Project (WMATA, 1999) shows one approach to addressing the difficulty of technologically integrating all regional transit modes. The Metro system chose to implement the project in two phases. The first phase established a central clearinghouse that was able to work with all existing fare collection equipment. In the next phase, the fare system hardware (fare boxes, readers, transponders, and smart cards) were modified to achieve full interoperability across the metropolitan region.

The Ventura County case study (USDOT, 2001) illustrates other issues related to working with new technology. The company hired to be the “systems integrator” for the regional transit system could not provide the level of service necessary to

adequately maintain the electronic payment system technology. However, Ventura County was forced to depend on this company because of the limited number of vendors available that could service the sophisticated technology. Consequently, the system did not initially perform up to expectations, resulting in degradation in service and poor data collection.

Labor relations

Heaslip, Collura, McQueen, and Irwin (2005) suggest that electronic payment systems have the potential to reduce the amount of labor needed to process fares. Some transit jobs may be eliminated and some employees may be assigned to different responsibilities and tasks. These changes may present both opportunities and challenges to both the employees (who may need to be trained for these jobs) and the employers (who need to address the institutional issues associated with such changes).

The Intelligent Transportation Systems (ITS) San Antonio literature (PBS&J, 2004) recommends that an extensive amount of training be conducted for both travelers and employees so that system implementation can be as problem free as possible. The literature also recommends transit operators hold discussions with labor representatives in order to address these issues.

Funding

Securing both capital and operating funds has been a continuing challenge for transit agencies in the U.S. In order to consider improvements in fare collection systems transit agencies typically need to plan for such investments as part of their fiscal planning process. The inclusion of investments in new fare collection technology such as fare boxes and associated equipment is often integrated into vehicle replacement programs and included in the regional transportation improvement plans. In other cases fare collection equipment may be procured and installed on existing vehicles. (Easley, Plotnikov, and Easley, 2001).

Organizational

One of the biggest challenges pertaining to the deployment of an integrated electronic payment system involves establishing an effective organizational structure that can manage a massive technological project across multiple geographic areas, political jurisdictions, and transportation agencies. As mentioned above, a strong “champion” is strongly recommended.

Many organizational issues need to be addressed related to clearinghouse functions. The Georgia Regional Transportation Authority report describes a common challenge. Passenger transferring from one transit operator to another must be accounted for in a way that is equitable for the different transit operators. The study recommends that an “inter-operator transfer agreement” be established that allows two (or more) agencies to account for and allocate the fare revenues paid in using two (or more) systems.

The Ventura County (USDOT, 2001) case study recommends that all issues concerning clearinghouse settlement responsibilities need to be designated during the planning phase of the payment project. The Federal Transit Administration report (Goeddel, 2000) shows that some transit operators have given all of the fare processing to banks or other financial institutions, eliminating the need for transit operators to handle fare collection.

Another challenge relates to transit agencies that may not be able to participate fully in a regional or statewide program due to regulations that prohibit such partnerships. Also smaller agencies may not have the financial strength of larger agencies and may not be able to risk a major investment in an integrated electronic payment project that also requires them to relinquish control of revenue collection (Easley, Plotnikov, and Easley, 2001).

Risks

One major risk relates to unexpected problems with implementing payment technology. As mentioned above, the Ventura County case study (USDOT, 2001) highlights many unexpected technical problems that arose with the operation of their electronic payment system. These problems were so significant that the system had to be shut down. Also payment systems need to be planned so that they can adapt to changing technology and the changing needs of users and transit agencies. Given the long periods required to implement integrated payment systems at a regional and statewide level, projects must be designed with flexibility or they risk the chance of not working with the latest technologies and equipment.

Another risk pertains to customer or user acceptance. While the results for most electronic payment system projects have been positive, a report by Fleishman, Schweiger, Lott, and Pierlott (1998) indicates that in some cases the actual use of the electronic payment system has grown more slowly than anticipated. A study by Mitretek Systems (USDOT, 2005) suggests that transit operators should conduct marketing efforts and provide incentives to attract riders for the purposes of increasing user acceptance. While it is recognized that marketing efforts require operating funds, such marketing expenses need to be viewed as a “cost of doing business”.

The Ventura County study (USDOT, 2001) points to the need to effectively market the electronic payment system to transit users as well as to convince them of the benefits. This is highlighted in the San Antonio presentation (PBS&J, 2004) that recommends the need to educate the general public and all stakeholders of the benefits of such payment systems in order to increase its perceived value and make it attractive to the traveler.

Another risk relates to unexpected costs and smaller cost savings than predicted. A report for the Federal Transit Administration (Goeddel, 2000) indicates that payment system development and implementation costs should be offset by savings in reduced fare collection. Staffing and labor agreements may impact the degree to which savings can be achieved.

The U.S. DOT website suggests that smaller transit agencies may not be able to financially join a regional or statewide electronic payment system. For example, the Puget Sound transit system provided a way to underwrite the costs and liabilities for smaller agencies in the region. But as pointed out earlier, Easley, Plotnikov, and Easley (2001) suggest that individual transit agencies may perceive a risk in losing individual control of money collection when they become part of an integrated fare collection system.

Opportunities

As newer technology becomes available, electronic payment systems may create expanded opportunities for transit operators and users. Easley, Plotnikov, and Easley (2001) report that such payment systems are increasingly being used for a wide range of purchases, including university and retail purchases. For example, the card being tested along the Lexington Avenue subway line in New York can be used to pay the subway fare as well as to purchase items in the local Macy's department store. At present, the MBTA is conducting a dialogue with MIT officials to integrate the current student identification pass used on campus into the Charlie Card technology. A report by Mitretek (USDOT, 2005) reviewed electronic payment systems projects in Europe and found that fare collection systems integrated across a large region or a state achieved greater benefits than non-integrated systems. The Ventura, California electronic payment system (USDOT, 2001) claims to have saved an estimated \$9.5 million per year in reduced fare evasion, \$5 million in reduced data collection costs, and \$900,000 by eliminating transfer slips. "Open" integrated fare card systems may also allow for integration with non-transportation uses such as retail. Increased involvement between the business community and integrated fare card partners complements marketing strategies on both sides to encourage transit use and convenience (Easley, Plotnikov, Easley, 2001).

The USDOT Intelligent Transportation Systems (ITS) website (USDOT, 2005) demonstrates that the technology is available to create a single regional system that can be used for parking, tolls and transit. The website also describes one of the Lessons Learned at the Puget Sound, Washington case study is that smart cards that can be adapted for purchases other than transit fares, offer a long term marketing potential that may provide an incentive for adoption by transit agencies and users.

The USDOT ITS website (USDOT 2005) also suggests that while smart card systems have been used to support multiple transit agencies in a region, very few have been designed to support a combination of transit, parking, and highway tolls. The Orlando case study cited in Section 2.1.1. suggests that it is technically feasible to do this.

McDonald (2000) suggests that many opportunities exist for transit agencies to partner with banks or other institutions so that electronic payment systems implementation risks are reduced, and systems costs (including updating technology) are shared.

Heaslip, Collura, McQueen, and Irwin (2005) suggest that system technologies provide the opportunity to improve environmental conditions by increasing the use of public

transportation and allowing transportation systems to run more efficiently, thus saving fuel. The San Antonio literature (PBS&J, 2004) describes how transit operators can manage demand with electronic payment systems by adjusting fares to encourage off peak use. Finally it should be noted that Heaslip, Collura, McQueen, and Irwin (2005) speak to the merits of congestion pricing in which agencies provide discounts for users that travel in less congested times of the day. Examples of transit authorities employing peak pricing strategies on rail services include the Washington Metropolitan Area Transportation Authority (WMATA) and the Bay Area Rapid Transit (BART).

In addition, the San Antonio literature (PBS&J, 2004) describes other opportunities. These include the possibility for transit operators to form partnerships and marketing tie-ins with banks, credit card companies, universities, etc. Electronic payment systems also give transit operators the opportunity to communicate more easily with customers. For example, surveys can be conducted via email and customers can be notified of special promotions or changes in service electronically.

Easley, Plotnikov, and Easley (2001) suggest that ultimately a single “open” electronic payment media will most likely evolve that can be used for transportation and non-transportation purchases. Several tests using smart credit cards are currently being conducted, including a demonstration project between Citibank and the Metropolitan Transportation Authority on New York’s Lexington Avenue subway line. A report by Mitretek (USDOT, 2005) shows that in many European cities, electronic payment projects have demonstrated that coordinated and integrated smart card based payment system was used for public transit, retail shops, libraries, swimming pools, and city services and was widely praised by users.

2.1.2 Summary and Conclusions

Based on the synthesis of literature, planning and implementing an integrated fare card will not be a trivial task and will raise many institutional and technological issues and present many challenges, risks, and opportunities. Easley, Plotnikov, and Easley (2001) describe the future as one that consists of a “single ‘open’ electronic payment media” that will be used for any kind of purchase, including transportation and other services.

Transit operators should enter into regional fare card projects with flexibility and a realistic understanding of the time, funding, and effort required. The regional fare card system will present many challenges. But it is anticipated that over time transit operators and their collaborators will arrive at a workable partnership that effectively balances the needs of the region with the needs of each agency.

2.2 Survey of Individuals

The primary objective of the survey was to obtain the views of a small group of individuals in the transportation community in the Commonwealth on the anticipated benefits and challenges associated with the deployment of an integrated fare card system

across the State.

The number of individuals totaled 5 and represented a cross-section of officials involved in the planning, management, and operations of rail and bus systems in the Commonwealth. Two individuals were employed with a regional transit authorities and the other three with a regional planning agency, a private bus operator, or a credit card company.

The survey included telephone interviews with each individual coupled in several instances with face-to-face discussions. Each individual received an email to prepare for a telephone call to discuss the benefits and challenges associated with planning and deploying an integrated fare card system. Appendix B provides a sample email message sent to each individual.

Finally, it should be noted that some of the individuals were also invited to participate in a panel session as part of the Annual Meeting of the Massachusetts State Chapter (ITS Mass) of the Intelligent Transportation Society of America (ITS America) in Boston on May 1, 2007. The session was moderated by the Massachusetts EOT Research Manager, Mr. Stephen Pepin. The views expressed in the panel discussion supplemented the comments compiled in the telephone interviews and the face to face discussions.

2.2.1 Findings

This section briefly presents the findings and major results of the survey and the ITS Mass Annual Meeting panel discussion and focuses on the survey results concerning anticipated benefits and challenges associated with the deployment of an integrated fare card system across the State.

Benefits

Benefits generally fell into five broad categories including: user convenience, equity and fairness, improved data collection, cost sharing, and potential decreases in operational costs and increases in revenues.

User Convenience

Several individuals identified user convenience as a potential benefit of an integrated fare card system in part based on the initial experiences with the MBTA's CharlieCard, a 1 kilobyte, contactless smart card with electronic payment, loss protection and automatic deposit features. Three out of five individuals also indicated that the opportunity to use a "one-stop" medium to access several different transit services would facilitate public transit travel and perhaps lead to increases in ridership. Greater payment convenience on buses could also facilitate boarding and reduce dwell times. Two individuals also suggested that user convenience might be further enhanced if the medium were integrated with parking services similar to the smart card in Washington D.C. and the pilot program on the New York City Metropolitan Transit Authority (MTA) Lexington Avenue rail line. It was also noted that a regional integrated fare card system might provide riders with greater flexibility for reverse commutes,

allowing them to commute from the core area of Boston to outlying areas in which other RTAs operate.

Another individual mentioned that initiatives in Cincinnati integrate the collection of transit fares and highway tolls along with taxi fares and in New York City fare card media may eventually be accepted at retail stores. Integrating a breadth of services such as these may also allow for the opportunity to bundle discounts between these services. For instance, a rider who drives at off-peak intervals may receive a park-and-ride fare discount or a transfer discount for transit-only integrated fare card.

It was also pointed out that the CharlieCard will soon enable users to pay for parking and may one day develop into a more universal payment system comparable to the New York City's pilot project.

Another individual mentioned that his organization tries to make transit travel easier by working cooperatively with the tourism industry to boost the general economic welfare of the region. To this end, the organization provides online trip planners, transit information in participating hotels and tourist destinations, and a simplified fare structure and collection system without inter-zone or transfer fees.

It was mentioned by one panel member that in other parts of the world integrated fare card systems use contactless cards as well as key fobs, cell phones, and wrist watches and work in collaboration with a variety of banks and credit lenders to again reinforce the notion that system designs are oriented toward improving customer convenience. It was also noted in the panel discussion that the design of the CharlieCard is intended to cater to user convenience.

Equity and Fairness

A potential benefit mentioned surrounds a transit agency's ability to flexibly modify fare rates to incorporate time of day, a user's age, zones of travel, and other variables. Some individuals believed that modifying rates in such a way is more equitable and fair to the riders and is an opportunity to increase rider confidence and, ultimately, patronage if instituted accurately and consistently.

Improved Data Collection

In the panel discussion as well as the interviews, it was pointed out that the integrated fare card technology may also provide increased opportunities for improved data collection to improve transportation management strategies, to classify a range of transit users and their appropriate fares, and to guide marketing strategies. This data is critical to transportation planners, managers, operators, and safety and security personnel. Planners use these data in both short- and long-term activities and, in particular, in the preparation of transportation improvement programs and long-term plans. Managers use such data in estimating annual budgets and in forecasting long-term revenue projections. Transportation operators have traditionally used travel data for day-to-day operational planning

purposes and more recently security personnel have considered integrated fare card in conjunction with access systems to monitor parking facility usage for safety and security purposes. One individual noted that the CharlieCard currently uses half of its data allotment, providing the MBTA with the opportunity to expand its data gathering capabilities.

Greater knowledge about a person's travel habits and patterns may also provide an opportunity for targeted marketing in transportation. With data compiled from an integrated fare card system, transportation agencies could market selected retail and other services to customers who travel on a particular route along which those services are provided. Targeted marketing such as that being used on variable message signs on taxis in the Boston area could provide a service to both the travelers and the companies

Cost Sharing

It was also brought out in the panel discussion that another potential integrated fare card benefit relates to the ability of various transit agencies to cooperate and share the integrated fare card costs and responsibilities. Expanding service to include several transit agencies could also allow for distributed capital investment costs to implement the system and could expand advocacy beyond Greater Boston; however, greater involvement generates a responsibility to enhance inter-agency communication and interaction. Along the same line, it was noted that increased stakeholders provide opportunities to advocate for integrated fare card deployment across the state and encourage its use.

Coordinating a group of Regional Transit Authorities to establish an integrated fare card and payment system inherently involves leadership, resource allocation and fiscal policy issues. Including an outside partner such as a third party clearinghouse in such a coordinated effort often helps resolve many of these issues. During the recent panel discussion, there was unanimous support for utilizing a third-party clearinghouse similar to the New York MTA's use of MasterCard to manage its transactions.

Reductions in Costs and Increases in Revenues

While it was recognized by some individuals that integrated fare card systems require capital investments, it was also pointed out that integrated fare card systems may lead to a reduction in operating costs associated with traditional fare collection systems as well as possible increases in revenues from advertising, accrued interest on pre-paid cards, and retained fares from unused cards.

Major operating expenses associated with the collection of transportation payments relate to the costs of handling cash and coins. Visiting a toll road agency and walking through the ground and underground levels of the toll plaza provides a clear indication of the labor intensive effort required by toll road staff in the handling of cash. Some transit authorities such as WMATA use trains and crews to collect and handle cash and coins daily and at the transit revenue office

staff often spend hours sorting and counting bills. It has been indicated elsewhere that the increased use of integrated fare cards will reduce the amount of cash and coins that transportation staff will have to handle and thus eventually lead to a reduction of operating costs related to fare collection (Heaslip, Collura, McQueen, and Irwin, 2005).

As was pointed out in the panel discussion, E-commerce has the potential to contribute to the reduction of costs to collect and process transportation payments. The availability of an integrated fare card system increases the ease with which e-commerce strategies may be employed to facilitate the payment and collection of charges for transportation services. For example, some toll roads have been allowing customers to use credit and debit card transactions via the internet to reload existing accounts and some transit authorities are now exploring similar internet based strategies to simplify payment systems for the customer.

Challenges

Although there may be considerable benefits associated with implementing an integrated fare card system, the selected individuals surveyed also anticipate some unique and familiar implementation challenges related to personal information security, administrative activities, technology issues, administration of the system, and affordability.

Personal Information Security

Several individuals echoed users' worries about personal information security if a fare card were lost or stolen, a popular concern given a host of recent credit card information breaches. They also recognized the benefit to record a large quantity of user information on the fare card to enhance data management, marketing strategies, and future administrative policies, but they also acknowledged the potential of mishandling data.

Depending on the specific configuration and technology, an integrated fare card operator will be able to collect and store some or all of the following data: who owns the integrated fare card account; the type of an integrated fare card device purchased; financial transactions on the integrated fare card account including the source and amount of funds loaded on the integrated fare card device; time and place of the transaction; and the user purchase and travel preferences.

The ownership of these data will depend on a number of factors including whether the system is open or closed and the specific relationships between the system participants. Since this data can be used as a revenue-generating source, the system operators should be proactive in disclosing to their customers what kind of data is being collected, who owns and controls it, what its intended use is, and with whom these data may be shared. Typical applications of the data generated and collected within an integrated fare card system would include service planning, pricing analysis, marketing analysis, and data mining.

In order to address most of the customers' privacy-related concerns, it was mentioned that system operators can offer different personalization options including fully anonymous accounts. If a customer chooses to open a personalized account or to personalize an integrated fare card device, the system operator should normally be able to guarantee that the value on the payment device can be recovered in case the device is lost or stolen. In the case that an anonymous account is open, the user may forfeit the right to claim the value on a lost or stolen integrated fare card device but can remain fully anonymous to the system operator(s). Thus, opening a personalized versus an anonymous account constitutes a trade-off between increased security of the value on the account and privacy.

To allay concerns about personal security, one individual noted in the panel discussion that some existing payment systems do not require users to register to use the medium, and, if users choose to register, they may be required to read and sign a privacy statement. Another individual indicated that his agency monitors its transit use with its users' home zip codes. It was also pointed out that registered CharlieCards will eventually allow patrons to utilize additional features of the new fare collection system including automatic purchases of passes and stored-value, as well as loss protection, which would then allow the MBTA to issue a replacement for a lost, stolen or damaged card with the product or value on the card at the time the MBTA was notified of the loss.

Administrative Issues

Several administrative concerns were voiced in the panel discussion. For example, the cost, time, and effort that will be expended to open an integrated fare card account or purchase and initiate an integrated fare card medium should be comparable to that of the existing payment systems. It was also noted that users should not be required to maintain a minimum balance on such accounts, since it may discourage low-income or occasional users from using the system. It was also suggested that it is desirable to give the users as many options for revaluing their integrated fare card accounts or integrated fare card medium as possible. It was also mentioned that the users should be able to revalue their integrated fare card account/medium with cash and that the pricing and discounts of a new integrated fare card should, at a minimum, be equivalent to those of the existing payment system.

It was also noted that integrated fare card operators will need to reassure card users that adequate customer support will be provided and that there will be compatibility between the new media and the older media; that the user should be able to have a defective, malfunctioning, or broken device exchanged free of charge or get a refund for a full amount paid for such a device; and that the users should also be able to terminate their integrated fare card account at any time and receive a refund for a returned device and current balance on the terminated account.

Another important consideration concerning the fairness of the integrated fare card service relates to the users' ability to monitor transaction activities on their account. Thus, the user should be able to obtain receipts and/or periodic account activity statements. The ability to access this information online would further improve access.

Finally, it was also mentioned in the panel discussion that account balances should be disclosed to the system users as a way to improve users' perceptions of the system.

Technology Issues

One individual spoke of his concern that different RTAs' media lack interoperability which prohibits the implementation of an integrated system. He also alluded to the challenge associated with different media and fare structures in the various RTA areas which may present technology and administrative issues and possibly customer confusion when trying to deploy an integrated system. To this point, two other individuals suggested that some integrated fare card systems may eventually operate on an industry standard, pointing to a potentially viable and practical solution to the interoperability issue.

Along the same line without integrated fare media users may be required to carry more than one smart card, increasing the potential for reader failure. While one of the smart cards advantages is the ability to scan through a wallet or from a variety of other contactless media, a user carrying multiple smart cards may overburden the reader. To this concern, it was noted that while that could happen, users would simply have to go back to the reader and scan the appropriate medium individually; neither the reader nor the entire system would fail. Another individual expressed some concern for how transit operators would react to system failure, particularly on a bus with an individual reader. Specifically, would operators revert to a cash system? Would they know the appropriate fare to collect when an integrated fare card system typically adjusted fares automatically?

Two survey participants also spoke to the potential challenges of using fare card media on bus services where card reader performance may be susceptible to the physical dynamics associated with potholes, frequent braking and inclement weather conditions. In light of these concerns, precautionary steps are taken when using card readers on buses including training bus operators to handle a reader malfunction.

Another panel member cautioned the audience about the challenges related to keeping pace with the quickly developing integrated fare card industry. As a burgeoning technological innovation applicable to nearly every metropolitan region, one individual mentioned that there is a particular onus to resolve evolving user issues, to refine operation inefficiencies, and to integrate with more RTAs.

Finally, two panel members mentioned that an integrated fare card system would have to account for zone changes and transfers, if they exist. One individual indicated that his agency removed its policy for zone changes and transfers in an attempt to simplify the system for tourists, who make up a considerable portion of its ridership. The other individual noted that transfer issues do not apply to the New York City MTA integrated fare card model because it only involves one line, negating the need to handle transfers; users must use general MTA fare media to transfer.

Service Coordination Issues

While each of the individuals surveyed recognized the MBTA as a requisite leader in planning and implementing an integrated fare card system in Massachusetts, it was recognized that an effort would need to be made to coordinate transit services between the MBTA and other RTAs in the State. One individual acknowledged challenges in the past on the part of one RTA promoting the service of another.

It was also pointed out that smaller RTAs have limited resources to plan for a far-reaching and integrated policy, further requiring cooperation with larger RTAs. Many smaller RTAs work to meet quarterly expectations and simply cannot consider programs of an integrated fare card's magnitude.

Individuals were also concerned about inter-agency labor relations, particularly if one agency uses union employees and another does not. The agencies may not be able to realize benefits associated with improved labor-effectiveness of its new integrated fare card due to local labor regulations. However, there are measures that could be implemented to reduce the impact of the integrated fare card system on people who worked under the old system. It was also pointed out that there are many jobs that are created by the implementation of an integrated fare card system. These jobs in customer service could be filled by people who worked in the old system.

One individual noted that his service spans an interstate region, all with different fare card systems and policies. For that reason his agency is less likely to adopt any single state's integrated fare card program; however, in other states his services may provide an opportunity to consider an integrated payment system across state boundaries as has been done in the I-95 Corridor with the EZ Pass program.

System Affordability

The costs to deploy a statewide integrated fare card system may overshadow the potential benefits. Cooperating with a firmly established partner such as the MBTA, as pointed out in the panel discussion, could provide the other RTAs an opportunity to share costs and to attract greater funding from state and federal sources and from a private third-party clearinghouse. In the panel discussion it was noted that utilizing a system similar to the Metropolitan Transit Authority's

partnership with MasterCard could resolve many of the issues presented from multimodal stakeholders. Although there would be institutional issues integrating the several transit authorities, a third-party financial agent could provide a possible solution to implement an integrated fare card system in Massachusetts and potentially beyond state borders.

2.2.2 Summary and Conclusions

While the individuals surveyed anticipate benefits to the deployment of an integrated fare card system, they also acknowledge that there will be challenges to integrated fare card system planning and deployment. Central to these challenges are administrative and technology issues. To continue to explore the benefits and challenges associated with integrated fare card deployment and to move the ongoing integrated fare card planning process forward, conclusions and recommendations are presented in Section 3.

3.0 CONCLUSIONS AND RECOMMENDATIONS

While the results of Task 1 and Task 2 indicate that individuals in Massachusetts as well as in California, Florida, Virginia, and other states anticipate integrated fare card system benefits, the results also suggest that there will be administrative and technological challenges encountered in integrated fare card system planning and deployment. The existing Charlie Card can provide an opportunity to test expansion of an integrated fare card with other statewide jurisdictions. Based on the results of this synthesis report, conclusions and recommendations were developed and proposed to serve as a set of guidelines to assist the transportation agencies and other stakeholders as integrated fare card and payment systems are being considered. These conclusions and recommendations are as follows:

Given that the MBTA Charlie Card has been deployed, this medium should be reviewed as a possible statewide integrated fare card.

- Given that the MBTA Charlie Card has been deployed, this medium should be reviewed as a possible statewide integrated fare card.
- An institutional structure needs to be established in order to seek and obtain input and feedback from important stakeholder agencies and individuals. Such a structure would lead to the determination of the current level of interest, expectations, merits, and challenges associated with the deployment of an integrated electronic payment system for transportation services in the Commonwealth. While the Task 2 survey results suggest that there is interest among some stakeholders in integrated payment systems in Massachusetts, experiences in New York, Washington D.C., Chicago and San Francisco, for example, suggest that such an institutional structure is essential in the planning stages to provide all stakeholders an opportunity to participate and voice their interests and concerns effectively. Examples of stakeholder agencies and organizations that have been involved in experiences elsewhere include regional transit authorities; public and private transit operators; toll road, bridge, and tunnel agencies; parking authorities and operators, major public and private sector employers; representatives from the credit card and technology industries; and university transportation centers. Input from these and other stakeholders will be critical to address the coordination, funding, and technology challenges as identified in the Task 1 literature review and the Task 2 survey.
- As part of the planning process, consideration should be given to preparing an agreement outlining the mission and goals of an integrated payment system involving multiple regional transit authorities. Based on expert judgment and experiences elsewhere, a special effort should be made in the mission and goals statement to identify the transportation markets to be served with the payment

system and the technologies available to deploy such systems. To the maximum extent possible, such an agreement should be simple and informal, similar to the agreement established by the Interagency Advisory Group (IAG) in the initial planning and deployment of the EZ Pass system. Consistent with the integrated payment system mission and goals, the agreement would propose that a Strategic Plan be developed consisting of an integrated payment system vision statement, system objectives, a system concept of operations, and a financial implementation strategy.

- In the development of the agreement consideration should also be given to establishing a stakeholder organization as the “lead agency”. The “lead agency” would have the major responsibility of working directly with all stakeholders and ensuring that the agreement is used as a guide in the planning process and that the Strategic Plan is employed consistent with the Plan’s vision and objectives and in concert with the views and desires of all stakeholders. Integrated payment systems experiences in California, Illinois, and Florida show that the “lead agency” varies by geographic location and that the “one size fits all” concept does not necessarily apply. For example, in some experiences the “lead agency” was the major transit authority in the State or metropolitan area, while in other areas “lead agencies” included the metropolitan transportation organization (MPO), a toll road agency, and a State Department of Transportation.

It is also noted that the conclusions and recommendations outlined above could provide guidance in the planning, design, and deployment of a statewide integrated payment system consistent with Governor Deval Patrick’s current transportation policy, as presented in the Massachusetts Executive Order, No. 488, establishing the Massachusetts Mobility Compact.

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5.0 APPENDICES

Appendix A - Annotated Bibliography

Massachusetts Cooperative Research Program,
ISA #4MS9793 Task #4
Synthesis Report: Integrated Fare Card Systems
September, 2006

TASK 1. LITERATURE SYNTHESIS

ANNOTATED BIBLIOGRAPHY

A.1

Title: *Public Policy Implications of Regional Electronic Payment Systems.*
Authors: Heaslip, Kevin, Collura, John, McQueen, Robert, Irwin, Donald.
Date: 2005

The research paper was written to provide support materials to policymakers and professionals to assist in electronic payment systems (EPS) decision making. The combination of increased demand for services, improvements in technology, and recognition of shared interests among service providers has resulted in the advancements in electronic payment systems to date. The implementation of a regional electronic payment systems offer benefits, challenges and new opportunities for transportation operators and users.

Electronic payment systems benefits include:

- A reduction in costs associated with handling cash.
- Convenience for users due to faster “through put” and cashless payment.
- The ability to classify a range of transit users (children, elderly, disabled) and deduct fares accordingly.
- The ability to make changes (fare changes, incentive programs, etc) quickly and affordably.
- Provide transit operators a range of user travel data that can benefit transportation management strategies. These include demand management, travel pattern analysis and, target marketing.
- Convenient accounting of employee subsidies and variable insurance rates that may be available to transit users.

Electronic payment systems challenges include:

- Privacy concerns - relates to the collection of personal data and travel habits of transit users.

- Labor relations - due to staffing reductions and new job descriptions for employees.
- Funding sources – electronic payment systems often requires large upfront capital investment.
- Technology and infrastructure – extensive evaluation of existing systems is required to determine which technology can best meet regional transit goals. Technology is rapidly changing - must be able to work with many different situations and must be flexible enough to evolve over time.
- Equity – what happens to users who do not have access to smart cards, etc.
- Organizational issues – many issues related to coordinating a structuring major institutional agreements and policies among different organizations (sometimes across state lines, etc).

Electronic payment systems opportunities include:

- Interoperability - the most successful systems will achieve the capability to function for a range of uses and services in a variety of locations across the region. With wider use, and improved technology, electronic payment systems can be implemented with many types of transportation and non-transportation transactions.
- Environmental - the use of electronic payment systems can also dramatically improve environmental conditions by reducing congestion, and inducing more people to use public transportation.
- Growth Management - electronic payment systems can be used to implement pricing schemes that promotes mixed use transit oriented development (TOD) in city centers in order to reduce sprawl and conserve open space.
- Electronic payment systems technology allows for the creation of public-private partnerships - for example, universities students may be able to use their ID card to access public transportation. The electronic payment systems system can keep records of users, and debit accounts accordingly.
- Data collection - information collected regarding user travel behavior could be used for target marketing to users in conjunction with retail outlets, etc. This could provide an additional revenue source to transit operators

A.2

Title: *Introduction to Electronic Payment Systems and Transportation*

Author: Intelligent Transportation Society (ITS) of America, Sharon Easley, Valeri Plotnikov, Richard B. Easley

Date: 2001

The research document was created to serve as a primer for transportation professionals interested in achieving a broad understanding of how electronic payment systems (EPS) will impact their operations.

Recent developments in microelectronics are helping to achieve a common payment

media that can be used for multipurpose (transportation and non-transportation) applications. Electronic payment systems options include “closed transportation only systems”, used for transportation services only, “closed multipurpose systems”, a service that includes limited functions beyond transportation such as vending, and “open systems”, where transportation agencies accept electronic payment systems media from one or more outside issuers (such as banks and credit card companies).

Two main types of issues must be addressed in order to establish a regional electronic payment system – institutional issues (who are the partners in the electronic payment systems, and what are their roles) and technological issues (what type of hardware is used).

INSTITUTIONAL ISSUES

Regional electronic payment systems must be coordinated among a range of partners. Partnerships between transportation agencies can be further extended and enhanced by also including non-transportation stakeholders. Potential benefits of partnering come from leveraging the resources of different institutions by building on existing infrastructure, building on the existing knowledge base and benefits gained from the economics of scale. Risk is also spread among a larger group when partnerships are formed. Potential partners include financial institutions, governments, universities, retail outlets, and employers.

TECHNOLOGICAL ISSUES

Hardware

Either “contact” smart cards or “contactless” smart cards, or a combination of the two (a “combi” card) will most likely be used as part of an electronic payment systems. Contactless smart cards are preferred by transit users because of the convenience of increased throughput. Transit agencies prefer contactless cards because they have lower maintenance costs and make boarding more convenient, which in turn attracts riders.

Interoperability

The lack of a strict standard for contactless cards seriously complicates the ability to utilize these cards for other applications beyond transportation. A major challenge for the transportation industry is to develop a nationwide infrastructure that can support a range of various kinds of transactions. The type of fare media selected should be capable of eventually working with transponders (“tags”, commonly used for toll collection on highways and bridges) and cellular phones, which already have microprocessor capabilities and may play an important role in electronic payment systems as more technology develops.

The future

The report indicates that a single “open” electronic payment media will most likely evolve that can be used for all transportation and non-transportation purchases.

Major benefits of regional integration of electronic payment systems:

- Provides seamless transportation travel through the use of a universal medium that allows individual operators the ability to retain their own fare structures and promotions.
- Reduction in revenue collection costs resulting from a bank, or other private entity, providing media, introduces economics of scale.
- Additional revenue options including advertising on cards, reduced fare evasion, “float”, and expired card value.
- Improved customer convenience through faster through-put, use of prepaid or stored-value media available at multiple locations.
- Expanded market by accepting commercial payment media (credit cards).
- Improved data collection and reporting capabilities, improved equity and timeliness of the reconciliation and distribution of revenues collected.
- Improved ability to modify fare policies and structures to better target specific markets.
- Fares can be more equitable for persons with special needs because they can be automatically reduced based on financial, physical or other circumstance.
- Can exit the “payments and settlements” business by using the capabilities of financial institutions.
- The specific goals and objectives of the agency or agencies will influence the type of program to be pursued. In addition to these goals, the capabilities and constraints that each agency faces also will impact the type of approach.

Barriers to regional integration of electronic payment systems:

- Some transit agencies may be legally prohibited from entering into partnership type agreements with other agencies.
- Smaller agencies may not want to risk money on developing electronic payment systems.
- An agency may not want to relinquish control of its revenue collection system.

A.3

Title: *Multipurpose Transit Payment Media. TCRP Report No. 32*

Author: Transportation Research Board.

Author: Fleishman, Daniel, Schweiger, Carol, Lott, David, Pierlott, George

Date: 1998.

The report examines the potential for introducing multipurpose payment “smart cards” that can be used to purchase transit services from multiple operators, and potentially, other goods and services. On the basis of experience around the world, guidelines are provided for development of multipurpose fare payment programs.

An increased interest in stored value and prepayment systems in the financial, retail, and service industries has dovetailed with an interest in the transit industry to reduce the use of cash and to improve customer service. However, implementing an integrated fare collection system that meets the needs of multiple transit agencies is a complex process.

The following major issues need to be addressed by transportation agencies considering Electronic payment systems:

- An institutional structure must be in place to implement and administer the program. Who are the participants? How will the electronic payment systems be organized and operated?
- Transit agencies should identify goals that they seek to achieve and any constraints (legal, financial, policy or other) to participating in a regional program.
- What are the expected costs and benefits to each potential participating agency? How are the costs shared?
- Identify the type of electronic payment systems: closed system, closed multipurpose system, or open system.
- Identify the business structure: What are the roles and responsibilities of different agencies? How much will the electronic payment systems cost, how will the system be financed, and how will the risks and benefits be shared among participants?
- Identify and resolve legal and regulatory issues. The issues will depend on the type of program and how many groups participate. Key areas to consider are: Who has the authority to issue the prepaid media (smart cards)? Who is responsible for lost cards, and maintaining user privacy?
- Identify card technology to be used. What type(s) of card will form the basis for the program? How will the new technology be integrated into the existing transit system and infrastructure? Can the technology adapt to future changes and to the needs of ALL the participating transit agencies and non-transit partners?
- Design a program that meets the goals of all parties. It should be reviewed and accepted by all major participants.
- Implement and evaluate a pilot or demonstration program that includes components of the different transportation agencies involved.
- If the institutional, operational, technological and customer acceptance aspects of the pilot program are demonstrated and found successful, the next step should be to proceed with a more extensive implementation, if not a full system wide program.

The report highlights the following potential benefits that can be gained by implementing electronic payment systems:

- Offers seamless transit travel
- Reduces fare collection costs
- Generates additional revenues
- Improves customer convenience
- Increases transit market, and increases ridership
- Improves data collection
- Improves revenue collection

- Improves ability to modify fare policy and structure
- Gets transit agencies out of the “payments and settlements” business

The report highlights the following issues and barriers related to implementing electronic payment systems:

- Lack of industry standards for technology.
- Need for privacy guidelines to address customer’s concerns regarding the protection of privacy rights.

The report concludes by noting that the ultimate success of electronic payment systems will depend on the degree of acceptance of multipurpose media by issuers, merchants, and consumers. The results from these efforts have been generally positive, but in some cases use has grown more slowly than anticipated.

A.4

Title: *Smart Card-Based Electronic Card Payment Systems in the Transportation Industry*

Author: Turban, Efraim, and Brahm, Joseph.

Journal of Organizational Computing and Electronic Commerce.

Pg. 282- 293.

Date: 2000

The article analyses the use of smart cards in public transportation, and provides advice to transit managers interested in pursuing electronic payment systems (EPS).

There are many things that transportation agencies must consider when planning the implementation of a regional electronic payment systems. While some agencies may have the ability to begin implementing systems now, other agencies many choose to wait until electronic payment systems standards are more broadly accepted. Agencies that choose to proceed with electronic payment systems must address the following issues:

- What kind of system to use? Electronic payment systems consist of one of three basic electronic devices - contact cards (magnetic strip or smart cards), proximity cards (or contactless cards), and tags (DSRC -dedicated short range communication, also known as transponders).
- Selection of an appropriate strategy will depend on the particular market. For example Phoenix allows bus customers to use credit cards. This is more convenient for users, but it poses problems too, including loss of revenue due to the use of “bad” credit cards.
- Electronic card systems typically require prepayment. An account is established with the vendor or with a central clearing house. Each transaction must be approved by a central clearinghouse at the time of the transaction to ensure that funds are available. Transportation agencies must determine if they will act as clearinghouse, or if another party will serve the clearinghouse function. Another

option for transit is prepaid proximity cards. They do not require central clearinghouses.

- Security issues: Card users must feel confident that their money is safe and that they will be billed properly. At the same time merchants must know that the cards they are accepting are good, and cannot be tampered with or counterfeited. New smart card technologies can offer a high degree of security.
- Standards: Currently, no one standard exists for smart cards. The banking industry developed their own smart card standard. Some transit systems allow their own smart card, plus the use of a smart credit card. Eventually systems may evolve to one universal smart card that acts similar to a credit card.

In general, the report suggests that electronic payment systems can provide the following benefits:

- Reduces cash handling expenses for transit agencies.
- Reduces financial losses due to fraud.
- Expedites customer transactions (faster speed).
- Enhances customer safety and convenience (no need to carry money, lost smart cards can be replaced).

The report recommends assessing the complete costs and benefits to both transit providers and users before planning the implementation of electronic payment systems. Transportation managers need to take a close look at their market and their products to determine what the best strategy regarding electronic payment systems will be. Successful electronic payment systems should provide benefits for both transit operators and users.

A.5

Title: *Regional Transit Action Plan, Regional Fare Policy White Paper
Georgia Regional Transportation Authority
Manuel Padron & Associates, July 25, 2003
Final Draft (project was not carried forward from this point)*

The report was prepared to analyze a range of regional fare policies as part of a Regional Transit Action Plan (RTAP). The Regional Transit Action Plan was organized to provide guidance to the Metropolitan Atlanta Regional Transit Authority as it began the implementation of an integrated regional fare structure that includes smart cards.

The RTAP identifies four main issues related to the implementation of a regional electronic payment system.

- Fare policy - the need to develop effective fare policies that address customer related, financial, and institutional goals of regional transportation agencies.
- Fare strategy – flat fare or differentiated fares (distance based, time based, market based.)

- Fare structure – combining a fare strategy with a specific fare level (i.e. express buses require a \$.75 premium over basic bus.)
- Fare payment technology and equipment (usually smart cards) - transit-only, multi-purpose, contactless, or bank issued credit card.

The report recommends forming a “Project Planning” team, consisting of representatives of the different transit agencies that can guide the project. Also, in order to protect the interest of the different regional transit agencies, and to help ensure the successful implementation of a regional electronic payment system, the document proposes the creation of an “Interagency Fare Policy Agreement” signed by all parties. The Agreement should include the following:

- A description of the Agreement and guiding principles
- A list of procedures for dispute resolution and a process to make amendments to the agreement
- A description of fare policy as it relates to fare structure and pricing.
- A description of how fare revenues are retained.
- List of individual responsibilities pertaining to the development of pass and transfer media (printing, sales, encoding costs).
- A summary of each operator’s roles and responsibilities.

In light of the time it takes to implement electronic payment systems, and the rapidly changing technology, the report recommends that an interim electronic payment system be put in place, similar to projects in other cities such as New York, Seattle and Los Angeles.

Electronic payment systems Smart Card benefits:

- Smart Cards can be used for multiple transit operators.
- Smart Cards have greater memory than stripe cards, enabling individual transit agencies across a region to keep their own fare structure in place.
- Smart Cards can work with a regional clearinghouse that allows for region-wide approaches to equity, and system integration.

Smart Card payment technologies can provide operational and administrative benefits to transit agencies:

- Reduced operator intervention in fare collection
- Reduced fare transaction time under smart card alternatives
- Improved data collection and reporting capabilities, such as better ridership data for planning purposes.
- Enhanced inter-operator transfer process.
- Improved reliability over magnetic technology. Experience indicates that magnetic systems fail 30 times as often as smart card systems.

- Increased savings possible to participating institutions through the outsourcing payment and settlement by financial institutions for smart card financial transactions.

The document cites the following major electronic payment systems issue:

A major issue associated with regional electronic payment systems is the accounting for inter-operator transfers as they relate to cost recovery for each operator's segment of a regional trip. An inter-operator transfer agreement must be established that allows two (or more) agencies to account for and allocate the fare revenues paid in using two (or more) systems.

A.6

**Title: Ventura County Fare Integration
A Case Study**

Date: September 2001

The case study illustrates an automated fare collection system (Smart Passport) field test using smartcard technology across multiple transportation agencies in Ventura County, California between 1996 and 1999. The intent of the project was to examine the interoperability of smart card technology among multiple transit operators using ITS technologies.

A primary objective was to create a seamless "universal ticket", or smart card, that could be used on all of Ventura County's transit systems. The case study highlights many of the difficult issues that may be encountered when a joint multi-agency project is attempted. The demonstration project ended in 1999 without Ventura County transit operators experiencing many of the program's anticipated benefits. The fare collection system experienced many operational and data processing problems, resulting in inconsistent data and infrequent report.

The Ventura County project introduced a range of issues that transportation planners and service providers need to examine before planning or implementing a coordinated multi-agency fare collection system.

Institutional issues:

- Regional smart card programs need a champion, usually a lead transportation agency that has the staff and resources to push the project forward over time.
- Staff resources and leadership capabilities need to be commensurate with the scope and complexity of the project, and need to be in place at the beginning of the project. Soon after Ventura County project began, all parties realized that the project staff was too small to manage the project. A project manager was hired.
- Multi-agency systems will require staff with technological expertise and data management skills.

- Regular and open communications is needed among all stakeholders. Good communication and cooperation among participants is critical to implementing a successful system, especially as problems arise.
- The systems integrator (usually the company hired to develop and maintain the EFS) needs to have a local presence. The Ventura County project suffered because the system integrator traveled back and forth to an office 100 miles from the project site. This resulted in a slow response time when problems occurred.
- Should establish a pricing structure for the new fare media that makes them competitive with other available fare media. A smart card will not be used if it costs the customer more than existing fare cards.

Technical issues:

- All staff will need extensive and ongoing training. The Ventura County system relied on sophisticated technology that required expertise to operate and maintain properly. Much of the data collected pertaining to passenger loadings was inaccurate in part because transit operators were not familiar with the technology.
- Hardware and software technology must be integrated among all transit agencies in order for the system to work. The technology selected must also work with any existing hardware and/or software that will remain part of the new system.
- Technical and reporting requirements identified during the planning stage need to be incorporated thoroughly into the development of an RFP so that roles and responsibilities are clearly understood.
- Clearinghouse and settlement responsibilities need to be designated in the planning phase of the program.

Operational issues (Customer acceptance):

- Implementation of new technology requires a comprehensive and effective marketing strategy using broadcast and print media.
- A program is needed that offers customers usage-based incentives and loyalties such as free transfers, fare discounts, and automatic replenishment.
- Formal and systematic surveys of and interviews with customers are needed to reliably assess customer satisfaction and to design strategies to improve satisfaction.

Benefits:

- Customers could replace a lost card.
- Customers don't need to use cash.
- Allows greater flexibility in fare structures, less expense in revenue collection.
- Can be expanded to "non-transportation" use. Ventura County is expected to form a transit-university project that will allow campus issued cards to be used for on campus purchases as well as transit fares.

CHALLENGES

Numerous operational and data processing problems were associated with the smart card demonstration project. Card users were allowed to ride for free when the system failed. This reduced revenue and also limited the accuracy of data collected related to ridership counts.

CONCLUSION

Even though the demonstration project experienced many technical problems, it resulted in some benefits. The project introduced the public to the smart card system. In fact an on board survey conducted on certain bus lines revealed that riders liked the smart cards. These results helped convince other transit agencies that there were real benefits to be realized from adopting electronic payment systems.

The Ventura County demonstration project helped teach valuable lessons regarding electronic payment systems. Transit operators that participated in the project have applied the lessons learned to a new smart card program that was subsequently introduced successfully.

A.7

Title: Benefits Assessment of Advanced Public Transportation System Technologies Update 2000

Author: Volpe National Transportation Systems Center for the Federal Transit Administration.

Date: November, 2000

The Advanced Public Transportation Systems (APTS) Program was formed to foster the development and implementation of advanced technologies in the transit industry. The study was conducted to identify the benefits of on APTS technology. It addressed five major technologies, including Electronic Fare Payment Systems.

The report studied the deployment or planned deployment of electronic payment systems in 118 locations across the United States.

The primary benefits of electronic payment systems identified by transit agencies are:

- Reduced fare collection/processing costs. Electronic payment systems reduce the handling of cash, which is a major cost of a transit agency's operating budget. Some transit agencies have given all fare processing to banks or other financial processing institutions.
- Lost revenues due to fare evasion, (the report estimates to be between 4% and 8% of revenues collected) are reduced.
- Increased transit ridership and convenience. Allows riders to access multiple transit modes across a region with one payment medium.
- Allows for flexible fare policies (time and/or distance based fares) to promote off-peak ridership, or ridership by a particular group (elderly, downtown commuters,

- etc). This capability has been shown to increase ridership.
- Expanded base for transit revenue. New revenue can be generated from increased marketing opportunities, interest on “float” earned on prepaid fares, transaction fees, and unused value on prepaid stored value cards.
 - More equitable fare structures. Electronic payment systems allow transit agencies to adopt more flexible and equitable distance based fare structures that facilitate coordinated transportation services and inter-modal transfers. This increases transit ridership and transit revenues.

The report concludes that the cost to introduce electronic payment systems is offset by cost savings made possible by reducing traditional cash processing costs.

A.8

Title: Smart Access – Electronic Fare Payment Demonstration Project Proposal
Author: Washington D.C. Metropolitan Area Transit Authority (WMATA)
Date: 1999

The WMATA submitted this document in response to the Federal Transit Administration (Federal Transit Administration) request for proposals for an “Operational Test of an Electronic Payment System for Transit Fare Collection, Parking Payments, Electronic Toll Collection and Other Applications”. The document summarizes plans for the WMATA “Smart Access” demonstration project of a smart card Electronic Payment System (EPS).

The study demonstrates the use of new computer technology to achieve system wide interoperability. It proposes to integrating transit, parking and toll road fees by introducing a central clearinghouse that can establish and maintain single transportation accounts. The clearinghouse will collect all fares, and will distribute revenues to the transportation agencies in accordance with the use of their services. The project requires retrofitting bus fare boxes, toll booth transponders as well as parking meters in order to establish interoperability with the WMATA’s transit smart cards.

Project goals:

- Demonstrate the ability to establish a single account, to be called SmartAccess, by using a central clearinghouse.
- Promote the migration to a single regional payment medium through the introduction of new technology applications.

Main issues:

- Technical compatibility of the payment mechanism.
- The exchange of financial activity data between the agencies providing the services.

Potential Risks:

- Significant cost overruns for demonstration projects or conversion projects.
- Technical incompatibility of equipment for different transit agencies.

Major benefits expected:

- Makes multi-modal trips more attractive to travelers, thereby making more efficient use of the existing transportation infrastructure.
- Reducing operating expenses by shifting account management functions from individual agency to centralized resource.
- Increase throughput, reduce staffing at transit and toll booths and thereby reduce operating expenses.
- Enable parking patrons to better comply with parking regulations, contributing to improved parking and traffic conditions in congested commercial districts.

Highlights:

- Uses a central clearinghouse
- The Smart Access program will allow:
- Retail purchase with smart card.

A.9

**Title: Electronic Payment systems (EPS): Beyond Transportation.
ITS America Pre-Conference Course book, San Antonio, Texas, 2004.**

The course was presented at the 2004 national ITS America conference. It provided an overview of the major issues that need to be addressed when planning and deploying regional electronic payment systems.

Major institutional issues:

- Electronic payment systems plans should be coordinated with the long range plans of regional planning agencies.
- Policymakers, transportation professionals, the general public and other stakeholders may need to be educated regarding the benefits and other consequences of deploying integrated electronic payment systems.
- Must define functional requirements of the electronic payment systems: identify the users, identify the modes of transportation that will be covered (transit, toll roads, buses, etc), determine media issuer (who issues the smart cards: banks, transit agencies)
- Design the distribution system to provide point of sale, recharge locations that will send record of transactions to the issuer.
- Establish the clearinghouse that is the entity or entities responsible for back office and other functions.

- Determine if system will be “open” or “closed”: There are three types:
Closed transportation only, includes transportation transactions only – card issuer designated by transportation agency.

Closed, multipurpose, includes transportation and non-transportation transactions – card issuer designated by transportation agency.

Open system, transportation agencies accept fare media from other issuers in addition to the designated electronic payment systems issuer.

- Establish partnering agreements of different types. Many different partnerships are possible. Transit agencies may want to partner with other transit agencies, universities, human service agencies, banks, etc.
- Develop training activities for users and employees so that implementation of system can be as problem-free as possible.

Other Issues:

- Labor: Discussions with local labor officials should be considered since so much of the deployment relies on transit employees.
- Privacy concerns: Steps must be taken to ensure customer confidentiality, and other factors related to privacy must be addressed.

Major Benefits:

- Real time data can go to transit managers regarding passenger volume, etc, so adjustments can be made.
- Increases convenience by allowing the option of not carrying cash. Many options of putting money on your account are introduced. Allows for a range of purchases on smart card, including transit and retail.
- Electronic payment systems work with a range of hardware including smart cards and transponders. One bill is received by the user.
- Smart card automatically tracks rider usage, and deducts charges according to fare schedule (i.e. deducts less money if rider uses transit during the off-peak hours).
- Allows partnerships and marketing tie-ins with credit card companies, major employers, and universities. For example, users may receive automated e-mails alerting them of specials at stores, entertainment options, etc.
- Reduces congestion at toll plazas and at transit stations.
- Reduces chance of theft of money.
- Difficult to counterfeit fare media.
- Can communicate with customer via internet for the purpose of conducting surveys and launching promotions.
- Flexibility for transit operators to try different pricing and incentive schemes without replacing fare media and equipment.
- System allows for auditing of travel patterns and adjustments to transport modes as necessary.

A.10

Title: Intelligent Transportation Systems Benefits, Costs and Lessons Learned: 2005 Update.

Author: Mitretek Systems, Washington, D.C. for the Federal Highway Administration.

The report addresses the benefits and costs of a range of intelligent transportation systems. A section of the report is dedicated to electronic payment systems (EPS).

Institutional issues:

To successfully deploy regional fare systems:

- Carefully plan and negotiate agreements on technical requirements.
- Incorporate customer acceptance techniques, including extensive marketing, and user incentives.

Benefits:

- Increased convenience to customers
- Can generate significant cost savings to transportation agencies by increasing the efficiency of money handling processes and improving administrative controls for multiple transit agencies.
- As with toll collection systems, benefits of integrated transit fare payment systems are expected to be greater than those of non-integrated systems.
- The report shows that in Europe, three projects demonstrated that the coordinated use of a smart card as a payment system for public transit, shops, libraries, swimming pools, and/or city services was widely praised by users.

A.11

ITS website “lessons learned” (www.itslesssons.dot.gov)

The ITS website describes a variety of issues related to electronic payment systems based on experience from case studies.

Orlando, Florida case study, reported in 2004.

Lesson Learned:

In Orlando, Florida, various transit agencies, working together, demonstrated that diverse and multimodal transportation agencies in a region can work together to establish an operational smart card payment system using a third party clearinghouse provider. The system allows smart cards issued by any participating agency to be used for payments and for accepting deposits to an account at all smart card accepting equipment.

The Orlando experience suggests the following effective approaches to managing

regional initiatives:

- Ensure that each participating agency has a management champion (someone who will take the initiative to make sure the process moves forward).
- Create a forum for project champions to meet regularly.
- Ensure that team members representing different agencies have a consistent presence on the project to promote progress and cohesiveness.
- Utilize a standard meeting schedule (weekly/biweekly/monthly) to build relationships and clarify roles and responsibilities.
- Identify and resolve specific collaboration issues with an agreed upon conflict resolution approach.
- Inform executive management on project progress and key issues with regular briefings.
- Establish a forum for decision-makers and project managers to come together to receive project updates, work through critical project issues, make decisions, and support successful institutional collaboration in a project involving multiple agencies.

Finally, Orlando implemented a “Field Operational Test” (FOT) used for evaluating the operability of the smart card in processing transportation payments at facilities operated by multiple regional agencies. This included a detailed cardholder recruitment plan in the planning phase of the project, to provide guidance on processes to set pricing, and to ensure high user involvement and loyalty.

Key lessons learned from this FOT are as follows:

- **Institutional Collaboration**

Previous regional smart card systems in the US have been primarily limited to supporting multiple transit agencies in a region (e.g., San Francisco TransLink), or to supporting the combination of transit and transit-related parking (e.g., Washington SmarTrip). The Orlando FOT was successful in demonstrating that it is technically feasible to extend the underlying operational concept to encompass transit, tolls and parking. In addition, the toll usage successfully demonstrated the feasibility of smart card accepting transponders.

- **Card Usage**

Extra effort in initial cardholder recruitment, screening and education could pay dividends: The limited number of cards being issued made it essential that cardholders be properly screened as part of the recruitment process. The usage patterns of potential recruits were screened by agency customer service representatives and via the project website to attempt to recruit cardholders who used the actual routes and locations accepting the cards. Flyers were also handed out at the specific toll plaza and parking garages where the cards were to be accepted

- **Equipment Inventory and Suppliers**

It is important to order more smart cards than the agencies initially think they will need: Smart card systems can switch to a new smart card from that originally selected, but only with additional costs to reconfigure the readers to accept the new cards. After the mandatory requirement for maintaining 800-1000 active cards throughout the 12-month demonstration period was established, the agencies attempted to order more smart cards from the supplier (Gemplus) to supplement the original order of 2100 cards. However, it turned out that this particular type of smart card had been discontinued.

- **Cardholder Incentives**

Incentive schemes can affect results: The cardholder incentives established by the agencies apparently influenced usage patterns during the demonstration. OOCEA customers received a smart card with \$5 preloaded, and were to receive a \$20 check at the end of the 12-month trial if they have remained an active user throughout the FOT period. However, this incentive was discontinued after issuance of the initial 300 cards by OOCEA, as it was determined that many customers discontinued use of the smart card once the initial five dollars had been used.

Central Puget Sound, Washington case study, reported February 2006.

LESSON LEARNED

It is important to understand the issues, strategies and trade-offs that motivate agencies to join in a regional partnership and provide appropriate support.

Among the findings reported are:

- Seek support from the state legislature before implementing a regional fare card project. In this case, the Washington State legislature provided the initial force that pushed the region's transit agencies to complete the project.
- Look to the larger agencies in the partnership to take a leadership role in technology and policy innovation. Larger agencies are often in the position to test new technologies and methods. Then, when a successful demonstration is achieved, other agencies can adopt the same type of system.
- Consider establishing a smaller scale fare card program before seeking to implement a comprehensive region wide program. The Puget Sound region benefited greatly by having a procurer fare card program implemented on a limited basis. It increased riders' familiarity and comfort with regional fare cards, and also demonstrated the value and viability of the system.

Some mechanism to underwrite the initial costs and liabilities for smaller agencies to join a regional fare card partnership may be the only way to assure full participation from all agencies at the beginning of a regional fare card program.

Smaller agencies often join regional systems even though short term benefits are not

expected. They may join because they have a desire to support the regional effort, because they don't want to be "left behind" technologically, and because they feel it will be more costly for them to join the system later.

- Plan to market a regional fare card for the purchase of goods and services other than transit rides. Smart cards that can be adapted for purchases other than transit fares offer a long term marketing potential that provides an incentive for adoption by transit agencies and users.
- Enter into a regional fare card project with flexibility and a realistic understanding of the time and effort required. The regional fare card system will present many challenges. It will take more time, patience, and flexibility than may be anticipated to arrive at a workable partnership that effectively balances the needs of the region with the needs of each agency.

A.12

Title: Evaluating Electronic Payment Systems in Public Transit

Authors: Collura, John, & Plotnikov, Valeri.

Date: 2001

The research paper proposes a broad approach to evaluating electronic payment systems (EPS) on public transit services. This approach addresses issues related to transit operators and riders as well as other electronic payment systems stakeholders in a sound, objective, and efficient manner.

Electronic payment systems objectives must be established in order to have a successful deployment. These objectives should reflect input and guidance from all potential project participants and stakeholders. The electronic payment systems selected should be the one that best meets these objectives. The research paper describes an evaluation plan that can help determine which electronic payment systems best meets a project's objectives.

To facilitate evaluation of electronic payment systems, the paper recommends that electronic payment systems' objectives be grouped into one of several general categories related to 1) electronic payment systems performance, 2) user acceptance, and 3) other objectives related to institutional, organizational, and other issues deemed important to electronic payment systems participants and stakeholders. These objectives include the following:

Objectives related to transit operator include:

- Costs related to handling cash and tokens.
- Need for better data for planning purposes.
- Better intermodal coordination.
- Ability to achieve more flexible fare structure.
- Reduce fare evasion and fraud.

Objectives related to transit user include:

- Service quality.
- Convenience.
- Ease of transfer between different modes of transit.
- Variable fare pricing (off peak etc).
- Simplified financial transactions.
- Equity
- Privacy

Objectives related to technology include:

- Fare media accepted (magnetic card, smart card, combi card, contact or contactless cards)
- Fare structure (distance based, or flat fare, or other).
- Capital and operating costs.
- Security.

The paper presents an example of an evaluation plan that uses both quantitative and qualitative measures to assess the extent to which electronic payment systems meets the intended objectives.

A.13

Title: Institutional Issues Concerning the Implementation of Integrated Electronic Payment Systems in Public Transit

Authors: Collura, J., & Dinning, Michael

Date: 1996

Title: Electronic Payment Systems in Public Transit

Authors: Collura, J., & Dinning, Michael

ITS America 1996 Annual Meeting

Date: 1996

Based on a review of six case studies – Boston, Chicago, New York City, San Francisco, Seattle, and Washington D.C., Dinning and Collura identify the following key institutional issues that need to be addressed when implementing an Electronic Payment System (EPS). These center around: 1) strategic planning and fare policy, 2) technology used, 3) the payment process, 4) partnering agreements and governance, 5) user acceptance, and 6) privacy.

Issues related to strategic planning and fare policy:

- Important to make a “business case” in order to get others to join collaboration.
- Must have a careful plan that lists objectives of any electronic payment systems.
- Fare policy must be addressed (will one fare policy be adopted, or will individual

- agencies maintain their existing fare policies).
- Strategic plan or “business case” should estimate the capital and operating costs, and project economic, operational and other benefits. Plan should also address schedule and implementation (including field testing).

Issues related to technology:

- Contact or contactless smart cards? Many transit operators are introducing contactless smart cards because of perceived advantages for throughput, reduced maintenance costs, and convenience.
- Plan for interoperability. Transit operators would like future smart card technology to use open system architecture, to allow interoperability. This should be an important part of planning.

ISSUES RELATED TO THE PAYMENT PROCESS

Payment process includes the sale and issuance of fare media, and payment settlement and reconciliation of revenues among service providers, including clearinghouse (internal or external clearinghouse). Closed systems (transit use only) or open systems (range of uses, including retail). Open systems will most likely require an external clearinghouse.

ISSUES RELATED TO PARTNERING AGREEMENTS AND GOVERNANCE

When two or more transit operators are involved in the electronic payment systems, some kind of written agreement will need to be established. Each operator will describe its fare policies and structures, and a method to equitably apportion revenue collected. Will also need to be coordinated with an external clearinghouse, if one is used. Regional transit operators are more likely to be part of a smart card network because the smart card can ensure that revenues are apportioned according to actual service provided by the various transit agencies. Smart cards also allow the individual transit agencies to maintain their separate fare structures if they desire.

ISSUES RELATED TO USER ACCEPTANCE

Must convince users (including transit drivers and employees) that the electronic payment system is a good investment, and must overcome any resistance to use.

PRIVACY ISSUES

Smart cards generate a record of transactions and travel that some users may feel is invasive. Some transit agencies are considering giving users the option of not having identification numbers on their smart cards (thus eliminating the possibility of canceling their card if lost or stolen). Also, in order to reassure users, transit operators should develop stringent privacy policies that clearly spell out how personal information and travel data can be used.

POTENTIAL BENEFITS

For the transit agency:

- Reduced operating costs related to staffing at transit stations and at fare processing locations. Increased revenues through decreasing fraud (counterfeiting,

- fare evasion, card theft)
- Increased revenues due to interest received on prepaid stored value.
- Increased revenues due to increased ridership.
- Better data regarding passenger behavior can facilitate future transit planning.

For the passenger:

- Increased convenience: cashless system, easy transfers, no need to keep buying passes, discounts.
- No standing in line at turnstile, or to buy tokens/passes.
- Benefits to elderly and disabled because contactless smart cards don't require direct contact with card reader.

A.14

Title: Developing a Regional Approach to Fare Collection.

Authors: Booz-Allen & Hamilton, Inc.

Date: 2000 (Draft Final Report)

The report was presented to the Greater Washington Area Regional Transit Operators in order to identify key issues associated with the integration of transit services in the greater Washington/Baltimore area.

The study reviewed two technologies: magnetic stripe cards and smart cards. It also reviewed the issues related to integrating three different transit modes: bus, commuter rail/light rail, and heavy rail.

https://exchange.ecs.umass.edu/exchange/collura/Inbox/Final%20Report%20Format.EML/1_multipart_xF8FF_2_report%20formatting%20071205.pdf/C58EA28C-18C0-4a97-9AF2-036E93DDAFB3/report%20formatting%20071205.pdf?attach=1
https://exchange.ecs.umass.edu/exchange/collura/Inbox/Final%20Report%20Format.EML/1_multipart_xF8FF_2_report%20formatting%20071205.pdf/C58EA28C-18C0-4a97-9AF2-036E93DDAFB3/report%20formatting%20071205.pdf?attach=1

The report offered the following major recommendations:

- Begin the project by conducting presentations on the regional fare collection program for the senior management at each participating agency.
- Create a strategic plan agreed to by all parties.
- Assign necessary staff: usually to represent finance, accounts payable, planning, systems, etc.
- Adopt regional policies for the fare collection program, particularly with regard to data reporting and the sharing of costs and revenue.
- Adopt a common discount plan for high volume card loading and bi-directional transfers.
- Identify appropriate fare collection equipment for the regional system, and begin the procurement process.

- Develop and issue a request for revenue clearinghouse services.
- Continue discussions and demonstration programs with potential transit partners of the smart card program, and resolve issues related to technology.
- Benefits (financial and risk sharing) can be gained by working with non-transit partners. These include banks, government, universities, and municipalities.
- Implement a demonstration project.

The following key regional policies were recommended in the report:

- Fare card ordering: WMATA initiate a single contract, but separate PO's will allow each operator to order directly, and to achieve volume discounts.
- Card cost and responsibility: card cost and revenue could be rolled into a regional pool and shared via formula.
- Card sales price to public: common sales price established to customers across the region, customer pays for ½ of cost of card.
- Card ownership: customer owns card after purchase, and is responsible for card.
- Procurement should be undertaken by the lead agency for all regional systems and equipment. This should take place to provide the maximum opportunity to integrate the various systems under one contractor.
- Concessions and off site sales: relationship and terms owned by individual transit agency.
- Card registration: voluntary by customer, benefit is balance is protected in case of loss or theft.
- Card balance inquiry: customer must purchase reader or interface with appropriate transit fare equipment.
- Fare card charging and recharging: All regional participants encouraged to provide on-board or in-station loading, as well as off-site loading. Cost is borne by operator.
- Automatic credit card loading: Clearinghouse provides automatic credit card uploading when registered customer balance falls below \$5.
- Interest earnings: Revenue balances should be held by operators that make the sale.
- Card design: Develop a single regional policy on card appearance and data fields.
- Card advertisement: Sell advertising on one side of card by batch. Revenue to offset clearinghouse costs.
- Fare volume discount: Develop a regional policy that provides a discount to customers that load fares of \$20 or more.

A.15

Title: Multipurpose Smart Cards in Transportation: Benefits and Barriers to Use

Author: Norene McDonald

Date: 2000

The paper addresses the major issues associated with smart cards by highlighting electronic payment systems applications in Hong Kong, Paris and San Francisco transit systems.

Transit operators choose to use electronic payment systems in order to reduce costs, improve service, provide flexible fares, and to increase revenues. Even so, the paper suggests that there needs to be a clear business rationale for adopting smart cards. Local conditions, particularly usage and fare structure should govern implementation decisions.

Major issues that must be addressed pertain to institutional arrangements, technical systems, user requirements, and system equity.

INSTITUTIONAL ISSUES

Will the system be “open” or “closed”?

Closed systems usually only pertain to transportation. They are usually administered by a transit agency alone, or in cooperation with a group of transit agencies. Closed systems put the risk (and reward) of the electronic payment systems venture on the transit agencies involved. Open systems include other, often non-transportation entities, to take part in the electronic payment systems system. These include banks, universities, retail establishments and government.

Who will administer the system, and who will act as the clearinghouse?

In an open system, most likely a bank or credit card institution will serve as administrator. Even so it may be in the best interest of all parties to have an independent (third party) run the clearinghouse. This arrangement can address concerns regarding risk, and a conflict of interest that may arise from any one agency having sole control of administration and clearinghouse functions.

TECHNICAL ISSUES

Many technical issues arise due to the lack of standards that are recognized across both transit and non-transit industries. The two most important technical standards are: physical interoperability, the design of the cards, software, and communications; and program interoperability, the ability of transportation programs to work with one another.

USER ISSUES

Before implementing electronic payment systems, transit agencies should conduct surveys to determine what the demand will be, and what users value in an electronic payment systems installation. Since most transit agencies require users to pay for smart cards, the users must be convinced that there is a value to using them. Survey information

will help determine the types of incentives needed to get people to use smart cards.

Another issue that must be addressed is user privacy. Smart card can collect an enormous amount of personal and travel information. Most transit agencies give users the option to have anonymous accounts that addresses this

EQUITY ISSUES

Federal law requires that public transportation be accessible to everyone. Transit agencies must address users that may not have access to smart cards, credit cards, cell phones, etc. They must also address inequities resulting from the need to pay for a smart card, and discounts, etc. that may accrue to riders that have smart cards. One approach is to implement a parallel system that also accepts tokens or fixed value cards (this will impact the cost savings of the electronic payment systems).

LESSONS LEARNED

Hong Kong Octopus system: integrates fare payment for five transit operators with one contactless smart card, used for buses, subways, and ferries.

Why was it adopted so successfully?

1. It was the second generation of electronic fare media.
2. Users were given discounts as incentives to use the Octopus card.

Reasons to use smart card in Hong Kong were:

- For the biggest transit operator it was to reduce maintenance costs and the faulty reads of the existing stored- value system
- For the smaller all cash systems it was to reduce the costs associated with handling cash.
- Independent clearinghouse processes all transactions. This entity also determines how all revenues are shared.

Paris Smart Card: The smart card program includes two transit agencies (Paris Metro and the French state railroad) and four banks. The smart cards act as electronic purses. By partnering with banks, the transit agencies reduce the implementation risk and share the system costs. The program was implemented in phases, beginning with a “pilot” phase that was used to serve as a test of the system. Plan was to make sure it worked properly and that issues were addressed before widespread use.

Appendix B – Sample Email to Selected Individuals

Dear [NAME],

The purpose of this email is to arrange a telephone call with you to continue our discussion regarding the merits and challenges associated with the deployment of an integrated fare card on transit systems in Massachusetts.

We expect that 30 minutes will be more than sufficient. Please specify a 30-minute period within one of the time blocks shown below:

- 1 Friday, March 9, 2:30 to 5:00
- 2 Monday, March 12, 2:30 to 5:00
- 3 Wednesday, March 14, 2:30 to 3:00 or 3:30 to 4:00
- 4 Friday, March 16, 2:30 to 5:00

You can contact me by either email or phone at 413-545-5404.

We look forward to the opportunity to speak with you.

Thank you.

John Collura, Ph.D. P.E.
Professor of Civil and Environmental Engineering

John Hersey, Master of Regional Planning '07
Research Assistant