Transit Cooperative Research Program
Sponsored by the Federal Transit Administration
RESEARCH RESULTS DIGEST
June 1997--Number 16

Subject Area: VI Public Transit Responsible Senior Program Officer: Stephen J Andrle

Multipurpose Fare Media: Developments and Issues

This TCRP digest presents the interim findings of TCRP Project A-14, "Potential of Multipurpose Fare Media," conducted by Multisystems, Inc., in collaboration with Dove Associates, Inc., and Mundle & Associates, Inc. Included in *the digest are (1) a summary of the emerging developments, (2) a discussion of key issues and concerns, and (3) a technicalappendix presenting the results of a survey of transit operators fare collection practices and plans.*

CHAPTER 1--INTRODUCTION

This digest contains examples of multipurpose transit fare payment programs and discusses institutional, technological, and financial issues that must be addressed to implement such programs. This will be of interest to transit managers, transit planners, transit financial officers, and other financial professionals. The desire on the part of both transit agencies and financial institutions to reduce the use of cash for payments and improve customer convenience has dovetailed with advancements in the payment technology area to facilitate various types of "multipurpose" media. Specifically, the development of integrated circuit ("smart") cards and the use of stored value has opened up new opportunities for reaching more than one market with a single payment option. Multipurpose transit fare media can take three basic forms:

- Multiple-use media that can be used in several applications (e.g., transit, retail purchases, banking);
- Integrated regional fare media that can be used on multiple transit agencies in an area (i.e., a "universal ticket"); and
- Integrated fare media that can be used in transit as well as other transportation modes (e.g., parking, tolls).

These may overlap, and in particular, the latter two approaches are often pursued together.

TCRP Project A-14, *Potential of Multipurpose Fare Media*, is intended to identify issues and concerns on the part of transit agencies and financial institutions, assess customer and financial implications associated with various approaches, monitor emerging developments, and assess the potential of increasing the role of the banking industry in transit fare payment and collection. This research is intended to provide both transit and financial services professionals (1) an understanding of the nature of the costs and potential benefits of such arrangements, as well as the issues that must be addressed in forging new alliances; and (2) specific guidelines to allow each to pursue common interests in the payments arena.

This digest presents the findings from the TCRP Project A-14 Interim Report. This digest identifies the full range of issues and concerns inherent in the consideration of multipurpose payment media and arrangements.

BACKGROUND: DEFINITION OF TERMS

In discussing the various types and aspects of multipurpose media, it is useful to understand the terms being used. **Multipurpose**

CONTENTS

media describes any payment option that can be used for more than one agency (but a single application, such as transit) or for multiple applications. **Multiple-use media** and **integratedfare media** are subsets of multipurpose media; the multiple-use concept has sometimes been referred to as **expanded utility.** One of the key functions of such cards is an **electronic purse**, which is essentially the stored-value portion of the card. A card may be dedicated to an electronic-purse function (and a card may contain more than one purse) or may also contain other functions (e.g., identification or information); the latter is known as a **multi-application card.** There is a fundamental difference between a card that can be used for several different types of applications (e.g., banking services, health care records, and vending) and one that has a single application (e.g., stored value) and can be used for multiple merchants or services; the technology implications of the different types of media are discussed in this digest. An electronicpurse-only card may also be called a **prepaid** or cash card. Finally, integrated fare media have been called **universal tickets** in some locations.

All these terms have come to refer primarily to variations of **smart cards**, although other technologies (e.g., magnetic-stripe cards) may also be able to support multipurpose applications. The memory and security capabilities--as well as processing capabilities, though not necessarily needed in the types of applications presented here--of smart cards have made them the technology of choice for virtually all recent multipurpose efforts. Technically, a smart card is an **integrated circuit** (or **chip/card** that has an onboard microprocessor and built-in logic; however, the term has come to be used to describe a range of automated card technologies, including **memory cards** (without microprocessors) and **radio frequency identification (RFID) cards and tags** (also often without microprocessors). In this study, the term smart card in this more general sense is used.

There are two major classifications of smart cards: **contact** and **contactless cards.** Contact cards require a physical contact between the card and the read-write unit, and must be inserted into a slot. Contactless cards do not have to be inserted into a slot, but rather can be read by passing the card close to (i.e., within a couple of inches or some other specified distance of) the read-write unit. Contactless--or **proximity**--cards commonly refer to cards using two different communication techniques. One type uses a contactless interface to provide power to the card and transfer data using inductive and capacitive techniques; these cards are of two basic forms: **remote coupling** or **close coupling,** depending on the particular interface and data transfer process. RFID cards, meanwhile, transfer data between the card and the read-write unit using radio frequency techniques; power is supplied using a battery or by means of received magnetic energy. Finally, one type of **hybrid card** combines a smart card with a magneticstripe, while a newer option (better known as a **combi--card** or **dual-interface card)** combines the attributes of contact and contactless cards--either using two separate chips or a single chip capable of being accessed in either fashion. (The characteristics and uses of the different types of cards are discussed in Chapter 6, Technicological Issues.)

One of the fundamental issues is whether a multipurpose card is issued and used in an open or closed system. An **open system** is one in which there are multiple card issuers and multiple service providers or merchants; for instance, credit and debit cards operate in an open system. A **closed system** is one in which the card is issued by a single entity and can be used only for that entity's services; transit fare payment has traditionally operated in a closed system, for example. What is emerging with the development of various types of multipurpose cards, however, is a **partly open** or **closed multipurpose system,** in which a single issuer's card--or a few related issuers' cards--can be used for more than one service. The integrated fare card or the expanded utility/multiple use transit card is an example of such a system. There is something of a continuum between open and closed; moreover, a system may evolve from closed to open. The types of issues and concerns that must be addressed in establishing a multipurpose arrangement are reviewed below.

TYPES OF ISSUES AND CONCERNS

Development of any type of multipurpose payment system probably requires a fundamental change in the way the participants have operated in the past. These changes apply to the customer, the transit agency, the financial institution, the participating merchant, the equipment vendor, and any other entities considering involvement in the venture. Issues and concerns may be related to the integration of multiple service providers and card issuers, as well as to the development or implementation of advanced payment media in general. Some concerns will be specific to each participating entity, while others will be common to all participants. The issues and concerns that need to be addressed can generally be categorized as follows:

- **Institutional:** who are the participants in the program, how is the program organized and operated, and what are the legal and regulatory requirements that must be addressed?
- **Technological:** what type(s) of card will form the basis for the program, what are the design requirements, how will the new technology be integrated into the existing system, and how can compatibility with future technological advancements be ensured?
- **Financial:** what are the expected costs and benefits of the program to each potential participant?
- **Customer-Related:** to what extent will customers participate in the

program, and how will their concerns be addressed (e.g., related to privacy)?

Because multipurpose payment systems are in their infancy, there is limited experience in addressing these issues. Various types of programs have been developed overseas, but even many of these examples are still in trial or pilot phases. In North America, development of several multipurpose programs has begun, but in-service applications are of limited scope to date. Thus, the means of resolving many of the questions that must be answered can only be speculated on at this point--based on comprehensive feasibility studies or preliminary assessment by individuals intimately involved in the development of the programs. Chapter 2 presents examples of the programs in place and under development; Chapters 3 through 8 discuss the various issues and concerns.

CHAPTER 2--EXAMPLES OF MULTIPURPOSE EFFORT

Extensive development in all types of multipurpose payment programs has occurred in the last few years. Advances in electronic payment media have spurred the development of stored-value and prepayment approaches and multiple-use arrangements in both the transit and financial and telecommunications sectors, and this parallel interest has led to the consideration of joint-payment structures. Efforts are in various stages at this point: some programs are in widespread use, some are in limited trial, some are in the planning stage, and some have been derailed (at least temporarily). This chapter reviews several major developments in this area; the projects and programs addressed are divided into two categories:

- Transit-initiated or transit oriented multipurpose programs: MARTA/VISACash, TransLink (SF area), Central Puget Sound (Seattle region), Washington (DC), Ventura Co. (CA), Cleveland, Ann Arbor (MI), Phoenix, MetroCard (New York MTA), Wilmington (DE), Toronto, Manchester (GB), Sydney (Australia), Honk Kong, and Seoul (South Korea); and

- Financial or telecommunications industry-initiated stored-value and electronic-purse programs: VISACash (United States and Canada), MasterCard/VISA (United States), Mondex (England), DANMONT A/S (Denmark), Banksys/Proton (Belgium), PTT Postcard (Switzerland), Quick-Link (Australia), EPS/SmartCash, Europay Clip (multinational, multi-currency card), Chipper (Netherlands), Postchecque (Belgium).

The second group consists primarily of programs that have been or will be introduced in multiple locations in different parts of the world, while the transit examples are specific projects. These projects and programs are discussed here briefly and will be reviewed in greater depth in the project final report.

TRANSIT MULTIPURPOSE PROGRAMS

Multipurpose fare programs are a relatively new phenomenon in the transit industry; however, there are growing numbers of regional fare integration and multiple-use efforts throughout the world. In North America alone, there are smart-card-based regional integration projects under development or partially in place in northern and southern California, Seattle, and Toronto. Washington, DC, is the site of a multipurpose transportation project (involving transit and parking). Multiple-use projects (with banks, universities, retail establishments, or other entities) have been implemented in Atlanta and Ann Arbor, and are being or have been considered in Cleveland, New York City, and Wilmington, DE. Multipurpose transit projects have been initiated in the United Kingdom, Australia, Korea, Hong Kong, and elsewhere. Table 1 shows the range of multipurpose projects involving transit; as indicated, most of these projects use (or plan to use) smart cards.

Examples of multipurpose transit projects in place or planned are summarized below.

Atlanta MARTA/VISACash Project--The Metropolitan Atlanta Rapid Transit Authority (MARTA) is participating, with VISA and three banks (NationsBank, First Union Bank, and Wachovia Bank), in the VISACash stored-value (contact) card rollout. VISA covered the cost of installing card read-write units in two turnstiles in each MARTA station in mid-1996, and the VISACash card (initially issued as a prepaid disposable card, later to be issued as a reloadable card) is accepted for direct fare payment; the system went live in May 1996. Card vending machines (selling only the NationsBank card at this point) are located in key stations. This pilot project is testing the institutional and operational feasibility of an arrangement in which the transit agency does not produce the payment media, but rather participates as a "merchant" in a multiple-use card and electronic-purse program. MARTA is planning to issue a Request for Proposals to enter into an agreement with a single entity (e.g., a bank) in a multiple-use arrangement. The overall VISACash program is discussed briefly below, under "Financial Services and Other Programs."

San Francisco Bay Area TransLink Program--This project involves development of a regional integrated stored-value card system for transit operators in the Bay Area. Initially, the project was to use magnetic tickets, similar to the existing Bay Area Rapid Transit (BART) ticket, and the original TransLink ticket was tested at BART and two bus systems (BART Express and Central Contra Costa County) in 1994 and 1995. However, following a trial period, it was decided not to proceed with the original plan. The Metropolitan Transportation Commission (MTC),

TABLE 1 Current and planned multipurpose transit projects

Location	Type of Program	Type of Card	Integrator/ Card/Supplier	Status (Start Date)	Size of Trial or Program
Newcastle, Australia	M	contact	AES/Fujitsu	trial (June 1996)	160 buses
Sydney, Australia	M	contactless	CTA/Mikron	in use	1 million+ cards
Leuven, Belgium	M	contact	Banksys (Proton)	in use	terminals on buses
Montreal, Quebec	R	contactless	NA	planned (1997)	integrated system - 3 agencies
Guelph, Ontario	M	contact	Mondex/Royal Bank	trial planned (late 1996)	multiple use (Mondex)
Toronto/Ajax/Burlington, Ontario	R	contactless	Precursor/Mikron	trial	bus rtes, 2800 cards (Ajax); plan for comm. rail
Copenhagen, Den.	M	contact	DANMONT	trial (late 1995)	18 TVM's at rail stations
Chambery, France	M	contactless	NA	1 yr. trial (early 1995)	2000 student cards
Valenciennes, France	M,R	dual *	AES/Bull/Racom	trial planned (Fall 1996)	French Railroad and buses, multiple use planned
Marseilles, France	M	contactless	AES/various	trial (1994)	(E.C. GAUDI program)
Munich/Frankfurt/Hamburg,German	M,R	contact	Schlumberger	trial (1996)	telephone/rail/bus card ("Paycard")
Hong Kong	R	contactless	AES/SONY	trial (1996)	20,000 cards, plan for 3 million cards (by 1997)
Dublin, Ireland	M	contact	Schlumberger	3-mo. trial (Feb. 94)	25 buses, 2000 cards
Rotterdam, Netherlands	M	contact	Chipper	trial (1997)	regional transit (PTT/Postbank Chipper)
Oslo, Norway	R,T	contactless	Scanpoint/Mikron	trial planned (early 95)	1200 bus, 108 LRT, 69 rail
Seoul, S. Korea	M,R	contactless	Intec/Mikron/Gemplu	in use (Feb. 1996)	8700 buses, 1.2 million cards, plan for multi-use
Biel, Switzerland	M	contact	Bull	in use (3+ yrs.)	30,000 cards
Manchester, UK	M	contactless	AES/GEC, SONY	full use by 1997	5000 cards, 2700 bus
Phoenix, AZ	M	magnetic	MasterCard/VISA	in use (May 1995)	(accept credit cards on bus)
Culver City,Foothill, Montebello, CA	R	magnetic	GFI	in use (March 1994)	280 buses (Metrocard)
San Francisco, CA	R	contactless	TBD	trial planned (1997)	26 transit agencies
Ventura Co., CA	R	contactless	Echelon/Racom	in use (March 1996)	7 agencies, 3500 cards
Washington, DC	T	contactless	Cubic	1 yr.trial (Dec. 94)	19 stations,22 buses, 5 pkg lots, 1000 cards
Wilmington, DE	M	contact	Gemplus	trial planned (on hold)	150 buses (Wilmington Trust - SmartCash)
Atlanta, GA	M	contact	Gemplus, G&D	trial (May 1996)	33 rail stations (3 banks - VISACash)
Ann Arbor, MI	M	contact	Schlumberger	trial planned (1996)	80 buses; 35000 campus cards
New York, NY	M, R, T	TBD	TBD	planned (on hold)	(plan for multiple use)
Cleveland, OH	M	dual*	TBD	trial planned (1997)	bus/rail & other (bank, retail, campus, etc.)
Seattle, WA	R	contactless	TBD	trial planned (1996)	5 transit agencies, ferry

* contact & contactless
NA= data not available
TBD=to be determined

Type of Program: R=regional Integration
T=transit and parking or tolls
M=multiple use

the lead agency, commissioned a study to determine the most appropriate technology. This study, completed in late 1995, evaluated technology and clearinghouse options, including the potential for private sector involvement. This study has led to a recommendation for a regional integrated system based on contactless smart cards; it has also been recommended that private entities be invited to participate in a range of system management and operational elements, particularly related to clearinghouse and equipment maintenance functions. A trial is planned for early 1997, with full regional implementation by the end of 1998.

Seattle/Central Puget Sound Area Regional Fare Integration--The transportation agencies (bus, railroad, and ferry) in the Central Puget Sound region recently completed a Regional Fare and Technology Integration Feasibility study. This study recommended development of a contactless smart-card-based system that would facilitate easy transfers between the different systems and modes. Other key goals are to improve the operating efficiency of each individual agency and to expand market opportunities within the region. On the basis of the results of the feasibility study (completed in mid-1995), a detailed analysis of smart cards was undertaken, involving a business needs assessment and feasibility analysis for the recommended regionwide fare payment system. Concomitant to this analysis, three related efforts have been initiated: (1) the Washington State Ferries is developing a fare collection system that is intended to be compatible with the regionwide system; (2) the Transportation Operators Committee is identifying policy issues associated with regional fare integration; and (3) the participating agencies are undertaking an assessment of issues and opportunities related to establishment of a regional revenue clearinghouse. On the basis of the findings of these efforts, the agencies in the region have initiated a trial of contactless smart cards; the technology is being tested (as of October 1996) on bus routes at King Co. Metro and Pierce Transit. Following completion of the trial, the plan is to proceed with implementation throughout the region over the next 2 years.

Washington Metro Go-Card Project--In December 1994, the Washington Metropolitan Area Transit Authority (WMATA) began testing the feasibility of a contactless card (using Cubic's Go-Card) for use on rail and bus, as well as at park-and-ride lots. The project included installation of read-write units in 24 rail mezzanines, 21 buses (on 3 routes), 1 bus depot, and 5-park-and-ride facilities, and tested the ability to use the Go-Card as a common payment instrument. Automated vending machines (AVMs) can read and display the value remaining on a Go-Card and add value to the card when payment is made in the AVM. The Go-Cards are used in the fare gates to enter and exit the Metro system. On the bus, the maximum fare is deducted on entry by the "target reader" (3-zone fare, for example). The passenger must check out on leaving, using either the front or rear door; if a one or two zone ride is taken, the appropriate value is restored. The same concept is used to pay for parking fee collection. Data from rail, bus, and parking subsystems is transmitted via modem to WMATA's central computer system to apportion revenue. The test began with 5,000 Go-Cards given to Metro employees and 1,000 to selected Metro riders. On the basis of the successful completion of the demonstration, WMATA has decided to proceed with the use of smart cards on the entire rail system. As of late 1996, the agency was seeking interest on the part of financial services companies in some type of multiple-use arrangement.

Ventura Co. (California) Passport Program--As part of Phase III of the Advanced Fare Payment Media Study (funded by the FTA and California Department of Transportation), the contractor, Echelon Industries, has installed contactless smart-card read-write units on buses at the seven transit operators in Ventura County. The Passport is a monthly pass and stored-value card (smart card) that can be used on any bus in the county. All but one of the participating operators (South Coast Transit, the largest operator in the county) allows on-board recharging of the smart cards; after notifying the agency in advance, a card is activated for the month on the first use that month. The program went into service in March 1996. In the previous phase of the project, Echelon had tested these units (at three agencies: Gardena, Torrance, and LA DOT) with contact cards on some buses and contactless cards on others, in order to evaluate the user acceptance and performance of the two types of cards.

Ann Arbor Transportation Authority (AATA) Smart Card Project--In conjunction with a multifaceted FTA-funded Advanced Public Transportation System (APTS) project, AATA has introduced a smart-card system for use on its bus system. University of Michigan campus cards (a contact card) provided on the Ann Arbor campus is accepted for fare payment. A total of 35,000 campus cards have been issued to date. The demonstration is designed to test, among other issues, the feasibility of the cards on buses and, ultimately, the potential for integrating the cards with an automated vehicle location system.

Cleveland Multiple-Use Transit Program--The Greater Cleveland Regional Transit Authority (GCRTA) is developing a multiple-use smart-card program. GCRTA has been exploring possible multiple-use arrangements with a range of potential partners in the area; discussions have been held or are planned with banks, colleges, retail establishments, hospitals, sports teams, museums, other transit agencies, and the Ohio Department of Human Services. GCRTA envisions use of a combination contact-contactless card in an initial demonstration planned for 1997.

Phoenix Credit Card Program--Valley Metro in Phoenix, Arizona has been accepting commercial credit cards (MasterCard and VISA) for fare payment on its 400 buses since May 1995. On each boarding using a credit card, a single full fare ($1.25 for local service, $1.75 for express service) is recorded in the database under the credit card account number. The cards are swiped through the same card readers used for the passes. At the end of each week, all trips for each card are "batched" and submitted to the credit card clearinghouse; the cardholders are then billed for their trips as part of their normal monthly bill. The clearinghouse reimburses the transit agency the next day for the trips submitted. The key to making use of commercial cards viable were the decisions (1) not to perform online verification of each account and (2) not to issue a receipt with each boarding. Valley Metro accepts the risk of fraudulent cards, but only for a maximum of 1 week's worth of trips per card; the clearinghouse informs the agency if any of the cards used are stolen or otherwise invalid, and Valley Metro then enters the fraudulent account numbers into the card-reader database. Thus, a subsequent attempt to use a bad card will be rejected. Valley Metro claims that there have been no problems with the program, as of its sixth month. The agency also reports that the program has been wellreceived by users, although use has been limited to date. There were approximately 1,100 uses during the initial month of the program (May 1995), and this had risen to roughly 1,900 in the second month. Valley Metro has not yet actively marketed the program.

New York Metropolitan Transportation Authority (MTA) Metro Card Program--The MTA is implementing an automated fare collection system. The fare medium for the new system, MetroCard, is a magnetic-stripe stored-value card, and read-write ticket processing units have been installed on all buses and will be installed in all rail stations. The cards can be purchased at stations and nearby retail units in specific denominations, and can be recharged as value is used. The project was designed with the intent of expanding the use of the card to the other transit operators in the region as well as for tolls and other uses such as telephone and retail. The MTA established a subsidiary, the MTA Card Company, to carry out the expanded utility plan by entering into a joint venture with a private company; the joint venture was to be responsible for implementing and administering the multiple-use arrangements--and for distributing the MetroCard in general. The MTA selected a prospective partner (Chase Manhattan Bank) and entered into negotiations over the terms of the partnership agreement. Unfortunately, the two sides were unable to agree on the financial terms (i.e., the transaction fees the MTA would pay to Chase Manhattan Bank), and negotiations were terminated in May 1996. The MTA would still like to proceed with integration with other transportation services in the region, and is still considering multiple-use options, but the mechanism for administering these functions had not been decided as of this writing.

Wilmington (DE) SMART DART Project--This multiple-use project is intended to use the EPS/SmartCash card (issued by the Wilmington Trust Bank) on Delaware Authority for Regional Transportation (DART) buses. The plan is for the 135 DART buses to be equipped with smart-card readers (attached to the existing fareboxes). The stored-value cards would be provided to bank customers, and would also be made available to non-customers, i.e., for use on the transit system, as well as for other services at specific locations. The U.S. DOT is funding the cost of the farebox modification on the bus fleet. The project is designed to demonstrate the use of contact smart cards on buses, the bank/transit institutional arrangement, and also the potential for employer involvement. Participating employers would provide cards to interested employees, and would place funds (i.e., stored value) directly on the cards--probably through on-site addvalue machines or automated teller machines (ATMs). Because of delays in getting the overall SmartCash program off the ground, the DART project has been on hold since mid-1995; however, EPS recently renewed discussions with DART. (The overall EPS/SmartCash program is discussed in the next section.)

Toronto Regional Fare Integration--The Ministry of Transportation of Ontario has for several years been considering various approaches to introduce fare integration among the agencies serving the Greater Toronto Region. Early initiatives involved the introduction of integrated passes (paper and magnetic) for use on multiple operators. The most recent effort involves tests of integrated smart cards on buses and commuter rail. Contactless smart cards are used on buses in Ajax and Burlington and are planned for use in Mississauga. Equipment will also be installed at GO Transit commuter rail stations interfacing with these routes. These trials are part of the region's long-range development effort, that is, to test different technologies and arrangements and determine the best regional integration approach.

Manchester (England) One-Card Project--This contactless smart-card system, in testing on buses, was developed with the intention of expanding to a wide variety of purchase applications ranging from transit, commuter rail and taxi fares, and parking charges to supermarket purchases and telephone calls. The project is being financed by a joint venture (Payment Card Manchester Limited) owned by the transit agency Greater Manchester Passenger Transport Executive (GMPTE) and the fare system integrator (AES Prodata); each partner owns 50% of the system. AES provided the equipment at no charge, and the transit agency will pay a transaction fee for full-fare rides; there is no fee for "concessionary" (half-fare) rides. At least initially, the card is used to pay *for* the fare, rather than for direct fare payment; in other words, on

buses, the rider tells the operator his or her destination (this is a zonal system) and the operator enters the appropriate fare, which is then deducted from the fare card. Unlimited ride passes will also eventually be available on the cards. The system is being tested by 5,000 people who are entitled to concessionary fares (i.e., reduced fare for seniors and disabled.) This testing phase began in February 1994 in a single suburb of Manchester. The plan is to extend the test to more than 3,000 buses (operated by several different agencies), schools, and retail businesses throughout the greater Manchester area.

Sydney, Australia Integrated Card System--Another joint public-private multiple-use venture is being developed in Sydney, Australia. This program is being developed by Card Technologies Australia Limited and service provider Transcard Australia; participants in the pilot project include the transit operators, McDonald's, Shell, Coca Cola, Cabcharge Australia, and leading banks. The initial trial was conducted in a major transit corridor in St. Mary's in western Sydney. Although the system is based on a contactless card, a key aspect of the integrated card system (WICS) is that it is designed as an open system to allow eventually (1) the use of different card technologies (contactless, contact, and magnetic), as required, and (2) any terminal/reader manufacturer to integrate WICS into its own units. A range of terminals (i.e., read-write units) is being developed and will be tested in the system; these include bus-ticket issue machines with integrated validators, rail validators, taxi terminals, retail agent terminals (with bank certification), retail purchase terminals, vending machine integrated readers, toll booth integrated readers, and fast food outlet driveway integrated readers. One of the features of the system will be the ability to use the existing banking systems for adding value to cards; clearing and settlements will also be done through the banking system. Following completion of the initial trial in early 1996, CTA ordered more than 1 million cards (in March 1996) for full rollout of the system.

Hong Kong Contactless Card Project--The Mass Transit Railway (MTR), Kowloon Canton Railway (KCR), and three other transportation operators in Hong Kong have established a joint-venture company--Creative Star Ltd.--to introduce a common fare medium (contactless card) encompassing all major forms of public transport in Hong Kong: both heavy and light rail, bus, and ferry. The contract to install the system was awarded to AES Prodata (using SONY cards) in late 1994. The system trial began in early 1996, and more than 20,000 cards had been issued as of September 1996. The full system will involve approximately 3 million cards and 4,000 pieces of processing equipment. Considerable interest has also been shown by many non-transport organizations for potential future card applications.

Seoul (South Korea) Contactless Card Project--In what is currently the largest multipurpose transit application, contactless card terminals have been installed on all of the 8,700 buses operated by the 86 bus companies (serving 449 routes) that make up the Seoul Bus Union. Intec Ltd., a Korean system integrator, built and installed the bus units and is handling the clearinghouse function; the cards, produced by GemPlus using Mikron's MIFARE system, are issued by a financial institution, Lucky Goldstar Credit Card Corp. More than 1 million cards have been issued (as of October 1996), accounting for more than 800,000 transactions per day. The system installation was completed in July 1996. Intec has been awarded a contract to place terminals on an additional 4,300 buses outside of Seoul, and the plan is to issue a total of 4 million cards in Korea by early 1998. In addition, operational tests on the Seoul subways were scheduled to begin by the end of 1996, and other (no-transit) applications for the cards are planned as well; these uses include ID cards for city officials, customer loyalty cards, and electronic purse (in conjunction with Lucky Goldstar Credit Card Corp.).

Other transit agencies and regions are also considering multipurpose options, and these will be reviewed in the next phase of the study. Financial services and other programs are discussed in the following section.

FINANCIAL SERVICES AND OTHER PROGRAMS

Several banks and other types of institutions (e.g., telecommunications and postal companies) are developing, testing, and rolling out stored-value and electronic-purse programs in various parts of the world. Several universities have also introduced stored-value campus cards (using smart cards); current U.S. examples include five branches of the University of Michigan system and Florida State University. The United States is behind Europe and Australia in seeing trials of stored-value programs, but one public trial is in place (Atlanta) and several others are being tested by individual banks (e.g., at their own headquarters). Other trials are planned, including the joint VISA/MasterCard project in New York City. In all, there are more than fifty electronic-purse projects in place or planned around the world. Key examples, either already in use or in or near the testing stage, are summarized below; more extensive discussion of several of these and other programs will be presented in the final report.

VISACash--VISACash was the first stored-value smart-card open system program to be launched in the United States. VISA formed an alliance with three banks to develop and implement the program: First Union, Wachovia, and NationsBank. The initial VISACash card operating system was licensed from DANMONT, the Danish electronic-purse system (see below). VISA is serving as the network operator, performing transaction clearing and settlement for all the financial institutions. Financial institutions are responsible for card management functions, merchant solicitation and

servicing, as well as transaction processing and settlement. Because merchants transmit individual transactions as part of the settlement process, the VISACash system should be regarded as an "off-line, accountable" under the definitions proposed by the Federal Reserve Bank.

VISA and the three banks worked aggressively to recruit merchants and customers. First Union projected that it would sign 5,000 merchant locations before the Summer 1996 Olympic Games. First Union planned ultimately to issue 1 million disposable and 300,000 reloadable cards; the bank planned to introduce a reloadable card to its customers later in 1996. NationsBank sought to appeal to the card collector market with 18 different cards and was the only bank allowing telephone orders with payment by check, money order, or VISA credit card. The banks targeted the standard cash-intensive merchants (i.e., fast food, gasoline, and telephone) to accept the card. It is estimated that, during the Olympics, VISACash was used for more than 200,000 transactions, accounting for more than $1 million; this translates into an average of 11,000 transactions per day, with an average value of approximately $5.50 per transaction. By August 1996, 4,200 terminals had been installed. VISACash trials are also underway in three locations in Canada: Vancouver, Toronto, and the Province of Quebec. VISACash will also be used in trials elsewhere, including New York City, as described below.

MasterCard / VISA Project--MasterCard and VISA, along with Chase Manhattan Bank and CitiBank, announced in April 1996 that they would be jointly implementing a stored-value pilot program in New York City. The pilot will be conducted in an area on the Upper West Side of Manhattan in 1997. The program is expected to include 50,000 cardholders and about 500 merchants, and is projected to run for 6 months. The commitment of both card associations to develop a single merchant terminal capable of accepting multiple cards is a significant step towards interoperability. VISA has indicated that the same system being used in Atlanta will be used in New York City (through CitiBank); MasterCard recently announced plans to use the Mondex system (through Chase Manhattan Bank) in the project, rather than its own MasterCash system that had been demonstrated in Australia. Although disposable cards will not be used in the pilot program, they may be required in a full rollout to reach those consumers who bank at a financial institution that is not participating, or who are unbanked.

Mondex--Mondex is a smart-card electronic-purse program developed by Midland Bank, National Westminster Bank, and British Telecom (BT) in 1990. The initial pilot for the card is taking place in Swindon, England, although trials are in place or planned for several other parts of the world, including the United States (in the MasterCard/VISA New York project and at Wells Fargo Bank's San Francisco headquarters), Canada (Royal Bank of Canada and Canadian Imperial Bank of Commerce are planning a pilot in Guelph, Ontario), and Hong Kong (Hong Kong Bank is planning two pilots). Following the recent purchase of 51% of Mondex by MasterCard International, seven American companies (Chase Manhattan Bank, Wells Fargo, Dean Witter/Discover, AT&T, First Chicago NBD, Michigan National Bank, and MasterCard) have agreed to form a company (Mondex USA) to market Mondex in the United States. Mondex has been developed to represent a "true" form of electronic money. The basic Mondex products are a smart card (card balance can be checked with a reader the size of a key fob) and a "wallet" the size of a small hand-held calculator; the wallet can be used to check card balances, view the last ten transactions of a card that is inserted in the wallet, or transfer value from a card and either store it temporarily in the wallet or transfer it to another card. Value can also be added to a card at an ATM or a designated screenphone. Mondex is working on the capability to add value through the Internet using a personal computer with a card reader. Because merchants will transmit only a total amount during the settlement process, the Mondex system would be regarded as "off-line, unaccountable" under the definitions proposed by the Federal Reserve Bank. Under current proposed Federal Reserve regulations, the product would be exempt from Regulation E.

At this time, about 10,000 cards have been issued in Swindon. This is 20% of the customer base of the National Westminster and Midland Banks. Mondex is seeking to make the card issuance process more efficient and will market the program to non-issuing institutions promoting the fact that the consumer does not have to switch banks to participate. Mondex has signed up approximately 750 merchants in Swindon. Currently, the retailer has to use a separate terminal to accept cards, but Mondex is developing a single terminal that will also handle magnetic-stripe credit-card cards. Transactions are stored individually in the terminal and the merchant can print out a transaction register if desired. At settlement, the retailer inserts his or her card into the terminal, where the value of the transactions is transferred to his or her card. The merchant can then transmit the total to the bank for deposit or use the card for the purchase of goods and services.

DANMONT A/S--In 1991, the Danish banks and telephone companies agreed to establish an independent company, DANMONT A/S, as the "System Operator" of their central clearinghouse for a national payment card. The objective was to introduce a nationwide prepaid smart card that could be used for purchases from vending machines, telephones, trains, buses, and parking meters. Cards are sold in denominations of DKK 100, 250, and 300 (the equivalent of between $20 and $50). One-time cards (i.e., there is no capacity to add value) are used primarily to simplify the electronic money tracking logistics; the cost of the one-time cards is borne largely by

advertising revenue. In Phase II, it is expected that rechargeable cards and add-value machines will be introduced. The system is offline and the user remains anonymous. The system is managed by the "system operator" (DANMONT A/S), which provides the sole link between the card issuers, card and equipment suppliers, and service providers. This allows even small retailers to join the system as service providers, even if they are not large enough to be independent card issuers. Seven different manufacturers have invested in and operate different services. Eight banks and a telephone company issue cards, and other manufacturers and card issuers have expressed interest in the system. National implementation was begun in March 1993. The program operates in 39 cities throughout Denmark.

Banksys / Proton--The Proton electronic-purse program, developed by the Belgian banking association Banksys, is the largest such program in the world. Banksys, owned by the major Belgian financial institutions, owns all 1,000 ATMs in Belgium. Banksys also operates an online point of sale (POS) service throughout the country with a cardbase of 6 million cards. Unlike most other programs that develop specifications and certify terminal manufactures, Banksys has been the exclusive supplier in Belgium for both magnetic-stripe and smart-card terminals; the supply of terminals is considered a major source of revenue. The Proton electronic-purse program was launched in February 1995 in two cities, Leuven and Wavre, located outside of Brussels. Cards are loaded through ATMs or through the approximately 300 reload terminals located at bank branches. All banks operating in the pilot cities are equipped to issue and reload cards. The Proton program has a terminal base of approximately 30,000. As of early 1996, card acceptance terminals were operating in approximately 1,500 of the 3,600 possible merchants. By March 1996, more than 850,000 transactions had been completed using the cards; the average transaction amount has been US$6.00. Although Banksys receives a record of all transactions performed by a card, it only retains the transaction record to verify the card balance and then discards the specific transaction information. This procedure was implemented to address concerns by cardholders that a record of their cash purchases would be maintained. How the Federal Reserve Board would classify this system is unclear, because the system can store all the transactions and be an "accountable" system.

A national rollout of the program in Belgium was initiated in February 1996. Beginning in 1997, the plan is that all existing debit and credit cards will have a chip added to the card and will support the electronic purse. Banksys has also licensed the Proton operating system to electronic-purse programs in other parts of the world including the Netherlands, Switzerland, Australia (QuickLink pilot, see below), Brazil, and Canada. For instance, the Bank of Montreal and Toronto Dominion Bank planned to begin testing the system (as the *Exact* card) in Kingston, ON, in late 1996. American Express has recently licensed the Proton system for use in the United States. Banksys planned to issue a multi-application card in September 1996 that could handle as many as eight different applications. Regarding transit applications, Banksys has stand-alone terminals on several buses operating in Leuven and hopes to integrate this process into the farebox. Banksys will install automated ticketing machines at several bus terminals by the end of 1996.

Swiss PTT Postcard--The Swiss Post, Telegraph, and Telephone (PTT) implemented a smart-card electronic-purse program in Biel/Bienne, Switzerland, in 1991. Initially, 13,000 consumers were given the Postcard, a contact smart card; more than 1.3 million Swiss consumers carry the Postcard. For almost the last 2 years, the Postcard has been co-branded with the MasterCard logo, giving the card wider acceptance than it had originally received. The Postcard can be used to purchase various items and services, including telephone calls and fare cards from terminals at rail and bus stations throughout Biel/Bienne. The pilot project has shown the Postcard program to be profitable as well as technologically feasible. The system has been operated at costs lower than originally expected, indicating that such a system could be run profitably. Vendor acceptance of the card product has been varied. Service providers have given mixed reviews--vending providers found the Postcard to be a relief from dealing with high coin volumes, while other POS vendors believed the card was not flexible enough to accommodate high-value transactions.

New South Wales (Australia) QuickLink--The QuickLink Card System, a stored-value pilot program, has been operating in Newcastle, New South Wales, Australia, since late 1995. QuickLink uses the Proton system. Approximately 18,000 reloadable cards have been distributed to consumers, and 50 reload points are available. Cards can be reloaded either online or offline through POS terminals. The plan is ultimately to make the cards available anywhere they can be used. No fee is currently associated with obtaining or using the card, but fees may be imposed at some future point, that is, as the program expands to include additional vendors and applications. Approximately 300 QuickLink terminals are available and cover various applications, including payphones and POS terminals. University of Newcastle Union students can use the card in the dining halls. Vending machine applications are also being considered. Regarding transit applications, the New South Wales state bus system planned to install terminals on every bus by the end of June 1996, and a pilot program was to be launched then. This is not a fare collection application per se; rather, tickets are purchased with cash on the card.

EPS/SmartCash--Electronic Payment Systems (EPS) was established in 1992 to provide transaction processing support for the MAC ATM network and to develop additional card and banking-related products and services.

In 1995, EPS announced plans for SmartCash as a nationwide stored-value smart card. EPS' partners in this venture were major payment systems companies, including MasterCard, Bank of America, Chase Manhattan Bank, Chemical, Wachovia, First Union, Wilmington Trust, NationsBank, GemPlus, and VeriFone. EPS is owned by five financial institutions: CoreStates Financial Corporation, National City Corporation, KeyCorp, PNC Bank Corporation, and BancOne Corporation. As of November 1996, EPS had fully developed its system and was demonstrating the system for the member financial institutions.

Europay Clip--Europay International, the European payments association, recently (June 1996) announced creation of the first multinational, multicurrency, smart-card electronic-purse system. The card product, called Clip, incorporates a still-unpublished version of the Europay/ MasterCard/VISA (EMV) interoperability specifications. Associations or banks in several countries (i.e., Italy, Iceland, the Czech Republic, and Austria) have indicated that they would use--or are strongly considering--the Clip system in their own electronic-purse systems.

Chipper--PTT Telecom and Postbank in The Netherlands have introduced the Chipper multi-application electronic-purse system. The system is open to a broad range of card issuers, and several different functions can be combined on a card; these include reloadable purse, home banking, ID, Internet access, retail loyalty programs, parking charges, and transit. Cardholders can load value onto the cards from bank accounts via public telephones. The system also offers the *Telechipper*, a low-cost card reader that can be attached to a private telephone or personal computer; the Telechipper allows remote access to retailers or other providers through the transmission of audio signals. The plan is to issue 1 million cards in early 1997, with as many as 10 million in circulation by 1998. Several trials are underway, including use by retail chains, provincial authorities, and transit operators (e.g., the regional transit authority in Rotterdam).

Postchecque--La Poste, the Belgian post office, has developed a multifunction, multi-client electronic purse called Postchecque; the card is considered competition to the other Belgian purse, Proton. Postchecque is available for use by any interested entity. As of October 1996, agreements had been signed with several major retailers and were being negotiated with Belgian Telecom, oil companies, and transit operators in Belgium.

SUMMARY

As shown by the number of projects reviewed here, there is considerable activity in developing and implementing multipurpose payment programs. In transit, electronic payment media, particularly smart cards, have facilitated the consideration of new approaches to regional fare integration, as well as integration of transit and other payment methods. Various models are being considered for each type of multipurpose arrangement. Efforts to date have had modest successes and setbacks. For example, in one case (MARTA/VISACash), a joint transit-financial institution program was successfully implemented in a very short period, whereas another joint effort (MTA/Chase Manhattan Bank) failed to come to fruition. The two programs, however, clearly differ in scale, complexity, and level of expectation and risk (on both the transit and the financial sides). Furthermore, the background and settings are very different in the two projects. Thus, it cannot be concluded--on the basis of these limited results--that one approach "works" and the other does not. The details underlying both efforts must be considered, and the lessons from each must be examined. Transit-oriented multipurpose projects of all types are very recent developments, and, so far, have produced more questions than answers.

As in the transit arena, the multipurpose program focused on financial transactions (i.e., the stored-value or electronic-purse system) is in its infancy. Unlike transit, developments in the financial arena, with global effects at stake, have been marked by both fierce competition and new alliances, often involving the same parties. With basic electronic-purse systems taking several different forms (e.g., the Mondex cash substitute model versus the VISACash credit/debit card model versus the SmartCash traveler's check model), the major system operators are vying for the allegiances of new programs. Ultimately, a shakeout among the competing systems is probable, because the desire for interoperability--coupled with preferences expressed by the marketplace--should considerably reduce the number of competing operating systems.

The degree of acceptance, first by individual card issuers, then by merchants, and finally by consumers, will also affect the success of specific programs, as well as many of their operating parameters (e.g., the pricing of transactions and card use). This acceptance has only recently begun to be tested in many parts of the world (including North America), although a few programs have been in place for at least 2 years. The early results from these efforts have been positive, but use has grown more slowly than anticipated. There are important questions in the minds of all prospective participants (i.e., issuers, merchants, and consumers) in a stored-value smart-card program.

Issuers will also want to know the following:

- How will my organization benefit from issuing these cards?
- How much will it cost to issue these cards?
- What are the institutional, legal, and technological in instituting such a program?

- Will merchants and consumers accept this program?

Merchants will want to know the following:

- How will I benefit from accepting these cards?
- How much will it cost to accept these cards?
- Will my customers use the card?

Finally, consumers will want to know the following:

- How convenient will it be for me to use the card (where can I get it, where can I refill it, and where can I use it)?
- What happens if I lose the card, or if the reader does not work?
- Will my privacy be compromised by using the card?
- How will I benefit from using the card?
- How much will it cost to use the card?

As different types of programs continue to roll out and additional experience is gained, these questions will be answered. Complete answers will not be available until this new concept is understood and implemented on a broad scale. Chapters 3 through 8 identify and describe the issues raised by these questions in order to provide at least a framework for addressing them.

CHAPTER 3--INSTITUTIONAL ISSUES

ALTERNATIVE INSTITUTIONAL ARRANGEMENTS

A multipurpose payment program can be established in a range of institutional settings, including a transit-only *environment*, a more general public transportation setting, or a broader "open" environment. The institutional setting and arrangements will depend largely on who is initiating the program (e.g., transit agency versus financial or other institution) and the capabilities and constraints (e.g., financial, administrative, legal, and technological) and goals (e.g., reduce costs and increase revenues) of that entity.

The key institutional parameters that need to be established in a multipurpose payment program include the following:

- Whether the system will be closed or open;
- Whether the system will be administered by the transit agency (or group of agencies) or by a financial or other private entity; and
- The types of entities involved, their roles, and their legal and organizational relationship.

ROLES IN A MULTIPURPOSE SYSTEM

In general, a multipurpose payment system will involve the following basic roles:

- **User**--anyone who uses the payment media to purchase services or products from merchants;
- **Merchant**--an entity (e.g., a transit agency or a retailer) that will accept the media as payment for the provision of a *service* or a product;
- **Issuer**--the entity (e.g., the transit agency or a bank) that provides the media (and is identified on the media) and pays the merchants on the basis of the stored-value they have received from users;
- **Distributor**--a point of sale and recharge location of the media; the media are received from the issuer, and records of transactions are sent to the issuer; a distributor can be a bank ATM, a transit ticket vending machine, a transit agency ticket agent, an outside vendor, or a participating merchant;
- **Acquirer**--an entity that obtains card transaction information from merchants and transmits it to the appropriate issuer; acquirers may not be needed in a closed system; and
- **Clearinghouse**--an entity or organization responsible for managing many of the support functions for the multipurpose program, including card management (e.g., issuance and distribution), revenue management (e.g., collection, reconciliation, and settlement), customer service, and marketing.

The *clearinghouse* concept tends to differ in scope from one project to the next, but is key to any multipurpose transit fare program. In a closed system in particular, the clearinghouse may carry out the requirements associated with issuer, distributor, and acquirer.

BASIC INSTITUTIONAL APPROACHES: OPEN VERSUS CLOSED SYSTEMS

As indicated above, the decision to pursue an open versus a closed system (or something in between) for multipurpose payment media is driven by several factors, including who is initiating the program, the goals of the initiating entity, and the capabilities of this entity. From a transit agency's point of view, the options for a multipurpose program can be categorized as follows (the basic structures are depicted in Figures 1, 2, and 3, and are summarized in Table 2):

- **Closed (transportation-only) system**--In this option, a transit agency or a group of agencies (possibly including other, non-transit, transportation providers) issues fare media usable on any of the agency's (or member agencies') services. Individual functions (e.g., card production and distribution, revenue reconciliation and settlement, equipment procurement, and perhaps maintenance) can be contracted out or provided by one or more of the member agencies. Examples of this general approach include the Hong Kong Creative Star project, the Ventura County Smart

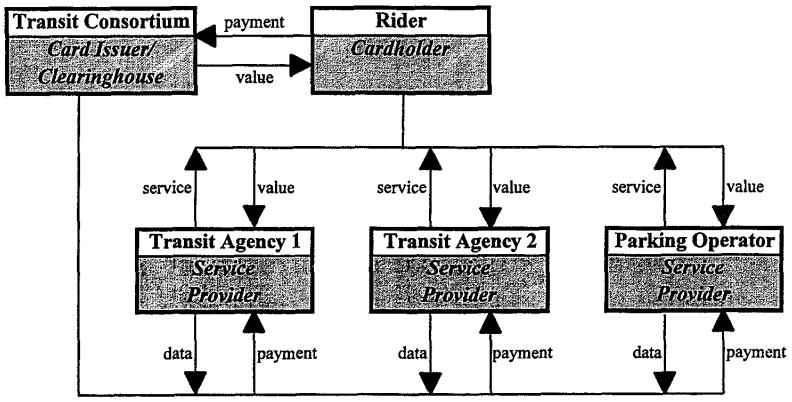
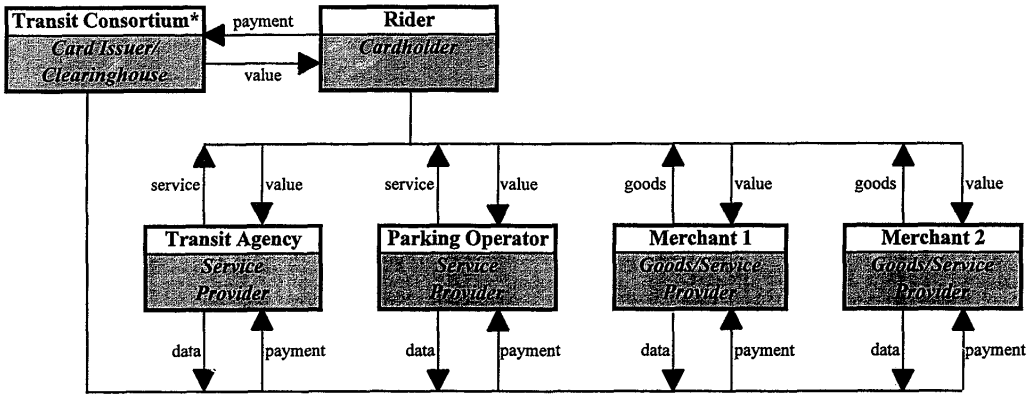
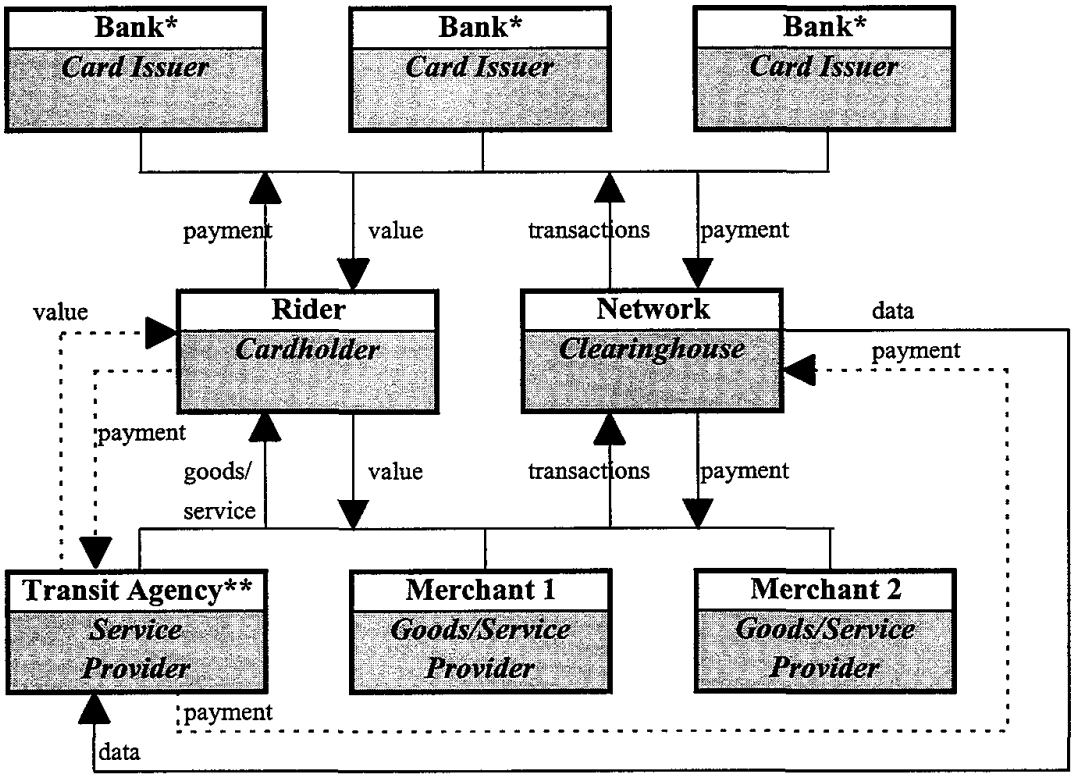


Figure 1. Closed (transportation only, multi-operator) payment system.



* may be partnership with financial institution or equipment vendor/integrator

Figure 2. Closed multipurpose payment system.



* or other entity
** may also be card issuer (- - - - - - if transit agency is card issuer)

Figure 3. Open payment system.

TABLE 2 Comparison of roles in closed vs. open payment systems

Role	Closed (transportation only)	Closed Multipurpose	Open
user	anyone buying a fare card	anyone buying a fare card	anyone with multiple use card (from bank or transit agency)
merchant	participating transit and other services (e.g., parking, toll)	transit (and other transportation) services and other participating entities (e.g., retailers)	any entity accepting card (e.g., transit agency, retailers, banks)
issuer	participating transit and other services (e.g., parking, toll)	participating transit and other services (e.g., parking, toll), or private partner	banks, other participating entities (e.g., transit agency)
distributor	participating transit and other services (e.g., parking, toll)	transit (and other transportation) services and other participating entities (e.g., retailers)	banks, other participating entities (e.g., transit agency)
acquirer	(same as clearinghouse)	(same as clearinghouse)	private entity
clearinghouse	lead transit agency, consortium, or third party contractor	lead transit agency, consortium, third party contractor, or private partner	central network

Passport project, and the regional integration project being developed in the Seattle area.

■ **Closed multipurpose system**--In this option, the transit agency(ies)-issued fare media can be used for certain other purposes (e.g., vending, telephones, newsstands) as well as for transportation purposes. Again, the support functions can be provided by the agency(ies) or contracted out; however, in this arrangement, a partnership with a financial institution, equipment vendor, or other private entity becomes a possibility as well. Examples include the proposed MTA MetroCard expanded utility project, the Manchester (GB) smart-card project, and the plan for the expansion of the Seoul (Korea) smart-card project.

■ **Open system**--In this approach, the transit agency(ies) accepts media from multiple issuers. There are several possible models for a transit agency's participation in an "open" system, including (1) the transit agency becomes a participating "merchant" in a general electronic-purse and stored-value card program or an application in a multi-application program, and thus probably pays transaction fees for its customers' use; (2) the agency becomes a formal partner in the arrangement, sharing both the benefits and the financial risk involved in the venture; or (3) the agency (or consortium) administers its own payment program, but allows outside issuers' cards to be used provided they meet the program's requirements. In the first scenario, the transit agency does not issue cards itself. In the second scenario, the transit agency may be one of multiple card issuers or may "co-brand" the cards issued by others-that is, the card would carry the transit agency's name as well as the issuer's name. In the third scenario, the agency(ies) issue(s) cards. Examples of the general open system approach include the MARTA/ VisaCash project in Atlanta and several projects abroad (e.g., DANMONT, Swiss PTT, Sydney). The proposed San Francisco project will probably pursue an "open system perspective." Finally, although not involving stored-value cards, Valley Metro's (Phoenix) acceptance of commercial credit cards is a key example of transit's participation in an open system.

The closed system option is an expansion of the current fare collection system in place at every transit agency to incorporate neighboring transit services and, perhaps, other modes (e.g., parking, ferries) as well. As shown in Figure 2, the second option is essentially an extension of the first, because the fare card's use is expanded to include functions beyond transportation services. In New York City, for instance, the MTA introduced the stored-value MetroCard for transit use only, but planned to add the expanded utility capabilities through a partnership with a private firm. The third option--the open system--represents a fundamental change from the way transit agencies manage fare collection activities. Although some transit agencies will have an interest in participating in such a program and not issuing their own electronic fare media, others will prefer to retain full control over their fare systems and will not wish to participate as a merchant in an open program. An agency or group of agencies considering an appropriate approach must weigh the advantages and disadvantages of the alternative approaches against its own goals and constraints. The relative advantages are summarized in Table 3.

What may occur in certain instances is an evolution from a fully closed system to a closed multipurpose system to an open system. This would probably occur over several years, because an agency (or integrated regional program) might wish to wait until bank-issued cash cards were well-established. Another path is for a transit agency to enlist in a bank-initiated multiple-use or multi-application program, but to provide its own multipurpose media as well. At least for the foreseeable future, most transit agencies will need to remain in the fare collection business to some extent, because they will have to collect cash fares (at least on buses) or tokens and tickets to accommodate occasional riders. Agencies may decide that the benefits of administering their own multipurpose programs outweigh the benefits of participating in an open system. For example, in the Seattle regional fare integration project, it has been recommended that the multipurpose fare system be administered by the consortia of transit agencies in a relatively closed system initially, with possible expansion to a more open system once smart cards become more widespread.

The San Francisco TransLink project, although developed as a closed multipurpose system, is envisioned as being open to compatible media issued by outside entities. The *TransLink Program Plan* calls for the system to "accept for payment of transit services with cards issued by any entity provided: (1) the cards meet the TransLink standards, (2) the issuing entity has been properly investigated to ensure its legitimacy, and (3) a satisfactory business arrangement is reached between the issuing entity and operators (individually or collectively)"*(1)*. This plan also recommends that the TransLink program maintain maximum flexibility in terms of media technology, that is, the system should be designed to accept contact as well as contactless cards in the future; the card-reading devices should be able to accommodate readers for both types of cards, although it is suggested that only the contactless readers be installed initially. This flexible strategy will facilitate movement toward an open system approach.

As reflected in the Seattle and San Francisco plans, the availability of a viable alternative (i.e., to an agency developing and administering its own program) is an important consideration for the transit agency in choosing an approach. In Atlanta, for instance, the rollout of the VISACash card by the three banks enabled MARTA to take advantage of the opportunity to accept the cards for fare payment. Until such programs are introduced elsewhere, transit agencies do not have a similar

TABLE 3 Closed versus open: relative advantages for transit agencies

Area	Closed	Open
Financial effect	Retain all additional revenues Lower exposure to fraud	Reduced fare collection costs Limited financial risk
Degree of control and administrative responsibility	Retain authority over all fare collection functions	Reduced responsibility (e.g., for distribution and settlement)
Appeal to customers and pricing flexibility	Greater flexibility in pricing (e.g., setting discounts or bonuses)	Greater appeal to customers: more flexible card and wider distribution

option available to them. Although the opportunity for transit agency entry into the multipurpose payment world can dovetail with the implementation of electronic-purse programs by financial institutions, those agencies unwilling to wait for the arrival of electronic-purse and multi-application cards must initiate their own efforts. Several financial institutions and other entities involved in payments products and services have expressed interest in assisting them in this process, through partnership or contracting arrangements. Possible arrangements are discussed below.

THE IMPETUS FOR MULTIPURPOSE MEDIA PROGRAMS

Transit Agencies

The specific goals of the transit agency or group of agencies will play a major role in dictating the type of program to be pursued. For instance, if regional fare integration is a key motivating factor (at least initially), then some type of closed system--administered by one or more transit agencies--is the likely approach. If, on the other hand, the reduction of fare media distribution and processing costs is of greater importance, then the transit agency may prefer to become a participant in an open, multiple-use program initiated by a financial institution.

Several factors will influence the program initiated. Besides the transit agency's goals, its capabilities and constraints will be key factors. For instance, some agencies may be legally prohibited from entering into partnership-type agreements with private entities. In other cases, an agency may be unwilling to relinquish direct control over its fare payment system. The availability of resources will also influence the decision; an agency (or group of agencies) with insufficient funds to acquire and implement a new fare system will be more interested in a scheme that reduces its own financial requirements.

Financial and Other Institutions

The growing interest in multipurpose payment arrangements in the transit industry has been paralleled by a steady move toward prepaid and stored-value media by the financial services and banking industries. The banks see a significant market in capturing small cash purchases through prepaid media. It is estimated that, worldwide, there are more than $8 trillion worth of cash expenditures each year; nearly a quarter of this is in expenditures of $10 or less. In the United States alone, there are roughly 340 million cash transactions per year, accounting for about $1.7 trillion; more than a third of this total is on transactions of less than $20. The banks hope to generate revenues through transaction fees (and possibly card use fees) and to reduce costs by requiring fewer bank tellers.

This move toward stored-value media has also been driven by the growing interest in smart cards for various payment applications. The financial services industry sees smart cards as the future standard technology for all payment-related media (e.g., credit cards, electronic benefits transfer, medical claims processing, and retail loyalty programs) as well as access and identification media for online transactions in the near future. Another goal in offering stored-value cards is to expand the range of services provided to consumers, as banks seek to improve their status in the increasingly competitive payments environment.

In general, tying in with a large transit agency offers a bank or other entity several benefits, including the following:

- The opportunity to establish quickly a critical mass of users of the bank's prepaid media;
- Access to new customers for its other products and services (e.g., bank accounts), perhaps through co-branding of fare media;
- Access to transit facilities (particularly rail stations) for installation of bank ATMs--to dispense the prepaid media and to provide other banking functions; and
- Access to merchants closely affiliated with transit (e.g., vending machine operators and newsstands).

Moreover, transit use is particularly well-suited to the use of prepaid media and stored value in particular: it involves many low-value transactions, and it requires rapid transactions (i.e., online authorization for payments is infeasible). Furthermore, transit agencies typically require exact payment and do not give change. Most transit agencies offer some type of prepayment, typically in the form of

unlimited-ride passes or multiple tokens or tickets. Of particular relevance, the transit industry has been using stored-value media for more than 25 years. Thus, the transit industry has experience with this approach, and its riders are accustomed to prepayment.

Besides looking at transit as a participant in a card program, financial institutions also see opportunities to assist transit agencies, through partnership and contracting arrangements, in establishing and adminis-tering their own stored-value programs. Banks can offer their expertise in managing the various elements of the payments business, including the back-end reconciliation and settlement functions as well as the production and distribution of the media themselves.

MANAGEMENT STRATEGIES

Besides addressing the question of how open the payment system will be, the transit agency or consortium must identify the various management and operational functions required and who will be responsible for these functions in administering the payment system. In a fully open system, the transit agency or consortium acts as merchant and possibly issuer and distributor (one among many). In a closed system, several options can be considered, depending on the management functions required and the capabilities of the transit agency(ies). For instance, the transit agency or consortium initiating the program can retain direct responsibility for all or most functions, or it can involve the private sector (through a contacting or partnership arrangement).

The basic management and operational options related to a multipurpose program are as follows:

- Direct transit agency responsibility for all functions, with possible contracts for specific functions;
- Third-party contracting for overall operation of clearinghouse, with possible subcontracts for certain functions; and
- Partnership with a private company, with the responsibilities divided among the partners or the formation of a new entity (essentially a "joint venture") responsible for all functions.

The selection of the most appropriate option will depend on a combination of factors, including the transit agency's or consortium's primary goals, capabilities, and available resources, as well as any legal constraints (e.g., related to private involvement in managing public funds). In considering the advantages and disadvantages of the three basic management options, the major issues relate to degree of day-to-day administrative responsibility for all functions, the cost and financial benefit effect on the transit agency or consortium (including the need for additional staff), and the transit agency's ability to use the financial sector's capabilities and expertise and existing transaction-processing infrastructure. (These advantages and disadvantages are summarized in Table 4.)

An important consideration in pursuing a public-private partnership is the potential difficulty involved in developing and implementing a mutually acceptable agreement between a transit agency and a private entity, particularly a financial institution. Besides any regulatory barriers, developing a partnership agreement can be complicated by the following three key factors:

- General market stored-value media have not yet been widely tested in the United States--and acceptance by the general public has, therefore, not yet been established (i.e., outside of a handful of transit agencies), creating a sense of risk in such a venture;
- The underlying motivations for public and private institutions are fundamentally different: a private company's interest in any such venture will be driven primarily by the desire to generate a profit or at least to minimize its risk while gaining access to a new customer base; a public agency is certainly interested in generating additional revenues, but is likely to be at least as concerned with such goals as improving the quality and efficiency of its service and increasing ridership; and
- Financial institutions have selected contact cards as the preferred medium for their new payment instruments, while transit agencies generally prefer contactless cards.

Given these factors, the development of a partnership agreement with a financial institution is likely to be difficult and may be time-consuming. The barriers to establishing such partnerships should be eased once one or more such agreements have been completed; however, it will be some time before any partnerships under consideration are demonstrated to be requirements and constraints facing transit agencies. There are several models for such arrangements around the world, including the systems being implemented or tested in Manchester (joint public-private venture), Sydney (private company, with various public and private participants), and Melbourne (outsourcing of all revenue collection and management services).

Regardless of the specific arrangement, private-sector involvement is likely in most multipurpose programs. Although many agencies will prefer to retain overall control over any new fare systems, they will probably contract out specific functions, if not overall management of all clearinghouse functions.

CHAPTER 4--OPERATIONAL AND ADMINISTRATIVE ISSUES

Several operational and administrative issues must be addressed in establishing and managing a program. Key issues include the following:

- Pricing of media (e.g., related to discounts and bonuses for purchase or use) and
- Sale and distribution of media (e.g., related to initial availability and ease of reloading media).

TABLE 4 Clearinghouse management/operation options--advantages and disadvantages

	Management Option		
	Public Control	**Contract Management**	**Public-Private Partnership**
Advantages	Transit agency retains direct responsibility over all functions (but has ability to contract for specific functions) Transit agency keeps all benefits	Transit agency able to reduce day-to-day administrative responsibility Transit agency avoids need to hire significant additional staff Transit agency able to take advantage of private-sector expertise and existing financial infrastructure Transit agency keeps all benefits	Transit agency able to share risk and costs Transit agency able to take advantage of private-sector expertise and existing financial infrastructure
Disadvantages	Transit agency assumes full risk and costs Transit agency may need to hire significant additional staff Transit agency unable to take advantage of private-sector expertise and existing financial infrastructure	Transit agency assumes full risk and costs Transit agency must yield day-to-day control of customer service functions; contractor may not have same level of concern	Transit agency must share benefits Implementation may be difficult and take a long time (agreement will be complicated, and there may be legal restrictions on such arrangements)

PRICING OF MEDIA

Electronic fare technology allows individual agencies to maintain their own fare structures in an integrated system. However, the provision of discounts and bonuses on purchase (or reloading) of stored-value cards can significantly complicate a multiple-use arrangement; this is because every expenditure--transit or other--will be subject to the same discount. The prepaid stored-value concept makes it difficult to allocate the discount just to transit. (In a multi-application card, where transit is a separate application, this problem is avoided.)

Several ways exist to circumvent this problem; these include (1) offering a discount on rides taken, rather than offering a bonus on the amount of purchase, and (2) introducing a "loyalty" program that rewards frequency of transit use. A multiple-use arrangement will be simpler if no discount or bonus is offered; however, a discount or bonus--particularly when adding value--can encourage a transit rider to keep the same card for an extended time.

A similar issue relates to the use of transit vouchers (such as New York's TransitChek or CommuterChek in several other cities) to purchase multiple-use stored-value cards--or direct employer provision of cards (i.e., in lieu of monthly flash passes). Because there is no requirement that a multiple-use card be used for transit, an employer providing vouchers or actual fare cards might be subsidizing retail purchases or telephone calls rather than transit use for some employees. One solution to this problem would be to prevent the use of subsidized vouchers in purchasing multiple-use stored-value fare cards; in such a case, the vouchers could be used only for buying transit-only fare media. Similarly, subsidized fare media provided directly to employees would have to be restricted to transit use in some fashion. This could take the form of a post payment-employer billing option, for instance. Another possibility is to offer unlimited ride passes (on fare cards) that can only be used for transit.

SALE AND DISTRIBUTION OF MEDIA

One of the most important factors likely to determine the success of any stored-value program is the availability of the cards and the ease of reloading--and checking remaining value--on them. This is a crucial concern to potential card users, particularly those bus riders who do not use rail in multimodal systems or riders in bus-only systems. In rail stations, cards can be sold and reloaded by "ticket" agents, through AVMs or, possibly, through bank ATMs (e.g., in an open system). In New York, the stored-value (magnetic) MetroCard is sold and reloaded by ticket agents-as well as through a series of remote vendor locations. In Atlanta, the NationsBank VISACash card is sold through in-station vending machines. Although NationsBank is the only bank authorized for in-station vending, VISACash cards are available from First Union Bank, Wachovia Bank, and NationsBank tellers; the cards eventually will be sold through ATMs as well. Card readers can also be provided in stations to allow users to check remaining value; New York uses such devices. Thus, card availability in general should not be a major issue for rail riders, although there can be delays if high-volume stations do not have enough vending machines. In an open system, the transit agency can maximize the availability of cards to its riders by arranging for issuing entities to install vending machines or ATMs in the stations. This is less important if the stations are close to ATMs or other sales outlets.

Ensuring sufficient availability of cards for bus riders is more problematic. One option is to establish a widespread remote sales network (e.g., sell cards through ATMs and at common remote sales locations such as drug stores, supermarkets, and newsstands. However, this will still result in availability problems for some riders (e.g., those boarding in suburban areas and not having ready access to a sales point or the "un-banked," as is discussed below). Other possibilities include the following:

- Employer distribution,
- Purchase at home (i.e., via telephone, mail, or computer), and
- Sale on board buses.

Although there may be problems related to restricting subsidies to transit use, as mentioned above, employer distribution remains an option for any prepaid (or post-paid) fare medium; in some cases, the smart card may be a monthly pass, as is in the Ventura County program.

The sale of payment media at home is one of the key emerging developments in banking. "Virtual banking" is being facilitated by the development of home-banking services (e.g., using software such as Intuit's *Quicken,* Microsoft's *Money,* or Meca Software's *Managing Your Money)* and electronic commerce over the Internet in general. Some banks have also made available remote "terminals" that use the telephone lines to provide direct access to the bank and to one's account. Regarding a stored-value application of this approach, Mondex users can load value onto their cards through special Mondex telephones in their homes or offices. Mondex cards can also be loaded at cash machines, through specially equipped public telephones, and from a cardholder's own Mondex "Wallet"; the wallet contains stored value and allows the owner to transfer value (i.e., enough for that day) onto his or her Mondex card. Similarly, VeriFone has introduced the "Personal ATM"; this is a low-cost, palm-sized, card-accepting device that can be connected to a telephone line. It allows the user to download value to a smart card, to transfer funds from one account to another, and to perform other banking functions in a secure environment. The ability to load value

at home could be a key factor in successfully introducing stored-value cards in general and will be especially useful for bus riders.

Another potential option for reloading, if not initially purchasing, cards is on board the buses. In Ventura County, for instance, all but one of the participating transit agencies permits on-board recharging of the smart cards; these cards are monthly passes and are activated for the month on the first use that month, that is, after notifying the agency in advance of a desire to do so. Cards can also be loaded on board in London. A similar approach has been suggested for consideration in the smart-card program in the Seattle region: once the cardholder has established an account with the transit agency, he or she would be able to request via telephone or personal computer that a certain amount of value be added to the card; the requests for value would then be downloaded to the buses each day, and the cardholder's card would be loaded with the requested amount of value the next time he or she boarded a bus. While such an approach resolves the problem of where to reload cards, it complicates the fare collection system. Beyond the significant communications and processing requirements, many agencies will not want to permit on-board loading because of operational considerations such as (1) the negative effect on overall in boarding times, (2) the limited space available for an additional piece of equipment at the front of a bus, (3) the additional maintenance requirements associated with that equipment, and (4) the possibility that the operator would have additional responsibilities (i.e., if he or she had to handle reloading).

In an open system, distribution and reloading through ATMs (or any other bank-related source) is a problem for riders who do not have bank accounts. To address this problem, the transit agency will have to provide cards through its own sales mechanisms or facilities (i.e., AVMs, ticket agents, outside vendors, employers, on board buses, or via telephone or mail). Alternatively, cards could be sold and reloaded through bank ATMs if cash were accepted (i.e., rather than requiring users to transfer value from their own bank accounts).

In summary, the pricing and availability of cards must be addressed in establishing multiple-use programs. The transit agency must consider the effect on its revenue and ridership if it cannot incorporate key elements of its fare structure on a multiple-use card; this may be a factor in deciding either to issue its own card or not to participate in such a program. The ready availability of cards and the convenience of reloading them are vital to the success of any prepaid program. Emerging developments in at-home banking may be an important breakthrough in promoting the use of stored-value cards for transit and for general commercial use. The next chapter reviews legal and regulatory issues that may affect multipurpose payment programs.

CHAPTER 5--LEGAL AND REGULATORY ISSUES

The development of stored-value and prepaid card applications has resulted in a range of legal and regulatory questions. Because prepaid applications are new to the financial services industry, many of the legal issues are in areas where the existing statutory and regulatory authority and case law are scant or nonexistent. The legal treatment of stored-value media is under review (e.g., by the Federal Reserve Board and the Federal Deposit Insurance Corporation). Although many of these issues may not apply specifically to transit-only media, the move toward open payment systems necessitates their consideration by transit agencies. Key legal and regulatory issues dealing with prepaid card products include the following:

- Authority of banks and non-banks to issue prepaid cards;
- Electronic funds transfer (EFT) regulations (i.e., Regulations E and Z);
- Abandoned property and escheatment laws;
- Responsibility for lost or stolen cards, card or equipment malfunction, and issuer insolvency; and
- Privacy.

AUTHORITY TO ISSUE PREPAID CARDS

One of the key issue areas concerns the legal authority of banks to issue prepaid media, as well as the authority of non-banking institutions to issue payment instruments. These questions center on both banking regulations and general business law. In the United States, there is no clear authority for either nationally or state-chartered financial institutions to sell a prepaid card, because such activity is not expressly empowered in the Banking Act of 1933. On the other hand, no legal challenge has been made, and the Comptroller of Currency has upheld the ability to sell traveler's checks. A key difference between traveler's checks and prepaid cards is that the former are redeemable in currency, while the latter can be used only for the purchase of goods and services. The regulations potentially affecting banks' issuance of prepaid cards (e.g., Regulations E and Z) are discussed below.

The issuance of prepaid media by non-banking entities, such as telephone carriers and transportation (e.g., transit, toll, and parking) agencies, has begun to raise certain legal questions as well. In general, the courts have recognized that businesses engage in operations similar to banking functions without constituting banking. One of the fundamental issues concerning prepaid cards relates to whether the issuing body is "receiving deposits" in selling the cards. The Federal Deposit Insurance Corporation (FDIC) is expected to issue a ruling that most stored-value card balances will not qualify for deposit insurance. It is expected, however, that there will be an exception for certain stored-value programs, allowing banks to offer

deposit insurance for cards in those programs. It could turn out that only cards intended for use on very small purchases will be uninsured, while cards marketed to consumers who will maintain larger amounts on their cards will be insured.

EFT REGULATIONS

The key Federal Reserve Board regulation that deals with EFT and might affect prepaid card issuance is Regulation E. Regulation E provides consumers protection in dispute arising from EFT transactions. Federal legislation essentially exempting stored-value cards from Regulation E is pending in both the House and Senate. In response to the proposed legislation, the Federal Reserve Board recently recommended that certain types of stored-value cards continue to be subject to certain portions of Regulation E. In April 1996, the Federal Reserve Board published for comment its recommendations as to which sections of Regulation E, if any, should be applicable to stored-value media.

The Federal Reserve Board has recommended that, as a general rule, *offline* card systems (transactions take place offline and transaction records are maintained on the card or in a central database) should be exempt as long as the card value does not exceed $100, but that *online* card systems (transactions are authorized online and transaction records are maintained in a central database) should be subject to certain provisions of Regulation E. The general preliminary recommendations are summarized in Table 5. While the Federal Reserve's regulations have not been finalized--and the proposed federal legislation has not yet been passed--there are several unanswered questions related to defining the parameters of different card systems. How these questions are resolved--and indeed the exact nature of the final Regulation E statutes affecting stored-value and prepaid media--may affect the specific types of stored-value systems that are pursued and the operating rules that will have to be established for these programs.

EXPIRED VALUE AND ABANDONED PROPERTY LAWS

Another important issue underlying the success of prepaid card programs is the treatment of expired or unused card value--the dollar value (a) that remains on a card after it has expired or (b) that is never used (e.g., because the card is thrown away or kept as a collectible). The revenue potential associated with expired card value makes this issue an important component of the card issuer's overall business case. The possible regulatory barriers to the issuer being able to retain the expired card value are that (1) the expired value may have to be turned over to the state and (2) the cardholder may be able to apply for a refund of the expired value. The applicability of the *abandoned property law* (commonly referred to as "escheatment") to prepaid cards, especially those that do not have cardholder registration features, is uncertain at present. Most states have enacted abandoned property laws that dictate that "unclaimed property" be given to the state after a specified time. In some cases, transit agencies planning to institute stored-value card programs are seeking exemptions to the state law to enable them to keep the expired value. This issue has not yet been resolved.

A related issue is the cardholder's rights to a refund of expired value. If the purchase of the card is considered a contract, many lawyers argue that the value to a cardholder of an expired prepaid card would terminate by agreement, rather than becoming unclaimed property subject to escheat. In other words, this is similar to a sporting event that gives the ticketholder the right to exchange the ticket up to the time of the original event. Furthermore, lawyers may argue that value that does not exist for the cardholder, that is, that which is unclaimable, cannot be described as "unclaimed" for the purposes of the abandoned property law. The issue of refunds for expired value is also related to the question of providing for refund or reimbursement for card theft or loss, or for card or terminal malfunctions.

The three banks participating in the Atlanta VISACash program have skirted the expired value constraints by establishing "maintenance fees" of as much as $5.00 per month that begin to be assessed against the card's remaining value once the card expires. Thus, any expired value will soon become maintenance fee revenue to the issuing bank. Resolving the issues associated with expired value is crucial in determining the financial benefits of a prepaid card program.

RESPONSIBILITY FOR LOST OR STOLEN CARDS, CARD OR EQUIPMENT MALFUNCTION, OR ISSUER INSOLVENCY

Because there is no legislation governing stored-value cards, there are no regulations related to the handling of lost or stolen cards, card or equipment malfunction, or bankruptcy or failure of the card issuer. The types of regulatory questions associated with these issues include the following:

- **Lost or stolen cards**--Is the issuer responsible for replacing or refunding a card that is lost or stolen? Stored-value cards are intended to serve as "electronic cash," and the consumer must bear the loss of cash; thus, the cardholder would reasonably be expected to absorb the loss of the card value. On the other hand, given the $50 limit on liability for a lost credit card, consumers may push for a similar provision for stored-value cards.
- **Card or equipment malfunction**--If a card or the card-accepting equipment malfunctions, is the issuer responsible for the associated loss? The issuer should probably cover any equipment-related loss, and would probably be responsible if the card itself is shown to be faulty. However, there may be questions as to (a) whether the cardholder has damaged

TABLE 5 Preliminary recommendations for Regulation E treatment of stored-value cards

Application of Reg. E Section	Offline Unacct. Any Amount	Offline Acct. <$100	Offline Acct. >$100	Online Acct. <$100	Online Acct. >$100
Unsolicited Card Issuance	No	No	No	No	No
Initial Disclosure	No	No	**Yes**	No	**Yes**
Change in Terms Notice	No	No	No	No	No
Transaction Receipts	No	No	No	No	No
Periodic Statements	No	No	No	No	**No**[1]
Liability Limitations	No	No	No	No	No
Error Resolution	No	No	No	No	No

[1] Exempt only if cardholders are provided a means to check their balance and a summary of recent transactions is provided on request.

the card and (b) who decides which party is at fault. Issuers may have to guarantee replacement of malfunctioning cards, regardless of who is at fault, if they are to attract consumers to the product.

■ **Bankruptcy or failure of issuing entity**--If the issuing bank or other institution files for bankruptcy protection or fails, who is responsible for (1) the value remaining on stored-value cards and (2) payments to merchants that have accepted the card for purchases or services?

There is clearly a need to instill consumer confidence in stored-value card systems if this new product is to be widely accepted. Therefore, regulations covering the rights and responsibilities of card issuers and users are likely to be introduced. The evolution of such legislation can be seen in several foreign countries where the prepaid concept is more advanced. For instance, in Denmark, the Payment Cards Act of 1984 included the following provisions:

■ Limited cardholders liability for the loss or unauthorized use of the card,

■ Regulated the solicitation of cardholders,

■ Controlled the use of cardholder and merchant information, and

■ Established a maximum value that could be placed on the card.

Japan has passed similar regulations in its 1990 Prepaid Application Legislation; this legislation includes the following requirements:

■ Prepaid card issuers must register with the Ministry of Finance when the accumulated unused value (of the pool) exceeds US$69,000. In practice, issuers have to lodge a guarantee or deposit of 50% of the unused value at the end of every March and September.

■ Organizations issuing prepaid cards to their employees must advise the Ministry of Finance when the accumulated unused value exceeds US$48,000.

■ Prepaid cards should be so marked to reflect that they comply with the legislation.

Simultaneously, a Prepaid Card Association was formed in Japan to review system integrity and to ensure adequate protection of consumers.

Transit agencies may or may not be subject to the same types of regulations as banks will be when they are issuing closed system payment media. Even if they are not, however, transit agencies introducing stored-value media will have to decide on their own policies regarding consumer rights and refunds and reimbursements. Policies among existing smart-card programs vary. In Ventura County, the Passport (a monthly pass) will be replaced for a payment of $5.00. In London, cardholders can purchase an optional "Fare Protect Scheme" that protects the buyer against loss of a card.

PRIVACY ISSUES

Information privacy rights constitute a major issue that will be raised by consumers with the introduction of smart cards for stored value and other applications. Consumer privacy in general is becoming a key concern in conducting financial transactions. Because a stored-value card carries the use information on the card, a key question is, who has the right to control or use the data on the card? Another question is what are the rights of the consumer when information passes from the original party in a transaction to third parties (i.e., "redisclosure")? The right to privacy is protected by federal and state laws and has been upheld by the courts. Various federal statutes addressing specific applications (e.g., communications and computer use) and many states have passed legislation to provide consumer protection in financial transactions and other areas. The privacy of an automated payment system is viewed as crucial by many consumers, and the banking system, in most cases, has been very sensitive to this issue. Transit agencies, on the other hand, have not had to pay attention to the need for customer privacy. This is partly because, excluding those who purchase period passes, agencies have not maintained information about the user

of a specific card. With stored-value media, however, the agencies will be able to collect detailed information on individuals' card use. Most transit agencies see this as a major benefit of electronic fare media and will want to use the newly available information on individual riders to improve service, presumably to the benefit of the cardholder. However, because cardspecific information can be used as a revenue-generating source by the agency (e.g., through the sale of cardholder lists), privacy issues become important.

Transit agencies will have to address riders' concerns in this area as they adopt electronic fare media; where transit payment becomes part of an open system, these concerns probably will be magnified. It has been suggested that card issuers develop their own policies governing the protection of privacy for stored-value cardholders. Many consumers believe that this would be preferable to the introduction of new formal government regulations.

SUMMARY

In summary, the development of stored-value card systems has various legal and regulatory questions. These questions hinge on (1) the similarities to and overlap with existing payment systems (e.g., credit and debit cards) and (2) the differences from those systems. One of the key issues relates to trade-offs between consumers' desires for guaranteed security of the payments (and value) on the one hand and for privacy on the other. Because the stored-value concept is in its infancy, few regulations exist. Many people have argued that regulation is largely unnecessary. For instance, in Europe, where prepaid smart cards are widely used, consumers have not been overly concerned that the value on their cards is not insured. In general, it is believed that, whether regulators in the United States choose to assert jurisdiction--and how they interpret existing regulations and statutes or promulgate new regulations--will largely be a function of the success and profile of stored-value and prepaid card applications. The more the application develops as a parallel payment system, the greater will be the drive to ensure adequate regulation.

CHAPTER 6--TECHNOLOGICAL ISSUES

Several technological issues must also be considered in pursuing a multipurpose payment program. The major issues relate to selection of an appropriate card technology and integration of the new technology into an existing fare collection system.

There is an overlap between these because the latter may influence the choice of a technological direction. Moreover, rapid development in card technology, coupled with the institutional developments in progress, has complicated the selection process, introducing a new concern about ensuring flexibility regarding future technology developments and planning for migration to new technologies.

The issues for consideration in selecting and implementing an appropriate media technology are discussed below.

TYPES OF SMART-CARD TECHNOLOGY

Smart cards have become the technology of choice in all types of multipurpose payment programs. Although the use of magnetic-stripe media is increasing in the transit industry--for stored-value as well as read-only prepaid applications--the focus of most efforts to build both integrated fare and multiple-use programs has shifted from this technology to smart cards. The specific reasons for considering smart cards vary from one case to the next; however, the advantages of smart cards over magnetic-stripe media for use in multipurpose arrangements include the following *(2):*

- The higher expected reliability of smart cards and the supporting equipment,
- The greater data and processing capabilities of smart cards (e.g., to facilitate operation of a complex multi-agency program and to provide better information on transit use patterns to transit agencies), and
- The move toward adoption of smart cards by the banking and financial services industries-and the potential for joint arrangements.

Thus, although MTA and the Chicago Transit Authority (CTA), for instance, are installing magnetic-stripe stored-value fare systems, both agencies expect the eventual addition of smart cards to enable multiple-use arrangements with financial institutions. Because neither agency envisions completely *replacing* the magnetic system with smart cards soon, smart cards would become one of several media options, and the issue of integrating a new technology into an existing system becomes an important consideration; this issue is discussed below.

Contact Versus Contactless Smart Cards

Given that smart cards will be used in most multipurpose programs within the next few years, the choice of technology shifts to one of *contact* versus *contactless;* within the next year or so, a *combined* contact-contactless card should also be a realistic option. Both contact and contactless cards can be either *memory cards* without an onboard microprocessor or *microcontroller circuit* (or *microprocessor) cards.* The simplest memory cards have "programmable logic area" chips and are used for prepaid non-reloadable cards (e.g., prepaid telephone cards) or identification-only cards. More advanced memory cards include algorithms within the programmable logic area, and are used for simple stored-value and electronic-purse applications. Microprocessor cards are more secure

than memory cards and can be programmed to perform various processing functions. The type of chip affects the capabilities of the card, as well as the price; these issues are discussed below. For contactless cards, the type of chip also determines the amount of power needed; microprocessor cards require more than five times as much power as memory cards(3). For this reason, most contactless cards do not contain onboard microprocessors. The contact cards initially being used in stored-value card trials, such as VISACash, are also memory cards.

Contactless (or combined) cards are the preferred option for transit applications, although contact cards are being introduced for financial and most other types of transactions (e.g., campus uses, health care, government benefits, and retail). The advantages of contactless card systems for transit agencies are as follows:

- Potential for lower fare collection equipment maintenance costs, because there are no moving parts in the read-write units;
- Greater reliability of equipment, because there are no open slots that can be jammed (e.g., from insertion of foreign objects);
- Greater convenience for riders, especially for elderly or disabled riders who may have difficulty inserting a card; and
- Faster boarding of buses and entry through turnstiles.

Cost analyses that compare the different smart-card and magnetic technologies have been undertaken in several studies, including those in Paris, Seattle, San Francisco, and southern California. These and other analyses indicate the contactless card is more cost-effective for transit agencies than either contact smart cards or magneticstripe cards; these financial considerations are described in Chapter 7.

Although contactless cards are preferred by most transit agencies, contact cards have been implemented in several transit applications and are planned for others. These applications all are multiple-use programs involving, and generally initiated by, financial institutions; examples include electronic-purse projects in Denmark and Switzerland, trials in Atlanta and Dublin, and a planned project in Ann Arbor. The New York and Wilmington transit and multiple-use projects have been delayed indefinitely, but the plan in each case was to use a contact card. Our survey of transit agencies (see the appendix) revealed that nearly as many agencies expect to use contact as contactless cards in the next few years; this probably reflects the predominance of contact cards in nontransit uses.

Contact card technology has been around considerably longer than contactless card technology and has been used in the longer-running smartcard programs, including prepaid telephone cards in Europe and electronic-purse applications in several locations. Contact cards have been standardized in many aspects, as is explained below, and further standardization is under development. Financial and other institutions have invested considerable time and resources in developing contact card specifications and applications, and contact cards have become the technology of choice for most nontransit applications. Because such institutions generally do not need the increased speed of use of contactless cards, they have as yet had no incentive to pursue the higher-cost contactless card technology. The potential link with transit is beginning to change some financial institutions' perspective on this issue, however.

Many companies are producing smart cards and the chips they contain. Companies manufacturing contact cards include* GemPlus, Schlumberger, Micro Card/CP8 Transac, Giesecke & Devrient, DataCard, Orga, US3, Silcox, and Solaic; chips for these cards are made by Motorola, SGS Thomson, Oki, Siemens, Atmel, Hitachi, and Philips, among others. Contactless cards are also produced by several of these companies; chips (and in some cases, cards) are manufactured by Racom, Mikron, Cubic, Sony, GEC, Innovatron, Motorola, ADE, Nedap, Mixcom, and AEG, among others.

Combined Contact-Contactless Cards

As transit agencies consider the introduction of smart cards as a key fare medium, taking advantage of multiple-use or open system capabilities--and the resulting benefits--is attractive. If an agency wishes to become part of an open payment system, however, the only current option is to accept a contact card, as MARTA is doing in the VISACash pilot. In some transit-initiated fare projects, such as those in San Francisco and Seattle, the strong preference for a contactless card has outweighed the desire to link directly with the financial payments industry. Even in these efforts, the project planners have expressed the intention to allow for the eventual migration to a more open system; conversely, MARTA would like to use contactless cards, while maintaining the open aspects of the current system. Several other transit agencies are considering joint arrangements with financial institutions as well. Several banks also see the potential for joint-payments programs,

* **SPECIAL NOTE:** The Transportation Research Board, the Transit Development Corporation, the National Research Council, and Federal Transit Administration (sponsor of the Transit Cooperative Research Program) do not endorse products or manufactures. Trade or manufacturers' names appear herein solely because they are considered essential to the clarity and completeness of the project reporting.

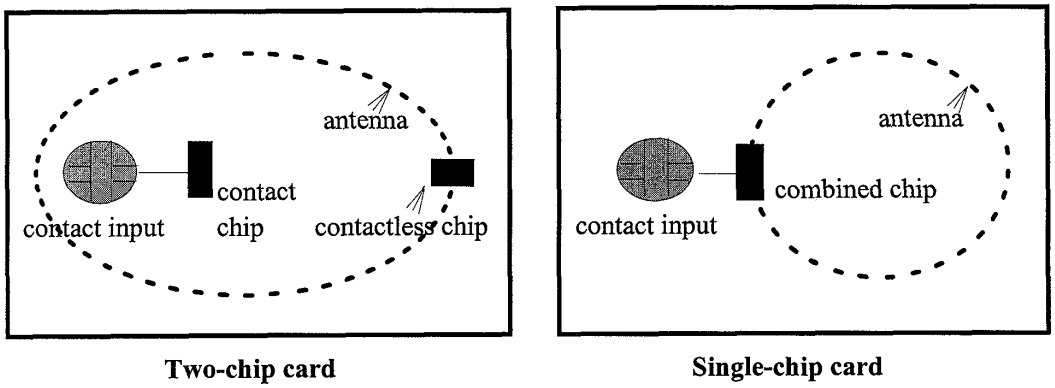


Figure 4 Combination contact-contactless smart cards.

although the major source of interest in a combined contact-contactless card is from the transit industry.

There is considerable interest in combined cards. Such cards are being developed (and tested in some cases) to provide a card that can be used in either type of system. These cards--combicards or dual interface cards-are of two basic types (see Figure 4): two separate chips (and thus separate purses), and a single chip (and purse) that can be accessed through either the contact or contactless interface. The first type of card, now available (e.g., the GemPlus GemTwin card) and being tested by Bank of America and others, is considered an interim solution, because the two functions are completely separate; in other words, the user cannot load value through the contact portion and use that value on transit. The other type of card allows such transactions: value can be loaded and used through either means. Such chips and cards are being developed by several companies and joint ventures, including Philips/Siemens (based on the Mikron MIFARE contactless card), Racom/CP8 Transac (based on the Racom contactless card), Inside Technologies, and Motorola. The Racom/CP8 Transac card will be tested on the French National Railway in Valenciennes later in 1997.

The combined card is a more complicated device--and hence likely to be more expensive--than either a contact or contactless card alone. This raises the question: who will pay for the card? In an open system, will a bank pay the cost differential (i.e., compared to a contact card) to issue a combined card so that it can be used on transit in the contactless mode, or will the bank issue contact cards, leaving the transit agency to provide the combined card (i.e., including the bank's contact card and its applications) for its riders? This remains to be seen. In a closed multipurpose system, the transit agency would presumably issue the cards, which could then be used for other (nontransit) purposes in either the contactless or contact mode as needed. Another longer-term possibility is that "blank" cards will be sold at consumer electronic or other stores, and purchasers will add applications (e.g., stored value, transit fare payment, and prepaid telephone use) as desired; in this scenario, the consumer would buy a contactless, contact or combined card, as needed. Depending on the demand for combined cards, the unit cost could ultimately drop to a point close to that for contact cards, but at least initially, the differential could be substantial (e.g., 1.5 to 2 times the cost of the contact card, depending on the amount of memory and processing capability of the cards in question). There is also an issue regarding the power requirements for the contactless portion of the card if a microprocessor (i.e., to handle the financial or other applications) is needed.

SELECTING AND IMPLEMENTING A TECHNOLOGY

In general, the key concerns in choosing a particular type of media or equipment for a multipurpose program may include the following factors:

- The agency's fare media needs and fare collection goals,
- System costs and the funding available, and
- The technology to be used by other entities in the region-coupled with concerns regarding card standards and interoperability.

Fare Collection Needs, Goals, and Costs

The transit agency's fare collection needs and goals--along with the funding available--will dictate to a large extent the type of technology it will select. An agency's interest in establishing and operating its own or perhaps a regional payment system allows the consideration and selection of any technological solution. In the integrated regional program in Ventura County and those being developed in the San Francisco and Seattle regions, for instance, contactless cards have been chosen as the most appropriate medium. An alternative approach, participating in a more open system in collaboration with a bank, may dictate use of contact cards--as is true in Atlanta and Ann Arbor. It is to be

hoped that the combined card will eliminate the need to make this distinction, although this will raise additional financial, technological, and institutional issues, as mentioned above.

Another key factor that comes into play--and that may strongly influence the agency's basic goals and needs--is the cost of alternative approaches and the availability of sufficient funding. An agency (or consortium) that believes it can afford to finance a new payment system on its own probably will be less interested in pursuing a partnership or participatory arrangement with a financial institution than an agency that cannot afford such a system. For instance, agencies that have committed large sums to installing new magnetic-based automated fare collection (AFC) systems (e.g., CTA and MTA) are unlikely to be able (politically, as well as fiscally) to immediately pay for installation of their own smart-card systems. Thus, MTA sought to establish a partnership with a private entity to finance its multiple-use smart-card program; CTA has begun to explore a similar arrangement with a local bank. (Financial issues associated with introducing multipurpose programs are addressed in Chapter 7.

Standards and Compatibility with Other Systems

Compatibility with the payment systems of other transportation operations in a region will also influence the technology choice. The concern here goes beyond a simple choice between contact and contactless cards or magnetic cards. The question of *standards and interoperability* must be addressed: can a card issued by one entity be used by another entity that may not have the exact same system? Standards are being developed for both contact and contactless cards, but as of yet there is no real interoperability among the various cards and operating systems. International standards exist for certain contact card parameters, including the size of the card, the size and location of the contacts, and several other aspects of the card and chip design. In addition to these standards, a set of specifications is being developed to address the interoperability of card acceptance, security, and payment functions. The jointly developed EMV specifications govern financial (debit and credit) transactions using contact smart cards and have evolved in three parts:

- Definition of the mechanical and electrical characteristics along with card and terminal transmission protocols;
- Definition of the terminal commands, applications, and data elements; and
- Definition of how the card, terminal, and settlement processing network will work together.

These specifications address only debit and credit transactions, although they may ultimately include prepaid and stored-value and electronic-purse cards. Several other organizations are working to produce standards for prepaid and electronic-purse cards; the Smart Card Forum, the European Commission for IC Card Standards, and the European Committee for Banking Standards (ECBS), among others, are considering such areas as data definitions, security protocols, and technical card specifications. Nevertheless, neither standards nor specifications promoting interoperability among prepaid and stored-value card schemes do not exist. The several stored-value systems in operation or trial (e.g., VISACash, Mondex, Banksys, DANMONT, Chipper) all use ISO-compatible contact smart cards, yet none of these cards work in any of the other systems. The forthcoming VISA/ MasterCard/Chase Manhattan Bank/ CitiBank venture in New York will require a certain level of interoperability between two different systems. This will be a key step toward widespread interoperability, as has developed with ATMs and credit or debit cards.

With regard to contactless cards, standards are being developed to address certain parameters. However, there are several distinct types of cards on the market; they differ for such physical and operating parameters as power generation technique, type of memory technology, radio frequency, data transmission rate, internal logic, and memory capacity. A comparison of four of the more widely used transit contactless cards is shown in Table 6. As indicated, these cards have somewhat different combinations of characteristics. The key parameters affecting potential interoperability at this point are the memory and processing technology and the radio frequency. The major memory technologies in existing contactless cards are electronically erasable programmable read-only memory (EEPROM) and ferroelectric RAM (FRAM). FRAM is a relatively new technology. EEPROM is used for both contactless and contact cards; as the name suggests, data are erasable and modifiable, allowing the cards to be reloaded and reused (i.e., until the card itself wears out). In contrast, disposable prepaid cards (contact only) are electronically programmable read-only memory (EPROM); once data have been encoded, they cannot be erased. These cards can be updated by adding data (e.g., value) to unused sectors of the card--if there are any; once capacity has been reached, the cards must be discarded. The relative advantages and disadvantages of the different technologies are a matter of debate, and it is unclear which--if any--will become the industry standard. With regard to radio frequency, however, 13.56 MHz has been recommended as the standard for power transmission, and as indicated in the table, this frequency has been adopted by the major contactless chip and card makers.

The smart-card industry is moving toward the adoption of standards for both contact and contactless smart cards. Although the existence of standards as well as specifications for

TABLE 6 Comparison of characteristics of selected contactless cards

Characteristic	Type of Card			
	Card A	Card B	Card C	Card D
Power Source	RF	RF	RF	RF
Type of Memory	EEPROM*	FRAM**	EEPROM	EEPROM
Frequency	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz
Data Rate	106 kbps	106 kbps	250 kbps	38.4 kbps

* EEPROM=electronically erasable programmable read-only memory
** FRAM=ferroelectric random access memory

various card parameters and operating procedures will help move toward interoperability, certain de facto standards probably will develop also. Besides interoperability, the primary benefits of standardization will be an increase in the number of sources of chips for card manufacturers and of cards and equipment for system users; this should result in lower costs, particularly for the chips themselves.

OTHER TECHNOLOGY ISSUES

Beyond the factors discussed above, other issues that a transit agency or consortium should consider in selecting and implementing a new payment technology include the following:

- Integrating the new technology into the existing fare collection system and
- Ensuring flexibility regarding future technology developments and planning for migration to new technologies.

Unless an agency is replacing its entire fare collection system with a new system, a key concern will be how the new portion of the system (i.e., the smart cards) will be integrated with the current system. This issue includes not only direct equipment interfaces, but also administrative and operational elements, including fare policy and pricing of media relative to existing media (discussed earlier), sale and distribution of media (including employer involvement), marketing, collection and reporting of data, settlement among participating agencies, training of operators and other agency personnel, and maintenance of equipment (e.g., do current maintenance personnel possess the technical capabilities to maintain and repair smart-card readers).

In some cases, the transit agency or group of agencies will consider the smart-card system as a separate element of the overall fare collection system, with its own pricing, distribution, and data collection functions. This is likely to be the situation in an open system such as at MARTA, because the transit agency accepts an outside card for fare payment. However, even where the transit agency provides its own cards, the smart-card readers may be essentially stand-alone units that do not directly interface with the existing collection elements of the farebox or fare gate; this has been the case at WMATA, for instance, with its Go-Card pilot project. The alternative approach is to fully integrate the new technology into the existing system. This requires retrofitting equipment and the data transmission infrastructure; the complexity of this task will depend on the size of the transit system, the modes of service and types of fare collection equipment in place, and the complexity of the various system elements. Finally, if an agency is just now procuring and implementing a new fare system, it may be possible to plan for the addition of or transition to smart cards. The CTA, for instance, specified its new AFC equipment to be smart card-capable; thus, every fare gate is equipped with a contactless card "target." Of course, these readers are designed to work with the Cubic Go-Card; if the CTA ultimately opts for another type of card, these units may have to be replaced (or at least modified).

The latter point underscores the difficulties inherent in planning for future flexibility. The card technology is still developing, particularly in the area of combined cards, and an agency developing a smart-card system may wish to maximize its ability to migrate to a newer technology once it becomes available. One of the initial recommendations in the TransLink study, for instance, was to procure equipment that would allow future use of contact as well as contactless technology, that is, once the use of commercially provided stored-value cards becomes widespread (3). Until that time, only the contactless readers would be active. The development of combined cards, however, has advanced considerably since the completion of that study, a little more than a year ago. The designers of the TransLink program must decide whether to continue following the initial recommendation, thereby retaining maximum flexibility, or to assume that combined cards will obviate the need to accept contact cards for transit uses. The rapid pace of

technological developments, along with the parallel developments in potential institutional arrangements, has added new complications to the process of choosing the most appropriate path to follow.

CHAPTER 7--FINANCIAL ISSUES

A fundamental factor affecting the potential of multipurpose media and joint transit and banking arrangements is the nature of the financial implications of such efforts from both the cost and the revenue side. There will be various capital and operating costs and benefits associated with implementing any new fare technology or payment system, and the net effect on the transit agency and any participating financial institutions will depend on the multipurpose program and any institutional arrangement, as well as the level of current fare collection or payment system costs. The key financial issues fall into the following categories:

- What is the nature of the capital and operating costs?
- Who will pay for which items?
- What is the nature of potential cost savings, new revenues, and other (nonfinancial) benefits?
- Who receives which types of benefits?
- How can a multipurpose arrangement be structured financially so as to produce a "win-win" situation for all participating entities?

This chapter reviews the various types of costs and benefits associated with implementing and administering multipurpose arrangements. This includes consideration of the direct capital and the operating and maintenance costs and the potential savings, as well as revenue implications related to multiple-use card programs.

COST EFFECTS

General Cost Concerns

The costs associated with fare collection are a significant concern to transit agencies. As *funding* for transit becomes increasingly limited, minimizing all types of expenditures gains importance. Thus, cost is a major consideration in assessing potential fare collection approaches. In the survey of transit agencies conducted for this study (see the appendix), "reduce cost of producing/distributing fare media" and "reduce cost of fare collection/ processing equipment" were each rated "very important" or "important" by about two-thirds of the respondents. In an earlier survey of 150 transit agencies, 83% of the respondents cited cost as the most important--or at least one of the most important--factors related to fare collection (4).

Cost is likely to be of particular concern in implementing a multipurpose media program if this program is being added to an existing electronic fare payment system or one being implemented. As mentioned earlier, several transit agencies are installing magnetic-stripe AFC systems. It will in most cases be difficult for an agency to justify (to the public and to political decisionmakers) paying to add smart-card capabilities to a new system promoted as "state of the art." Some agencies, such as those in the Seattle area, are planning new fare systems based largely on smart cards. However, even in such situations, there is still a need to provide alternative lower-cost payment options--tokens, tickets, magnetic cards, or at least cash; given the high unit cost of smart cards, it is not cost-effective to offer smart cards for one-time or occasional users. Similarly, even in an open payment system, where the transit agency accepts outside cards, the agency probably will always have to maintain its own fare collection equipment to accommodate riders who do not have access to or choose not to use the open system media.

Cost is also an issue for financial institutions in contemplating stored-value or multi-application programs, particularly given the uncertainty surrounding the acceptance of the concept and the size of the return on what will be a major investment. In the survey of 98 financial institutions undertaken by Dove Associates to find out about plans to issue smart cards, respondents expressed strong interest in smart cards, but also expressed significant concerns about the costs of providing smart cards; cost concerns were almost unanimously cited as a disadvantage of issuing smart cards, and, in fact, represented the single most important component of a potential issuer's decision. The benefit to the institution was the second most important issue. Specific financial concerns included the economic justification for spending much more on the cards themselves ($3.00 to $6.00 was the expected range reported in the survey) than is spent (i.e., roughly $0.10 for a magnetic-stripe card), as well as the cost of upgrading cardaccepting devices so that customers can use the cards. Thus, developing a reasonable business case was deemed crucial to these institutions' participation in smart-card programs.

The remainder of this chapter describes current transit fare collection costs and the types of capital and operating costs that can be expected in multipurpose fare programs.

Current Transit Agency Fare Collection Costs

The costs associated with transit fare collection can be substantial, although the range is large. On the basis of the survey conducted as part of this study, some agencies spend less than 1% of their total fare revenue on fare collection and related costs, while others spend as much as 20%; the average for all agencies responding to

the survey is roughly 6%. The percentages reported in the survey are summarized in Table 7. As indicated, agencies in all categories tend to spend less on production and distribution of media than on collection and processing of fares; the average for all agencies is just less than 2% for the former and more than 4% for the latter.

Cost Categories

The cost elements associated with developing, implementing, and administering a multipurpose fare program will vary to some extent depending on the specific type of program (e.g., open versus closed system), the modes of service and type of fare collection (i.e., bus/pay on entry, rail/barrier, light rail/proof of payment, commuter rail/pay on board), the nature of the existing equipment and the extent to which the new equipment will be integrated into the current system. In general, however, introducing a closed (i.e., agency-initiated) smart-card-based system will include many, if not all, of the following types of items:

- System design and development effort (i.e., staff or consultant time), including specifications for equipment, media, and clearinghouse processes;
- Procurement and installation of fare collection and dispensing equipment (e.g., card reader and processors, card dispensing, and recharge machines);
- Procurement and installation of computer system (including software);
- Installation or modification of communications infrastructure and system;
- Purchase or production of fare media;
- Day-to-day administration;
- Maintenance and repair;
- Marketing (promotion and education of customers);
- Sales and distribution;
- Revenue accounting; and
- Training (e.g., maintenance, operations, customer service, revenue, and finance).

In an open system and possibly in a closed multiple-use system in which a private entity or a public-private partnership is managing the system, some of the above items may be replaced by the following costs:

- Transaction fees and
- Loss of revenue currently received from "float" (from prepaid media sales) and unused value (from stored-value media).

Each agency will categorize specific costs somewhat differently, but the fundamental issues to be addressed are (1) how the new system will affect the current operating and maintenance cost structure, and (2) what are the capital costs for the new system.

Operating and Maintenance Cost Effects

Transit-Operated Program

The operating and maintenance cost effect of introducing a multipurpose payment program will depend on (1) changes to existing cost elements, including cost savings, and (2) new cost elements. Potential changes in existing elements include automating certain sales, distribution and processing functions, as well as maintenance requirements. Cost savings may be achievable in terms of agency personnel needed to carry out these functions, as well as in expenses such as sales commissions for prepaid media or contract services for data collection. For instance, several transit agencies implementing new electronic fare systems (e.g., the CTA, MTA and MBTA, as well as GMPTE in Manchester) have projected significant savings in fare collection labor costs. Most of the savings are expected to result from eliminating the need for rail station ticket agents, as well as reducing the need for revenue processing and accounting personnel. A complicating factor, however, is that labor agreements effectively prevent most immediate staff reductions (2). Although it may be possible to reassign the affected staff to other functions, certain projected personnel savings may be fully achievable only over a relatively long period. On the other hand, where services are contracted out or performed through outside agents (as with off-site sale of media), the costs can be readily reduced as appropriate. In Manchester, for example, the annual amount paid in commissions to the primary vendor selling fare media is expected to be reduced from $400,000 to $200,000.

In the area of maintenance personnel, the use of contactless cards and readers is expected to reduce costs because of the low maintenance requirements anticipated for this equipment. The increased sophistication of electronic fare equipment in general will, on the other hand, create new challenges for an established maintenance organization, possibly requiring more highly trained personnel. At a minimum, considerable retraining will be necessary. The net effect of contactless card programs on operating and maintenance costs has not yet been ascertained, because of the lack of long-term operating experience with the technology, although some agencies have projected significant maintenance cost reductions with such programs.

Another area often cited as offering potential cost savings with the use of smart cards is on-board data collection. The storage and processing capabilities of smart cards offer potentially significant cost savings over existing data collection activities. In Manchester, for instance, it is believed that the smart-card system will largely replace the existing manual rider survey effort, saving the transit agency nearly $1 million per year. In the southern California smart-card trial (Gardena, Torrance, and Los Angeles DOT), the system integrator also estimated a significant data collection savings.

TABLE 7 Transit agency costs of fare collection

Mode or Size of System	Cost (as Percent of Total Fare Revenue)					
	(a) Production and Distribution of Media		(b) Collection and Processing		Total (a + b)	
	Range	Average	Range	Average	Range	Average
Heavy Rail	0.5-10	2.8	1.5-7	4.2	2-17	7.1
Commuter Rail	0.2-7	2.7	1.6-15	9.2	1.8-22	11.9
Light Rail	0.4-2	1.3	1-7	3.4	1.4-9	4.7
Large Bus	0.2-5	1.9	0.3-3.5	2.1	0.5-8.5	4.0
Small-Medium Bus	0.1-2	1.1	0.4-6	2.3	0.5-8	3.4
Overall Range/Average	0.1-10	1.9	0.3-15	4.3	0.5-22	6.2

Source: survey of transit agencies (June 1996)

A comprehensive analysis of the cost effects of implementing a multipurpose fare system was undertaken as part of the Central Puget Sound regional fare study (5). This study compared new versus existing costs for the King County Metro transit system, and estimated that the effect of the recommended smart-card system on Metro's fare collection operating and maintenance costs could range from an *increase* of $139,000 per year (roughly 4% of the total current annual cost) to *a reduction* of $309,000 (more than 9% of the current total). The estimated effect on the *existing* cost elements is a savings of $495,000 to $804,000 per year (at full system implementation), or 14% to 22% of these elements. The cost categories in which significant savings were projected include "information production,", "pass program administration and sales," "general accounting," and "customer service office." The study estimated that *new* cost elements (i.e., clearinghouse costs and costs for operating and maintaining new onboard equipment) would add between $495,000 and $635,000 per year, or 14% to 19% of the current total. The net effect of the new system on Metro's costs also includes an estimate of new revenue expected.

Open System or Public-Private Partnership

In open payment systems or closed systems involving a joint public-private partnership, the cost effects will be very different from those discussed above. The chief cost for the transit agency may be a transaction fee per use of the multipurpose card to the system operator or card issuer. The extent of this cost--as well as the effect on other costs--to the transit agency will depend on the specific institutional arrangement and operating agreement as to which entity covers the cost of which elements. This is crucial for both the transit agency and prospective partners in developing a business case for a multipurpose system. As can be seen in the dissolution of the MTA/Chase Manhattan Bank negotiations, the structure of the transaction fee agreement is fundamental to the development of a workable partnership. The revenue paid to the issuer must be weighed against the perceived risk in the endeavor, and all parties concerned must be convinced that the agreement is mutually beneficial. In New York, differences in expectations regarding the extent of the risk led to an inability to reach agreement on the level and nature of the transaction fees.

Because of the limited experience in instituting multiple-use programs, there are as yet no established fee models. Each program has its own unique arrangement. In Manchester, for instance, the transit agency pays fees only for use of the cards by its full-fare riders-not for concessionary riders. MARTA pays a slightly lower fee per transaction than do other merchants for use of the VISACash card (approximately 2% of the value of each $1.50 transaction versus approximately 2.5% for the others), although the exact rate is individually negotiated. In accepting credit cards, Valley Metro in Phoenix has reduced the amount it has to pay in transaction fees by batching transactions, rather than sending them one at a time. Once the stored-value card becomes a common commodity, it is possible that more standardized fee arrangements will develop, as they have for credit and debit cards. Regardless, the transaction fee is an important concern, either as a cost (to participating transit agencies) or as revenue (to the issuing financial institution or partnership); the revenue aspect of the fee is included below, under "Types of Benefits."

Another "cost" associated with transit participation in an open system or private partnership arrangement is loss of revenue from interest on float and unused or expired card value. As defined in a recent article in the *New York Times Magazine*, "Float is wealth in transit, money that has been parked temporarily in a place where someone, probably not you, can earn interest on it"(6). Transit agencies have benefited from this source for years through the sale of period passes and other prepaid media (i.e., multiple ride tokens or tickets or stored-value cards). Thus, agencies must consider the effect of forfeiting this revenue in entering a new type of arrangement. Although use of stored-value media is limited among transit agencies, the potential loss of revenue from unused value must be considered if an agency is

relinquishing control over issuance of its stored-value media.

Regarding the overall effects, a transit agency participating in an open system (or in a closed system operated by a private entity) should experience cost savings in several of the elements discussed above (at least sales and distribution of media and revenue accounting). The net effect will therefore be determined by the level of cost savings--operating and capital--compared to the transaction fee and any loss of float income.

Capital Cost Effects

Capital cost elements for a transit agency include the following:

- Fare media,
- Fare collection and distribution equipment (i.e., card read-write units and card vending and recharge machines), and
- Clearinghouse and communications equipment and systems (e.g., computers and communications).

The first two categories will be necessary regardless of the type of institutional arrangement; at issue will be who pays for what. The need for items in the third category will depend on the arrangement in place; for instance, much of the clearinghouserelated system will not have to be installed at the transit agency if a bank or other entity is responsible for clearinghouse functions.

Fare Media

The cost of the fare media is an important element in identifying the costs and benefits of a new fare system. The current unit cost of a smart card is much higher than that of a magneticstripe card, although the *life-cycle cost is* the key consideration. The production cost of a smart card varies widely, depending on the specific technology (contact versus contactless versus combination), the amount of memory, and the processing capabilities of the card; the purchase price will then depend on the volume being procured. For instance, the disposable prepaid contact cards being used in the VISACash pilot in Atlanta cost approximately $1.50 each; the reloadable version of the card costs about $3.00. Contactless cards used in transit applications currently range from $4.00 to $12.00, depending on card configuration and volume. Combination cards are not yet available, but they are expected to be competitive in price with contactless cards. In contrast, the unit cost of a magnetic-stripe card is less than $0.50. The prices of smart cards should drop somewhat over time, as more vendors enter the market and card use expands. Although smart cards are unlikely to approach the purchase cost of magnetic media in the foreseeable future, smart cards are more reliable (in terms of failure rate) and have a much longer useful life than magnetic cards. Thus, if users retain their original smart cards for an extended time, the life-cycle cost can become comparable to that of magnetic media.

The key to a transit agency in providing smart cards in a cost-effective manner requires (1) having users pay the cost of the cards themselves, (2) providing centives (e.g., in the form of discounts or bonuses) for users to hold onto them for an extended period, or (3) having an outside entity (e.g., a bank) provide the cards. Analyses of cost and benefits of smart-card-based systems, such as that for Seattle, have typically assumed an average life of 5 years for a smart card. The Seattle study also recommended consideration of a charge for the card, perhaps $5.00 to $10.00; this would also serve as a "buffer" or reserve in case the rider had insufficient stored value to pay a particular fare. As acknowledged in that study, it is important to demonstrate to cardholders that the card has value in order to encourage retention of cards. People are used to holding onto credit and debit cards for long periods, but fare media are rarely held for more than 1 month at a time. Consumer education will be an important element in implementing a smart-card system. Until transit riders are accustomed to treating fare media like credit and debit cards, however, some type of financial incentive (e.g., a bonus on recharging the card, or some form of rider loyalty program) will be important.

Incentives and card charges are feasible for riders who use the card regularly. However, occasional and one-time riders will neither benefit from nor be interested in keeping a card for a long time, and they are unlikely to be willing to pay a charge for acquiring the card. To maintain any reasonable cost-effectiveness in its fare collection system, an agency introducing smart cards will also need to provide a lower-cost fare option for these riders. A cost-effective approach may be to offer smart cards only for riders interested in maintaining high stored values and to continue to accept cash--and perhaps magnetic cards, tokens, or paper tickets as well--for use by one-time or infrequent riders. The final option for a transit agency to minimize the media cost is to (1) become a participant in an open system and accept a commercially available multiple-use payment card or (2) use some form of vendor financing; in either approach, the agency would not have to purchase the cards itself.

Equipment

The costs for equipment in a multipurpose fare system will depend on several factors such as the system size and modal configuration, the nature of the existing equipment and systems (and the extent of changes to it), and the nature of financial agreements among the project participants (i.e., who is paying for what). In general, for a closed transit agency-run program, the following basic types of equipment are likely to be required:

- Card-accepting devices or transaction processing units (i.e., bus or rail read-write units),
- Card vending and recharge machines,

- Garage (bus) and station (rail) computers,
- Agency computer (in a multi-agency system), and
- Central data collection and clearinghouse computer system.

It is difficult to specify typical costs for these items, because the costs will vary considerably depending on site-specific factors. As described in *TCRP Report 10*, "Fare Policies, Structures and Technologies," fare collection equipment tends to be a customized product. Unit costs are generally developed for each type of equipment on the basis of the supplier quotations, equipment characteristics, experience with recent purchases, and appropriate multipliers to allow for economies of scale and escalation for the time value of money. The price for equipment depends on such factors as the quantities being ordered, the vehicle or station modifications needed, and the specifications and performance requirements stipulated by an agency.

Regarding the individual types of equipment identified above, the full cost associated with the card-accepting devices (CADs) for smart cards will depend on whether they are physically integrated into the existing fareboxes or turnstiles or installed as separate units. For instance, in Washington, DC, the contactless "targets" were attached to the outside of the turnstiles, and installed as stand-alone units on the buses. In Atlanta, the contact card devices have been integrated into the turnstiles. The unit costs of several the CADs used in bus service have been on the order of $2,000 each; the bus units in Manchester (contactless) and Dublin (contact) were of this magnitude, and this figure was used in the Seattle feasibility study for contactless bus units. On the other hand, depending on the particular requirements, lowercost readers can conceivably be used; for example, the units being implemented to read the campus contact cards in Ann Arbor are less than $500 each. (Specific equipment costs will be explored in greater detail in the next phase of this study.)

Cards can be sold and recharged through either (1) stand-loneunattended card vending and recharge machines or (2) processors incorporated into cash registers (at stores or other remote sales locations) or existing media dispensing equipment (in agents' booths in rail stations or in existing ticket vending machines). In Atlanta, NationsBank has installed smart-card vending machines in key rail stations, although in Washington, contactless card targets were added to the ticket vending machines (TVMs) and add-fare machines, allowing riders to add value to their smart cards. In an open system, cards should be obtainable and rechargeable from ATMs or bank branches, although the transit agency may wish to sell the cards as well. The costs associated with sale and recharge units vary widely.

The final major capital cost element is the communications and data collection and processing computer systems. As noted above, there may be three distinct systems: the garage or station, the agency, and the central clearinghouse systems; in multipurpose programs involving only a single transit agency, the central computer will functions as the agency computer. The garage or station computer records all fare transaction information--and card purchase and recharge data--for the buses using that garage or for a particular rail station, and communicates these data to the agency computer (or the central computer if applicable). In a multiagency system, each participating agency will have a computer that aggregates all of the garage or station inputs and communicates with the central clearinghouse system. This computer will also be used to remotely control and monitor station equipment and download updated fare information, as well as to prepare agency--level reports. Finally, the central clearinghouse system processes all transaction data from the agency--or garage or station-computers. In a multi-agency system, this computer allocates revenue among the agencies, and communicates with bank networks if necessary. As with the other types of equipment, costs vary considerably for the computer systems and communication links.

Potential Cost Savings

Potential capital cost savings are related to the procurement of equipment and the provision of the cards themselves. Whether there will be any savings depends on the specific institutional arrangement in place. In Manchester, for example, the system integrator (AES Prodata) is providing the on-bus smart-card reader units at no charge as part of the partnership agreement with the transit agency. In Atlanta, VISA has paid to install the card readers in turnstiles in MARTA's rail stations; the cards are also provided by the three participating banks at no charge to MARTA. In the Ventura County Passport project, the smart-card units are also provided at no charge to the operators; the cost is being assumed by the California Department of Transportation as part of a demonstration program. The former two projects involve payment of transaction fees by the transit agencies (in Manchester, no fees are paid for half-fare or "concessionary" riders). Thus, the capital cost "savings" will eventually be offset by the fees.

REVENUE EFFECTS

Types of Benefits

The introduction of electronic fare payment is expected to produce various benefits to a transit agency. While some of these are financial, others are related to goals such as improving convenience for the customer. The types of benefits typically associated with electronic and stored-value media are as follows:

- *Improved flexibility,* in terms of the range of fare options that can be offered and the ability to modify the fare structure;

- *Improved revenue accountability and security*, in terms of improved ability to track transactions and discourage employee theft or mishandling of fare revenue;
- *Reduced fare abuse*, including reduction of counterfeiting of media and short payment or illegal reuse of media;
- *Improved ridership data* generated from fare payment;
- *Reduced operator and rider interaction and administrative and operational requirements*, that is, related to the need for operators to sell and verify the validity of media (e.g., flash passes and transfers, in particular);
- *Improved convenience* for riders, for purchasing and using the media;
- *Ancillary revenue* from float and unused value on stored-value cards, and perhaps from transaction fees (in a multiple-use program); and
- *Expansion of employer programs*, which will result in additional revenues from people who buy passes because they are subsidized and who would not otherwise use transit regularly.

Contactless smart cards in particular also offer additional benefits, including the convenience of not having to insert or swipe the card; this is believed to be especially important for elderly or disabled riders who may have trouble using another medium. Other contactless card benefits include the following:

- *Faster throughput* (i.e., boarding of buses and passing through fare gates);
- *Lower maintenance costs*, because there is no physical contact with the turnstile or farebox and the readwrite unit has no moving parts; and
- *Improved reliability of fare collection equipment and media;* this can result in forfeiting less revenue because of equipment malfunctions.

The question is, to what extent can these benefits be translated into financial benefits (i.e., new revenues or cost savings)? As discussed above, there will be savings where personnel costs can be reduced and where capital costs can be avoided (e.g., where an outside entity is paying for equipment or cards). Additional revenues can result from an increase in use, a reduction in fare abuse or evasion, and through the creation of new revenue sources such as unused value, float, or transaction fees. The sources of potential revenues are described in the following section.

Potential Revenues

For transit agencies, the potential sources of additional associated with multipurpose payment programs are as follows:

- Increased fare revenues (from increased ridership and from reduced fare abuse or evasion),
- Float on prepayment or card balances and unused or expired value, and
- Transaction fees (from merchants).

For financial institutions issuing stored-value cards or involved in settlement or other clearinghouse functions, potential revenue sources overlap with those for transit with other types of fees added to the list. These sources include the following:

- Reduced card fraud or abuse,
- Float on card balances and unused or expired card value (or maintenance fees on expired cards), and
- Transaction fees (from merchants) and other types of fees (for reloading, settlement, reporting, etc.).

The specific type of additional revenue sources will depend on the parameters of the payment system and the function(s) of the institution in question. The different revenue sources are described below.

Increased Ridership--The first of these sources, higher fare revenues from increased ridership, is based on the assumption that some riders will expand their use of the system if they have stored-value (or any prepaid) cards. In surveys of reported (or intended, in a new system) use of stored-value media, riders have indicated the likelihood of making some additional trips because of the convenience of having the cards. For example, in a survey in Chicago regarding intended use of the new stored-value cards, respondents indicated that they expected to increase their tripmaking on CTA after purchasing the cards; analysis of the results produced an estimate that the fare cards can be expected to induce 2% to 5% increase in trips among these riders (7). Use of the transit system will also grow if the customer base is expanded. For instance, holders of an open system payment card may decide to use transit because they already have the fare media in hand, whereas they might not otherwise go out of their way to purchase a transit-only fare instrument or gather the exact change needed to ride. The greater convenience of transferring between transit systems offered by an integrated fare card should also generate some additional rides.

Finally, another potential source of fare revenue is the expansion of employer-subsidized fare programs. The fact that a smart-card-based pass could be issued for more than 1 month at a time would result in a smaller monthly administrative requirement for an employer, which could attract additional companies to a pass program. Because of the subsidy, some employees will buy a monthly (or other period) pass even if they do not use transit every day; the difference between the amount an employee formerly paid (i.e., in cash or individual tickets) and the full price of the pass represents additional revenue to the transit agency. The Central Puget Sound study concluded that the planned smart-card program could generate a 20% increase in the number of passes sold through the Employer Pass Subsidy Program, resulting in an annual revenue increase of $450,000 to

$750,000 (5). While the increase in transit use in any one of these scenarios may be relatively small, they are not mutually exclusive and could combine to result in a significant boost to fare revenue.

Reduced Fare Abuse or Evasion--Because of their enhanced security characteristics, smart cards are expected to reduce the potential for abuse or fraud and evasion. In the survey for this study, the average amount of revenue reported lost through "theft, fraud, counterfeiting" was approximately 1% for all respondents, or an average of roughly $1 million per year; this amount was significantly higher for the larger systems, an average of approximately $1.8 million, or 1.6%, for the heavy rail and commuter rail systems. Counterfeiting of magnetic cards has not been found to be a significant problem in the transit industry; because advances in protection technology have made magnetic cards increasingly difficult to duplicate (2). However, there has been substantial abuse of flash passes, through counterfeiting and use of invalid passes. The reduction or prevention of fraud is often cited as a primary reason for deciding to use smart cards. The Central Puget Sound study estimated the potential revenue effect from reducing fraudulent pass use at $120,000 to $180,000 per year, assuming that smart cards would cut the extent of pass-related fraud by 50%. In Manchester, an annual increase of at least $2.5 million is anticipated through the reduction of abuse in the use of concessionary (half-price trip) cards.

For financial institutions, the reduction of fraud is envisioned to be the largest source of anticipated additional revenues. The European card association, Europay International, for example, has estimated that moving to smart cards (for credit and debit cards, as well as the introduction of a stored-value card) will result in a benefit (from reduced fraud as well as cost savings) of $2.9 billion over the 7-year conversion period *(8).* Europay executives believe that this benefit is significant enough to warrant conversion to smart cards, regardless of any additional revenues that might be generated from new card services (e.g., float).

Float on Prepayment or Card Balances--Float on card balances or on any prepaid sum is another source of revenue for card issuers. A key issue in a public-private multipurpose payment arrangement is who owns and manages the float pool? In a closed system, any agreement must carefully define whether the float (from stored-value cards) accrues solely to the initiating entity (e.g., the transit agency or consortium of agencies) or to the actual issuing entity (e.g., the bank or other private partner), or is it shared between the parties. In an open system, there also must be a specified arrangement for apportioning float revenues among the various card issuers; potential approaches are being studied by the Smart Card Forum. The relative effect of float as a revenue generator will depend on the average card balance for a program. This is difficult to calculate, because it depends on several factors: (1) the average initial purchase or reload amount, (2) the average remaining value at the point at which cards are typically reloaded, and (3) the average length of time a cardholder takes between reloading actions. The average balance can be influenced by the discounts or bonuses offered for purchase and reloading.

For a transit-operated program, any estimate of income from float on a new fare medium must consider the loss of float on existing media that are being replaced or from which riders are switching to use the new medium. For instance, the Central Puget Sound study assumes that float on smart cards would derive from two sources: (1) a nonrefundable buffer (envisioned to be $5.00 to $10.00 in the feasibility study) on each card created by requiring cardholders to pay the cost of the card itself; and (2) any stored value held on a card. This study calculated potential income from float on the basis of the estimated fare buffer value of outstanding cards ($600,000 to $750,000 per year), the stored value on cards ($400,000 to $600,000 per year), and an assumption regarding the loss of float on existing prepaid media ($150,000). The resulting estimate of interest income (assuming an annual return of 5%) is $43,000 to $65,000 per year.

Unused or Expired Card Value--In any prepaid or stored-value card program, a certain portion of some cards' value will never be spent (i.e., for transit trips or purchases). In some cases, the cards will reach their expiration date, while in other cases, some of the value will never be used. People may throw away cards before they are fully expended, or they may keep the card as a collectible. This is more likely to occur with a prepaid (non-reloadable) card than with a reloadable card, although, depending on the pricing incentives associated with reloading a card, reloadable cards can certainly generate unused value as well. In the absence of (1) a discount or bonus or other loyalty program associated with retaining and reloading the same card or (2) a replacement charge for the card, many cardholders will throw cards away as they approach zero value.

This unused value is not *new* revenue, because it has been prepaid--it is revenue that is not expended. As explained previously, this places unused or expired value in the category of abandoned property, which may make it subject to being returned to the cardholder or turned over to the state. This has led to the establishment of a variation on the revenue source: a *maintenance fee* that begins at the time of the card's expiration; such an arrangement has been instituted by the banks taking part in the VISACash demonstration in Atlanta.

Merchant Transaction Fees--The major source of new revenue associated with many multiple-use card programs is likely to be the fee per transaction a merchant pays the card issuer. The merchant can be a retailer or other vendor paying a fee to a bank, a transit agency, or a public-private partnership issuing cards or the merchant can be a transit agency accepting a card issued by another party. The latter case represents a cost to a transit agency, as well

as a revenue source for the card issuer. There is no set structure for fees in a stored-value program--rates are being negotiated with each merchant in some programs as the card issuers seek to enlist participants. In the VISACash program, for instance, the typical rate is approximately 2.5% per transaction, although MARTA pays somewhat less, about 2%. The transaction fee is a fundamental element of the business case for most multiple use or stored-value programs. Of course, not all such programs rely on transaction fees. Mondex, for instance, makes its revenues on cardholder fees, because merchant transaction processing is optional; this is discussed below.

Other Types of Fees--Besides fees for merchant transactions, there may be a range of other fees in an open system (e.g., related to use of the card, handling transactions, reporting, or other functions). These may accrue to the issuer, or perhaps to an acquirer or clearinghouse network operator, and may take the following forms:

- Cardholder fees,
- Card reload fees,
- Advertising fees,
- Terminal sales or rental fees (for transaction acquirers),
- Interchange or settlement fees (for transaction acquirers or network operators),
- Management report fees (for transaction acquirers or network operators), and
- Vendor certification fees (for network operators).

In general, these types of fees apply primarily to a financial system card program. A bank or other issuer may charge a cardholder fee similar to a credit card annual fee, a monthly fee, or a reload fee similar to an ATM use fee, for instance. Mondex sees cardholder fees as its primary source of revenue; in the Swindon trial, customers receive the card free of charge for the first 6 months, but are then charged the equivalent of US$2.25 per month. Customers using the Mondex "wallet" are charged US$5.25 per month.

A transit-managed program is less likely to charge such fees on a regular basis, although it could establish an initial charge for the card. Some transit smart-card programs charge--or are considering--an initial fee for the card that is higher than the stored value contained on the card. In Manchester, for instance, the cardholder pays a minimum of $5.00 on receiving a card; this includes $3.00 worth of value and $2.00 to cover the cost of the card. In the Central Puget Sound area, it was suggested in the feasibility study that cardholders would have to pay the cost of the card (assumed in the analysis to be $5.00 to $10.00); this nonrefundable deposit would serve as a buffer to be accessed if the amount of stored value is insufficient to cover the cost of a particular trip. This buffer is assumed to be a key source of float. In the financial services arena, banks using the Banksys card make their own pricing decisions, but some charge customers up to US$5.00 to obtain the card.

With regard to other fees, practices vary widely. The different electronic-purse systems have different pricing approaches, and the specific pricing decisions are still in flux as these programs conduct trials and begin broader implementation. Mondex, for example, charges participating merchants a terminal rental fee; this fee is negotiated with each merchant. As explained earlier, Mondex does charge transaction settlement fees, but settlement is not required and the merchant is under no obligation to report transactions. In the VISACash system, there is an interchange fee that each participating bank must pay to VISA for handling the transaction; this fee is currently 1.2% of the purchase amount, plus $0.02 per transaction. Hence, on an average transaction amount of $2.50, the bank pays VISA $0.05.

A range of potential revenue sources could be realized through multipurpose smart-card programs. Other possible sources may develop as well, because the storage and processing capabilities of smart cards could facilitate new types of arrangements and functions currently unforeseen. Although the full extent of the possible benefits--and costs--has yet to be demonstrated in a long-running, broadscale, transit-oriented program, several studies have determined that the anticipated benefits outweigh the expected costs. Financial issues will be addressed further in the next phase of this study.

SUMMARY

The costs and benefits associated with a multipurpose payment strategy depend on the type of program and the details of the arrangement among the participating entities. Although analyses of possible programs have indicated positive cost-benefit ratios, each prospective participant must be convinced that it will share in this net benefit. Therefore, the single most important issue that must be resolved in establishing a joint transit-bank (or other private entity) payment system is the distribution of costs and revenues: who will pay for what, and who will receive which portion of the revenue?

In some cases, the transit agency will pay for the implementation of the new system, and these costs, it is to be hoped, will be offset by a combination of operating and maintenance cost savings and increased revenues. Alternatively, a joint arrangement may result in capital as well as operating cost savings, where the private entity (a bank or perhaps an equipment vendor) subsidizes or provides the new equipment and media needed. In such cases, the private "partner" benefits by placing its card in the hands of the transit rider market. On the other hand, there are costs to the transit agency associated with the latter arrangement, including the loss of float and unused value, and possibly the payment of transaction fees for use of the system. The financial issues can be complex, because there may be questions, for example, regarding allocation of both fees and revenues (e.g., from float) among participants. As such programs become more

prevalent, insight will be gained into the real (rather than projected) costs and benefits and how to structure workable agreements.

CHAPTER 8--CUSTOMER ACCEPTANCE ISSUES

Underlying the potential for all types of stored-value media is the extent to which the concept will be embraced by customers. Stored-value fare payment has been used in transit for more than 20 years, and its longterm acceptance at BART and at WMATA suggests that there is no reason why it should not be accepted by transit riders elsewhere. Moreover, prepayment in other forms (i.e., timebased passes and multi-ride tickets or tokens) is heavily used throughout the transit industry. On the other hand, the use of prepaid and stored-value payment options for other purposes is largely untested, particularly in the United States. Other than the recent rollout of the VISACash card in Atlanta, the introduction of prepaid telephone cards (these are used extensively in Europe), the use of campus cards at several U.S. colleges, and single-building trials by a few banks, the appeal of stored-value cards outside of transit has yet to be tested here. Traveler's checks have long been in use, but only for a very specialized purpose: spending while on vacation. Thus, the potential market for multiple-use media can only be speculated on at this point. Even in Europe, where electronic-purse programs have been introduced, widespread consumer acceptance has yet to be fully achieved.

Given both the transit and financial industries' interest in stored-value cards--coupled with concerns about the potentially high investment required to introduce these cards--there has been considerable market research into the potential use of such cards in various settings, as well as into potential customer concerns related to the cards' use (e.g., privacy). Surveys and focus groups have been employed to test transit riders' level of interest in stored-value transit media, multiple-use options, and smart cards in general in several locations. Meanwhile, several financial and related entities have conducted their own market research efforts to ascertain public receptiveness to smart cards and stored value, as well as other applications. Several such studies on customer acceptance of stored-value media and multipurpose transit media are presented in this chapter.

TRANSIT STORED-VALUE AND MULTIPURPOSE MARKET RESEARCH

Several transit agencies have undertaken market research efforts within the past few years related to the introduction of stored-value fare media and the use of smart cards as a fare payment mechanism. In surveys and focus groups, these agencies have sought to address such issues as the following:

- The likely acceptance and extent of use of these new media by current transit riders,
- The ability of such media to *increase* transit use by current riders as well as to generate use by current *nonriders*, and
- Issues and factors considered important to potential users.

In addition to the market research efforts targeted specifically to stored-value and smart cards, many agencies have conducted surveys related to use of prepaid fare media. These surveys have indicated that prepaid fare media (including flash passes and bulk purchase tickets and tokens) are popular with transit riders, primarily because of increased convenience and the ability to save money (through prepayment discounts). The popularity of prepaid fare options is documented in the high level of prepayment at many transit agencies. The average percentage of fares paid with prepaid media for the respondents to the transit agency survey (see the appendix) is roughly 47%. This percentage is as high as 92% (Toronto Transit Commission) for rail/bus systems and as high as 80% (Ottawa-Carleton Regional Transit Commission) in bus-only systems; two other bus-only systems (Spokane Transit Authority and Miami Valley Regional Transit Authority) reported figures around 70%. The success of existing prepaid options suggests that there is significant marketing potential for "cashless" fare media.

This chapter summarizes the findings from recent market research efforts associated with stored-value programs (using magnetic media) in Chicago (the AFC project), New York (the MetroCard AFC and the expanded utility programs), and southern California (the MetroCard project), as well as smart-card systems (stored value is one option) in the San Francisco Bay Area (the TransLink Program), southern California (the Advanced Fare Payment Program), and the Seattle region (the Regional Fare and Technology Coordination Program). Descriptions of the individual research efforts are included in the interim report and will be presented in the final report for this study.

General Reaction to the Stored-Value Concept

The following are user reactions to the stored-value concept:

- Respondents were generally positive toward the concept of stored-value media. Transit riders place considerable value on the convenience associated with using a stored-value fare card, although the cost of fare payment is the single most important factor affecting choice of a fare method.
- Convenience of purchase and reloading is an important issue. Bus riders in particular view the ability to readily purchase a card a potential problem and are concerned that they will have to go out of their way to do so.
- Respondents selecting fare cards indicated that they expected to increase their trip-making after purchasing

the cards. In Chicago, adjusting for "commitment bias," it was estimated that the fare cards would induce approximately a 2% to 5% increase in trips among these riders. Roughly 25% of MetroCard (Los Angeles area) users indicated that they were using transit more since buying MetroCard.

■ A financial incentive for using stored-value cards is considered important. In the Los Angeles MetroCard survey, for instance, the most frequently suggested improvement was to provide a discount for using the MetroCard." Of the respondents, 86% said that they would use the card more often if it were discounted. Most consumers in the San Francisco Bay Area were also interested in high-use discounts.

Reactions to Multiple Use

The following are user reactions to multiple-use cards:

■ The overall reaction to the use of a stored-value card as a payment device for applications other than transit was mixed. Almost 50% of the New York City consumers interviewed thought "very highly" of the expanded use concept and would anticipate using the card. In the Los Angeles, San Francisco, and Seattle areas, however, multiple use for nontransportation applications was considered relatively unimportant.

■ Consumers were, overall, more comfortable with the introduction of the stored-value card's use capabilities in stages, rather than all at once. Consumers indicated that they would be more receptive to expanded use after they had become comfortable with use of the card for transit purposes.

■ Many people projected monetary values loaded on the card at a higher level then had been expected. In New York, survey respondents indicated that they would place an average of more than $100 on the card; in the San Francisco area, respondents indicated that they would put a maximum of more than $50.00 and a minimum of $8.00 on the card initially.

GENERAL PURPOSE MARKET RESEARCH

The high level of interest in the smart-card and stored-value markets on the part of financial institutions has also resulted in several market research efforts over the past couple of years. Like the aforementioned transit agencies, several major banks and associations have undertaken surveys to ascertain the potential acceptance of and concerns about these new payment options. This section summarizes the overall general findings from recent market research (quantitative and qualitative) done by the Smart Card Forum (conducted in 1995) and MasterCard (conducted in 1994 and 1995). The individual market research efforts are discussed in the interim report and will be presented in the final report for this study.

General Reaction to the Stored-Value Concept

Consumers have had the following reactions to the stored-value concept:

■ Consumers are comfortable with the concept of a multi-application card. In research conducted by the Smart Card Forum, for instance, about 67% of the respondents were "positive" to the idea, with 25% "enthusiastic." Just less than one half (42%) of the group would seriously consider acquiring a multi-application card. In MasterCard's research, more than onehalf of the respondents expressed positive interest in the stored-value concept, and approximately 60% of the U.S. respondents indicated they would switch financial institutions to obtain the stored-value product. In this research, Americans said they would carry an average minimum of $100 and an average maximum of $300 on their cards.

■ The two main reasons given for the positive reactions to the multiapplication card were its value in an emergency and the ability to consolidate existing cards. The emergency information especially pertained to medical and insurance information. The primary benefits of the card were seen as being convenience, consolidation, and storage of emergency information. The card was also considered useful as a budgeting item (e.g., to help control expenditures). The ability to combine several cards into one card was also identified as a major benefit.

Barriers to Use

Participants considered that the chief barriers to their use of a smart card were lack of privacy or security and limited merchant acceptance of the card. People were concerned about what would happen to their money if the card were lost or stolen. Many participants believed that the card would only be accepted in a few places at first, and it would take some time for the card to be accepted on a widespread basis. The need for a PIN to use the card was seen as a negative when making small dollar purchases, although PINs were considered favorably for making large purchases. Finally, several participants were concerned about how the information stored on the card would be accessed. Other concerns (from various other research efforts) included the following:

■ Not being able to know easily how much money is left on the card,

■ The likelihood of spending more money,

■ Malfunctioning card reading devices, and

■ The potential that a fee would be charged to use the card.

Thus, the market research reviewed in this study indicates a generally positive response to stored-value media and smart cards in general for transit use. There appear to be mixed feelings among transit riders

about a multiple-use card, although there are indications that riders would be more responsive to a multiple-use card after becoming comfortable with its use in a transit setting. Among general market consumers, smart cards are accepted positively, although stored value does not appear to be considered the most important application. The market research suggests that there is a need for effective consumer education in the introduction of any new fare payment technology, especially a multiple-use card. Transit has long used prepayment and has demonstrated the concept of stored value for more than 20 years. Although the extent of the ultimate market for multiple-use media is not clear at this point, the market research suggests that consumers are interested in the stored-value concept for transit, transit-related, and nontransit services.

REFERENCES

1. Benton International, *TransLink Program Plan.* for the Metropolitan Transportation Commission, (Dec. 1995).

2. Fleishman, D. et al., *TCRP Report 10,* "Fare Policies, Structures and Technologies," TRB, National Research Council, Washington, DC (May 1996).

3. Christian, F, "Is the Contactless Smartcard in Step with Technology?" *in CardTech/SecurTech Proceedings, Volume 1: Technology* (May 1996).

4. Echelon, Inc., *Advanced Fare Payment Media Study,* for USDOT/FTA (1992).

5. IBI Group and King County Department of Metropolitan Services, *Central Puget Sound Regional Fare and Technology Coordination Feasibility Study: Technical Appendices, (*Jan. 1996).

6. Gleick, J., "Dead as a Dollar," *New York Times Sunday Magazine (*June 16, 1996).

7. Multisystems, Inc., *Stored Value Fare Card Pricing Survey and Ridership/ Revenue Model,* Final Report for Chicago Transit Authority (Dec. 1995).

8. Kutler, J., "Europay Stacks up the Evidence Members Can Cash in by Putting Their Chips on the Smart Card," *American Banker June* 13, 1996).

APPENDIX: TRANSIT AGENCY SURVEY

This appendix presents the results of a survey of transit agencies conducted as part of the study; the questionnaire and cover memo are presented at the end of the appendix. The focus of the survey was on current fare collection practices and costs, plans for use of emerging technologies, agency goals for improving fare collection systems, and issues and concerns regarding possible multiple-use payment arrangements. A questionnaire was sent to 86 transit agencies throughout North America. These include all agencies operating rapid rail, commuter rail, or light rail service, as well as a range of bus-only systems (small, medium, and large). A total of 54 transit agencies, or 63% of the total sent, responded to the survey. The respondents are shown in Table A-1, separated by modal classification (see below); annual systemwide ridership is presented for each. The results of the survey were processed using the Statistical Product for the Social Sciences (SPSS) software. The responses are summarized as follows.

OVERVIEW OF THE TRANSIT AGENCIES

All modes of public transportation are represented among the respondent agencies. Although many of the responding agencies operate only one mode, some of the agencies are multimodal. To prevent counting an agency's response more than once for results that are presented by mode, each agency was categorized according to the following hierarchy:

- *Bus-Only-This* category consists of those agencies that operate motorbus-only. The only exception is the Detroit Transportation Corporation, which only operates automated guideway.
- *Light Rail/Streetcar-This* category consists of those agencies that operate light rail or a combination of bus and light rail.
- *Commuter Rail-Agencies* in this category operate either commuter rail only or a combination of commuter rail with bus and/or light rail.
- *Rapid Rail-As* a minimum, agencies in this category operate rapid rail only or a combination of rapid rail with any of the other modes already mentioned.

Using these categories, the modal breakdown for the survey respondents is summarized in Table A-2. As shown in Table A-2, most survey respondents (57.4%) are bus-only systems. Rapid Rail is the next largest category with 18.5% of the survey respondents. The remaining 24% of the respondents consists of light rail and commuter rail systems.

PRESENT FARE COLLECTION SYSTEM

In the survey, each agency was asked a set of questions about its current fare collection system. These questions addressed the areas of media, payment options, and fare collection and issuing equipment. Each of these areas is described below.

Types of Media

Each agency was asked to identify the types of media accepted on its services. The responses are summarized in Table A-3. The total in Table A-3 is the number of agencies that submitted at least one response. The numbers and percentages do not add up to the total because multiple responses are possible. For example, an agency may accept cash, tokens, and magnetic-stripe cards. As such, this agency is counted once for every response and once in the total. By far, cash is the most widely accepted medium for transit travel with 98.1% of the agencies accepting it. Onehalf of the agencies report that tokens are accepted. The next most widely accepted medium is magnetic-stripe cards. Nineteen (35.2%) of the survey respondents accept swipe cards. Very few agencies accept credit cards (nine respondents), debit cards (five respondents), stored-value cards (eight respondents), or smart cards (three respondents). "Other types," which constitute 46.3% of the survey respondents, includes flash passes, paper tickets, transit checks, and photo ID cards.

Payment Options

In addition to the types of media, each agency was asked to identify all available payment options, that is, the different products (e.g., passes and multi-ride tickets) that it offers. The responses are summarized in Table A-4. As

TABLE A-1: Survey respondents

Category	Location (Agency)	Annual Ridership (000's)
Rapid Rail	Atlanta (MARTA)	62,700
	Baltimore (MTA)	92,800
	Boston (MBTA)	178,403
	Chicago (CTA)	441,000
	Los Angeles (LACMTA)	361,000
	New York (MTA)	1,550,000
	Philadelphia (PATCO)	11,134
	Philadelphia (SEPTA)	200,000
	San Francisco (BART)	79,870
	Toronto (TTC)	389,700
Commuter Rail	Ft. Lauderdale (Tri-Rail)	2,755
	Los Angeles (SCRRA)	5,000
	NY (MNCRR)	62,376
	Toronto (GO Transit)	32,000
	Vancouver (BC Transit)	200,000
Light Rail	Buffalo (NFTA)	27,300
	Calgary (CT)	56,300
	Dallas (DART)	43,500
	Detroit (DTC)	2,300
	Pittsburgh (PAT)	70,000
	Portland (Tri-Met)	63,468
	Sacramento (RTD)	23,088
	St. Louis (BSDA)	50,000
Bus-only	Albany, NY (CDTA)	10,000
	Ann Arbor (AATA)	4,085
	Bridgeport, CT (GBTD)	4,750
	Charlotte, NC (CT)	12,000
	Cincinnati (SORTA)	22,457
	Contra Costa Co., CA (CCCTA)	3,988
	Culver City, CA (CCMBL)	4,000
	Dayton, OH (MVRTA)	15,000
	Grand Rapids, MI (GRATA)	3,600
	Hartford (Connecticut Transit)	19,000
	Honolulu (HPTA)	80,650
	Houston (Metro)	60,000
	Lafayette, IN (GLPTC)	1,950
	Las Vegas (RTC)	28,500
	Louisville, KY (TARC)	15,000
	Madison, WI (Metro)	9,730
	Memphis (MATA)	12,682
	Montebello, CA (MBL)	5,438
	Norfolk, VA (TTDC)	8,365
	Orange Co., CA (OCTA)	42,188
	Ottawa (OC Transpo)	71,800
	Phoenix (Valley Metro)	30,000
	Raleigh-Durham, NC (TTA)	338
	San Antonio (VIA)	46,349
	San Bernardino, CA (Omnitrans)	9,822
	San Mateo, CA (SamTrans)	23,088
	Seattle (Metro)	76,400
	Spokane, WA (STA)	7,467
	Talahassee, FL (Taltran)	3,674
	Tampa, FL (HART)	10,000
	W. Covina, CA (Foothill Transit)	12,500

TABLE A-2 Number of respondents by type of system

Type of System	Number	Percent
Bus Only	31	57.4
Light Rail/Streetcar	8	14.8
Commuter Rail	4	7.4
Rapid Rail	11	20.4
TOTAL	54	100.0

TABLE A-3 Present fare collection system: media types

Media Types	Agencies Responding	
	Number	Percent
Cash	53	98.1
Token	27	50.0
Magnetic Stripe (monthly pass)	19	35.2
Credit Cards	9	16.7
Debit Cards	5	9.3
Magnetic Stripe (stored value)	8	14.8
Smart Cards	3	5.6
Other Types	25	46.3
TOTAL	54	100.0

Note: Question permitted multiple responses

TABLE A-4 Present fare collection system: payment options

Payment Options	Agencies Responding	
	Number	Percent
Weekly Pass	14	26.4
Monthly Pass	47	88.7
Discounted Multi-Rides	23	43.4
Stored Value	9	17.0
Other Options	20	37.7
TOTAL	53	100.0

Note: Question permitted multiple responses

with media types, the numbers and percentages do not add up to the totals because multiple responses are possible. As shown in Table A-4, a significant number of agencies offer some form of prepayment option. The most widely available form of prepayment appears to be the monthly pass. A monthly pass option is available at 88.7% of the systems. Multi-ride tickets are the next most widely available with 43.4% reporting these as an option. Weekly passes are offered by 26.4% of the respondents and stored-value cards are offered by 17%, a relatively low proportion. Twenty agencies reported the availability of payment options other than those mentioned. These consisted primarily of day passes, group passes, and specific multi-ride punch cards and tickets.

In addition to listing the payment options, the respondents also provided data on the percentage of fares paid with prepaid media. These data are summarized by type of system in Table A-5. As shown in this table, rapid rail and commuter rail have the highest proportion of prepaid fares, with 57.5% and 53.3% prepayment, respectively. Light rail is next with 49.6% prepayment. Bus-only systems have the lowest proportion of prepayment.

Existing Fare Collection Equipment

Each agency was asked to indicate its existing types of fare collection and issuing equipment. The responses are summarized in Table A-6. Because multiple responses are possible, the numbers and percentages do not add up to the totals. Electronic registering fareboxes are the most widely used pieces of fare collection equipment. Of the respondents, 82% indicated that electronic registering fareboxes are part of their existing fare collection equipment. Magnetic-card swipe readers (i.e., monthly pass verification) are the next most widely used, with 32.7% of the respondents indicating that these are part of their existing equipment. Nonregistering fareboxes are used by only 28.8% of the agencies. In terms of fare issuing equipment, TVMs appear to be the most widely used. Of the 52 agencies responding to this item, 34.6% indicate that TVMs are part of their existing equipment. A relatively small percentage indicate that read-write equipment (both smart-card and magnetic media) is used. The category of other equipment includes turnstiles, ticket validators, and token-vending machines.

PLANS FOR NEW FARE COLLECTION SYSTEM

Each agency was asked to indicate the media technologies and equipment that it is likely to use within the next 3 years. The emphasis of these questions was on emerging technologies such as stored-value, smart cards, and proximity cards (contactless smart cards).

Fare Media Technologies

The media technologies that the respondents indicated they are likely to use within the next 3 years are summarized in Table A-7. Forty-one agencies provided responses about planned media technologies. A magneticstripe, stored-value card technology was the most often cited with 70.7%. Contactless and contact smart-card technologies are expected to be implemented by 34.1% and 29.3% of the respondents, respectively. More than 24% of the respondents are planning to use either credit or debit card technologies.

Fare Collection and Issuing Equipment

The fare collection and issuing equipment that the respondents indicated they plan to use within the next 3 years are summarized in Table A-8. Electronic registering fareboxes and TVMs are the two largest categories with 66% and 54%, respectively. Just below these are magnetic and smart-card read-write equipment. Of the respondents, 46% plan to use magnetic-card read-write units while 44% plan to use smart-card read-write equipment. Other equipment planned for use includes ATM machines, multi-use debit cards, discount phone cards, and credit and debit TVMs.

FARE SYSTEM COSTS

The survey respondents were asked to provide the costs in actual or estimated dollars for the following: production and distribution of fare media, fare collection and processing, fraud, and counterfeiting. In addition to providing the costs in dollars, respondents also provided the percentage of total fare revenue that each of these costs represented. The three categories of costs as a percentage of total fare revenue are presented by type of system in Table A-9. Each cost category is discussed separately below.

TABLE A-5 Percentage of fares paid with prepaid media

Type of System	Percentage of Prepaid Fares
Bus Only	40.0
Light Rail/Streetcar	49.6
Commuter Rail	53.3
Rapid Rail	57.5
AVERAGE	46.0

TABLE A-6 Present fare collection system: equipment

	Agencies Responding	
Equipment	Number	Percent
Nonregistering Fareboxes	15	28.8
Ticket Vending Machines	18	34.6
Electronic Registering Fareboxes	43	82.7
ATM Machines	2	3.8
Magnetic Card Swipe Readers	17	32.7
Smart Card Read-Write Units	3	5.8
Magnetic Card Read-Write Units	9	17.3
Other Equipment	9	17.3
TOTAL	52	100.0

Note: Question permitted multiple responses

TABLE A-7 Plans for media technologies

	Agencies Responding	
Media Technologies	Number	Percent
Magnetic Stripe (stored value)	29	70.7
Contact Smart Cards	12	29.3
Contactless Smart Cards	14	34.1
Credit Cards	10	24.4
Debit Cards	10	24.4
TOTAL	41	100.0

Note: Question permitted multiple responses

TABLE A-8 Plans for collection and issuing equipment

	Agencies Responding	
Equipment	**Number**	**Percent**
Electronic Registering Fareboxes	33	66.0
Ticket Vending Machines	27	54.0
Magnetic Card Swipe Readers	18	36.0
ATM Machines	8	16.0
Magnetic Card Read-Write Units	23	46.0
Smart Card Read-Write Units	22	44.0
Other Equipment	8	16.0
TOTAL	50	100.0

Note: Question permitted multiple responses

TABLE A-9 Comparison of fare system costs

Type of System	Cost as a Percentage of Total Fare Revenue		
	Production and Distribution	**Collection and Processing**	**Theft, Fraud, Counterfeiting**
Bus Only	1.1	1.9	0.3
Light Rail/Streetcar	1.2	3.4	0.9
Commuter Rail	2.7	9.2	1.3
Rapid Rail	7.4	9.1	1.7
AVERAGE	2.5	4.2	0.8

- *Production and Distribution-As* a percentage of total fare revenue, the average cost (for all survey respondents) of production and distribution of fare media is approximately 2.5%. Rapid rail systems have the highest relative costs. Fare media production and distribution costs for rapid rail systems is 7.4% of total fare revenue.
- Commuter rail systems are the next highest with 2.7%. Bus-only and light rail systems are approximately the same, with production and distribution costs that are slightly more than 1% of total fare revenue.
- *Collection and Processing-Of* the three categories of fare system costs, the costs of fare collection and processing constitute the largest portion with an average of all systems of 4.2% of fare revenue. Collection and processing costs are about equal for rapid rail and commuter rail systems at approximately 9%. Light rail system collection and processing costs are 3.4% of total fare revenue. Bus-only systems have the lowest collection and processing costs at 1.9% of total fare revenue.
- *Theft, Fraud, and Counterfeiting-The* responding systems' average estimate for revenue lost to theft, fraud, and counterfeiting is very low-less than 1%. Rapid rail systems report the highest level of lost revenue (1.7%) followed by commuter rail systems (1.3%). Light rail systems report that just less than 1 % of revenue is lost through theft, fraud, and counterfeiting. Bus systems report the lowest level of lost revenue at 0.3%.

RATING OF GOALS FOR IMPROVING FARE SYSTEM

Each of the survey respondents was asked to rate 14 goals related to improving its fare system. Each goal was rated on a scale of one to five of overall importance-one being not important and five being very important. The results of the ratings were compiled by goal by type of system to arrive at a mean rating. The mean ratings for each goal are presented in Table A-10, and the overall ratings are shown graphically in Figure A-1. The table includes the average rating for all respondents as well as the mean rating by type of system for each goal. Each type of system is discussed separately below.

All Systems

Overall, the highest rating of 4.6 was given to the goal of improving convenience for riders. Immediately below rider convenience was improving the ability to collect needed data-a rating of 4.3. The following are the five highest rated goals for all systems:

- Improve the convenience for riders,
- Improve the ability to collect needed data (e.g., origin and destination data),
- Improve the ease of administering fare collection by bus operators and other personnel,
- Improve fare system security and accountability (e.g., reduce fare abuse, fraud, and theft), and
- Improve card read-write unit reliability.

The remaining goals were rated within a range of 3.5 to 3.8, indicating that these goals also are relatively important. The only two exceptions were the goals for integrating payment with other transportation providers and integrating payment with nontransportation uses, which rated 2.7 and 2.5, respectively. This would indicate that the responding agencies believe these goals are less important.

Bus-Only Systems

Among bus-only systems, the goals for improving rider convenience and improving the ability to collect data were rated equally at 4.5, indicating that the bus systems hold these to be the two most important goals. The following are the five goals rated highest by bus-only systems:

- Improve the convenience for riders,
- Improve the ability to collect needed data (e.g., origin and destination data),
- Improve the ease of administering fare collection by bus operators and other personnel,
- Improve the ability to integrate with other on-board technologies (e.g., automated vehicle location [AVL] or automated passenger counter [APC] system), and
- Improve card read-write unit reliability.

TABLE A-10 Rating of goals for improving fare systems

Type of System	Mean Rating						
	Improve Card Read-Write Reliability	Improve Fare System Security and Accountability	Improve Ability to Collect Needed Data	Maintain Ability to Use Existing Fare System Equipment	Improve Ability to Integrate with Other On-Board Technologies	Improve Ability to Modify Fare Structure and Policies	Reduce Cost of Producing and Distributing Fare Media
Bus Only	3.9	3.8	4.5	3.8	4.0	3.7	3.7
Light Rail/Streetcar	4.0	4.4	3.8	4.0	3.6	3.8	3.4
Commuter Rail	4.3	4.0	4.8	4.7	3.8	4.3	4.0
Rapid Rail	3.8	4.1	3.8	3.5	3.2	3.9	4.1
ALL SYSTEMS	3.9	4.0	4.3	3.8	3.8	3.8	3.8

TABLE A-10 Rating of goals for improving fare systems (continued)

Type of System	Mean Rating						
	Reduce Cost of Fare Collecting and Processing Equipment	Improve Convenience for Riders	Improve Ease of Administration	Improve Throughput	Create "Seamless" Regional Transit Travel	Integrate Payment with Other Transp. Services	Integrate Payment with Nontransp. Uses
Bus Only	3.8	4.5	4.4	3.5	3.2	2.6	2.5
Light Rail/Streetcar	3.3	4.6	4.5	3.6	3.5	2.6	2.5
Commuter Rail	4.0	4.5	3.0	3.0	4.3	3.5	2.3
Rapid Rail	4.0	4.6	4.0	3.8	4.1	2.6	2.7
ALL SYSTEMS	3.8	4.6	4.2	3.6	3.5	2.7	2.5

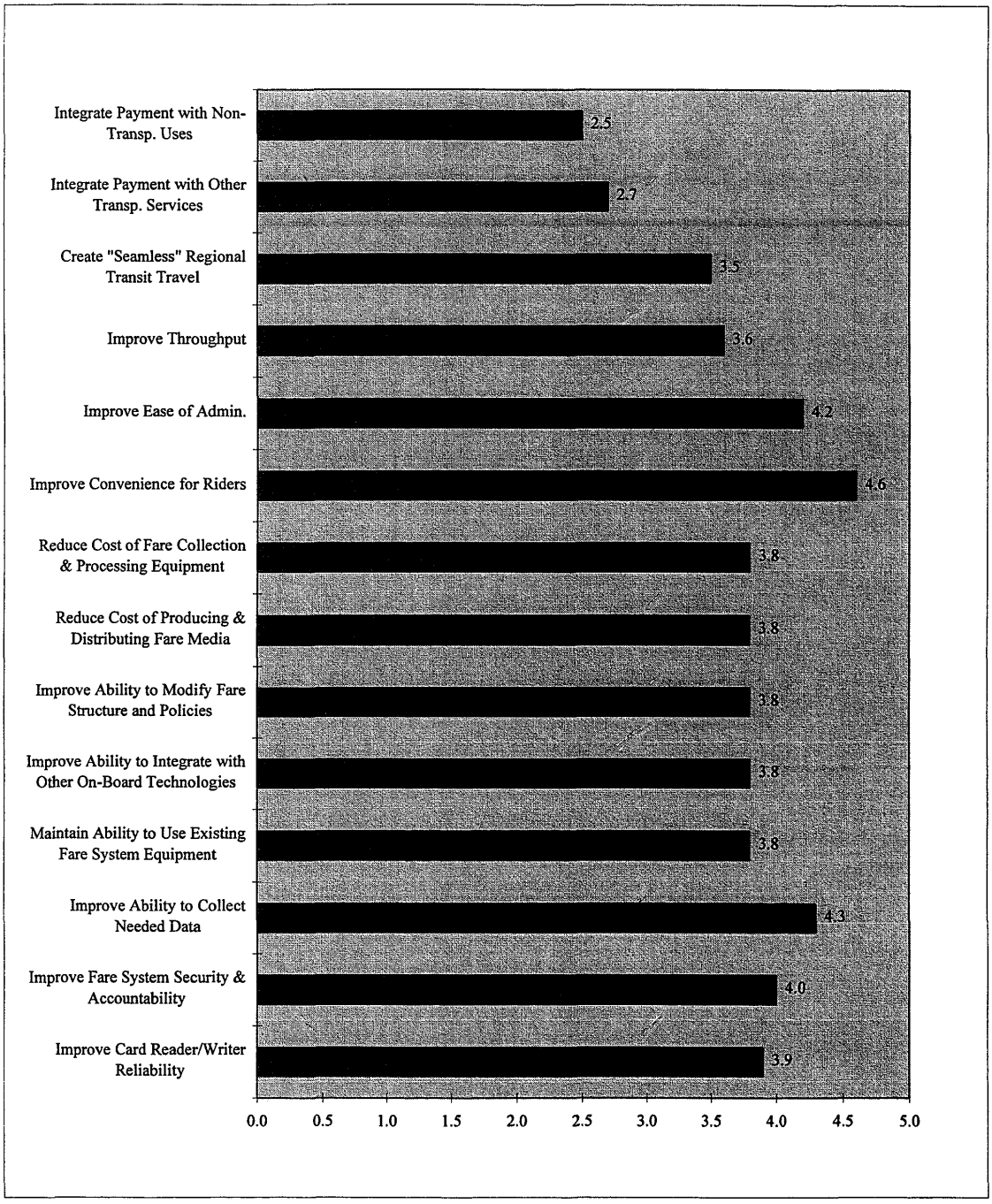


Figure A-1. Rating of goals.

With two exceptions, the remaining goals were all rated within a range of 3.2 to 3.8. Integrating payment with other transportation services and integrating payment with nontransportation uses were rated 2.6 and 2.5, respectively.

Light Rail/Streetcar Systems

As with bus-only systems, light rail systems rated the goal of improving rider convenience the highest, giving it a 4.6 rating. The next highest was a 4.5 rating given to improving the ease of administration. The following are the five goals rated highest by light rail/streetcar systems:

- Improve the convenience for riders,
- Improve the ease of administering fare collection by bus operators and other personnel,
- Improve fare system security and accountability (e.g., reduce fare abuse, fraud, and theft),
- Improve card read-write unit reliability, and
- Maintain ability to use existing fare system equipment.

The goals rated lowest by light rail/streetcar systems were integrating payment with other transportation services (2.6 rating) and integrating payment with nontransportation uses (2.7 rating). The remaining goals for improving fare systems were rated within a range from 3.3 to 3.8, indicating that these are relatively important to light rail/streetcar systems.

Commuter Rail Systems

The goals most important to commuter rail systems are improving the ability to collect needed data (4.8 rating) and maintaining the ability to use existing fare system equipment (4.7 rating). The following are the six most important goals for commuter rail systems:

- Improve ability to collect needed data (e.g., origin and destination data),
- Maintain ability to use existing fare system equipment,
- Improve the convenience for riders,
- Improve ability to modify fare structure and policies,
- Improve card read-write unit reliability, and
- Create seamless transit travel in the region.

The last three in the list above were rated by commuter rail systems as having equal importance-each was given a 4.3 rating. With only one exception, the remaining goals were considered relatively important, with ratings ranging from 3.0 to 4.0. The lowest rating of 2.3 was given to the goal for integrating payment with nontransportation uses.

Rapid Rail Systems

The most important goal for rapid rail systems is that of improving rider convenience, which received a rating of 4.6. Three goals shared the next highest rating of 4.1-reducing the cost of producing and distributing fare media, improving fare system security and accountability, and creating seamless regional transit travel. The following six goals were considered most important by rapid rail systems:

- Improve the convenience for riders,
- Reduce the cost of producing and distributing fare media,
- Improve fare system security and accountability (e.g., reduce fare abuse, fraud, and theft),
- Create seamless transit travel in the region,
- Maintain ability to use existing fare system equipment,
- Reduce cost of fare collection and processing equipment, and
- Improve ease of administering fare collection by bus operators and other personnel.

The last two goals in the list above were given equal importance by rapid rail systems-each received a rating of 4.0. The goals rated lowest by rapid rail systems were integrating payment with other transportation services (2.6 rating)

and integrating payment with nontransportation uses (2.7 rating). The remaining goals received ratings within a range of 3.2 to 3.9.

RATING ISSUES AND CONCERNS RELATED TO POTENTIAL MULTIPLE-USE ARRANGEMENTS

Respondents were asked to rate issues related to multiple-use arrangements according to the same scale used for the goals for improving fare systems. Multiple use was defined as the use of media (e.g., a smart card) for the services of more than one entity (i.e., transit system, retail outlet, bank, and so forth). Six issues were rated. The ratings for each of these issues by type of system are presented in Table A-11 and shown in Figure A-2.

All Systems

Institutional issues were rated as the most important for all systems. Institutional issues received a rating of 4.2. The next most important issues were cost issues and card technology issues, each receiving a 3.8 rating. The following list presents each of the issues in the order of importance from most important to least important:

- Institutional issues (e.g., maintaining control over the fare system, including the ability to modify fare structures),
- Cost of providing electronic fare media and of participating in a multiple transit use or joint banking and transit program (e.g., the need to buy new equipment or the high unit cost of smart cards),
- Card technology issues (e.g., the need to accept technology selected by other agencies),
- Privacy issues for riders (e.g., addressing rider concerns with use of electronic fare media),
- Clearinghouse/settlement issues (e.g., related to apportioning revenues among participating agencies), and
- Legal and regulatory issues (e.g., constraints on an agency's ability to enter into agreements with other entities).

The privacy and clearinghouse issues were rated equally important, with a 3.6 rating.

Bus-Only Systems

Bus-only systems rated institutional issues as the most important (4.0 rating). Cost issues and card technology issues were next in order of importance, each with a rating of 3.7. The following list presents the issues in order of overall importance:

- Institutional issues (e.g., maintaining control over the fare system, including the ability to modify fare structures),
- Cost of providing electronic fare media and of participating in a multiple transit use or joint banking and transit program (e.g., the need to buy new equipment or the high unit cost of smart cards),
- Card technology issues (e.g., the need to accept technology selected by other agencies),
- Privacy issues for riders (e.g., addressing rider concerns with use of electronic fare media),
- Clearinghouse/settlement issues (e.g., related to apportioning revenues among participating agencies), and
- Legal and regulatory issues (e.g., constraints on an agency's ability to enter into agreements with other entities).

Light Rail/Streetcar Systems

Light rail/streetcar systems rated institutional issues and clearinghouse/settlement issues as the most important (4.3 rating). Cost issues and privacy issues were rated equally important-each was given a 3.8 rating. The following list presents the issues in order of importance to light rail/streetcar systems:

- Institutional issues (e.g., maintaining control over the fare system, including the ability to modify fare structures),
- Clearinghouse/settlement issues (e.g., related to apportioning revenues among participating agencies),
- Cost of providing electronic fare media and of participating in a multiple transit use or joint banking and transit program (e.g., the need to buy new equipment or the high unit cost of smart cards),

TABLE A-11 Rating issues and concerns related to potential multiple-use arrangements

	Mean Rating					
Type of System	**Cost Issues**	**Card Technology Issues**	**Institutional Issues**	**Legal and Regulatory Issues**	**Privacy Issues for Riders**	**Clearinghouse/ Settlement Issues**
Bus Only	3.7	3.7	4.0	3.3	3.5	3.4
Light Rail/Streetcar	3.8	3.3	4.3	3.3	3.8	4.3
Commuter Rail	4.5	4.5	4.8	4.5	3.8	4.0
Rapid Rail	3.6	3.8	4.6	2.9	3.6	3.8
ALL SYSTEMS	3.8	3.8	4.2	3.3	3.6	3.6

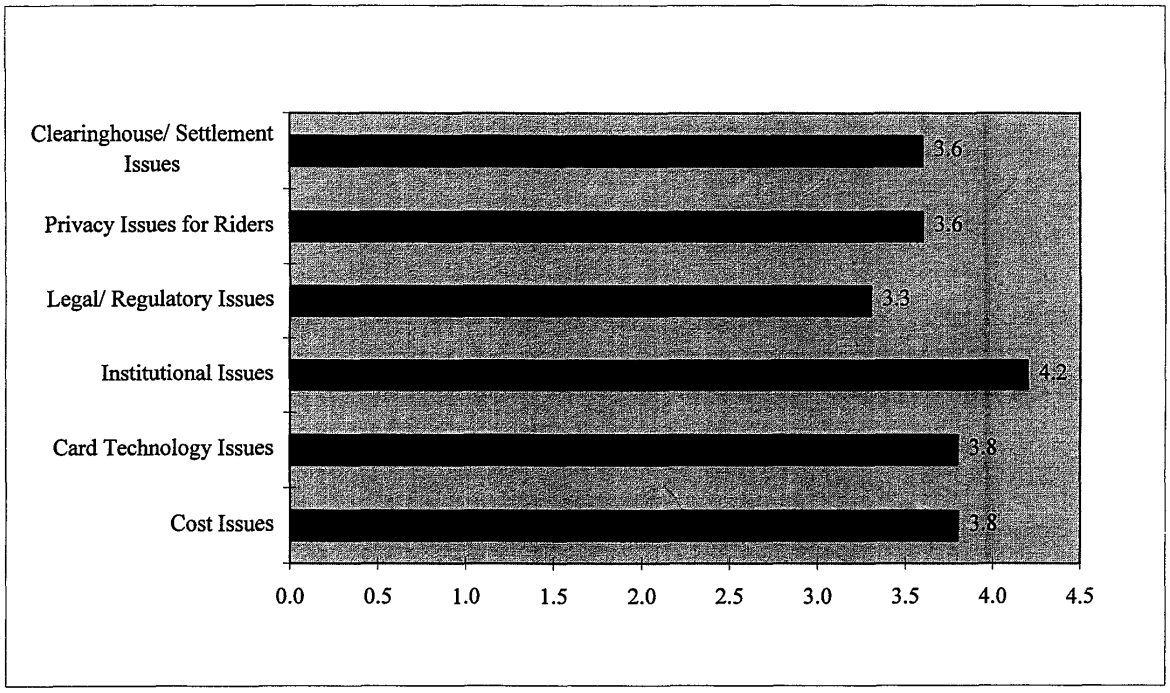


Figure A-2. Rating multiple-use issues.

- Privacy issues for riders (e.g., addressing rider concerns with use of electronic fare media), Card technology issues (e.g., the need to accept technology selected by other agencies), and
- Legal and regulatory issues (e.g., constraints on an agency's ability to enter into agreements with other entities).

Card technology issues and legal and regulatory issues were rated equally at 3.3.

Commuter Rail Systems

Institutional issues also were rated most important by commuter rail systems. Institutional issues received a rating of 4.8. Cost issues, card technology issues, and legal and regulatory issues were rated equally important. Each was given a rating of 4.5. The following lists the various issues in order of importance to commuter rail systems:

- Institutional issues (e.g., maintaining control over the fare system, including the ability to modify fare structures),
- Cost of providing electronic fare media and of participating in a multiple transit use or joint banking and transit program (e.g., the need to buy new equipment or the high unit cost of smart cards),
- Card technology issues (e.g., the need to accept technology selected by other agencies),
- Legal and regulatory issues (e.g., constraints on an agency's ability to enter into agreements with other entities),
- Clearinghouse/settlement issues (e.g., related to apportioning revenues among participating agencies), and
- Privacy issues for riders (e.g., addressing rider concerns with use of electronic fare media).

Rapid Rail Systems

Institutional issues received a rating of 4.6 from rapid rail systems and were considered the most important of the issues. Rated equally at 3.8 were card technology issues and clearinghouse/settlement issues. The following list presents the issues in their order of importance to rapid rail systems:

- Institutional issues (e.g., maintaining control over the fare system, including the ability to modify fare structures),
- Card technology issues (e.g., the need to accept technology selected by other agencies),
- Clearinghouse/settlement issues (e.g., related to apportioning revenues among participating agencies),
- Cost of providing electronic fare media and of participating in a multiple transit use or joint banking and transit program (e.g., the need to buy new equipment or the high unit cost of smart cards),
- Privacy issues for riders (e.g., addressing rider concerns with use of electronic fare media), and
- Legal and regulatory issues (e.g., constraints on an agency's ability to enter into agreements with other entities).

Cost issues and privacy issues for riders were rated equally important at 3.6.

SUMMARY

A survey of North American transit agencies was undertaken as part of TCRP Project A-14 to identify fare collection practices and costs, plans for use of emerging fare technologies, goals related to improving the fare collection system, and issues related to multiple-use arrangements. The key findings are as follows:

- *Prepayment is very widespread.* Almost 90% of the responding agencies offer monthly passes, and 26% have weekly passes as well. More than 43% offer discounted multiple-ride options. The average percentage of fares paid with one of these prepaid media is 46%; for the largest agencies (those with rapid rail), the average is 58%.
- *The use of electronic fare payment methods has spread slowly to date, but is expected to increase over the next few years.* The survey revealed that relatively few transit agencies in North America have electronic fare payment systems: 15% use magnetic stored-value media and 6% use smart cards; 17% use credit cards, however, all but one of these are for purchase of fare media. In contrast, 50% of the respondents use tokens. Many agencies believe, however, that

they "are likely to use" electronic media within the next 3 years: 26% indicated likely use of contactless smart cards, 22% contact cards, and 54% magnetic stored-value cards.

- *Agencies consider a wide range off are collection goals to be important, although multiple use is not considered very important.* The highest rated goals are "improve convenience for riders" (4.6 of a possible 5 in terms of relative importance), "improve ability to collect needed data" (4.3), "improve ease of administration" (4.2) and "improve fare system security and accountability" (4.0). The lowest rated goals are "integrate payment with nontransportation uses" (2.5) and "integrate payment with other transportation services" (2.7). All of the other goals presented were rated as being relatively important (3.5 to 3.9).
- *Regarding possible multiple-use arrangements, all of the issues and concerns presented were considered relatively important.* Agencies rated "institutional issues" the most important issue; it received an average of 4.2 out of a possible 5 in terms of relative importance. "Legal and regulatory issues" was the lowest rated item, but it received an average of "3.3." The other issues were rated about the same (3.6 to 3.8).

On the basis of the survey results, many transit agencies (more than half of the respondents) are considering new fare technologies for the relatively near future; the options under consideration include smart cards and the use of stored value in general. These plans are consistent with the importance placed on fare system goals such as customer convenience, ease of administration, data collection capabilities, and security and accountability. However, although "create seamless regional travel" is considered relatively important, most agencies do not currently view multiple use as a major goal.

TRANSIT SYSTEM FARE COLLECTION SURVEY

This survey is being conducted as part of TCRP Project A-14 (Potential of Multipurpose Fare Media).
Please complete the following questionnaire , and mail or fax it to

Daniel Fleishman
Multisystems, Inc.
10 Fawcett St.
Cambridge, MA 02138
Fax: 617/864-3521; Telephone: 617/864-5810

Thank you for your cooperation!

SURVEY RESPONDENT INFORMATION:

Contact Person:
Telephone/Fax:
Agency Name and Address:

TRANSIT SYSTEM DESCRIPTION:

A) Modes (please check appropriate boxes):

☐ Bus ☐ Rapid Rail ☐ Light Rail/Streetcar
☐ Automated Guideway/People Mover ☐ Paratransit/Demand Responsive

B) Please indicate annual ridership for the entire system:

PRESENT FARE COLLECTION SYSTEM -- MEDIA AND PAYMENT OPTIONS:

C) Please check the appropriate types of fare media you now accept:

☐ Cash ☐ Tokens ☐ Magnetic stripe swipe cards
☐ Credit cards ☐ Debit cards ☐ Magnetic stripe stored value cards
☐ Smart cards ☐ Other type(s) of other fare media:

D) Please check the available payment options:

☐ Weekly pass ☐ Monthly pass ☐ Discounted multiple rides
☐ Stored value ☐ Other payment options:

E) Please indicate the percentage of fares paid with prepaid media: ☐ %

PRESENT FARE COLLECTION SYSTEM -- EQUIPMENT:

F) Please check all of the following types of fare collection/issuing equipment that apply:

☐ Non-registering fareboxes ☐ Ticket vending machines
☐ Electronic registering fareboxes ☐ ATM machines
☐ Magnetic card swipe readers ☐ Smart card readers/writers
☐ Magnetic card readers/writers (ticket processing units/validators)
☐ Other fare collection/issuing equipment that applies:

PLANS FOR NEW FARE COLLECTION SYSTEM:

G) Please check the fare media technologies that you are likely to use within the next 3 years:

☐ Magnetic stripe stored-value cards ☐ Contact smart cards
☐ Contactless smart cards ☐ Credit cards
☐ Other media ☐ Debit cards

H) Please check the fare collection/issuing equipment that you are likely to use within the next 3 years:

☐ Electronic registering fareboxes ☐ Ticket vending machines
☐ Magnetic swipe readers ☐ ATM machines
☐ Magnetic card readers/writers ☐ Smart card readers/writers
☐ Other fare collection/issuing equipment you are considering:

FARE SYSTEM COSTS:

I) Please indicate the cost of producing and distributing fare media:

Actual or estimated dollars: Percent of total fare revenue: ☐ %

J) Please indicate the cost of fare collection/processing:

Actual or estimated dollars: Percent of total fare revenue: ☐ %

K) Please indicate the amount of revenue lost through theft, fraud, counterfeting, etc..

Estimated dollars: Percent of total fare revenue: ☐ %

RATING OF GOALS FOR IMPROVING FARE SYSTEM:

L) Please indicate the importance of the following issues by circling the appropriate number:

<---------- IMPORTANCE ---------->

Not important — Very important

1. Improve card reader/writer reliability and reduce maintenance requirements.
   1 2 3 4 5
2. Improve fare system security and accountability (e.g., reduce fare abuse, fraud, theft)
   1 2 3 4 5
3. Improve ability to collect needed data (e.g., origin/destination data)
   1 2 3 4 5
4. Maintain ability to use existing fare system equipment
   1 2 3 4 5
5. Improve ability to integrate with other on-board technologies (e.g., AVL or APC system)
   1 2 3 4 5
6. Improve ability to modify fare structure and policies
   1 2 3 4 5
7 Reduce the cost of producing and distributing fare media
   1 2 3 4 5
8. Reduce the cost of fare collection/processing equipment
   1 2 3 4 5
9. Improve the convenience of riders
   1 2 3 4 5
10. Improve the ease of administration of fare collection by bus operators and other personnel
   1 2 3 4 5
11. Improve throughput
   1 2 3 4 5
12. Create "seamless" transit travel in the region (if there are multiple operators)
   1 2 3 4 5

13. Integrate transit payment with payments for other transportation services (e.g., parking, tolls)
   1 2 3 4 5
14. Integrate transit fare payment with payment media for non-transportation uses (e.g., small purchases, telephone calls)
   1 2 3 4 5
15. Other:
   1 2 3 4 5

RATING OF ISSUES/CONCERNS RELATED TO POTENTIAL "MULTIPLE USE" ARRANGEMENTS:

(i.e., a single card that can be used for 1) yours and other neighboring transit systems, and/or 2) transit as well as retail, banking or other non-transit transactions)

M) Please indicate the importance of the following issues by circling the appropriate number:

<---------- IMPORTANCE ---------->

Not important — Very important

1 2 3 4 5

1. Cost of providing electronic fare media and/or of participating in a multiple transit use or joint banking/transit program (e.g., need to buy new equipment or high unit cost of smart cards)
   1 2 3 4 5
2. Card technology issues (e.g., need to accept technology selected by other agencies)
   1 2 3 4 5
3. Institutional issues (e.g., maintaining control over the fare system, including the ability to modify fare structures)
   1 2 3 4 5
4. Legal/regulatory issues (e.g., constraints on agency's ability to enter into agreements with other entities)
   1 2 3 4 5
5. Privacy issues for riders (e.g., addressing rider concerns with use of electronic fare media)
   1 2 3 4 5
6. Clearinghouse/settlement issues (e.g., related to apportioning revenues among participating agencies)
   1 2 3 4 5
7 Other:
   1 2 3 4 5