TCRP
REPORT 94

TRANSIT
COOPERATIVE
RESEARCH
PROGRAM

Sponsored by
the Federal
Transit Administration

Fare Policies, Structures and Technologies: Update

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

TRANSIT COOPERATIVE RESEARCH PROGRAM

TCRP REPORT 94

Fare Policies, Structures and Technologies: Update

MULTISYSTEMS, INC.
Cambridge, MA

With

MUNDLE & ASSOCIATES, INC.
Philadelphia, PA

SIMON & SIMON RESEARCH AND ASSOCIATES, INC.
Ellicott City, MD

SUBJECT AREAS
Public Transit

Research Sponsored by the Federal Transit Administration in Cooperation with the Transit Development Corporation

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2003
www.TRB.org

TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions*, published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), *Transportation 2000*, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA, The National Academies, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time. It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

TCRP REPORT 94

Project A-25 FY'01
ISSN 1073-4872
ISBN 0-309-08764-3
Library of Congress Control Number 2003108814

Price $27.00

NOTICE

The project that is the subject of this report was a part of the Transit Cooperative Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the project concerned is appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical advisory panel selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and while they have been accepted as appropriate by the technical panel, they are not necessarily those of the Transportation Research Board, the National Research Council, the Transit Development Corporation, or the Federal Transit Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

Special Notice

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

Published reports of the

TRANSIT COOPERATIVE RESEARCH PROGRAM

are available from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, DC 20001

and can be ordered through the Internet at
http://www.national-academies.org/trb/bookstore

Printed in the United States of America

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. On the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce M. Alberts is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. William A. Wulf is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, on its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both the Academies and the Institute of Medicine. Dr. Bruce M. Alberts and Dr. William A. Wulf are chair and vice chair, respectively, of the National Research Council.

The **Transportation Research Board** is a division of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board's mission is to promote innovation and progress in transportation through research. In an objective and interdisciplinary setting, the Board facilitates the sharing of information on transportation practice and policy by researchers and practitioners; stimulates research and offers research management services that promote technical excellence; provides expert advice on transportation policy and programs; and disseminates research results broadly and encourages their implementation. The Board's varied activities annually engage more than 4,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation. **www.TRB.org**

www.national-academies.org

AUTHOR ACKNOWLEDGMENTS

The research described in this report was performed under TCRP Project A-25 by Multisystems, Inc., with assistance from Mundle & Associates, Inc. and Simon & Simon Research and Associates, Inc.

Daniel Fleishman of Multisystems served as Principal Investigator for the project and is the author of this final report. The case studies were prepared by Daniel Fleishman, Rick Halvorsen, Joana Conklin, Doug Parker and Larry Englisher of Multisystems; George Pierlott and Subhash Mundle of Mundle & Associates; and Rosalyn Simon, Monica Simon and Robert Carlson of Simon & Simon Research and Associates.

The guidance of Gwen Chisholm, the TCRP Program Officer for the project, and the Project Panel is also acknowledged.

FOREWORD

By Gwen Chisholm
Staff Officer
Transportation Research Board

TCRP Report 94: Fare Policies, Structures and Technologies: Update identifies, describes, and evaluates key fare structures, policies, and technologies that are being considered by transit agencies, with a focus on their impact on customers, operations management, and effective and equitable fare integration. The report includes data on fare structures, policy-making procedures, and ongoing efforts to implement fare technology.

This report provides guidance on making decisions related to fare policies, structures, and technologies. It includes practical information that can be readily used by transit professionals and policy makers in fare-related planning and decision making. This report updates information presented in *TCRP Reports 10 and 32* and presents the latest developments and research results related to fare policy and technology issues.

Every transit agency must periodically address fare policy, structure, and technology issues. While each of these areas has been evaluated separately, it is important to understand the interrelationships among them. Policy generally guides the direction for fare structure, but technology changes can also affect structure decisions. Emerging electronic payment technologies, in particular, facilitate the consideration of new types of pricing strategies and payment options. *TCRP Report 10, Fare Policies, Structures and Technologies,* published in 1996, explored developments and issues related to policies, structures, and technologies; it presented the experiences of transit agencies in selecting and using various approaches, as well as the advantages and disadvantages of emerging payment technologies. Subsequently, *TCRP Report 32, Multipurpose Transit Payment Media,* published in 1998, further examined the role of emerging technologies, with a focus on the use of smart cards in "multipurpose" payment programs. *TCRP Report 32* included various institutional, financial, technological, legal, and customer-related issues associated with linking a transit agency's payments with those of other transit agencies, nontransit modes (e.g., tolls, parking), and nontransportation entities (e.g., financial institutions, telecommunications companies, universities, and government agencies).

In the years since publication of *TCRP Reports 10* and *32*, there have been further advances in development and use of emerging technologies—including both magnetic stripe and smart cards—and concomitant changes in fare policies and structures. A number of the innovative programs identified in those reports as being in the conceptual stage have now been implemented—or terminated, in some cases—and major new projects have been initiated. Important lessons are now available that will aid agencies considering the new technologies or pricing approaches.

This report provides updated information and guidance on the latest developments in the areas of fare policies, structures, and technologies.

Multisystems, Inc., in association with Mundle & Associates, Inc. and Simon & Simon Research and Associates, Inc., reviewed trends and developments of the past

few years related to fare structure/policy design and technological advancements. The research team identified and described emerging types of fare-related initiatives and partnerships, defined evaluation criteria and measures, and evaluated each type of program or initiative in terms of its impact on the agency's customers and operations. The research also included 13 case studies, covering a range of system sizes and modes and various types of fare structure and technology initiatives.

CONTENTS

FARE POLICIES, STRUCTURES AND TECHNOLOGIES: UPDATE

SUMMARY

The overall goal of Transit Cooperative Research Program Project A-25 was to provide transit agencies with guidance in making decisions related to fare policies, structures and technologies. The research entailed a study of the trends and emerging developments in each of these areas and consisted of the following major elements:

- Comprehensive review of relevant literature and research findings to identify both trends and developments of the past few years and strategies now being considered by transit agencies in areas related to fare structure and policy design and technological advancements.
- Identification and description of emerging types of fare-related initiatives (e.g., new payment options based on the use of electronic fare media) and partnerships (e.g., with universities, employers, and social service agencies).
- Development of an evaluation framework and methodology to facilitate the assessment of the various types of fare programs and initiatives; a set of evaluation criteria and measures was defined; and each type of program or initiative was evaluated to determine its impact on a transit agency's customers and operations.
- Case studies of agencies that have recently put in place, or are in the process of introducing, various types of fare programs and initiatives. Thirteen case studies were conducted, covering a range of system sizes and modes—as well as a range of fare technologies and structural characteristics:
  (1) Akron Metropolitan Regional Transit Authority (Akron, OH)
  (2) Chapel Hill Transit (Chapel Hill, NC)
  (3) Chicago Transit Authority
  (4) Connecticut Transit
  (5) King County Metro Transit (Seattle, WA)
  (6) Maryland Mass Transit Administration (Baltimore, MD)
  (7) Metropolitan Transportation Commission (San Francisco Bay Area)
  (8) New Jersey Transit
  (9) Orange County Transportation Authority (Orange Co., CA)
  (10) TransitCenter (New York City)
  (11) Tri-County Metropolitan Transportation District (Portland, OR)

(12) Ventura County Transportation Commission (Ventura Co., CA)
(13) Washington Metropolitan Area Transit Authority

The key findings of the study are summarized below.

FARE POLICY AND STRUCTURE ISSUES AND TRENDS

- Transit agency fare levels are increasing. The basic single-ride peak fare has increased significantly in recent years, as evidenced by the fact that roughly a third of North American agencies had fares of $1 or more in 1994, while two-thirds of these agencies had reached this level in 2000; the most common fare in 1994 was $0.75 (20% of agencies), while in 2000 it was $1 (19%). In 2001, the $2 level was reached by a couple of agencies. Although few agencies directly tie fare increases to inflation rates, many agencies have more or less tracked inflation in making moderate fare increases. For instance, a $1 fare in 1994 would have risen to $1.15 in 2000 if adjusted for inflation.
- The transit industry continues to favor simplified fare structures. Even with the availability of electronic payment options, most agencies continue to utilize flat fare structures (i.e., with no fare zones or peak/off-peak differentials). The percentages of agencies using fare differentials has actually declined in recent years, as several agencies have reduced the complexity of their fare structures (e.g., by eliminating or reducing the number of zones).
- A growing number of agencies has eliminated free or low-priced transfers in conjunction with the sale of 1-day passes on buses and in rail stations. There has also been an increase in the use of short-term passes (i.e., 1- to 3-day) in general, both for visitors and regular riders.
- Agencies are introducing an increasingly broad range of payment options that segment the market based on frequency of use and willingness to prepay. Most agencies now offer one or more types of unlimited-ride pass as well as some form of discounted multiride option. However, the percentage discounts—or bonuses—offered with multiride options (tickets, tokens or stored value farecards) has declined somewhat in the past few years, with fewer agencies providing “deep discounts.”

FARE PAYMENT TECHNOLOGY DEVELOPMENTS

Influence of Electronic Payment on Fare Policy and Payment Options

- An increasing number of agencies are implementing electronic payment technologies, and many of these agencies have selected—or are at least strongly considering—smart cards.
- Electronic payment technologies have facilitated a range of flexible new fare payment options, including stored value or stored rides, “rolling” time-based passes (which are activated on first use), frequency-based discounts, automated transfers and fare differentials, guaranteed last ride (or “negative balance”) policies, and guaranteed lowest fare strategies.
- The introduction of electronic payment has significantly influenced the basic fare structure for some agencies, but most agencies have simply increased the range of payment options offered without making significant changes in the basic fare structure.

Issues Associated with Use of Smart Cards

- The decision to use contactless—or sometimes dual interface—smart cards for fare collection has grown rapidly in the past several years. In the United States, smart cards are currently in use in half a dozen locations, and more than a dozen other programs are in the planning stages. Abroad, large regional programs are in place or are being implemented in most world capitals.
- One of the key concerns regarding smart card use is the high cost of the cards themselves. Some agencies have sought to encourage retention of the cards—and to cover their purchase cost—by levying a card issuance charge (e.g., $5); this charge typically allows the cardholder to register the card with the agency and receive balance protection in the case of loss of the card. Other strategies for addressing high card costs include the development of (1) low-priced paper contactless tickets targeted for distribution to one-time or occasional riders, and (2) recycling systems designed to capture the smart card (or smart "token" in one system) after it has been used.
- One of the major concerns within the transit industry has been how to promote standardization and interoperability among the different contactless card technologies. Vendors have begun to address this issue by developing cards and readers that combine multiple card interfaces. From the agency side, there are several efforts underway, in the United States and abroad, to establish industry-wide standards or guidelines for transit smart card applications.
- In light of interoperability concerns, a major technical issue/constraint facing all of the agencies seeking to add smart card capability to an existing fare collection system is insuring compatibility with the existing system. Integrating one vendor's smart card system into another vendor's equipment has proven to be a significant challenge.
- Using electronic fare media in a proof-of-payment (POP) system requires special procedures and equipment. Electronic farecards cannot be directly used in a POP environment, since POP requires the rider to display a validated ticket or a flash pass to a fare inspector. Thus, in a POP system, the rider must validate the card and the inspector must be able to check the validity of the card. The most common approach being implemented in U.S. systems is to provide in-station card processing units and to have the inspectors carry hand-held card readers.

Development of Regional Fare Integration Programs

- Electronic payment media are increasingly being introduced to serve multiple transit agencies in a region—i.e., to facilitate seamless travel using a single farecard. Use of electronic fare media allows each agency to retain its own fare structure while accepting a regional farecard (e.g., with payments made from a common stored value purse). In a smart card-based system, a customer would presumably also be able to load individual payment options (e.g., a pass) from one or more agencies onto the same card.
- Integrating multiple agencies has been shown to be a complicated undertaking, likely requiring fundamental changes from the way each individual agency manages fare collection on its own. Complex partnership agreements are typically needed to establish responsibilities, ownership, and allocation of costs and revenues. A separate clearinghouse or back-end payment settlement system can be developed to manage these processes, but all participating agencies must reach agreement on revenue management policies and procedures.

Potential for Developing Multiapplication Programs

- The growing use of smart cards for various types of uses (e.g., electronic toll collection, parking, financial services, mobile commerce, loyalty programs, and identification/access/security) provides opportunities to combine transit and other applications on one card. While most smart card programs focus on a single application, the goal of many issuers is to ultimately provide multiple functions on a card.
- Transit fare payment is increasingly seen as a key application, regardless of the primary use and issuer of the card. Thus, a broad range of new types of transit agency partnerships can now be considered with entities that would issue a smart card, accept one for payment of their goods and services, or both. A number of U.S. agencies are already testing—or at least plan on pursuing—multiapplication arrangements, and several transit smart card projects abroad have established multiapplication arrangements. Moreover, the recent announcements by Visa and MasterCard of tests of contactless credit/debit applications could further pave the way for transit's participation in multiapplication partnerships.

Benefits and Impacts of Electronic Payment Programs

- Electronic payment programs have been shown to benefit both agencies and their customers. Some of these benefits result from an agency implementing electronic payment in general (i.e., magnetic or smart card), while others can be attributed specifically to use of smart cards.
- Electronic payment programs in general provide customers more convenience and a greater variety of payment options, such as rolling activate-on first use passes and stored-value/stored-ride farecards.
- The major customer benefits related to use of smart cards include (1) the availability of features such as registration/balance protection, autoload, and negative balance; (2) the ability to use the same card with multiple agencies (if available); and (3) the improved convenience of the contactless interface (i.e., the card does not have to be removed from a wallet or purse). Other potential benefits of smart cards for customers include multiapplication capabilities and innovative fare structure options (e.g., a frequency-based discount or guaranteed lowest fare strategy).
- Besides facilitating the implementation of a greater range of fare options for customers, electronic payment systems in general have been shown to have the following benefits to agencies: allowing agencies to more carefully track ridership and revenue impacts of different fare initiatives; reducing the use of cash for fare payment; reducing fare collection costs associated with producing/selling/distributing fixed-calendar period passes; reducing opportunities for fare abuse and evasion; reducing operator requirements for administering fare collection; and reducing the extent of rider-operator confrontations regarding the validity of passes and transfers.
- With regard to overall cost impacts, though, agencies implementing electronic payment systems have typically found that there are invariably new costs associated with introducing the new technology. Thus, while certain expenses should be lowered, implementation of an electronic payment system will not necessarily result in an overall reduction of fare collection costs.
- Beyond the above benefits linked to electronic payment in general, there are a number of benefits associated with introducing contactless smart cards, including faster boarding or throughput than fare media that have to be inserted or swiped; lower maintenance requirements than magnetic card readers (since the contact-

less units are sealed and have no moving parts); facilitation of innovative types of fare options; and potential to use data on card usage to improve service planning.
- The cost to an agency associated with smart card implementation and operation will depend on the specific nature of the program. An agency may have to pay all of the capital costs, or these costs may be partially covered by the initiating agency in a regional program. In any type of regional system, however, the individual agencies will have to cover at least some operating costs on their own (i.e., related to such areas as administration, reporting, and equipment maintenance). Moreover, each agency will ultimately have to pay for clearinghouse and support services associated with such activities as card management and revenue allocation; such payments may be in the form of a fee per smart card transaction or on a percentage of smart card-based fare revenue.
- Where an agency is participating in a regional smart card program, the costs related to the new system are likely to add to, rather than replace, the agency's existing fare collection costs. For this reason, those agencies that have developed smart card systems in particular tend to view them primarily as a means of better serving their customers—and, hopefully, attracting new customers—while also improving revenue management.

EMERGING FARE-RELATED ISSUES AND PROGRAMS

Equity and Environmental Justice Issues

- Environmental justice initiatives to insure that all population segments receive fair treatment are increasingly affecting transit agencies' consideration of potential fare changes. Such initiatives have resulted in legal challenges to proposed fare increases in several cities; moreover, even where such challenges have not proven successful—or have not actually entered the courts—they have influenced the fare policy decision-making process.
- In some cases, equity-based challenges have resulted in modifications to fare proposals or legal restrictions on future changes. In others, they have merely required the agencies to go to great lengths to explain and defend their rationale for raising fares. Moreover, because of such challenges, many transit agencies, especially those in other large cities, feel that they must now pay greater attention to equity concerns in considering possible fare changes.

University Programs

- Many universities have established partnerships with the local transit agencies to provide specially priced passes or other payment options to students. The basic types of programs include special pass and unlimited-access programs; special reduced single-fare arrangements; and joint transit agency–university farecard programs.
- By providing a low-cost and convenient form of transit payment to the university community, the transit agency should see increased ridership, while building "brand loyalty" to the transit system in terms of likely future use by students. Meanwhile, the university may be able to ease on-campus parking requirements by shifting some drivers to transit.
- It is important to carefully design the pricing parameters of a university pass program so as to minimize the potential negative revenue impact on the agency. In particular, an agreement should be structured so that it allows the agency to increase the amount paid per person based on actual usage.

Employer Benefits Programs

- Transit agencies have long pursued partnerships with employers to facilitate, if not subsidize, employees' use of transit to commute to and from work. These partnerships were originally limited to the distribution of monthly passes by employers to employees. The programs subsequently became more flexible with the introduction of transit vouchers that the employees could use to acquire the transit payment option of their choice. These basic approaches have since evolved, fueled both by a steady increase in the tax-free transit benefit employees could receive and the emergence of electronic payment technologies. Key types of employer-oriented benefit programs now in place include annual pass programs, transit voucher programs, and automated benefits distribution programs.
- Employer pass and voucher programs have been shown to benefit employees, employers, and transit agencies. The simpler—and less costly—it is for an employer to administer such a program, the more likely it is for an employer to participate in it. Similarly, the more convenient it is for employees to take advantage of commuter benefits, the more likely it is that they will use transit to get to and from work. Annual pass programs have made participation convenient for both employers and employees. However, it is important in establishing these programs that transit agencies structure pricing in such a way that they protect themselves against losing revenue; the pricing should be able to capture at least some revenue from the new trips being generated.
- In voucher-type programs, the direct provision of farecards and the emerging automation of benefits distribution are also greatly improving the convenience for all parties. As the use of electronic payment options spreads, more and more agencies will be able to offer such mechanisms within their regions, thereby expanding the range of options available.

Access-to-Jobs Programs

- Addressing welfare-to-work transportation issues has required creation of new collaborations among public agencies and private organizations, establishment of new transportation services, and development of innovative funding strategies. However, an important element of all access-to-jobs programs has been the provision of a mechanism for individuals to pay for these services, in terms of both subsidizing travel and furnishing the actual payment media. This has resulted in various types of special transit payment arrangements. The use of electronic payment media has also been proposed as a means of improving these arrangements.
- Access-to-jobs partnerships have been shown to benefit eligible riders by providing affordable access to employment and training sites. However, since these programs often involve participation by a number of different entities, it is important that the participants clearly understand—and be sensitive to—each other's goals and concerns in developing and implementing the program.

In summary, transit agencies have, in recent years, increasingly considered fare policy and fare structure changes and new payment options that target the needs of specific user groups and make use of emerging subsidy arrangements—while at the same time addressing local concerns pressed by community and environmental groups. In general, agencies have had to broaden the context in which they considered fare-related initiatives, and, consequently, they have sought to take greater advantage of opportunities to participate in new types of partnerships and funding programs linked to spe-

cific market segments (e.g., university, employer, and access-to-jobs programs). At the same time, the expanded capabilities of electronic payment technologies (i.e., magnetic stripe farecards and smart cards) have benefited agencies by facilitating the provision of a range of flexible payment options and increasing the efficiency of methods for distributing transit benefits and fare media to customers. Electronic fare media have also facilitated development of the aforementioned types of partnerships and have provided a framework for regional multiagency fare integration. All of these initiatives promise to aid transit agencies in better serving their existing markets while also attracting new riders.

PART I:
OVERVIEW

CHAPTER **1**

INTRODUCTION AND RESEARCH APPROACH

INTRODUCTION

Transit agencies have begun, over the last several years, to develop and implement fare policies, structural changes, and new payment technologies and payment options intended to target the needs of specific user groups, types of travel, subsidy arrangements, and environmental issues. Responding to the demands of specific market segments and community groups (e.g., low income riders and environmental activists), as well as to opportunities to participate in new types of partnerships and funding programs (e.g., related to university programs and to access-to-jobs and other benefits programs), agencies have had to broaden the context in which they consider fare structure and fare collection changes beyond the traditional set of policy goals (e.g., increase ridership, increase revenue, maximize convenience, minimize fare evasion).

Meanwhile, the continued evolution and increasingly widespread usage of electronic payment technologies has facilitated the above types of efforts by making possible a greater range of payment options and offering a more efficient means of distributing transit benefits and fare media. Electronic payment, particularly in the form of smart cards, is also supporting such strategies as regional fare integration and partnerships with nontransit entities (e.g., parking authorities, toll operators, financial institutions, universities, employers, and social service agencies). These multiapplication initiatives offer the potential to improve transit's market penetration by increasing the convenience of using transit and the establishment of loyalty programs; these new partnerships may also offer the opportunity to share administrative costs and, possibly, generate new revenues for the transit operator.

TCRP Report 10, *Fare Policies, Structures and Technologies*, published in 1996 (*1*), studied the state of the art of developments in each of these fare system components and explored the interrelationships among the parameters. TCRP Report 32, *Multipurpose Transit Payment Media*, published in 1998 (*2*), focused specifically on the decisions necessary in developing and implementing multiapplication smart card programs. However, as Automatic Fare Collection (AFC) has continued to expand the potential roles of, and opportunities for, fare payment, it has further magnified the need for transit agencies to understand the relationships among fare policy, structure, and technology. At the same time, the parallel growth of social, environmental, and political influences has further complicated these relationships.

TCRP PROJECT A-25 AND OVERVIEW OF THE FINAL REPORT

In light of the above trends and developments, it was felt that an update of the findings of the two previous studies was warranted. TCRP Project A-25, Fare Policies, Structures and Technologies: Update, was therefore initiated with the overall goal of revisiting these fare system parameters and their interrelationships. The resulting study provides a compilation and distillation of lessons learned regarding the implementation and application of emerging fare policies, structures, and technologies.

The chapters of the report are as follows:

- **Chapter 2: Fare Policy and Structure Issues and Trends.** This chapter reviews trends and developments of the past few years in areas related to fare policy and structure decisions.
- **Chapter 3: Fare Payment Technology Developments.** This chapter reviews trends and developments related to electronic fare payment technologies (i.e., magnetic farecards and smart cards); the chapter includes a review of emerging electronic payment applications (e.g., regional payment integration and multiapplication programs).
- **Chapter 4: Emerging Fare-Related Issues and Programs.** This chapter discusses emerging fare-related issues (e.g., related to equity and environmental justice concerns) and partnership opportunities (e.g., with social service agencies, employers, and universities).
- **Chapter 5: Summary of Findings.** This chapter summarizes the key findings of the research.

The appendices provide additional information as follows: bibliography; summary of key study resources; guidance on the estimation of fare system costs; the process and preliminary results of the evaluation of the various types of fare initiatives; and the process followed in identifying and

conducting the case studies, as well as the reports for each of the case studies.

(1) Akron Metropolitan Regional Transit Authority (Akron, OH)
(2) Chapel Hill Transit (Chapel Hill, NC)
(3) Chicago Transit Authority
(4) Connecticut Transit
(5) King County Metro Transit (Seattle, WA)
(6) Maryland Mass Transit Administration (Baltimore, MD)
(7) Metropolitan Transportation Commission (San Francisco Bay Area)
(8) New Jersey Transit
(9) Orange County Transportation Authority (Orange Co., CA)
(10) TransitCenter (New York City)
(11) Tri-County Metropolitan Transportation District (Portland, OR)
(12) Ventura County Transportation Commission (Ventura Co., CA)
(13) Washington Metropolitan Area Transit Authority

CHAPTER **2**

FARE POLICY AND STRUCTURE ISSUES AND TRENDS

INTRODUCTION

As explained in TCRP Report 10, the primary parameters of a transit agency's fare system—policy, structure, and technology—are closely interrelated: "Policy generally sets the direction for the strategy and specific structure, but technology choices can also affect the structure selected (*1*)." Thus, it is important to review the issues and trends associated with each of these parameters.

ISSUES INFLUENCING FARE POLICY DECISIONS

General Policy Factors

"A transit agency's fare policy establishes the principles and goals underlying and guiding the agency's pricing-related decisions" (*1*). While some agencies establish formal fare policies that govern fare-related decisions, most agencies' fare system changes are made in response to a particular issue or problem (e.g., a revenue shortfall or, possibly, introduction of a new mode). Report 10 noted that, according to the American Public Transportation Association (APTA), only 3% of respondents to the *1994 APTA Fare Summary* reported that they make fare changes on a regularly scheduled basis; the remaining 97% reportedly make fare changes only "as needed" (*1*). According to a more recent survey (1998) (*3*), more than half of transit agencies have a regular fare review process, although "unexpected revenue shortfall," "major route/service restructuring," and "installation of new technology" are also significant triggers for reviewing the fare structure; the results of this survey question are summarized in Table 2-1.

As indicated in Table 2-1, a mandated fare recovery ratio triggers a fare review at just under a quarter of the responding agencies. Table 2-2 presents the incidence of fare recovery ratio requirements and goals as reported in the *2000 APTA Fare Summary*. As shown in Table 2-2, roughly equal numbers of agencies have fare recovery requirements and goals, although nearly 60% of agencies report that they have neither. Compared to the 1994 APTA figures, the percentage of agencies having fare recovery requirements is roughly the same; however, the percentage reporting fare recovery goals has increased from 15% in 1994 to 24% in 2000. Thus, a growing number of agency governing bodies are at least establishing fare revenue targets for their agencies, if not going so far as to mandate specific levels.

Emerging Factors and Issues

While most agencies continue to initiate fare structure changes primarily in response to specific problems (e.g., revenue shortfalls, declining ridership, or introduction of new modes of service), fare policy and pricing initiatives have been increasingly influenced by developments related to a range of issues and opportunities for new types of partnerships and payment options. Key issues and emerging developments related to fare policy and pricing include the following:

- **Equity and environmental justice concerns**. The movement to insure that all population segments—particularly low income and minority groups—receive equal treatment with regard to environmental issues is increasingly encompassing the fare decision-making process. This has led to concerted opposition to (and in some cases legal action against) proposed fare increases. Such actions have resulted in the "Consent Decree" in Los Angeles, for instance, that has legally limited the extent to which the LACMTA can raise fares for a specified period of time.
- **New programs and partnership opportunities.** Programs such as the following are presenting transit agencies with new pricing partnership opportunities:
  - **Partnerships with other entities and programs**. Social service agencies (for access-to-jobs and other benefits programs), employers, and universities are increasingly establishing partnerships with local transit agencies to provide low-priced passes or other special payment arrangements.
  - **Multiapplication programs**. The introduction of smart cards presents opportunities to establish payment partnerships with other nontransit entities (e.g., parking authorities, toll operators, financial institutions, retailers and government agencies).
  - **Focus on providing for "seamless travel."** With travel patterns increasingly requiring transferring between adjoining transit agencies' services, there has been a growing emphasis on the development of

TABLE 2-1 Triggers for agency fare structure review process

Action/Event	Number of Agencies	Percentage of Total
Regular review process	37	53*
Unexpected revenue shortfall	35	50
Major route/service restructuring	24	34
Installation of new technology	20	29
Mandated fare recovery ratio	16	23
Addition of new type of service (e.g., LRT)	16	23
Other short-term "crisis"	16	23

SOURCE: Survey of agencies in Multisystems, *Transit Fare Collection Decision Models for Fare Policy and Cost Analysis—Final Report,* for U.S. DOT/SBIR Program, November 1998.
*Respondents were allowed to select more than one option; thus, total does not add to 100%.

multiagency agreements and integrated regional payment arrangements.

Thus, while pricing level decisions are increasingly being influenced by political and equity concerns, transit agencies are also focusing more and more on meeting the needs of particular market segments through partnerships and special payment and pricing arrangements. The result has typically been the establishment of such options as special low-priced passes—or full-price passes subsidized by another entity (e.g., social service agency, university, or employer). Examples of the types of fare initiatives associated with the above issues and programs are discussed in the remainder of this report.

With regard to regional fare integration, agencies operating in the same region are moving from simple interagency transfer agreements to more comprehensive integrated regional payment options. As indicated in Table 2-3, a significant number of agencies currently have some type of joint pass arrangement with at least one other agency. In other cases, agencies have transfer—or fare upgrade—provisions with agencies with which they intersect; in other words, Agency 1 accepts a transfer from someone coming from Agency 2, or else charges only the difference between the two base fares. (It must be kept in mind that many agencies operate in regions in which they are the only transit provider; these agencies would not be candidates for any type of multiagency arrangement.) The emergence of electronic payment options, particularly smart cards, has facilitated the increasing focus on integrated multiagency payment systems—i.e., introducing a regional farecard that is accepted at any participating agency. This trend is discussed further in the next chapter, Fare Payment Technology Developments.

FARE STRUCTURE TRENDS

As explained in TCRP Report 10, the fare structure consists of three basic elements: fare strategy, payment options, and pricing levels. Fare strategy refers to the general type of fare

TABLE 2-2 Fare recovery ratio requirements and goals

Type of System	Number of Systems	Systems With Required Fare Recovery Ratio	Mean Ratio To Be Recovered	Systems With Fare Recovery Ratio Goal	Mean Ratio To Be Recovered	Systems With No Goal or Requirement
Bus	251	50	32%	55	32%	146
Heavy rail	15	5	43%	4	51%	6
Light rail	22	7	37%	7	41%	8
Commuter rail	18	6	46%	6	39%	6

SOURCE: *2000 APTA Transit Fare Summary*, 2000.

TABLE 2-3 Multiagency fare arrangements

Type of System	Number of Systems	Reduced Multiagency Regional Pass	Arrangement with 1 Other Agency			
			1-month pass	2-week pass	1-week pass	Other*
Bus	251	42	51	14	14	36
Heavy rail	15	1	4	4	3	3
Light rail	22	5	7	3	3	5
Commuter rail	18	4	13	3	1	5

SOURCE: *2000 APTA Transit Fare Summary*, 2000.

* Other arrangements include annual pass, stored value card, 10-ride card, and 1- to 4-day passes.

collection and payment approach (i.e., flat versus differentiated fares) and to the transfer pricing and policy; differentiated fares include zonal charges, peak/off-peak differentials, and express or rail surcharges. Payment options include cash, period pass, single or multiride tickets or tokens, and stored-value/ride farecard. The final piece of the fare structure is the actual pricing levels of each payment option, including percentage discounts (if any) for prepaid options. Trends in each of these areas are reviewed below.

Trends in Fare Levels

Although it is often paid by a relatively small percentage of an agency's riders, the peak period full fare (commonly known as the "base fare") is typically the most visible and most often criticized (e.g., by politicians and community groups) element of an agency's fare structure. Table 2-4 shows the changes in base fare levels between 1994 and 2000 for North American transit systems, as reported in the *APTA Transit Fare Summary*. As would be expected, fares have increased somewhat during this period. Whereas 64% of the agencies reported base fares under $1 in 1994, that percentage dropped to 36% by 2000; the most common fare was $0.75 in 1994, but rose to $1 in 2000. In 2000, 22% of agencies had fares of $1.25 or more, double the percentage in 1994. Perhaps most significantly, in 2001, two agencies (MTDB in San Diego and SEPTA in Philadelphia) became the first to raise the base fare (for noncommuter rail service) to $2—and NYMTA followed suit with its decision to increase its base subway and bus fare to $2 in early 2003. MTDB subsequently announced its intention to move to a $2.25 fare in 2003.

The increase in organized opposition to fare increases, coupled with a general preference to keep fares low, has led many agencies to keep fares at the same level for as long as possible (i.e., until a serious revenue shortfall requires a change). At this point, very few agencies have programmed regular fare increases (e.g., X% every two or three years, or as necessary to keep pace with inflation). As indicated earlier, some agencies do undertake regular reviews of their fare structures, but these reviews apparently seldom result in anything other than very minor fare structure modifications.

Of course, in considering fare levels, it is instructive to examine the extent to which they have kept pace with inflation. Table 2-5 shows what 1994 fare levels would have been in 2000 if allowed to rise according to inflation (based on the national Consumer Price Index). Thus, for instance, an increase of the base fare from $1 (1994) to $1.15 (2000)

TABLE 2-4 Changes in base fare levels, 1994–2000

Type of System	Number of Systems		<$0.50		$0.50		$0.51 -- $0.74		$0.75		$0.76 -- $0.99		$1.00		$1.01 -- $1.24		$1.25 -- $1.49		$1.50		>$1.50	
	94	00	94	00	94	00	94	00	94	00	94	00	94	00	94	00	94	00	94	00	94	00
Bus	293	249	13	5	40	14	35	10	60	48	40	13	57	91	15	12	20	33	7	12	6	11
Heavy rail	15	15	1						1		2		2	3		2	4	5	3	4	2	1
Light rail	18	22	1							1	3		6	6	2	3	3	9	3	3		1
Commuter rail	18	18									2	1	1	3	1	1	1					13

SOURCE: *1994 APTA Transit Fare Summary,* 1994, and *2000 APTA Transit Fare Summary,* 2000.

TABLE 2-5 Inflation-adjusted fare levels

1994 Fare Level	1994 Fare Level in 2000, Adjusted for Inflation
$0.25	$0.29
0.50	0.57
0.75	0.86
1.00	1.15
1.25	1.44
1.50	1.73
1.75	2.03

would simply be tracking the overall inflation trend. Thus, while very few agencies directly tie fare increases to inflation rates, many agencies are more or less adjusting for inflation when they make moderate fare increases.

Fare Strategy Trends

Flat versus Differentiated Fares

Basic fare strategies fall into two general categories: flat and differentiated. In a flat fare structure, riders are charged the same fare, regardless of the length of the trip, time of day, speed, or quality of service. Alternatively, fares can be differentiated by one or more of those parameters, resulting in distance-based or zonal fares, time-based (e.g., peak/off-peak) differential, and/or service-based differential (e.g., express surcharge or bus-rail differential). Each of these approaches has certain advantages and disadvantages, mainly related to relative ease of use and administration versus impact on ridership and revenue; however, the principal arguments in favor of differentiation have focused on issues related to efficiency and equity. In particular, it has been argued that a higher fare should be charged to cover the higher operating costs associated with serving longer trips, operating peak period service and providing premium service, such as express bus or rail; otherwise, the users of the higher-cost services are effectively cross-subsidized by the users of shorter-distance, off-peak, or local bus services. Differentiated fares are also seen as able to generate greater revenues than lower flat fares, since the users of the higher-cost services (e.g., longer distance) have often been found to be less price-sensitive than those using the lower-cost services.

Table 2-6 compares the incidence of fare differentials in 2000 to that in 1994, the year of the data reported in TCRP Report 10. The percentage of agencies using any of the three basic types of differentiation has declined since 1994 with the exception of light rail systems, which show a slight increase in both zonal pricing and peak/off-peak differential; most commuter rail systems continue to use zonal rather than flat fare structures—and this mode also has by far the highest incidence of time of day differentials. Thus, despite arguments such as those cited above, most agencies have continued to display a preference for the simplicity of flat fares. As noted in TCRP Report 10, "Transit agencies by and large simply do not seem willing to address the complexities associated with designing, implementing, administering, and marketing" distance-based/zonal strategies (*1*). In fact, several agencies have sought to simplify their fare structures in recent years by eliminating or reducing the number of zones (e.g., in Baltimore, in Norfolk, in Raleigh-Durham, in several towns in Connecticut, throughout Delaware, and on buses in Washington, DC) or removing peak/off-peak differentials (e.g., has been proposed in Denver). The impacts of fare simplification efforts at two agencies (Maryland MTA and Connecticut Transit) were considered as part of the case studies for this project.

Transfer Pricing and Policy

The other key fare strategy element is transfer pricing and policy. Many systems are designed so as to require many riders to transfer either between bus routes or between bus and rail; thus, the pricing, rules, and policy regarding transfers are fundamental aspects of an agency's fare structure. While obviously important for riders, transfer pricing and rules also represent major issues for operators, as there can be disagreements as to the validity of a transfer on a particular route at a particular time. Many agencies have also experienced prob-

TABLE 2-6 Incidence of fare differentials: 1994–2000

Type of System	Percent of Total with Zonal or Distance Fare		Percent of Total with Time of Day Differential		Percent of Total with Express Surcharge	
	2000	1994	2000	1994	2000	1994
Bus	30	37	4	6	23	27
Heavy rail	20	33	7	7	0	7
Light rail	27	21	14	11	5	5
Commuter rail	89	94	28	24	0	0

SOURCE: *1994 APTA Transit Fare Summary,* 1994, and *2000 APTA Transit Fare Summary,* 2000.

lems related to theft or fraudulent resale of transfers. There is thus a tradeoff between the convenience of a free or low-priced transfer for the passenger and the foregone revenue and other administrative issues for the operator. For a more detailed discussion of the issues associated with transfer practices, see R. Stern, *TCRP Synthesis of Transit Practice 19, Passenger Transfer System Review* (*4*).

Despite the drawbacks, the vast majority of North American transit agencies do offer free or reduced price transfers. As shown in Table 2-7, 64% of agencies have free transfers, and 25% charge less than the full fare for transfers to and from vehicles in the same system. However, a number of agencies have in recent years opted to eliminate free or low-priced transfers in conjunction with the introduction of a day pass that is sold onboard buses. Agencies that have implemented this strategy include the Maryland MTA (Baltimore), OCTA (Orange County, CA), DART (Dallas), First State Transit (State of Delaware), and SCVTA (San Jose, CA). The day pass is typically priced so that a rider who must transfer pays roughly the equivalent of two to three linked trips per day. In other words, transferring riders are not penalized by the elimination of transfers as long as they make a round trip. For riders who do not transfer, their fare payment is unchanged by the elimination of transfers. In Dallas, the full fare is $1 and the day pass $2, while Baltimore's full fare is $1.35 and the day pass $3—or the equivalent of 2.2 trips per day; OCTA's day pass of $2.50 represents 2.5 full fare trips. Of course, there are issues associated with the sale of day passes, including the need for an appropriate onboard sales mechanism; these issues are discussed below, under Payment Option Trends.

Rather than essentially replacing transfers with day passes, some agencies have considered the possibility of eliminating transfers in favor of a significantly lower full fare (e.g., reducing the fare from $1.25 to $0.75, but eliminating free transfers). While this will remove the administrative and operational issues with transfers, it can result in a substantial loss of either revenue or ridership depending on the specific pricing and the extent of transferring. It can also result in major fare increases for those riders making more than one transfer on each journey. For these reasons, very few, if any, agencies have opted for such an approach.

Impacts of Fare Strategy Initiatives for Case-Study Agencies

Three of the case-study agencies implemented fare strategy initiatives such as those described above:

- **Maryland MTA** (Baltimore) eliminated zones and free transfers and introduced a day pass available onboard vehicles.
- **Connecticut Transit** (CT TRANSIT) (serving Hartford and several other towns in the state) eliminated zones and introduced a day pass available onboard vehicles but did not eliminate free transfers; CT TRANSIT has also introduced stored-ride farecards and "rolling" passes that are activated on first use.
- **Orange County Transportation Authority** eliminated free transfers and introduced a day pass available onboard vehicles; OCTA also recently introduced rolling passes, although not stored-value (or stored-ride) farecards.

The full case studies are presented in Part II. However, it is useful to compare the results of these efforts in terms of their impacts on customers and agency operations. Table 2-8 summarizes the key impacts of these three initiatives; these impacts are discussed briefly below.

Customer Impacts and Benefits. The major impacts on, and benefits to, customers include the following:

- Overall, the major benefit to customers in all three systems has been the simplification of the fare payment process, making the system easier to understand and more convenient to use.
- These initiatives resulted in a significant reduction in the cost of travel for many riders. The elimination of zone charges in Baltimore and Connecticut produced a direct fare reduction for riders in the outer zones.
- While the elimination of free transfers in Baltimore and Orange County ostensibly raised some riders' costs, the concomitant introduction of a relatively low-priced day pass has produced lower overall fares for most riders.

TABLE 2-7 Transfer pricing policy

Type of System	Number of Systems	Transfers to and from Other Vehicles		
		Free	Reduced	Full Fare
Bus	251	161	62	28
Heavy rail	15	10	2	3
Light rail	22	13	4	5
Commuter Rail	18	10	0	8

SOURCE: *2000 APTA Transit Fare Summary*, 2000.

TABLE 2-8 Case study comparison: fare strategy initiatives

Case-Study Agency/ Type of Program (Year Initiated)	Maryland MTA (Baltimore)/ Eliminated Zones/Transfers (1996)	Connecticut Transit (CT)/ Eliminated Zones (1996)	OCTA (Orange Co., CA)/ Eliminated Transfers (1999)
Nature of Program	Eliminated zones and transfers; introduced day pass (sold onboard)	Eliminated zones, introduced day pass (sold onboard) & rolling passes	Eliminated free transfers, introduced day pass (sold onboard) & rolling passes
Transit Agency Goals of Program	Simplify fare structure, increase ridership and revenue	Simplify fare structure, increase ridership, reduce operator requirements	Reduce transfer abuse and rider-operator conflicts
Customer Impacts and Benefits			
Usage rates	Day pass used 4 times/day	Day pass used 4.25 times/day	Day pass used 4.6 times/day at $2.50, 4 at $2
Attitude toward program/other benefits	System easier to understand and use; improved convenience with onboard sale of Day Pass	System easier to understand; more convenient with day pass, rolling passes; seamless travel through use of same card on all CT systems in state	Improved convenience with onboard sale of day pass and rolling passes
Cost of travel	Riders in outlying zones had fare reductions as high as 40%. Elim. of $.10 transfers offset by $3 Day Pass	Reduced cost in outer zones; low priced day pass ($2.50)	Reduced cost for many with day pass
Agency Impacts and Benefits			
Ridership	Ridership grew by 6% after change; demand has continued to grow since then	Ridership fell by <1% in first year, but then returned to prechange; steady since then	Ridership has grown signif. since change, but change unlikely a key factor
Revenue	Revenue grew by >12% after change; revenue hasn't grown since then (due to heavy use of Day Pass)	Revenue fell by 2% in first year, has fallen somewhat since (due to heavier use of passes)	Revenue grew by 17% after elimination of transfers, then by 6% after day pass increase
Other Impacts/Benefits	Reduced fare disputes with operators, reduced evening boarding times	Reduced operator requirements regarding zones; reduced use of cash and fare collection costs	Reduced operator requirements, fare disputes; and use of cash
Liability to agency			
Economic liability	Risk of revenue loss with elimination of zones, but elimination of transfers and sale of Day Pass offset possible loss. Also some risk of abuse of Day Passes, but no evidence of this	Risk of revenue loss with elimination of zones, but minimal loss (due to range of new options and fact that most riders were Zone 1)	Risk of revenue loss with introduction of day passes (due to lack of controls initially); shift to electronic distribution has improved controls
Political/legal liability	Possibility of complaints regarding elimination of transfers, but introduction of Day Pass (priced at 2.2 trips) offset opposition	None	Possibility of complaints regarding elimination of transfers, but introduction of day pass (priced at 2.5 trips) offset opposition
Constraints and Barriers			
Technical	Requires day pass issuers	Issues regarding confusion over purchase of day pass on bus. Rolling passes require Automatic Fare Collection	Problem regarding controls over distribution of day passes addressed with new equipment
Institutional/Funding	Intensive outreach/visioning process (with staff and public) minimized any potential barriers	CT conducted extensive marketing campaign in introducing changes	None
Required Equipment and Technology			
	Day pass issuing units	Read/write technology	Read/write technology

As indicated in the table, riders in all three systems use the day pass four or more times a day on average.

Agency Impacts and Benefits. The major impacts on, and benefits to, the agencies include the following:

- The elimination of zone charges did not result in a significant loss of fare revenue, as might have been expected. In both Baltimore and Connecticut, the simplification of the fare structure, coupled with introduction of new fare options, attracted new riders and thus offset the loss of zonal surcharge revenue. Revenue in Baltimore actually rose following the fare restructuring, and has continued to grow since that time.
- The sale of day passes onboard buses effectively offset the expected loss of ridership—as well as rider complaints—that might be expected with the elimination of free or low-priced transfers. Moreover, these initiatives resulted in significant revenue increases in both Baltimore and Orange County.
- These initiatives greatly reduced the extent of transfer abuse and the incidence of rider-operator arguments regarding the validity of transfers.

In short, all three of these agencies feel that they have benefited considerably from these fare strategy initiatives. However, it should be kept in mind that, while none of these strategies have any specific technology requirements, the onboard distribution of day passes requires some type of pass-issuing unit if the agency is to avoid having operators be responsible for manual distribution of the passes. Moreover, the use of more flexible payment options (e.g., stored-value farecards or rolling passes) clearly requires some type of electronic technology; these options are discussed further in the next section.

Payment Option Trends

Types of Payment Options and Fare Instruments

The other major element of the fare structure is the *payment options* that are available. As described in TCRP Report 10 (*1*), the basic types of payment options are:

- Single-ride
- Multiride
- Period pass
- Stored value
- Postpayment

These generic payment options can be in the form of various fare instruments or payment media, including:

- Cash
- Token
- Paper ticket
- Magnetic stripe ticket or farecard
- Smart card
- Credit/debit/ATM card
- Transit voucher

While most of these payment media are used for actual payment of the fares, several (i.e., credit/debit/ATM cards and transit vouchers) are primarily used to purchase a fare instrument. However, it should be noted that credit cards have also been used in a postpayment mode for direct fare payment in one U.S. transit system (Valley Metro in Phoenix). This strategy was in place for several years, but was discontinued in mid-2002. Because there was no on-line validation of the cards, Valley Metro was subject to fraudulent card usage; the agency ultimately decided that it was losing too much revenue through fraud, and thus opted to end the program.

With regard to transit vouchers, certain programs issue them in the form of farecards (e.g., in New York City and Washington, DC), so that they can be used for direct fare payment; this approach is discussed further in Chapter 4 and in individual case studies (Part II). Most of the emerging developments related to payment options are tied to the introduction of electronic payment technologies and are discussed below. The rest of this section reviews general trends regarding use of passes and discounted multiride options.

Prepayment and Market-Based Pricing

TCRP Report 10 identified market-based pricing as another form of differentiated pricing: differential fares are offered based on frequency of use and willingness to prepay, rather than service or time of day differentials. A market-based pricing strategy typically includes some combination of period passes and discounted tickets, tokens, or stored value farecards. Such a strategy provides the agency an opportunity to target different market segments (e.g., frequent versus occasional riders), while also gaining the operational and administrative benefits associated with prepayment (e.g., reducing cash-handling requirements). Table 2-9 shows the percentages of fare revenue agencies receive from prepayment. As indicated, the most common percentage range is 20% to 39%; however, nearly half of the agencies represented in the table receive 40% or more of their fare revenues through prepaid options. Those agencies operating rail understandably have the highest percentages, as they tend to have the highest fares and therefore a greater incentive for regular riders to buy passes or multiride options.

With regard to types of prepaid options, Table 2-10 shows that three-quarters of North American agencies offer at least one type of unlimited-ride period pass, with monthly passes by far the most dominant category. As indicated, the overall percentage of agencies with passes is virtually unchanged since 1994. Among the other pass types, a third of the agencies have short-term (1- to 3-day) passes, 17% offer 1-week

TABLE 2-9 Percentage of fare revenue from prepayment

Type of System	Number of Systems	Number of Systems by Percentage of Fare Revenue from Prepaid Fare Options				
		<20%	20–39%	40–59%	60–79%	80–100%
Bus	180	26	65	44	32	13
Heavy rail	14	0	1	3	2	8
Light rail	14	0	2	4	3	5
Commuter Rail	15	0	1	1	2	11

SOURCE: *2000 APTA Transit Fare Summary*, 2000.

passes, and 5% 2-week passes; in addition, 8% have some form of 12-month pass. As discussed below, a number of agencies have begun to convert their passes to rolling passes (i.e., activated on first use); this requires the installation of electronic payment capabilities.

The use of short-term passes, particularly day passes, is growing, and they are increasingly being targeted to both regular riders and tourists. Such passes have traditionally been provided primarily for out-of-town visitors, as many agencies have sold them only through hotels, convention centers, and other off-site locations. However, as discussed earlier, agencies are beginning to view day passes as alternatives to low-priced transfers, and several are now selling them onboard buses and in rail stations. Some agencies have even considered partial-day passes. Portland Tri-Met, for instance, recently introduced its 6-hour Quik Tik at a price ($3) lower than its day pass ($4); this pass is sold at Ticket Vending Machines (TVMs) and onboard buses (see the Tri-Met Case Study in Part II). Meanwhile, a few agencies offer passes that are valid only after a certain time of day; for instance, WMATA's "day pass" is good beginning at 9:30AM. With the growth of electronic payment, we can expect to see an increase in the types of passes offered to riders.

While not as widespread as passes, discounted multiride options are offered by many agencies. These options vary in terms of the number of trips that must be purchased to receive the discount, as shown in Table 2-11. The most common number of tickets or tokens for a discount is 10, although some agencies offer different discounts at different trip thresholds. As indicated in the table, 13% of agencies now utilize stored value as a payment option; as discussed further below, the incidence of this option will certainly increase with the growth of electronic payment.

With regard to the level of the discount offered, Table 2-12 shows that there is a fairly even distribution of agencies with discounts of less than 10%, 10–19%, and 20% or more. However, the table also reveals that there has been a general shift over the past few years toward lower percentage discounts. While the incidence of discounts in the 10–19% range is virtually unchanged since 1994, the percentage of agencies with discounts under 10% has nearly doubled, with the percentage above 20% declining accordingly. In some cases, this shift has occurred as agencies have moved from paper tickets or tokens to stored value farecards. In Chicago, for instance, the CTA's stored value farecard has a discount (actually a purchase bonus) of 10% (i.e., $11 value for $10). Prior to introducing electronic payment, the CTA had sold 10 tokens at a 17% discount; the discount had been as high as 28%, but had been reduced as part of subsequent fare changes. While CTA, NYMTA, WMATA and other agencies that have introduced stored value currently offer a simple purchase bonus (typically 10%), there are a number of alternative approaches for

TABLE 2-10 Incidence of passes among transit systems

Type of System	Number of Systems	Total Number with Passes	Percent of Total		Number of Systems with Each Type of Pass				
			2000	1994	1-mo.	2-wk	1-wk	12-mo.	1-3–day
Bus	251	187	75	74	187	13	43	20	84
Heavy rail	15	12	80	77	12	2	9	1	9
Light rail	22	22	100	100	22	1	8	6	15
Commuter rail	18	18	100	76	18	0	9	2	3

SOURCE: *1994 APTA Transit Fare Summary,* 1994, and *2000 APTA Transit Fare Summary,* 2000.

TABLE 2-11 Incidence of discounted tickets, tokens, farecards

Type of System	Number of Systems	Trips Needed for Discount*						Stored Value
		1	2–4	5–9	10–19	20–39	>40	
Bus	251	5	4	10	103	35	17	33
Heavy rail	15	2	2	5	6	2	3	8
Light rail	22	1	1	5	13	1	2	1
Commuter rail	18	1	6	0	11	1	0	1

SOURCE: *2000 APTA Transit Fare Summary*, 2000.
*categories not mutually exclusive (e.g., an agency might have 5- and 10-trip tickets with different discounts).

providing bonuses or discounts with stored value media; these are reviewed in the next section.

PAYMENT OPTIONS FACILITATED BY ELECTRONIC FARE MEDIA

Electronic Payment Options

As suggested earlier, electronic fare media—generally either magnetic stripe farecards or smart cards—facilitate consideration of a range of new types of payment options. Some agencies have used electronic media essentially to automate their existing options, while others have totally revamped their fare structures with the installation of electronic technology. The CTA took the former approach, replacing its discounted tokens with stored value (with a purchase bonus) and converting its passes from fixed calendar periods to a rolling/activate-on first use basis. The NYMTA represents the most graphic example of the latter approach, as it moved from the most basic fare structure in the industry—featuring no multiride discounts, prepaid passes, or discounted transfers—to an automated system that includes stored value (with a purchase bonus), several types of rolling passes, and free intermodal transfers.

The basic payment options possible with electronic fare media and their purchase parameters can be summarized as follows:

- **Value-based or trip-based options**. These can be either user-encoded or pre-encoded (with a fixed amount). Agencies vary in their requirements for a minimum initial payment for user-encoded cards. For instance, the CTA, WMATA and BART all permit purchase of a farecard containing just enough for a single trip (although without any discount or bonus at that level); in contrast, the NYMTA requires that at least $3 be placed on a MetroCard. There is typically a higher minimum value to obtain a purchase bonus: CTA and WMATA each provide a 10% bonus if the rider buys a farecard worth more than $10 and $20, respectively; BART offers a 6.7% bonus for a $30 farecard. NYMTA had offered a 10% bonus with purchase of a $15 farecard, but increased the bonus to 20% (when buying a $10 farecard) in conjunction with its May 2003 fare increase.

TABLE 2-12 Incidence of discounts (for 10-ride options): 1994–2000

Type of System	Percentage of Systems with Discount (from Base Fare) of							
	<10%		10–19%		20–29%		>30%	
	2000	1994	2000	1994	2000	1994	2000	1994
Bus	33	18	38	40	17	27	12	15
Heavy rail	33	29	17	29	33	14	17	29
Light rail	46	30	23	50	23	0	8	20
Commuter rail	0	11	64	67	27	22	9	0

SOURCE: *1994 APTA Transit Fare Summary,* 1994, and *2000 APTA Transit Fare Summary,* 2000.

- **Time-based options**. These can either allow unlimited-rides (during the specified period) or be capped at a certain number of rides (during the specified period). As indicated above, the key pass development related to electronic payment has been the conversion of fixed time period passes (e.g., "September" or "September 16–30") to rolling passes good for a specified number of days (e.g., "30 days" or "14 days"), or perhaps even a certain number of hours (e.g., "24 hours" or "4 hours"). Such passes are activated the first time they are used. This increases the rider's flexibility considerably; for example, a rider who will be on vacation for a week during the month can buy 3 weeks' worth of 7-day passes rather than a single 30-day pass. The use of rolling passes can also reduce the administrative burden on the agency, since pass purchases no longer occur solely within a short time period (e.g., at the end of a month, or during the first few days of the next month). Rolling passes are currently in use by a number of agencies, including CTA, NYMTA, WMATA, OCTA, Houston Metro and Connecticut Transit. Agencies are increasingly utilizing this approach as they introduce electronic payment.

- **Combined value and time-based options**. Electronic fare media are capable of carrying both stored-value and pass options. This may be in the form of stored value for use on one mode or operator's service, along with a time-based pass that can be used on another mode or service in the region; for example, WMATA has offered a variety of farecards containing stored value for use on Metro rail that also serve as flash passes that can be used on specific bus services. In an integrated regional payment system, a rider could have a farecard that has stored value for occasional use on all participating agencies' services, as well as a period pass for the service regularly used.
- An electronic payment system can also automatically facilitate a fare differential (by time of day, mode or distance) or a transfer discount that would otherwise have to be handled using a separate paper transfer.

The other key parameter for farecards is the type and level of discount or bonus provided as an incentive to purchase and use the card (and to use transit in general). The basic types of discount and bonus options that might be considered are as follows:

- **Initial purchase bonus**. This is the most common form of stored-value bonus, as described above.
- **Add-value bonus**. An alternative approach is designed to encourage retention of a farecard: a bonus is not provided on initial purchase of a farecard, but rather only on additional value; this has been suggested as a possible strategy for use with smart cards in particular, given the cards' high unit cost.
- **Frequency-based per-ride discount (above a threshold number)**. A reduced fare is charged for each ride above a certain minimum number of rides taken with a particular farecard.
- **Farecard discount relative to use of cash**. A farecard can carry a lower per-trip fare than if paying cash.

While the above strategies can be used with any type of electronic payment, the greater memory and processing capabilities of smart cards—coupled with the fact that they are intended to be used for a much longer period—make it possible to consider additional pricing innovations that would not be feasible with magnetic media; these include the following:

- **Guaranteed last ride (or negative balance)**. In this option, a ride is guaranteed, regardless of the remaining value on the farecard. In other words, if a rider boards a bus or enters a faregate and the farecard is revealed to have insufficient value for that trip, a "negative balance" (up to the value of a single ride) is permitted. The next time the cardholder adds value to the card, the amount of that ride is deducted from the total value added. This strategy was tested by the CTA in its smart card pilot project and is being considered in a number of other programs.
- **Guaranteed lowest fare**. This option is a variation on the frequency-based per-ride discount mentioned above. As proposed for introduction in the Washington, DC SmarTrip program (where it is known as "Fair Fares"), this strategy assures riders that they will automatically be charged the lowest fare for which they are eligible (i.e., based on their extent of usage of their farecards). A counter on the card keeps track of each card's use within a certain time period, and the fare system is programmed so that the rider pays the lowest possible fare, based on actual usage. For instance, once a cardholder has taken a certain minimum number of rides during a day, the card automatically becomes treated like an unlimited use day pass, and all subsequent rides that day become free. Even at this point, however, rides continue to be tracked; thus, if the cardholder uses the card a sufficient number of times in a 7-day period, the card becomes treated like a weekly pass (and subsequently a two-week pass, and ultimately a monthly pass—assuming these are offered by the agency). A variation on this basic strategy is to use it in conjunction with postpayment. In Groningen, Netherlands, for instance, the "Tripperpas" smart card program offers cardholders a "best price" guarantee, but the card does not carry stored value; rather, the card-

holder establishes an account and the cost of travel is deducted from this account (i.e., similar to an electronic toll system). Such an arrangement, which is similar to an electronic toll account, is also being tested in Frankfurt, Germany, and Sapporo, Japan.

All of these discount and bonus strategies are intended to provide incentives to purchase and use a farecard as opposed to paying with cash or using a token or paper ticket. Some of the approaches (i.e., add-value bonus and frequency-based discount) also serve to encourage retention of a farecard. However, the incentives differ in their relative impacts on ridership and revenue. Thus, it is important that an agency carefully consider these impacts in selecting a pricing strategy. A guaranteed last ride option, for instance, is attractive to riders in that it addresses concerns about running out of farecard value where it may be inconvenient to add value (i.e., on most bus routes). However, this approach discourages the retention and reuse of a single farecard, and can potentially result in significant revenue loss, if people abuse the privilege; thus using this strategy also requires some type of strong incentive to retain and reload cards.

A guaranteed lowest fare option also has the potential to result in some revenue loss, as it converts rides that would otherwise have been paid for to free rides. An agency will thus have to balance the possible revenue loss against the likely gain in ridership—and general marketing benefit—associated with the strategy. A more straightforward frequency-based per-ride discount would presumably have a smaller revenue impact—since it charges for each ride—although it may not offer an agency quite as compelling a marketing angle. As with any of these pricing strategies, the impacts on both revenue and ridership will ultimately depend on the exact nature of the bonus or discount relative to the full fare—and compared to the discount offered by passes and other prepayment options (if any). The agency will also have to determine the relative importance of its goals (maximize ridership, maximize revenue, maximize rider convenience, maximize prepayment, etc.) in establishing an overall set of payment options.

The next section reviews trends related to the basic types of fare collection in the transit industry.

TRENDS IN TYPE OF FARE COLLECTION

Type of fare collection refers to the manner in which fares are paid or inspected; the basic options are as follows:

- **Barrier** (i.e., pay on entering and/or exiting a station or loading area). Involves turnstiles, faregates, and ticket agents or some combination of all three; may involve entry control only or entry and exit control, particularly for a distance-based system.
- **Pay on boarding** (i.e., on entering the vehicle). Typically involves a farebox or a ticket or card processing unit.
- **Self-service/barrier-free or proof-of-payment** (POP). The rider is required to carry a valid ticket or pass when on the vehicle and is subject to random inspection by roving inspectors; typically involves ticket vending/validating machines.
- **Conductor-validated**. The rider can either prepay or buy a ticket onboard from a conductor.

Each fare collection approach has become closely associated with a particular mode of transportation (see Table 2-13 for a summary of the application of these approaches to specific modes). Heavy rail lines are typically barrier systems, although POP (in Los Angeles) and pay on boarding (in Cleveland) are also in use. In North America, virtually all buses have pay on boarding, while a number of European bus systems use POP. While some light rail systems have employed barrier (Boston, for underground stations) and pay on boarding (Pittsburgh and Boston, for surface stations), POP has been adopted for most Light Rail Transit (LRT) lines. POP is the newest fare collection approach and, with the rapid expansion

TABLE 2-13 Use of fare collection approaches by mode

Approach	Light Rail	Heavy Rail	Commuter Rail	Bus Rapid Transit	Bus
Proof of Payment	✓	✓	✓	✓	✓
Barrier	✓	✓		✓	
Pay on boarding	✓			✓	✓
Conductor-validated			✓		

of LRT service in the United States, has seen increasing use over the last two decades. POP is also expected to be used in a number of the new bus rapid transit services now being developed or implemented, although barrier and pay on boarding systems are also being considered. (A separate TCRP project (A-24) has developed *A Toolkit for Self-Service Barrier-Free Fare Collection* (*5*), which provides guidelines for implementing and managing a POP fare system.) Finally, conductor-validated fare collection is used by many commuter rail systems, although the newer systems have tended to opt for POP instead. In many cases, the choice of approach is clearly suggested by the operating restrictions or requirements of the service, while in other instances, the agency will have to weigh the costs and benefits of two or more alternatives. Table 2-14 presents a comparison of these approaches with regard to several defining parameters.

TABLE 2-14 Comparison of fare collection approaches

Factor/Issue	Proof of Payment (POP)	Barrier	Conductor-validated	Pay on boarding
Equipment needed	Ticket Vending Machines (TVMs), validators, Ticket Office Machines (TOMs), hand-held readers*	Faregates, TVMs, add-fare machines	TVMs,* TOMS,* validators,* hand-held readers*	Fareboxes, ticket processing units*
Station or platform characteristics	Open (elevated) or on-street platform	Requires space for gates and TVMs, and defined entry/exit	Open platform	NA
Handling large passenger volumes	Crowded cars can interfere with inspection. May require high number of TVMs	Doesn't affect ability to collect fares.	Crowded cars can interfere with inspection.	Slows boarding
Fare evasion	Depends on inspection pattern, fine structure, level of crowding	Caused by faregate "jumping," short-swiping farecards	Minimal, since conductor inspects or collects fare from everyone; could be problem at congested times	Caused by using invalid pass or transfer. Also caused by crowding at boarding point
Handling Intermodal transfers	Transfer from bus can be used as POP on LRT; POP can include transfer to bus	Transfer from bus must be machine-readable; transfer to bus must be issued with rail ticket	Transfer from other mode can be shown to conductor	(see other approaches)
Handling zonal fares	More complicated (to use and to enforce); must include origin for validation	Requires exit gates and add-fare machines	Commuter rail lines invariably zoned	Rider tells driver destination (or zone), pays accordingly
Use of Automatic Fare Collection (AFC)	Use to buy POP ticket, or have to validate farecard—or have pass (inspectors need hand-held readers)	Faregates read farecard and deduct value or indicate valid pass	Conductors need hand-held farecard readers / processing units	Need ticket processing units/card readers; ease of revaluing is issue
Security and customer service	Inspectors provide presence on vehicles and platforms. Added security needed at other times	If no ticket agents, security needed in stations and on trains	Conductors provide presence on all trains	Driver responsible for security and customer assistance on bus
Customer Convenience	Needs validation of multiride or stored value tickets; may be queues to buy or validate, but not to board	Depends on types of payment accepted in gates (easiest if cash accepted); may be queues	No need to prepay or validate, no need for exact change, and no queuing to pay or board	Needs either prepayment (pass or multiride option) or exact change;** may be queues
Capital costs	Lower than barrier, unless high vol. Requires many TVMs	Cost of faregates high, but requires fewer TVMs than for POP (validation at faregate)	Lower than POP; may be lowest (depending on number of TVMs used)	Lowest costs: fareboxes, but no TVMs
Operating costs	Higher labor cost than barrier	Lower labor cost than POP	Highest labor cost	Lowest labor cost

* optional; may be required if AFC is used

** validating fareboxes will not require exact change, but change will be in form of stored-value card

A decision on fare payment technology is separate from choosing a basic fare collection approach. However, the type of technology selected can have definite implications on the approach. For barrier, pay on boarding and conductor-validated systems, the major implication of electronic payment is the need for appropriate equipment (e.g., magnetic/smart card readers and vending/add-value machines for barrier and pay on boarding, hand-held readers for conductor-validated). For POP, however, there are additional considerations. As noted in the *Toolkit for Self-Service Barrier-Free Fare Collection* [SSFC], "The major challenge is that stored value farecards (either magnetic stripe or smart card) cannot be directly used in a proof of payment environment, as SSFC requires the rider to display a validated ticket or a flash pass to an inspector. A faregate or farebox equipped to read electronic farecards automatically identifies the validity of the card and deducts the proper fare value (i.e., if the card is not an unlimited ride pass). This is infeasible with a TVM and visual fare inspection. Thus, use of farecards in a SSFC system requires special accommodations to allow the user to validate the card and the inspector to check the validity of the card" (*5*). The alternative methods for incorporating electronic payment into a POP system are discussed in the next chapter.

CHAPTER **3**

FARE PAYMENT TECHNOLOGY DEVELOPMENTS

INTRODUCTION

As indicated earlier, an increasing number of transit agencies are implementing electronic fare payment strategies. The use of electronic payment has influenced fare policy and has facilitated the introduction of a range of new payment options (e.g., stored-value farecards, rolling passes, and regional), as well as the opportunity to establish new types of partnerships and new fare media distribution methods. Developments related to the types of technology being employed and emerging applications are reviewed in this chapter.

Two basic electronic payment technologies have been used in fare systems:

- Magnetic stripe cards or tickets
- Smart cards, also known as "integrated circuit" or "chip" cards

Either technology can accommodate a wide range of payment options. There are differences, however, in a number of parameters; these differences, as well as the relative advantages, are discussed below and are summarized in Table 3-1.

MAGNETIC FARECARDS

There are two basic types of magnetic stripe media: *read-only swipe cards* and *read-write stored-value cards.* In either case, magnetic variations along longitudinal "tracks" in the stripe can store a certain amount of data. The read-only technology is similar to that used for credit or debit cards, and allows the automatic determination of the validity of an unlimited-ride pass. (Other "read-only" payment media technologies targeted to the transit market include the C-Card "CoinCard" and InkSure's "TicketSure" technology. The CoinCard is a read-only "capacitive" card in which stored rides are encoded in a laser-etched polyester film. The TicketSure fare media are machine-readable paper tickets printed with a special ink ("SmartInk") that makes counterfeiting very difficult; these tickets offer a possible replacement for paper transfers or single-ride fare tickets. Both of these technologies can be used to complement electronic (read-write) payment systems.) In contrast, read-write technology, used with a ticket processing unit (TPU) or bus ticket validator (BTV), can accommodate stored value and other automated payment options. The TPU can be in the form of either a swipe reader (as in the NYMTA MetroCard system) or a motorized transport (as in the CTA, WMATA and BART systems) that grabs the ticket after insertion and moves it over the read/write heads at a controlled speed. The ticket is returned to the passenger through the original slot or some other slot in the reader. A TPU can process an existing farecard, and some bus TPUs can be configured to issue some types of fare media (e.g., a transfer or a 1-day pass, or even stored value).

Development of Magnetic Farecard Systems

As noted in TCRP Report 10, fare collection systems using magnetic stored-value farecards date from the 1960s, first introduced on rail systems in Chicago (Metra Electric ICGRR Line) and Philadelphia (PATCO), and subsequently used (also on rail only) at BART in San Francisco and WMATA in Washington DC in the 1970s. Magnetic farecards can be made of plastic or paper and may or may not include printing (i.e., of value remaining) on the card. The BART and WMATA systems are examples of the paper option, and both print remaining value on the ticket. The newer stored-value systems, such as those at New York MTA and CTA (Chicago), use thin polyester cards that are more durable than the paper tickets; these systems do not print remaining value on the cards. Both types of card are relatively inexpensive, ranging from under $0.02 to about $0.10 apiece, depending on the specific characteristics of the card and the volume purchased.

The use of magnetic farecards on bus systems is a more recent development, but read-write technology had been implemented by over 30 U.S. bus operators (as of late 2002). Most of these utilize GFIGenfare's Ticket Reading/Issuing Machine (TRiM) technology. The TRiM unit is a TPU that mounts on the side of the GFI Cents-A-Bill fareboxes. In addition to reading a ticket inserted by the passenger, a TRiM unit can also issue a magnetic ticket/transfer from an internal supply of blanks. Several systems use Cubic's Bus Ticket Processing Unit, either in conjunction with GFI fareboxes (i.e., in Chicago, on CTA and Pace buses) or with Cubic's own fareboxes (i.e., NYMTA, Houston Metro and AMA in San Juan, PR).

TABLE 3-1 Comparison of electronic payment technologies

	Magnetic Farecard	Smart Card
Description	• Cards are paper (like WMATA farecards) or thin, flexible plastic or polyester (like NYMTA MetroCard), with a magnetic stripe. • Read-write Ticket Processing Unit in fareboxes or faregates use motorized transport or swipe reader to check pass validity or decrease a stored value/rides balance. • Attended or unattended devices are used to purchase or load value/rides (or a pass). Prevalued cards can also be sold (e.g., by merchants selling other fare media).	• Cards are rigid plastic (like a credit card) with an embedded microchip. Paper tickets are now being introduced. • Contactless card readers in fareboxes (or standalone) or faregates communicate with cards brought within close proximity to check pass validity or decrement a stored value/rides balance. • Attended or unattended devices are used to load value/rides (or a pass). Cards are purchased at ticket offices, by mail, or Internet. • A card with both contact and contactless interfaces enables multiapplication partnerships with banks, social service agencies, campuses, or other entities.

Strengths	• Cards are inexpensive (less than $0.10).
	• Cards can be readily vended from point of sale devices (e.g., Ticket Vending Machines [TVMs]) or possibly from fareboxes. (TVMs that vend smart cards are much more expensive.)
	• If cards are used for stored value (rather than rides), when the card balance drops to a small level (e.g., $0.05—$0.10), some customers may purchase a new card rather than revaluing the old one. This means that the residual value may never be used. This unused value becomes additional revenue to the issuing transit agency.
		• The smart card has the data capacity and security features needed to support multiple card applications. Such partnerships can help spread system costs and make card use more attractive.
		• The data capacity and processing capabilities of smart cards also enable the introduction of special features, such as:
		  • Registering the card, so that a lost card can be cancelled and the value restored on the replacement card.
		  • Automatically revaluing a card from a credit card account when the balance gets low; the card is updated the next time it is used.
		  • Automatically adding monthly employer or other transit benefits to cards in a similar manner.
		• Contactless cards easy to use (e.g., for disabled/seniors).

Weaknesses	• Data capacity may be too limited to support multiple agency pass or multiride options. Multiple agency use may be limited to stored value. • Card readers require considerable maintenance/cleaning. In addition, card slots are vulnerable to insertion of foreign items. In contrast, contactless smart card readers have no slots or moving parts—and thus require much less maintenance. • Card readers tend to be more expensive to purchase than contactless smart card readers	• Cards are expensive ($1.50—$10 each). To insure that a card is retained for long-term use, a card fee/deposit may be needed; this may raise equity objections from lower-income riders. Smart cards are not well-suited for one-time users (e.g., visitors). New TicketSure paper tickets will be much cheaper, but still more expensive than magnetic cards. • Variety of card interfaces in market place (both standardized and proprietary) complicate potential to integrate with other regions or other applications.

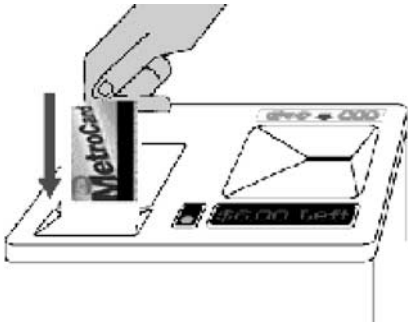
The latest generation of fareboxes are "validating" fareboxes, such as GFI's "Odyssey." All bills and coins are validated, including larger denomination ($5, $10, and $20) bills; change from a larger bill payment can be returned to the boarding passenger as stored value on a magnetic stripe ticket. Other validating fareboxes should soon be available in the North American marketplace as well. For instance, Scheidt & Bachmann and a consortium of C-Card and Diamond Manufacturing have each announced that they have developed a validating farebox. Agent Systems had previously introduced a validating farebox, the "Smart Box," but this unit was no longer in production (as of mid-2003).

It should be noted that the use of a vendor's magnetic technology by multiple agencies does not in itself ensure that all of the agencies will be able to read a common farecard. Different versions have software variations that often make different agencies' equipment incompatible. Thus, providing compatibility among several operators in a region may require upgrading existing units to the same version of the card processing software or replacing the units altogether. Similarly, a NYMTA MetroCard would not be read correctly at the CTA even though both are Cubic systems of the same vintage.

Examples of Magnetic Farecard Systems

The major examples of *multiple operator* magnetic systems are as follows.

- **New York City.** The New York City Transit *MetroCard* system, completed in 1997, is a Cubic system used on MTA-NYCT buses and rail, as well as Long Island Bus and NY Department of Transportation (DOT) buses; MetroCard equipment is now being installed on the Port Authority's PATH rail system as well. The subway faregates require that the ticket be swiped, like a credit card, while the bus fareboxes use a motorized transport. As indicated above, remaining value is not printed on the cards; value is displayed on the TPU or faregate—as well as in ticket vending machines and special card value units in subway stations.



- **Chicago.** Cubic also installed the stored value AFC system for the CTA and Pace (the suburban bus operator). As in NY, the card can be used on bus and rail. Unlike the NY MetroCard, however, the card must be inserted in rail faregates, rather than swiped. The Chicago Transit Card system installation was completed in 1997. A smart card pilot project was completed in 2001, and a full system-wide rollout of smart cards (to complement the magnetic cards) has been initiated. (See CTA Case Study in Part II for additional information.)
- **State of Connecticut.** Connecticut Transit operates service in the cities of Hartford, New Haven, and Stamford. These and several other systems all accept common magnetic fare media (e.g., 1-day pass, 7-day rolling pass, 31-day rolling pass and stored-ride farecard). These fare media are accepted by eight participating systems. The fare collection system uses GFI's TRiM units. (See CT TRANSIT Case Study in Part II for additional information.)
- **Southern California.** Five transit operators in southern California accept a common farecard (*Metrocard*). This GFI system was initiated in 1994 with three operators, and two others have since been added. The largest agency in the region, the Los Angeles County MTA, is now in the process of developing a region-wide Unified Fare System (UFS) that will include these initial agencies, as well as other operators in the region. UFS will feature smart cards as the primary regional fare medium, but magnetic cards will continue to be accepted by at least some of the participating agencies.

Thus, magnetic farecards are used in several regions by more than one operator. However, no region has as yet established a true universal magnetic system covering all of the transit providers in the region.

As suggested above, LACMTA plans to implement a full regional system, but this system will be based primarily on smart cards, rather than magnetics. In Chicago, the commuter rail operator (Metra) does not accept CTA's Transit Card. In New York, discussions have taken place for several years among the largest transit operators (NYMTA, New Jersey Transit, and PATH) regarding the potential for a common farecard, and, as said above, PATH will now be accepting the MTA's MetroCard. An eventual region-wide fare system could be based on further expansion of the MetroCard or could involve introduction of smart cards.

Several other regional payment efforts are in development—and several already exist overseas—but these are all based primarily on smart cards; these programs are discussed later in this chapter.

Impacts of Magnetic Farecard Systems for Case-Study Agencies

The following case-study agencies have installed magnetic farecard systems:

- **Chicago Transit Authority** has introduced stored-value farecards and rolling passes that can be used on CTA buses and trains and Pace buses.

- **Connecticut Transit** has introduced stored-ride farecards and rolling passes that can be used on any of the agency's services throughout the state.
- **Orange County Transportation Authority** recently introduced rolling passes, although not stored-value (or stored-ride) passes

The full case studies are presented in Part II. However, it is useful to compare the results of these efforts in terms of their impacts on customers and agency operations.

Customer Impacts and Benefits

Farecards have proven very popular with customers. For instance, within 3 months of initial implementation, a third of all CTA trips were being made with Transit Cards. At present, 95% of rail riders pay their fares with farecards, as do 68% of bus riders. At CT TRANSIT, the use of 1-day and 7-day passes in particular has grown steadily since their introduction; overall pass use has increased by more than a third since the introduction of electronic payment.

These electronic payment systems have produced a number of benefits to customers, including a greater variety of, and more convenient, payment options, such as the following:

- Purchase and activation without being constrained to a particular calendar timeframe (rolling passes).
- The benefits of an unlimited use pass without having to make the cash outlay required with a 30- or 31-day pass (7-day rolling pass offered by CTA and CT TRANSIT).
- Prepayment for customers who do not want to buy longer-term passes (stored-value/stored-ride cards offered by CTA and CT TRANSIT and 1-day passes sold onboard buses by CT TRANSIT and OCTA.
- Reduced cost of travel for many riders through 1-day passes or purchase bonuses.
- Seamless travel on multiple transit systems (CTA/Pace; CT TRANSIT/eight participating transit systems).

Agency Impacts and Benefits

Electronic payment systems have had the following major impacts on, and benefits for, CTA and CT TRANSIT:

- These systems have facilitated the implementation of more fare options for customers, many of which are more convenient and cost-effective. The systems also allow the agencies to track ridership and revenue impacts of different fare initiatives more carefully.
- These systems have considerably reduced the use of cash for fare payment: At CTA, 16% of boardings are currently made using cash, compared to 27% pre-electronic payment. At CT TRANSIT, the use of cash is 9% lower than when the new system was implemented.
- The popularity of the farecards has enabled CTA to eliminate tokens completely, thereby eliminating the costs associated with selling and redistributing tokens. CT TRANSIT's token use dropped by almost half following the introduction of stored-ride cards.
- The use of rolling passes has reduced fare collection costs associated with producing, selling, and distributing fixed calendar period passes. For instance, the agencies no longer need to print weekly and monthly passes that may be discarded if they are not purchased.
- These systems have significantly reduced opportunities for fare abuse and evasion through automatic verification of validity of fare media, and by curtailing counterfeiting of passes. The systems have also reduced operator requirements for administering fare collection, as well as the extent of rider-operator confrontations regarding the validity of passes and transfers.
- The use of stored-value has produced expired-value revenue associated with unused farecards This results from the fact that many people use magnetic farecards once or twice and then dispose of them, even if they still have some value—or, in some cases (e.g., CTA), farecards are actually issued with an expiration date. CTA estimates that on the order of $3 million per year is left on farecards that have reached their expiration dates (12 to 14 months after a card is issued). WMATA, whose case study is discussed in the next section, estimates that between $3 million and $5 million in unused value is written off annually.
- The total cost of implementing the CTA's system was $106 million. Of this total, 74% was for equipment, 13% for station construction, 5% for field forces, 4% for consultants, 2% for CTA engineering and administration, and 1% for marketing and start-up—total does not add to 100% due to rounding. (Estimated costs for implementing both magnetic farecard and smart card systems are presented in Appendix C.)
- With regard to potential cost savings, CTA initially envisioned that implementation of electronic payment would result in a personnel cost savings since they would have a reduced need for rail ticket agents. However, the new fare technology required a significant outreach and customer service effort on the part of the agency, and many of the rail ticket agents were converted to customer assistants. Therefore, CTA has not realized the anticipated personnel cost savings.

SMART CARDS

Types of Cards

Unlike a magnetic farecard, a smart card is generally made of rigid plastic, like a credit card, and contains a small embedded computer chip (lower-cost—and lower function—paper smart cards and recyclable smart tokens are also available). The earliest chips had memory but no microprocessors. These cards—still in use for certain applications—were developed to

provide a data storage location that had more capacity and was less vulnerable to tampering than the magnetic stripe on farecards. Communications between the reader and the chip can be either through a set of small metallic contacts on the face of the card (for a contact card) or through a short-range wireless interface (for a contactless card).

The first use of contact cards, primarily in Europe beginning in the 1980s, was for prepaid telephone cards and limited-purpose stored-value cards. More sophisticated chips with microprocessors began to be used later. These allowed data encryption calculations to be completed in both the card and the reader. Card uses were subsequently extended to general-purpose stored-value (also known as an electronic purse or e-cash) schemes and other types of bank cards.

Smart cards are being introduced for an increasingly wide range of applications, including toll and parking payments, Internet access, mobile commerce, electronic benefits transfer, campus (university and corporate) functions, and loyalty purchase programs. The processing and storage capabilities of smart cards have made it possible to consider multiuse or multiapplication programs, including two or more of these uses on a single card. Such arrangements offer the potential to increase customer convenience—for all participating applications—as well as to spread card issuance costs.

While most types of applications have tended to use contact cards, contact transactions have generally been found to be too slow for transit fare payment. Contactless, or proximity, cards, developed in the early 1990s, need only be passed within an inch or two of the card reader, and thus allow fare payment to be completed very quickly. A contactless transaction is typically completed within about one-fifth of a second. Early contactless cards achieved short transaction times by avoiding the sophisticated security calculations needed by banks. However, with faster microprocessors, these cards can now complete secure calculations quickly. This has led to the recent development of contactless chips for use for credit/debit and other nontransit applications, not all of which make use of plastic cards, for contactless chips can be integrated into many devices, including pagers, mobile phones, personal digital assistants (PDAs), wrist watches, and key fobs.

Banking and other nontransit applications continue to rely on contact cards where there is an installed infrastructure, particularly in Europe. However, Visa and MasterCard both announced in 2002 that they have developed contactless specifications for credit and debit functions. This suggests that, at least in the United States, where there is a very small existing contact card infrastructure, the growth in the use of contact cards may be rather limited in the coming years. There is at present growing use of contact cards for a variety of nonbanking applications such as parking payments, electronic benefits transfer, campus uses, network security/ID, and retail loyalty programs. However, any widespread adoption of contactless technology by banks and other financial institutions could ultimately cause other functions to shift to contactless interfaces as well; the extent and timing of such a shift remains to be seen.

Given the use of contact cards for most applications at present and the need for contactless transactions for transit purposes, the interest in linking transit and other types of transactions has understandably led to development of a new type of card, a dual interface card, that incorporates both a contact and contactless interface. With such a card, for instance, an e-purse could be loaded with value through a retrofitted ATM and then used for transit via the contactless interface. Alternatively, a card could be used for both transit and parking payments or for transit and university campus purposes. Of growing interest to transit and social service agencies is the potential to deliver electronic benefits (e.g., access-to-jobs subsidies) to cards that can then be used directly on transit. While most smart card programs have specified either contact or contactless cards to date, many transit agencies have begun to order dual interface cards for new programs. Given the apparent shift of focus of the financial sector—at least in North America and Asia—to contactless technology, however, transit agencies may soon be able to consider multiapplication opportunities without contact card functionality.

Examples of Smart Card Programs

After some early pilots in Europe in the late 1980s, several larger-scale transit smart card systems were implemented in Asia in the late 1990s. The largest of these are in Hong Kong and Seoul. There are now over fifty transit smart card systems in place or being implemented around the world; these include many of the world's major cities, such as Paris, London, Berlin, Rome, Sydney, Moscow, Shanghai, Tokyo, and Singapore. While smart cards have been slower to catch on in the United States, there has been a surge in activity in the past couple of years, and there are now a number of programs in place or under development. At this point, smart cards are in use on at least a limited basis in transit systems in Washington, DC; Chicago; the San Francisco Bay Area; Ventura County, CA; and Newark, NJ. Smart cards are also being introduced as parts of overall fare collection system upgrades or regional programs in a number of other locations. Table 3-2 summarizes the United States smart card programs in place, being purchased, or being planned as of late 2002.

Several key U.S. programs are described briefly below. Case studies of these efforts are included in Part II; their customer and agency impacts are compared below.

- **Washington, DC.** WMATA launched the SmarTrip system in May 1999, with smart card acceptance at all Metro subway faregates as well as at park and ride lots. As of mid-2003, over 325,000 cards had been issued. To obtain a

TABLE 3-2 Current and planned U.S. transit smart card programs

Location/Lead Agency (Program Name)	Type of Program	Integrator/ Vendor	Status
Los Angeles/LACMTA (UFS)	Regional farecard	Cubic	Contract awarded; rollout planned in 2004
San Diego/MTDB	Regional farecard	Cubic	Contract awarded; rollout planned in 2005
San Francisco/MTC (TransLink)	Regional farecard	ERG	Pilot completed mid-2002; additional cards/equipment ordered mid-2003
Ventura County/VCTC	Regional farecard	ERG	Implemented 2002
Washington-Maryland-Virginia/WMATA (SmarTrip)	Regional farecard	Cubic/GFI	In use on MetroRail, contract awarded for rest of region
Delaware/DelDOT	Regional farecard	NA*	Under development
Miami-Ft. Lauderdale-Palm Beach/MDTA-Tri Rail (UAFC)	Regional farecard	Cubic	Contract awarded 2002
Orlando/Lynx (ORANGES)	Multimodal integration	TTI	Under development
Atlanta/MARTA	Regional farecard	Cubic	Contract awarded 2003
Chicago/CTA (Chicago Card)	AFC option (also regional)	Cubic	Pilot completed, 100,000 card rollout in next phase
Boston/MBTA	AFC option	Scheidt & Bachmann	Contract awarded 2003
Las Vegas/Monorail	New fare system (new service)	ERG	Contract awarded 2002; transit service to open 2004
Minneapolis-St. Paul/Metro Transit	New fare system	Cubic	Contract awarded; rollout planned mid-2003
Newark/PANYNJ & NJT (SmartLink)	AFC option	Ascom/ASK	Pilot implemented 2001
New York City-NJ/PATH	AFC option	Cubic	Contract awarded 2002
Philadelphia/PATCO	New fare system	NA	Under development
Houston/METRO	AFC upgrade	Cubic	Contract awarded 2002
Seattle-Puget Sound/KC Metro	Regional farecard	ERG	Contract awarded; rollout planned 2005

* NA = Not applicable.

SmarTrip card, a rider must pay $5; this allows the rider to register the card—so that it can be replaced if lost or stolen. In October 2000, WMATA introduced the "SmartBenefits" program, in which employee transit benefits can be distributed directly onto their smart cards at the same locations where value is added to the cards (i.e., TVMs). New fareboxes and smart card readers are currently being procured (from a Cubic-GFI consortium) to expand SmarTrip card acceptance to the agency's Metrobus system as well as to connecting transit services in the region and Baltimore.

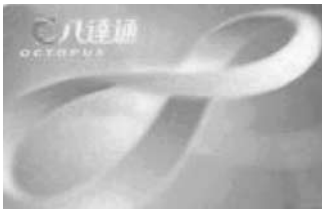
- **Chicago.** The CTA Transit Card system was designed to accept both magnetic stripe and contactless smart card fare media from the outset. A smart card pilot began in August 2000, with 3,500 Chicago Cards, as the smart cards are called, distributed to current riders. Based on the success of the pilot, a second phase (100,000 cards) has been authorized; a subsequent phase would include another 200,000–500,000 cards. Pace suburban buses are also equipped for smart card acceptance. As at WMATA, the smart cards utilize the Cubic Go-Card technology.

- **San Francisco.** The TransLink system for the San Francisco Bay Area plans eventually to allow the same smart card to be used on the 26 bus, rail, and ferry services in the region. A contract was awarded to a consortium of Motorola and ERG in 1999. An initial pilot phase with six agencies and about 3,000 card users was carried out during the first half of 2002; all six agencies agreed to continue accepting the card after the close of the pilot phase. An additional 400,000 smart cards, along with car-reading equipment, were ordered in mid-2003 as the first move toward full regional rollout (pending agency approval of rollout plans). The integrator plans to also pursue card applications outside of transit, including pay phones, universities, and parking.

- **Ventura County, CA.** The Ventura County Transportation Commission (VCTC) implemented the Go Ventura project in early 2002. Seven transit systems in the county are participating in this integrated regional smart card program. This follows completion of an earlier regional smart card demonstration, the Smart Passport project. Like TransLink, the Go Ventura system is supplied by the Motorola/ERG consortium. Like the earlier Smart Passport system, the new system includes contactless smart card readers, automated passenger counters, and an automated vehicle location system. The dual interface card technology will provide future flexibility in allowing for the addition of nontransit functions at some future point; these may include, for instance, certain university applications.

Notable transit smart card examples from abroad include the following:

- **London, United Kingdom.** The Oyster system (originally called PRESTIGE) will ultimately provide smart cards for use in the entire London Underground rail system and all 30 London Transport Bus Operating Companies. As of mid-2002, more than 16,000 card readers had been installed at 274 Underground stations and on 6,000 buses. The TranSys consortium (which includes Cubic and EDS, as well as several other companies) is financing the capital cost of the system and will operate it for 17 years. TranSys will receive an ongoing stream of payments throughout the operating period as long as performance standards are achieved. The consortium began to issue cards to transit agency employees in late 2002; a trial involving over 30,000 transit system employees will operate until the card is issued to riders beginning in late-2003. Two different types of contactless cards will be used in the system, using chips from Philips Semiconductors (Mifare) and Cubic. Nontransit applications currently envisioned for the Oyster card include parking, school-based services, electronic benefits, and retail/loyalty programs.
- **Paris, France.** RATP, the major transit agency in Paris, has established a consortium that includes financial institutions (Société Général and Caisses d'Epargne, among others), telecommunications and postal entities (France Telecom and La Poste, respectively), and system vendors and integrators (including fare collection equipment vendor Ascom/Monetel and smart card companies ASK and SchlumbergerSema) to develop and manage a regional multiapplication smart card system. The consortium, called Modeus, plans to eventually to issue 5 million cards that can be used for fare payment, small retail purchases, pay phone calls, and perhaps other types of transactions. Modeus recently announced that it will include the German Geldkarte e-purse scheme on at least some of the cards. While the e-purse will initially be used via a contact interface (i.e., on dual interface cards), the consortium would like to adapt the system to eventually operate in the contactless mode as well.
- **Hong Kong, China.** Hong Kong's Octopus system was launched in 1996. As of the end of 2002, nearly 9 million cards had been issued. The Octopus stored-value card can be used with eight bus, rail, and ferry operators in the region. The system was developed, and is operated by, a joint venture of the participating transit agencies known as Octopus Cards, Ltd. (originally called Creative Star). Central clearinghouse software and overall systems integration was provided by ERG, with Sony cards and readers. In early 2000, the consortium was granted a deposit-taking license by the government. This allowed nontransit use of the card, such as for retail purchases (currently accepted at more than 3,000 vending machines and 160 retail establishments, including Starbucks, Watsons, 7-Eleven convenience stores, and Hong Kong's two largest grocery store chains), parking meters, and telephone calls. Such external participants pay transaction fees to Octopus for their smart card transactions. In 2002, Octopus launched a loyalty program in connection with the retail applications; this has reportedly increased the retail usage of the cards considerably. Octopus has also begun to seek opportunities outside of Hong Kong, and, by early 2003, had signed a contract to provide a multiapplication fare system for a city in mainland China and had submitted bids to several cities in Europe.



- **Pusan, South Korea.** In 2000, Pusan Bank of South Korea began to issue dual interface multiapplication cards, called the Digital Pusan Card, that allow cardholders to pay transit fares, pay taxes over the Internet, and make retail store and vending machine purchases. The cards also carry digital certificates as well as credit/debit and loyalty applications. The transit and bank applications are separate, but linked so that fares and other payments can be deducted from either purse. Digital Pusan Cardholders can use the cards on existing readers on the city's buses and trains, as the Hanaro Transportation Authority had previously installed a contactless card system; 2 million transit-only cards had been issued for this system. While the initial technology is dual interface cards (Philips Semiconductors' MifarePro cards), developments are underway ultimately to switch all applications to contactless mode. The system was developed by Korean Electronic Banking Technology (KEBT). A second bank, Kyongnam Bank, has also

launched its own similar multiapplication card that can be used for transit payments.
- **Curitiba, Brazil.** A dual interface multiapplication card, the SchlumbergerSema Easyflex City card, has been introduced in Curitiba for use in transit and other functions. A smart card trial began in 1997, when 5,000 government employees were provided with cards for use as IDs, for securing pay advances, and for purchases in local grocery stores. Transit access was added in 2001, parking payment in 2002; other applications, such as recording health records, building access and payments in restaurants and gas stations are under consideration.

Impacts of Smart Card Programs

Several of the agencies in our case studies have smart card initiatives, including CTA, the Metropolitan Transportation Commission (San Francisco Bay area), Ventura County (CA) Transportation Commission, and WMATA. The full case studies are presented in Part II. However, it is useful to compare these efforts in terms of their impacts on customers and agency operations, as is done in Table 3-3. Highlights in the table include the following.

Customer Impacts and Benefits

- The major benefits to customers of smart cards have included (1) the availability of features such as registration/balance protection, employer autoload, and negative balance; (2) the ability to use the same card on multiple operators; and (3) the improved convenience of the contactless interface, i.e., the card does not have to be removed from a wallet or purse.
- Potential benefits of smart cards for customers include multiapplication capabilities (e.g., use of the card for nontransit purposes) and innovative fare options (e.g., WMATA's planned Fair Fares strategy, which would guarantee that the customer is paying the "lowest possible fare" for each ride).
- Users of smart cards have expressed generally high levels of satisfaction with the cards and programs. For instance, in Chicago, 93% of survey respondents were satisfied or very satisfied with the cards, and 86% expressed willingness to continue using the card after the conclusion of the pilot period and to recommend the card to others. In the TransLink program, both survey respondents and focus group participants expressed a high level of satisfaction with the program. Moreover, two-thirds of noncard users surveyed said that they are "very likely" to try the card. Sales of the SmarTrip card in Washington has grown steadily since its introduction, despite the fact that WMATA has done very little marketing of the program.
- In contrast to the use of magnetic cards, customers must often pay an initial fee to acquire a smart card. This cost is $5 in Chicago and Washington. There is no charge in the Go Ventura and TransLink programs (at least for the TransLink pilot), but a customer must pay $5 for card replacement and balance protection in these programs. The $5 charge was the aspect of the program liked least by survey respondents in Chicago (cited by 30% of respondents). The charge reportedly has not been an issue in Washington to-date, although expansion of the program to buses could conceivably produce some complaints.

Agency Impacts and Benefits

Due to the short time frame and limited scope of all of these programs to-date, it is difficult to identify significant actual impacts and benefits. There are a number of potential benefits to agencies associated with use of electronic payment in general and contactless smart cards in particular (see Table 3-1), and the case study programs all anticipate such benefits over time as the use of smart cards is expanded throughout each of the transit systems. The major types of impacts and benefits expected for these programs include the following:

- Contactless cards allow faster boarding or throughput than do fare media that have to be inserted or swiped. This could ultimately translate into service reliability improvements (i.e., as higher percentages of boardings are made using contactless cards).
- Higher data capacity and processing capabilities of smart cards facilitate the consideration of innovative types of fare options and the use of data on card usage to improve service planning.
- Smart card capabilities also facilitate convenience features such as autoload arrangements (including employer-based programs). For instance, the SmarTrip (through SmartBenefits) and TransLink programs both include employer autoload programs that make it easier for employers to provide commuter benefits to their employees.
- Smart cards offer the opportunity to include transit and nontransit applications (e.g., parking or retail payments, university or employer ID/access, and other functions) on the same card. For instance, as indicated earlier, the SmarTrip card can currently be used in WMATA parking facilities, and the agency has established pilot projects with First Union Bank and the General Services Administration (GSA). VCTC has established Go Ventura partnerships with a university and with county social service agencies. MTC and CTA both plan to pursue nontransit partnerships as well.

TABLE 3-3 Case study comparison: smart card initiatives

Case-Study Agency/ Name of Program (Year Pilot Initiated)	Chicago Transit Authority/ Chicago Card (2000)	Metropolitan Transportation Commission/TransLink (2002)	Ventura County/ Go Ventura (1994)	Washington Metro/ SmarTrip (1999)
Nature of Program	Smart card pilot; plan for phased full rollout	Regional pilot (6 agencies); plan for use by >26 agencies; plan for multiapplication	Regional smart card system (7 agencies); access-to-jobs, university applications	Smart card use on Metrorail and parking; plan for regional use; multiapplication
Special Features	Negative balance, balance protection	Employer autoload, negative balance, balance protection	Onboard autoload, negative balance, balance protection	Employer autoload, balance protection, "best fare" capability (being considered)
Other Participants	Cubic, clearinghouse operator	Transit agencies, employers, system developer/operator (ERG consortium)	Transit agencies, CSUCI, social service Agencies, Caltrain, SCRRA, ERG	Other transit agencies in region, First Union Bank, GSA, employers, Cubic
Transit Agency Goals of Program	Improved customer convenience, better data	Improved customer convenience, better data, seamless travel	Improved customer convenience, better data, seamless travel	Improved customer convenience, better data, seamless travel
Customer Impacts and Benefits				
Usage rates	3,500 cards used in pilot; plan for 200,000–500,000 in full rollout	7,500 cards issued, about 3,000 used in pilot	2200 cards (mid-2002)	325,000 cards (mid-2003)
Attitude toward program/other benefits	93% "satisfied/very satisfied"; 86% willing to continue to use card; key benefit security of card balance	High level of satisfaction with program in surveys and focus groups; also 67% of noncard-using transit riders said they are "very likely" to try out card, 22% "somewhat likely"	Positive reactions to system; improved convenience through above features	Very popular with riders: steady growth of sales, with no formal marketing
Cost of travel	$5 charge for card; this was attribute liked least	No charge for card, but $5 for balance protection and autoload	No initial charge for card, but $5 for card replacement	$5 charge for card
Agency Impacts and Benefits				
Benefits/advantages	Faster throughput/boarding, lower maintenance requirements; better ridership data	Demonstrated feasibility of implementing multiagency system; greater flexibility regarding fare options	Greater flexibility regarding fare options	Flexibility/opportunities (e.g., for multiapplication, regional integration), faster throughput
Costs/disadvantages	Key disadvantage is cost of cards ($6/card for pilot); little additional capital cost for pilot	Capital costs covered by MTC; minimal operating and maintenance costs in pilot, but will increase in full rollout (e.g., fees)	Little cost to agencies (capital costs covered by VCTC/Caltrans/FTA)	Cost of expansion to bus: $20 million for equipment, plus fees to regional clearinghouse, plus operating and maintenance costs
Constraints/Barriers/Issues				
Economic or political liability	Potential negative impact on revenue (loss of expired value from unused magnetic cards)	Potential negative impact on revenue for BART (loss of expired value from unused magnetic cards)	Problems with pilot, but these were addressed in new system	Potential negative impact on revenue (loss of expired value from unused magnetic cards); potential political (equity) issue regarding provision of smart cards only on bus
Technical or institutional barriers or issues	None; card readers preinstalled in AFC equipment	Integrating readers into existing equipment, developing fee structure; problems with hand-held readers (for POP)	Pilot had equipment reliability and various institutional challenges	Whether to provide magnetics on bus; whether to to provide only smart cards

Agency Cost and Revenue Impacts

With regard to costs associated with smart card implementation and operation, limited data were available for these programs; however, it must be kept in mind that all of these efforts represent relatively small portions of the agencies' overall fare collection systems. In two of the examples (TransLink and Go Ventura), the bulk of the costs are being covered by the regional planning agencies, using largely federal and state funds. General cost estimates for procuring and implementing both smart card and magnetic farecard systems are presented in Appendix C. Cost information identified for each of the case-study programs can be summarized as follows:

- In Chicago, the card-reading equipment had already been installed (as part of the original AFC system). Thus, the major costs associated with the pilot project were for the purchase of the cards themselves ($6 apiece for the initial order; $5 apiece for the subsequent order) and expenditures related to market research.
- In Washington, the card cost was initially $10 (for the pilot), but subsequently dropped to under $5 apiece. The costs associated with the expansion of SmarTrip to Metrobus will include capital costs for card readers and supporting equipment (e.g., computer systems, spare parts). The total capital cost, including the cost of new fareboxes, is approximately $20 million. However, fareboxes would be needed whether or not SmarTrip was to be expanded; thus the entire cost cannot be attributed to SmarTrip. Additional costs for the regional expansion of SmarTrip include the expenses associated with the regional clearinghouse; the methodology for allocation of these costs had not yet been determined as of this writing. (Maryland MTA will experience the same types of costs for its components of the SmarTrip program.)
- In Ventura County, the contract with the vendor of the Go Ventura system was approximately $1.8 million. With regard to the cards, the initial order price for the dual interface cards was $8.50 apiece. These costs were covered through capital grants from the California Department of Transportation and the Federal Transit Administration (FTA). The agencies' revenue collection and management costs reportedly have not been significantly affected to-date. VCTC, however, has incurred additional costs in managing the project. In particular, a new data manager has been hired to handle analysis and reporting functions.
- For TransLink, the capital cost (i.e., including system development and provision of initial equipment) through the end of the pilot phase was roughly $22 million; the capital cost for full system rollout is expected to total another $25 to 30 million. The operating expense for the pilot was on the order of $750,000; the total full system operating cost is projected at $8 to $14 million per year, depending on the level of usage of the cards and the nature of the fees collected; the specific type of fee payment arrangement for operating costs had not yet been developed for the full program rollout as of this writing. While MTC has covered all capital costs and the bulk of the operating costs to-date, most of the individual transit agencies have reported some expenses as part of their participation. As noted in the evaluation of the pilot program, the types and levels of detail on costs reported by the agencies varied widely and did not necessarily correlate with either the types of equipment installed or the level of usage of TransLink cards (*6*). These costs ranged from under $2,000 per month (for Golden Gate Transit) to approximately $20,000 per month (for BART). Agencies' costs were predominantly listed under categories such as equipment-related, administrative, or revenue and financial services.

  The TransLink evaluation report also presented estimates of potential cost savings for several of the transit agencies involved in the pilot phase. In each case, these savings assumed extensive system-wide usage of the smart cards and replacement of much, if not all, of the agency's existing paper fare media. The savings would thus result from eliminating the agency's own cost of producing and distributing fare media in favor of central procurement and distribution by the privately operated service center/clearinghouse. The estimates of potential annual savings for each agency reported in the evaluation ranged from roughly $500,000 to 1,000,000, on the order of 50 to 60% of current annual fare media production and distribution costs. Of course, it must be kept in mind that not all of the agencies' own costs will be completely eliminated in these cases, but rather replaced by some type of fee (e.g., per transaction) paid to the service center. Thus, it remains to be seen how realistic these estimates prove to be.

Constraints and Barriers and Issues.

Besides the capital and operating costs associated with these programs, these agencies have faced, or may face at some point, certain economic or political liabilities as well as technical or institutional barriers in implementing and operating smart card programs. Key liabilities and other issues affecting the case-study programs include the following:

- A potential economic liability facing all of the agencies that currently utilize stored-value magnetic farecards (CTA, WMATA, and BART) is the loss of expired-value revenue associated with unused farecards. WMATA and CTA each estimate that they accrue at least $3 million in expired/unused value each year. In converting customers from magnetic farecards to smart cards, the agencies stand to lose some of this unused revenue. In contrast to the disposable nature of paper magnetic farecards, the

purchase fee and registration process ensures that most smart cards will be retained and reloaded time after time, effectively eliminating the possibility of expired value. As such, these smart card programs will result in reduction of this unofficial source of revenue.

- The guaranteed lowest fare strategy, Fair Fare, under consideration by WMATA and Maryland MTA could also have a negative impact on fare revenue—though it should also result in some increase in ridership. As explained earlier, the strategy essentially converts rides that would otherwise have been paid for from stored value to free rides once the rider has reached the threshold usage level to have the card be read as a pass. The extent of revenue loss, if any, will depend on the exact structure and pricing of the program (e.g., number of rides needed to reach certain pass levels, pass breakeven levels) at each agency, as well as the number of riders using the strategy versus purchasing passes from the outset.
- For WMATA, there is also a potential political liability associated with the plan to continue charging an initial fee for obtaining the SmarTrip card when the system is expanded. While this approach has not been an issue for Metrorail riders, the situation could change when the program expands to buses, where, unlike on rail, riders will not have the option to use magnetic farecards (at no initial cost) to obtain the discounts or bonuses attached to use of electronic fare media. This situation, coupled with the fact that the bus market tends to be lower income than the rail market, could conceivably generate equity-related complaints from riders or from community organizations representing riders. Hopefully, WMATA will be able to avoid such complaints by providing free (or very low-cost) cards to low income riders and by educating these rider markets as to the benefits to be received by buying the card (e.g., registration and replacement of value if cards are lost).
- A major technical constraint facing all of the agencies seeking to add smart card capability to an existing fare collection system is insuring compatibility with the existing system. For instance, in an effort to facilitate installation of the SmarTrip readers into the Metrorail faregates, WMATA opted to sole source the implementation to the existing rail fare collection vendor (Cubic). CTA has avoided this issue, since smart card capabilities were built into the original AFC equipment; of course, in order to take advantage of the preinstalled card readers, CTA also had to sole source the provision of smart cards to Cubic. In TransLink, developing a strategy for integrating the ERG smart card system into the BART faregates being provided by Cubic has proven to be a significant challenge.
- Development and implementation of the regional smart card programs has required the establishment of often complicated agreements among the various participants on a broad range of institutional, financial, technical, and operational issues. These include details such as governance framework, cost and revenue allocation and settlement procedures, operator reporting requirements and customer service responsibilities, among others.

Smart Card Issues

As suggested above, there are a number of issues related to the use of smart cards that a transit agency or region must consider. Several of the major issues are discussed further below.

Card Cost Issues

In most of the above smart card examples, as well as in most others around the world, the smart card is intended to supplement the agencies' existing paper or magnetic fare media. The primary reason for this use of multiple technologies is that smart cards are currently much more expensive than magnetic cards or tickets: $1.50 to $10 for the former (depending on card processing and storage capabilities, as well as quantity ordered) versus $0.02 to $0.10.

In order to encourage retention of the smart card—as well as to defray their cost—some agencies have imposed a card issuance charge. The fee charged by WMATA has not proven to be a barrier to demand for smart cards to-date; sales of the SmarTrip card have grown steadily, despite the fact that WMATA has done very little marketing of the card thus far. Moreover, according to the agency, sales have been relatively evenly distributed among various purchaser income levels—including those with very low incomes.

The currently high card cost also makes it difficult for an agency to consider providing smart cards to one-time or occasional riders, since these people will certainly resist paying a purchase fee. To address this issue, much less expensive smart cards, as well as card recycling strategies, are currently being developed by the technology vendors. For instance, ASK SA, a French card-maker, has introduced its C-ticket, a contactless paper ticket intended for one-time or short-term use; ASK actually has two versions of the ticket, one with 64 bytes of memory, the other with 32 bytes. As of mid-2003, these tickets were being offered at a price reportedly as low as $0.20 apiece for very large orders (i.e., at least several million), and around $0.40 apiece for somewhat smaller orders. Paris transit operator RATP began testing these tickets in mid-2002 and may eventually use them to replace magnetic tickets for tourists and other infrequent riders; the paper tickets would thus become part of the family of different types of smart cards to be offered in the Paris regional payment program now being implemented. As of late 2002, over 2 million C-tickets had been shipped to RATP. RATP would like to eventually get the per ticket price as low as $0.05 apiece (i.e., for as many as 100 million tickets per year), although there is skepticism within the industry as to whether

this goal can be achieved in the foreseeable future (*7*). In late 2002, ASK also announced a shipment of more than 2.5 million C-tickets for use on the Italian Island of Capri's transit system; however, even with these low-price cards, riders must pay a deposit (equivalent to U.S.$0.50) to obtain a card. Meanwhile, Philips Semiconductors has introduced its own contactless paper ticket, called Mifare UltraLight; the 64 byte ticket is also expected to sell for an estimated $0.30 apiece in quantities of a million or more. In somewhat smaller quantities, contactless paper tickets are expected to be offered at prices of $0.50 or less.

Another approach is being taken by Sony, which has developed a recyclable contactless token. The plastic tokens are being introduced in New Delhi, India, for use on bus and subway; the system also uses conventional contactless plastic cards, similarly based on Sony's FeliCa technology. Each token will be good for a one-way trip or round-trip. On completion of the trip(s), the token will be inserted into a slot to be recycled.

Cubic has developed a different type of card recycling system for its fare collection system for Singapore. In this system, visitors can use a credit card (in a TVM) to acquire a card good for a day of transit use, including a deposit; when the card is reinserted into the TVM at the end of the day, the amount of the initial deposit is recredited to the person's account. Ascom has developed a similar technology. While such strategies may not eliminate the need to charge regular users for their smart cards, they do offer potential opportunities for providing cards to one-time or occasional users cost-effectively, thereby avoiding the need to provide a parallel magnetic system.

For regular riders, the alternative to charging a purchase fee for a card is to treat the initial fee as a deposit. This is the approach in Hong Kong; the fee is refunded on demand if the card is returned. The basic fee is the equivalent of about U.S.$6, although an option to get balance protection and $4 "overdraft" protection for about U.S.$20 has also been popular. The Octopus card has proven to be very popular in Hong Kong, as the ratio of smart card to magnetic card use has been around 5 to 1.

Smart Card Standards and Interoperability

One of the key smart card–related concerns in the transit industry has been how to promote standardization and interoperability among different technologies. Agencies want to facilitate the availability of multiple sources of cards as they introduce smart card systems. Moreover, in regional systems, the integration of fare payment among multiple agencies requires each of the participants to be able to accept cards issued by the other participating agencies. Thus, it is essential that all participating agencies agree to procure the same system or agree on a common technology standard that insures interoperability if agencies select systems from different vendors. While there exist certain standards for contactless cards, and broader standardization/guidelines efforts have been initiated, the contactless card systems implemented to date have utilized several different types of contactless interface:

- Several contactless systems, beginning in the mid-1990s (primarily in Europe and Asia) have used the "Mifare" interface developed by Mikron, a subsidiary of Philips Semiconductors; the Mifare technology has been licensed to several smart card manufacturers. The Seoul and Pusan systems (implemented by Korean integrators Intec and KDE, respectively) use Mifare-based cards, as does the recently announced Freiburg, Germany, regional system (implemented by Cubic). Other examples include the Ajax and Burlington bus systems outside of Toronto (both implemented by Canadian integrator Precursor). The Mifare technology is also being used in the London Oyster project (along with Cubic's Go Card).
- When Cubic began marketing a smart card upgrade for its magnetic systems in the mid-1990s, it used its own proprietary Go-Card. The WMATA SmarTrip and Chicago smart card systems utilize the latest version of Cubic's contactless communications interface. Cubic has also been awarded contracts to provide cards and equipment for several other systems, including Los Angeles and San Diego.
- Cards for the Hong Kong Octopus system (implemented by ERG) were developed by Sony and represent yet another communications interface. Sony's FeliCa cards are also utilized in transit systems in Singapore, Tokyo, and Shenzen, China, and have been introduced for retail e-purse and credit card applications in Japan as well.
- Regional systems now in place or being implemented by ERG in San Francisco, Ventura County, Seattle, Berlin, Rome and elsewhere are using cards based on a contactless chip developed by Motorola with yet a fourth communications interface. (Most of these contracts were awarded to a consortium of ERG and Motorola. However, Motorola has officially withdrawn from the transit smart card market and ERG has assumed responsibility for all of these contracts.) The same interface is also being used in chips/cards developed by several other companies, including OTI (Israel) and ST Microelectronics (France). This type of card is now being used in several French systems, including Nice and Lyon (both implemented by French integrator Ascom), as well as the Paris regional system.

Contactless card standards have been the focus of the International Organization for Standardization (ISO) 14443 standards development group. At this point, the Mifare and Motorola/OTI/ST interfaces have been adopted as dual standards (Type A and Type B, respectively). Sony, Cubic and several others have sought to have their cards adopted as additional ISO contactless standards, but these proposals have not been accepted thus far.

For a contactless card system to replace some of its components, such as cards, readers or system software, with components from another vendor, several interfaces need to be interoperable:

- The "low-level" electrical details of the wireless communications link need to be compatible (i.e., Type A or B, or, if a proprietary interface, the cards or other components must be from the same vendor).
- The software on the card chip needs to share a common command set and message formatting with the software in the reader, and these software applications must also have shared security codes.
- The software in card readers and revaluing devices must to be able to complete data transfers with the central clearinghouse system.

In light of the lack of a single technology, or even a single standard, vendors have addressed the interoperability issue by developing both cards (actually chips) and readers that combine multiple interfaces. Several multi-interface products have been developed thus far (*8*). Samsung has made a chip that supports Types A and B and can be configured to accept a third interface as well; Infineon has created two chips, one that will support Types A and B and one, a joint effort with Sony, that will support Type B and Sony's FeliCa. On the reader side, as mentioned above, Cubic's "Tri-Reader" is capable of reading Type A, Type B, and Cubic's own contactless cards; the Tri-Reader is being used in London to support Mifare (Type A) and Cubic cards. Several other vendors, including Ascom, ASK, and SchlumbergerSema, also offer multi-interface readers, typically ones capable of reading Types A and B.

Of course, it must be kept in mind that sharing a common low-level interface does not guarantee interoperability; as indicated above, software communications must also be compatible and there must be shared security data. At the software communications level, different suppliers are rarely compatible. Thus, unless they plan to rely on a single vendor, it is important that agencies participating in an integrated payment program agree on a common set of specifications for all smart card system components.

One example of an effort to promote interoperability is the multinational CALYPSO system. Developed by transit agencies in Paris, Venice, Lisbon, Brussels, and Constance, Germany, between 1998 and 2000, CALYPSO is a smart card system standard that can be licensed by any interested agency. It specifies the different aspects of a ticketing transaction between a terminal and a card. Eleven vendors are currently licensed to produce CALYPSO-compatible cards and readers.

There are also several efforts underway to establish industry-wide—or at least regional—system specifications or guidelines for transit smart card applications; these include the following:

- **ITSO.** A public-private partnership of transit operators and government agencies in the United Kingdom, known as the Integrated Transport Smartcard Organisations (ITSO), has developed a specification for the provision of "interoperable contactless smart card transport ticketing and related services in the United Kingdom" (*9*).
- **APTA.** The Universal Transit Farecard Standards Project, sponsored by APTA and FTA, is aimed at developing an industry standard and set of guidelines U.S. transit agencies can use in developing electronic payment systems. A working group consisting of federal government, transit agency, card and equipment vendor, and consultant representatives has been established to pursue development of these standards and guidelines. Initially, a regional fare system "Scoping Study" was conducted under TCRP Project J-6 (Task 42) (*10*). A second TCRP project (A-26: Smart Card Interoperability Issues for the Transit Industry), scheduled to begin in mid-2003, seeks to develop a standard transit smart card application that will facilitate interoperability among different agencies.
- **U.S.DOT/FTA/Volpe Center.** The *electronic payment guidelines and specifications documents* "define a framework for developing and implementing multi-application and other smart card–based transportation payment systems" (*11*). Guidelines documents have been developed to address regional multiagency integration, transit-financial partnerships, transit-university partnerships, and transit-employer partnerships.
- **New York Regional Smart Card Interface Specification.** The Port Authority of New York and New Jersey, in conjunction with other agencies in the region, has developed an "Interface Specification" designed to facilitate interoperability among payment systems implemented in the coming years by the region's transit providers.

Use of Smart Cards in a POP System

Incorporating electronic farecards into a POP system requires the provision of special equipment and procedures that allow the cardholder to properly validate the card for each trip and the inspector to check the validity of the card. The alternative approaches to facilitate use of smart farecards in POP are as follows:

- Modification of TVMs (or installation of separate vending/validating equipment in stations) to allow the rider to use the stored value to buy a validated paper POP ticket for that ride.
- Installation of stand-alone card processing units that will deduct value for a ride and validate the card for that ride but not print out a paper ticket. In this approach, the fare inspectors must be equipped with hand-held card read-

ers; they will then be able to determine whether the rider has paid for the trip (or has a valid pass).
- Contactless smart card readers can be mounted at each door of an LRT car, allowing a rider to "tag on" and "tag off" on boarding and alighting the vehicle.
- In any arrangement in which the inspectors have hand-held units, a cardholder with an electronic pass—rather than stored value—does not have to stop and validate the card at a TVM or card reader on every trip.
- Use of cards (or "sleeves" into which cards can be inserted) containing built-in LCD or LED displays. The rider presses a button on the card to display the fare payment details (e.g., expiration date of a pass, or the date and time of the most recent stored-value transaction), allowing the inspector to verify proper fare payment.

Given the development of new light rail, commuter rail, and bus rapid transit services, the use of POP fare collection is seeing considerable expansion. Thus, many agencies considering introduction of electronic payment must address this issue. In the United States, the smart card systems now in place or being developed in the San Francisco, Los Angeles, San Diego, Ventura County, Seattle/Puget Sound, Miami, Minneapolis, and Washington regions will all have to develop a POP-related strategy, for instance. In most of these cases, provision of in-station card processing units and hand-held readers is the approach being used or proposed. Tag-on/tag-off units are used in several European systems, although fare inspectors also carry hand-held units in some of these locations. In at least one case—the use of Ventura County's Go Ventura card on the Metrolink commuter rail service—the current plan is that the smart card will be used to purchase a paper POP ticket from a TVM.

EMERGING ELECTRONIC PAYMENT APPLICATIONS

As discussed above, the capabilities of electronic payment media and related equipment have allowed the use of fare payment mechanisms to be expanded beyond the single operator. Smart cards in particular are often being used to facilitate multioperator regional payment strategies and are also being considered in a range of multiapplication schemes linking transit payments with one or more other functions.

Regional Payment Integration

As suggested earlier, electronic payment media are increasingly being introduced to serve multiple operators in a region. The objective is to allow the same card to be used for payment on any participating system to facilitate seamless travel within a region. True regional fare integration would entail all agencies adopting a common fare policy, based on regional passes along with free or discounted interoperator transfers. However, the use of electronic fare media effectively permits each agency to retain its own fare structure while agreeing to accept a common fare medium. A rider can thus pay for rides on multiple systems with a single card.

In a smart card system, the rider typically would also have the option to load individual payment instruments (e.g., a pass) from one or more agencies onto the same card. Of course, a smart card could readily support a regional pass as well; the card would track the use of the pass on the different services, permitting allocation of revenue from pass sales among the participating agencies. Finally, a regional smart card could facilitate linked-trip discounts for interoperator transfers.

Of course, establishing a regional payment system is complicated. As explained in the *National Guidelines and Technical Specifications for Electronic Payment Systems*, "Implementing a regional multiple agency payment system will require fundamental changes from the way each individual agency operates on its own. The integration of card/revenue management functions from several agencies can be challenging. Complex partnership agreements must be developed to address responsibilities, ownership, and allocation of costs and revenues. A clearinghouse or payment settlement process can be established to manage these processes, but all participating agencies must come to agreement on revenue management policies and procedures" (*11*).

The types of issues and requirements that must be considered in developing a regional fare system generally fall under the following categories (*11*):

- **Overall Policy and Business Rules.** Establishing the business structure, including the financial and governance framework and system procurement strategy; addressing customer concerns; setting fare policy for the region.
- **Technical Requirements.** Developing system architecture and technology standards;, identifying effective implementation staging.
- **Administrative and Customer Support Functions.** Establishing revenue settlement and data-sharing procedures, as well as customer service functions.

The *National Guidelines* (*11*) describe these requirements. Regional fare system requirements are also discussed in TCRP Report 32 (*2*). Issues addressed in specific regional integration efforts are discussed in the following case studies in Part II: Connecticut Transit, Maryland MTA, TransLink, Ventura County, and WMATA.

Multiapplication Programs

As suggested earlier, the use of electronic payment media offers the potential to combine transit and other types of applications on one card. Chapter 4 provides examples of how magnetic and smart cards can facilitate new types of partnerships between transit agencies and universities, employers, and social service agencies. The growing use of smart cards for a range of uses also provides opportunities for other types of joint payment arrangements. This section discusses issues and emerging developments related to such multiapplication programs.

In discussing these programs, it is important, first of all, to define the term *multiapplication*. TCRP Report 32, *Multipurpose Transit Payment Media,* defines a *multiapplication* card as one that can be used for more than one function (e.g., payment of transit fares, identification, access to banking services, storage of health care records), while a *multiuse* card may carry only a single application, e.g., a stored value, but is accepted by multiple merchants or services (e.g., transit fares, retail purchases, and parking payments) (*2*). In other words, the latter requires only a single purse on the card, while the former may need several separate purses or applications on the card. Thus, these two types of card have different technological requirements (e.g., in terms of type and amount of memory and processing capability in the chip). For instance, a card carrying only a single e-purse can be a "memory card"—with no microprocessor—similar to the prepaid telephone chip cards long used in Europe.

In contrast, a true multiapplication card, with several distinct applications, typically requires more memory and a microprocessor, as well as specialized software capable of handling more than one application. Moreover, at least in the near term, a card that will be used for transit as well as other applications may need to be of the dual interface variety, containing both a contactless and a contact interface. As explained earlier, new developments related to contactless credit/debit applications may eventually obviate the need for a contact interface; however, this will not happen overnight. Regardless of the specific chip technology on the card, any combination of transit payment and other uses has generally come to be called a *multiapplication card;* this term is used in the remainder of this report. A related term, *multipurpose card*, is considered more general, describing both multiapplication and regional farecards accepted by multiple transit agencies. For further discussion of the different terms and technologies, see TCRP Report 32 (*2*).

Current and Emerging Smart Card Applications

Besides transit payments, smart cards can be used in the following types of functions and applications:

- Electronic toll collection (ETC) and parking payments
- Financial services/e-purse payments
- Payphones and mobile commerce
- Other payment and loyalty programs
- Identification, access and security

Electronic toll and parking payments. Several emerging developments are of interest in considering possible transit partnerships with ETC or parking systems. First, new types of toll transponders are being developed that will allow use with a smart card (i.e., the transponder includes a slot for a contact card or a contactless interface). Such an arrangement would allow people to use the stored value on their transit smart cards to pay tolls without having an account with the toll agency. A card-based transponder could also be useful in cases where a single vehicle is used by more than one person (such as taxis and rental cars). Developments in this area include the following:

- Mark IV Industries, which manufactures the transponders used in the E-ZPass consortium and a number of other ETC systems, has developed (in conjunction with Touch Technologies) the "SmartFusion" system. In this system, a dual interface smart card can be inserted into a slot in the transponder; the transponder then communicates with the toll equipment in the same way other transponders do now. SmartFusion prototype equipment was tested with E-ZPass toll equipment at the Palisades Parkway (NJ) toll facility in 2000–2001, but a commercial product has not yet been formally launched.
- EFKON AG, an Austrian company, has developed a transponder operating via infrared communication with toll readers with a contactless smart card interface. This allows use of a contactless card or a dual interface card in contactless mode. This system is being tested in Orlando, FL, as part of the ORANGES project, in a limited number of electronic toll lanes. (ORANGES is a federal operational test of a multimodal payment system that began in late 2002.)

In addition to using smart cards in conjunction with transponders, contactless cards can also be used directly with toll systems, i.e., by touching the card to the reader. This provides the driver the convenience of not having to use cash, but does not allow the fast throughput facilitated by longer-range transponder-based payments and does not reduce congestion at toll plazas. An example of this approach is in Malaysia, where dual interface smart cards (the multiapplication "MyKad" card coupled with the "Touch 'n Go" contactless e-purse) can be used to pay tolls as well as transit fares.

Beyond transportation payments, transponders are beginning to see usage for making purchases. The first test of such an arrangement has been underway since April 2000 in Orange County, CA. As part of this pilot project, drivers with Transportation Corridor Agencies's (TCA's) FasTrak accounts can use their toll transponders (made by SIRIT Technologies) for drive-through lane purchases at four McDonald's restau-

rants in Orange County. The restaurants pay the TCA a $0.25 handling fee for each food transaction. This type of program could potentially be used in conjunction with a transit stored value card inserted into a transponder. More recently, two McDonald's drive-throughs on Long Island started accepting payment with E-ZPass transponders in July 2001 as part of a New York MTA demonstration program. A similar test has been initiated in the Dallas area.

Parking meters in a growing number of cities are being equipped to accept smart cards, making it unnecessary to have exact change for a meter; smart cards can also be used in some parking lots. Card-accepting meters can be programmed to allow the user to pay only for the length of time a car is parked rather than the driver's having to guess in advance how much to pay. In New Britain, CT, for example, parkers initially select the length of time they wish to park and prepay accordingly; however, someone returning earlier than anticipated can insert the smart card in the meter and have the unused difference restored to the card. Examples of smart card-based parking applications linked with transit usage are as follows:

- In Washington, DC, WMATA's SmarTrip card can be used at the agency's rail station parking lots.
- In Orlando, the ORANGES project involves a central stored-value purse system to link transit, parking, and toll payment systems in the region. Payment transactions completed with the smart card readers operated by individual agencies are to be transmitted to the ORANGES clearinghouse for reimbursement. The plan is that smart card revaluing devices operated by any of the agencies will ultimately be able to be used to add to someone's ORANGES stored-value account balance.

Given that the payment requirements for parking meters and transit are similar (i.e., the need for exact payment at a device that does not give change), there is a clear opportunity to link payments for these modes on a single stored-value card. Existing smart card parking meters have been designed to accept only contact cards, thereby requiring the use of dual interface cards. As of this writing, the major parking meter manufacturers (e.g., Duncan, Mackay, NS POM) have not yet introduced meters equipped for contactless smart cards to their product lines. However, development is reportedly under way on contactless meters; and, indeed, a contactless interface should ultimately be more reliable than a contact interface, especially in cold climates, where card slots can become jammed with ice. Regardless of the type of card needed, as the use of smart cards for both modes expands, there is likely to be an increase in integration.

There could also be growth in the linking of transit and toll payments, e.g., through the use of card-accepting transponders. However, at least in the near term, such integration is probably more likely to take the form of accessing a common "transportation account," but not necessarily using the same payment medium. In other words, a customer would set up an account, either tied to a credit card or through some type of prepayment, much like the typical ETC account; this account could then be used for ETC payments as well as to automatically replenish the stored value on a transit/parking card. Since the ETC transponder remains in the car, there would be no need for someone with a central account to insert a smart card into the transponder. As suggested above, the purpose of a card-accepting transponder would be to enable someone without an account to use ETC or to facilitate use of a car/transponder by more than one person.

Financial services/e-purse payments. The smart card focus of U.S. financial institutions has changed somewhat over the past several years. As discussed in TCRP Report 32 (*2*), Visa, MasterCard and some banks at one point envisioned widespread growth of general purpose e-purse cards such as Visa Cash and Mondex. However, trials of Visa Cash in Atlanta during the Olympics in 1996 and both Visa Cash and Mondex on the Upper West Side of Manhattan in 1997–98 failed to attract significant interest from either consumers or retailers. The use of an e-purse as a replacement for cash for small retail purchases simply does not seem to have the appeal originally envisioned by the financial institutions.

However, in the past couple of years, U.S. financial institutions have shown renewed interest in smart card technology in general. American Express and Visa (through several member banks) now issue smart cards—though they each continue to have magnetic stripes as well—targeted primarily to secure use of the Internet. As of mid-2002, an estimated 12 million Visa cards and 3 million American Express smart cards had been issued in the United States. MasterCard has also introduced its OneSmart card that can be issued by interested member banks. Citibank, for example, began taking orders for its MasterCard CitiSmart cards in late 2001.

When combined with a card reader, cards such as the Amex Blue Card and the Fleet Fusion Card can be used for anonymous small value purchases or for increased security when making purchases on the Internet. These and other issuers have announced the intention to add loyalty programs and eventually credit and debit functions to the chip. Meanwhile, financial institutions are also partnering with specific retailers to issue branded smart cards that offer special discounts or loyalty rewards to users. For example, Target Corp. has issued nearly 9 million Visa smart credit cards, which can be

used at Target stores equipped with readers; Target had begun the process of installing some 37,000 smart card readers in 1,000 stores by late 2002 and expects to offer electronic coupons through the cards in 2003.

In contrast to the United States, e-purse programs are widely available in other parts of the world (*12*). There are more than 80 different e-purse systems currently operating in 40 countries. These include international "brands" such as Visa Cash and Clip, as well as schemes that are affiliated with specific countries (e.g., Danmont in Denmark). There are multiple competing schemes in a number of countries (e.g., Chipper and ChipKnip in the Netherlands, and Geldkarte and PayCard in Germany). To further complicate the situation, several systems that originated as country-specific schemes have been adopted in other countries as well. For instance, the German Geldkarte e-purse is now issued by several banks in France (under the name Moneo), and was recently selected as the purse to be included in cards to be issued by the Modeus transit card consortium in Paris. Finally, a number of smart card technology platforms, such as Belgium-based Proton and Finland-based Setec Oy, offer e-purse systems that can be included as standalone applications on multiapplication cards (e.g., issued by a transit agency or telecommunications company) or under other brand names. There have been several efforts to promote interoperability among e-purse systems. The latest initiative is the adoption of the Common Electronic Purse Specification (CEPS) by a number of major e-purse issuers, including Visa, American Express, Europay, Proton World, and several European banks. CEPS is designed to create an open global standard for e-purse smart cards, and has defined card and device applications, interfaces, data elements and messaging formats for e-purse schemes so as to allow cardholders to use compliant cards throughout the world. Of course, the advent of a common currency across Europe has considerably reduced the need for international e-purse specifications such as CEPS.

The use of the European e-purse schemes has actually shown dramatic increases in the past couple of years, i.e., since the introduction of the euro (*13*). Usage of most of the e-purse schemes had been generally disappointing, with many struggling since their introduction. Recently, however, more and more consumers have begun to use e-purses for small transactions rather than carry small euro coins.

While a number of European e-purse products can be used to purchase transit fare media, direct use of e-purse programs for transit fare payment has seen the greatest advancement in southeast Asia. As explained earlier in this chapter, the Octopus card in Hong Kong contains an e-purse that can be used for purchases in convenience stores and supermarkets, and there are two different bank-sponsored multiapplication schemes involving transit in Pusan, South Korea. In Daejon City, South Korea, Hana Bank will be issuing a dual interface card containing a Visa Cash e-purse that can be used for a variety of applications, including transit fares; about half of the cards will also include Visa credit functionality. In Japan, an association of 39 transit operators in the Osaka-Kyoto-Kobe region has awarded a contract for dual interface smart cards to JCB, the nation's largest card issuer. The cards will also include credit functionality, and JCB has begun recruiting merchants along transit routes to accept the cards for purchases. Finally, in Singapore, the transit agency is working with a bank to establish a partnership to co-issue a dual interface MasterCard that can be used in the EZ-Link smart card-based transit payment system.

One of the more significant aspects of several Asian e-purse programs is that they use (or plan to use) a contactless interface for nontransit transactions. All Octopus Card uses are currently contactless, and developments are underway in Pusan to switch all applications ultimately to the contactless mode. Another e-purse program, the nationwide Edy system in Japan, also operates in a contactless mode. While the Edy system does not currently extend to transit, it is based on the same Sony technology utilized in the Octopus system and thus could be combined with transit applications in Tokyo and elsewhere. Edy is operated by BitWallet, Inc., a consortium of banks, telecommunication companies, and technology vendors headed by Sony that also includes NTT DoCoMo (a major telecom carrier) Sumitomo Mitsui Banking Corp., Bank of Tokyo, Toyota, Fujitsu, Mitsubishi, and KDDI (a telecom).

In the United States as well, the aforementioned Visa and MasterCard plans to issue contactless credit/debit cards could well facilitate greater collaboration between banks and transit agencies. While the card associations intend to focus initially on applications such as fast food and convenience store purchases, transit applications could be added. MasterCard, along with Citibank, JP Morgan Chase, and MBNA, initiated the 6-month "PayPass" pilot project in Orlando, FL, in January 2003. The three banks planned to issue 15–20,000 credit cards (containing both a Type B contactless chip and a magnetic stripe) during the pilot; and a number of merchants had been recruited to participate, including Friendly's restaurants, Chevron service stations, Loew's movie theaters, and Wolf and Ritz camera shops. MasterCard had previously tested the card with its employees in the cafeteria at its corporate headquarters and found that the use of credit cards for payments there rose from 2% to 28% (*14*).

Bank-sponsored e-purse programs may eventually see acceptance in this country as well, although it is widely felt that an e-purse card would be of greater interest to both consumers and merchants if combined with applications such as transit and parking meter payments—i.e., applications that require prepayment using exact payment amounts. In the Atlanta Visa Cash project, while the cards saw relatively little use overall, transit represented the largest single use; moreover, one assessment of the Manhattan trial was that it might have been much more successful had it included transit as an application. Thus, as smart cards see greater use in transit and other markets, we may begin to see transit agen-

cies accept bank-issued e-purse cards or include commercial e-purse schemes on transit farecards.

In the meantime, banks may also seek to partner with transit agencies in other ways. For instance, WMATA and CTA have each pursued agreements with local banks related to the issuance of fare media:

- In April 2000, WMATA and First Union Bank initiated a pilot project involving the combination of WMATA's SmarTrip contactless transit application and First Union's magnetic ATM application in a single card. These cards, issued to about 1,000 interested First Union account holders, allow the users to load value from their ATM accounts into the transit chip at WMATA automated vending machines. As of late 2002, this trial was continuing. (The future of this program was cast in doubt with the 2002 purchase of First Union Bank by Wachovia Bank. While the existing cards could continue to be used, Wachovia had shown [as of mid-2003] no inclination to issue new bank cards carrying the SmarTrip application.)

- The CTA has established a preliminary agreement with LaSalle Bank to conduct a pilot project to vend CTA's magnetic stored-value cards through LaSalle ATMs at a dozen downtown and inner suburban locations. The plan is that a person buying a transit card will be required to have an account with the bank, at least during the pilot project, as the cost of the card will be withdrawn from the purchaser's bank account. (As of early 2003, this project had not been approved by the CTA's Board of Directors.)

Payphones and mobile commerce. Smart cards have long been used in Europe for payphones, and several U.S. telephone companies, such as GTE and U.S. West, have now begun equipping payphones for smart card acceptance in this country as well. Meanwhile, telecommunications companies around the world are starting to develop multiapplication programs, both for payphones and for personal mobile phones. In Mexico, for instance, a large smart card system (6 million cards are planned) is being rolled out for use in Tel-Mex payphones and for retail and fast food purchases; it will be possible to reload the cards via the payphones, a well as at bank ATMs and stand-alone kiosks. Those cards issued to Banco Inbursa customers are also being equipped with chip-based credit/debit functionality. In South Korea, SK Telecom (SKT) recently joined with five banks to launch a multiapplication card that will include the Visa Cash e-purse and a credit or debit application; several of the banks also plan to offer a contactless transit application, and other functions being considered include loyalty and Internet security applications. All three of South Korea's telecoms—SKT, LG TeleCom, and KT Freetel—have also recently announced strategies for mobile phones. These programs involve special dual interface smart cards for mobile handsets and, in some cases, credit applications stored in the handsets themselves; two of these programs will include transit applications, as is described further in the example below.

Smart cards are also being used as subscriber identity module (SIM) cards with certain types of mobile phones. Each SIM card contains unique user identification features, allowing the card to be used with any compatible device (freeing the cardholder from reliance on a single phone). SIM cards are most widely used with Global System for Mobile communications (GSM) phones; GSM is the dominant mobile phone architecture in Europe, but is not currently supported in the United States. However, SIM-type cards are also being introduced for other cellular architectures, such as CDMA (widely used in Asia) and TDMA (the most common format in North America).

Some of the more recent SIM cards use a larger amount of memory and support additional applications—one of which can be a small web browser suited for use with web sites equipped to communicate using the Wireless Applications Protocol (WAP). Although initial consumer reaction has been generally lukewarm to browsing under the limitations of the small display, some mobile service providers in Europe now use SIM applications to allow the customer to purchase items viewed at WAP sites. Typically, the customer uses the mobile phone to enter a PIN, which is authenticated over the phone by the SIM payment application. The SIM card then uses the phone to authorize the WAP site to complete the purchase (e.g., using prestored credit or debit card information, adding the value to the mobile phone bill, or deducting from a prepaid balance).

In the general area of mobile commerce (commonly called m-commerce), a possibly significant development is that four of the major international card companies, Visa International, MasterCard International, American Express, and JCB Co. (Japan), have recently established a joint mobile commerce group to facilitate wireless card-based transactions. The nonprofit Mobile Payment Forum is seen as linking the financial and mobile communications industries and will seek participation from a full range of merchants, vendors, and system operators.

Several recent technological m-commerce developments are of direct interest to the transit industry; these include the following:

- As indicated above, South Korean telecoms KT Freetel (KTF) and SKT are introducing m-commerce schemes for mobile phones that will include transit applications (*15*). KTF planned to launch its "K-merce" system by the end of 2002. The system will include a credit application (via credit card issuers Kookmin Bank or BC

Card) either embedded in the handset or stored in a dual interface card that will let customers pay transit fares that are then billed to the credit account; the alternative mechanism will be to reload the transit purse wirelessly and pay the fare from the purse. SKT's m-commerce scheme, also scheduled to be rolled out in late 2002, will also allow transit fare payment via a dual interface card used with a mobile phone. A third-generation mobile phone operator, KT ICOM, also plans to include a transit application—via an embedded contactless chip—in its new system planned for late 2003.

- A mobile transit ticketing system was tested in 2001 in Helsinki, Finland, that allowed purchase of transit tickets via mobile phones using the Short Message Service (i.e., text paging). In this system, developed by PlusDial MTSP and Add2Phone, the user requests and receives an electronic ticket on the phone. The ticket (displayed on the phone's screen) is then shown to the transit operator as proof of payment; the system also provides for checking service schedules via the phone. The initial test of this technology was very successful, and HKL (the Helsinki transit agency) planned to conduct further testing as of early 2002.
- A related m-commerce technology strategy being produced by smart card system developers OTI and Funge Systems will also facilitate contactless downloads and payments via mobile phones and PDAs. The user will load funds online or via telephone to a SIM-type card. The "smart phone" can then be used for purchases at compatible contactless point of sale devices, such as transit ticket vending machines. To obtain a transit ticket—or an item from another type of vending machine—the user will only have to hold the phone or PDA near the contactless reader (i.e., like using a contactless smart card); the cost of the ticket will be automatically deducted from the value stored in the phone or PDA. Thus, a secure off-line transaction will be feasible without the need for a phone call to authorize the purchase.
- In 2001, the Japanese mobile phone network operator NTT DoCoMo conducted a 6-month trial of a PDA-based m-commerce system in Sapporo. The PDAs contained Sony contactless chips, which carried an e-purse. The unit could be used to pay for subway fares, vending machine purchases, and other purchases, such as concert tickets. NTT DoCoMo, along with other mobile telecoms, is also involved in negotiations with JR East Rail in Tokyo to store the Suica fare payment application on miniature contactless smart cards that would be used with mobile phones.

Thus, transit fare payment would appear to be a natural application of m-commerce schemes. As emerging short-range wireless technologies such as Bluetooth begin to see wider usage, m-commerce strategies should expand as well; the emerging Bluetooth standard would allow payment applications in PDAs to communicate about thirty feet, a longer range than a contactless smart card interface can transmit.

Other payment and loyalty programs. Beyond bank-sponsored e-purse initiatives, a variety of other types of payment purchasing and loyalty program applications also offer potential tie-ins with transit payment. For instance, smart cards have been used by sports arenas, movie theaters, and other entertainment venues for such functions as ticketing, purchase of food or merchandise, and loyalty rewards programs. The County of Honolulu, for example, plans to implement a smart card system that can be used for transit and attractions, such as the local zoo. The City of Anaheim has received proposals to develop a smart card system for the Anaheim Resort; the purpose of this card is to give visitors access to the privately sponsored Anaheim Resort Transit system, facilitate point of sale retail transactions, and provide for other resort-related uses.

As indicated above, smart cards are being promoted as a means of providing secure online transactions, e.g., over the Internet via personal computers. This requires a reader attached to the computer, through either a wireless or direct connection. Smart cards are also seeing use with digital television set-top boxes; the cards are used for pay-per-view and for identification purposes. Meanwhile, some companies have introduced smart cards as digital gift certificates; for instance, Sony Canada offers such a card, and Rite Aid has tested this concept in its pharmacies, in the United States. Finally, smart cards have been used by various other types of entities that require low-value cash payments or exact change; examples include laundromats, vending machines, and copy centers. One example of a laundry industry card is the Speed Queen CardMate Plus program; this proprietary card can be used instead of coins to pay for washers and dryers operated by HOF Laundry Systems in the Washington, DC, area (*16*).

While such applications typically use cards as the payment medium, electronic commerce programs are also being introduced using noncard media. The m-commerce strategies discussed above represent one approach; another is the use of radio frequency identification (RFID) key fob devices, such as the ExxonMobil Speedpass. Speedpass, which is linked to a user's preregistered credit or checking account, has been available for buying gasoline at Mobil and Exxon stations since 1997; as of early 2003, more than 6.5 million Speedpasses had been issued and could be used at nearly half of the 16,000 Exxon and Mobil service stations; it is estimated that as many as 20% of transactions at these stations are being made with the device (*17*). Speedpass's functionality has recently been expanded, as the device can now be used to pay for purchases at 440 McDonalds' restaurants in Chicago. Speedpass is also being tested in several Stop and Shop supermarkets in Massachusetts, with plans to eventually expand to all of the company's stores; the Stop and Shop pilot is testing out a new feature in which retailers can operate their own loyalty programs. ExxonMobil plans to further

expand the use of Speedpass, as it has established a subsidiary (Speedpass Network) that is pursuing partnerships with grocery stores and other merchant chains (*18*).

Other fuel companies, including Shell Oil ("EasyPay") and Phillips Petroleum ("Philpass"), have also tested their own versions of the contactless device, although Shell has apparently ended its RFID testing in the United States (*19*). Meanwhile, a number of independent station owners have installed a similar system, provided by Verifone, called Veripass. Veripass differs from the other devices in that it has a smart card-type chip (provided by OTI) that can accommodate a loyalty program and other applications; Speedpass, produced by Texas Instruments, has limited memory and no processing capabilities, carrying only an ID number that ties the device to the user's account. Either technology could conceivably be deployed for transit payment, but, while a device such as Veripass could be configured to carry a prepaid transit application, a Speedpass-type device would have to operate in a postpayment mode (*18*).

Identification, access, and information. In addition to payment-related applications, smart cards and other chip-based devices are used for a variety of identification, access, and information functions. There has been some activity in security-related smart card areas over the past few years. However, the terrorist attacks of September 11, 2001, have created a renewed focus on the security and identification capabilities of smart cards. As indicated earlier, secure Internet access has been a key focus of cards issued by several financial institutions. However, smart cards are also seen as an excellent medium for providing identification and secure access in a range of other environments, including computer networks, airports, and government facilities. For instance, as companies and agencies develop public key infrastructures (PKIs) to ensure network security, smart cards can be used to carry digital certificates or private "keys" that employees need to access networks. Thus far, the federal government has been the major user of PKIs, but use by private companies is expected to grow.

Smart cards are also being considered, often in conjunction with biometrics, for providing various types of personal identification; among the suggested applications have been a "national ID card" for all U.S. citizens and a "trusted traveler" card for use by frequent travelers (i.e., to facilitate quicker passage through airport security checkpoint). The idea of any type of mandatory ID card is a controversial notion and has engendered strong opposition in Congress and in the Bush Administration, primarily due to privacy concerns. However, a voluntary ID card, such as the frequent traveler card, is less controversial, and has sparked interest among business travelers and the airline industry. In fact, several airlines and airports are reportedly working on developing a trial of the concept (*20*). In Canada, a smart card is under development by government agencies that will utilize iris-recognition technology to expedite identification of cardholders at customs and immigration booths in major Canadian airports. Similar cards have been proposed by U.S. airlines and government officials.

Federal agencies in the United States have actually begun to issue cards for access, identification, and other purposes. The GSA awarded a $1.5 billion Government Wide Acquisition Contract to five companies (EDS, Logicon, PRC, 3-G International, and KPMG Consulting) in May 2000 for the delivery of smart cards to federal agencies, and the GSA has been testing smart cards for its own employees since 1999. For a multiapplication trial initiated in August 2000, 100 dual interface cards were issued to GSA employees. Each of these cards included the WMATA SmarTrip transit application, contactless building access, biometric network access, medical emergency information, digital signatures for signing e-mail, and credit card capabilities. As of 2002, this trial remained in progress. The Department of Defense, beginning with the Navy, is in the process of issuing what could turn out to be as many as 4 million smart cards to employees and contractors; these cards provide for identification and secure building and network access and can also be used for some purchases. Finally, the U.S. Transportation Security Administration (TSA) has proposed a Transportation Workers Identification Credential (TWIC) card for all transportation industry employees. TSA planned to conduct a 5-month pilot beginning in mid-2003 to evaluate alternative card technologies (smart card, optical memory card, magnetic stripe, and bar codes), followed by a 7-month prototype development phase. TSA would then roll out the TWIC as early as 2004.

One of the newest uses of smart (and RFID) cards in the United States is to access vehicles in emerging car-sharing, or short-term auto rental, programs. These programs, run by companies such as Zipcar, Flexcar and Carlink, allow registered participants to rent a car by the hour; the cars are typically distributed among several locations in an urban area, perhaps including one or more rail stations. The companies provide registered users with smart cards or RFID devices that can unlock the cars' doors; similar companies in Europe also use smart cards to start the car. Given transit agencies' growing interest in issuing smart cards, car-sharing companies see a natural link with transit card programs. In fact, WMATA has considered entering into a partnership with Flexcar, Inc., allowing transit riders to use their SmarTrip cards to access the company's cars. The company is reportedly pursuing similar partnerships with other transit agencies as well, and the other car-sharing companies are similarly discussing possible partnerships with transit agencies in other locations (*21*).

Other purposes proposed for smart cards include improving the functionality of driver's licenses and providing for the convenient storage of individuals' health records. Several states have investigated automating driver's licenses, although none have made the move to smart cards as yet. Utah and New Jersey each proposed smart driver's license programs, but failed to get them approved by their state legislatures. Other states, including Maryland and Connecticut, have also studied this option. At the national level, a push for a standardized driver's license by the American Association of Motor Vehicle Administrators (AAMVA) has met with strong resistance from Congress, leaving any advanced technology strategy up to the individual states. In Canada, the Province of Ontario has announced plans to establish a card for all residents that would include the driver's license, as well as health records, birth certificate, and possibly other applications. Meanwhile, smart cards have been used extensively for maintaining health records in other parts of the world, including national programs in Germany (the system also covers Austria), France, Italy, and Taiwan.

Multiapplication Program Business Strategies

A transit payment application could conceivably be linked to one or more of the above functions through one of the following basic strategies:

- Allowing expanded use of the transit stored-value purse (e.g., for small retail purchases).
- Adding one or more other applications to the transit farecard.
- Including a transit application on another entity's smart card—or allowing a commercial e-purse scheme to be used for transit payments.

Thus, a key set of issues to be addressed in establishing a multiapplication arrangement relates to the nature of the business structure, including the financial and governance framework and the system procurement strategy. Such programs may involve complex partnership agreements that clearly lay out each party's position with regard to responsibilities (e.g., for card issuance, account settlement/clearing, data reporting), system ownership, allocation of program costs and revenues, and card branding and other contractual terms/conditions. (For a discussion of these issues, see the *National Guidelines (11).* Modules in this study most relevant to this section include the *Transit-Financial Module,* April 1999, the *Transit-Financial Collaboration Requirements Module—Summary,* August 2000, and *Smart Card Based Transit Fare Collection System Requirements—Overall Summary,* August 2000.

Also at issue is whether the multiapplication program will be established as an open or closed system or some variation thereof. These approaches can be defined as follows (*2*):

- The term *open system* is defined in different ways, although a truly 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. However, the term "open" is also frequently used, particularly in the transit industry, to describe a payment system in which an outside entity's (e.g., a bank) card is accepted for use by a transit agency (or other type of entity).
- 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 instance; other examples include a university campus card or a prepaid telephone card.
- A *closed multiapplication system* is emerging. In such a system, a transit agency's card can be used for more than one purpose. The integrated regional farecard or the expanded use transit card represents an example of such a system.
- An *intersecting closed system* is one in which one type of card carries another type of closed system application; an example is a university card that is loaded with a transit application.

As noted in TCRP Report 32, "Clearly, there is something of a continuum between open and closed; moreover, a system may well evolve from closed to open. For a transit agency, however, the key distinction is whether it is (1) issuing its own card or (2) accepting a card issued by one or more nontransit entities" (*2*). In other words, if a rider can use a card issued by a local bank to ride transit, this can be considered an open system.

The most common type of open payment system is the basic *e-purse* scheme, mentioned above. There are several different business models through which a transit agency—or a regional consortium—could participate in an open system:

- The agency could be a "merchant" service provider in an open system program. In this model, the transit agency would typically pay fees for fare transaction settlement.
- The agency could be a card issuer and a service provider in an open system. Issuer fees would offset service provider transaction fees, but the agency would also carry the various financial risks associated with being an issuer in an open system. This model is unlikely in a Visa- or MasterCard-sponsored system, since card issuance in such systems is limited to association members, all of which are typically banks.
- The agency or consortium could develop and operate an open system of its own. The agency would typically be an issuer and a service provider in this system and would also allow other entities to issue or accept cards, provided they met the basic program requirements. In this approach, the agency would carry the risks associated with both issuer and system operator.

Given the risks associated with becoming an open system issuer and operator, it is expected that most transit agencies would be reluctant to assume such a role. Thus, the first model, participating as a merchant/service provider only, is a much more likely form of transit participation in an open system for the foreseeable future.

Summary: Multiapplication Programs

The introduction of electronic payment media, particularly smart cards, presents transit agencies with opportunities to link transit fare payment to a range of other uses. The focus in many types of programs is increasingly on providing multiple functions on a card; transit fare payment is often considered an important application, regardless of the primary use and issuer of the card. New types of transit agency partnerships can now be considered with toll and parking systems, employers, universities, financial institutions, telecommunications companies, and various other entities that could issue or accept a smart card to access or pay for their goods or services.

As indicated above, several U.S. transit agencies are testing—or at least plan on pursuing—multiapplication arrangements. For instance, WMATA's SmarTrip card can be used for certain parking applications, and the agency is involved in trials of integration with a bank and government agencies, as well as plans to partner with a short-term auto rental program. LYNX in Orlando (FL) is involved in development of a multimodal payment system. Ventura County (CA) has implemented an integrated regional smart card system and is developing a plan to tie it in with a local university. TransLink in the San Francisco Bay Area plans to pursue links to parking and other functions. Other regions developing integrated electronic payment systems (e.g., Seattle, Los Angeles, San Diego, Boston, and Atlanta) are also likely to consider multiapplication opportunities. Meanwhile, a number of projects abroad have established various types of multiapplication arrangements in which transit is a major focus. For instance, in the Hong Kong Octopus system, the Octopus card is accepted by Watsons and 7-Eleven convenience stores, Starbucks coffee shops, vending machines, and designated parking meters and payphones.

Such projects demonstrate the broad range of both institutional and business settings and potential combinations of functions that can be included in a transit-oriented multiapplication program. As the use of smart cards for both transit payment and other purposes spreads in the United States in the coming years, the opportunities for linking multiple applications on a single card should show considerable expansion.

CHAPTER **4**

EMERGING FARE-RELATED ISSUES AND PROGRAMS

INTRODUCTION

As suggested in the previous chapters, fare policy and pricing initiatives are increasingly influenced by developments related to a range of issues and opportunities to establish various types of partnerships. Key issues and partnership opportunities include the following.

- **Environmental justice.** The movement to insure that all population segments are treated equitably with regard to environmental issues is increasingly encompassing and affecting the fare decision-making process.
- **University programs.** Many universities have established partnerships with local transit agencies to provide specially priced passes or other payment options to students, faculty, and staff.
- **Employer benefits programs.** In conjunction with the allowance of pretax employee transit benefits ($100 per month per employee as of January 2002), several types of employer-oriented programs have been developed.
- **Access-to-jobs programs.** Access-to-jobs programs are prompting transit agencies—along with social service agencies and employers—to consider special arrangements for providing transit payment options to program participants.

Environmental justice factors in particular have directly influenced final fare structure decisions in a number of cities, through concerted opposition to (and in some cases securing injunctions against) proposed fare increases or changes; political concerns in general have affected the decision-making process at other agencies. Meanwhile, the emergence of partnerships and special payment or pricing arrangements involving universities, employer benefits programs, access-to-jobs programs, and various other types of programs or entities represents another important development related to fare policy. The result has typically been the establishment of such options as special low-priced passes or full-price passes subsidized by another entity (e.g., social service agency, university, or employer). Examples of, and developments related to, such programs and initiatives are discussed in this chapter.

EQUITY AND ENVIRONMENTAL JUSTICE ISSUES

Environmental justice refers to efforts to insure that all population segments, including low-income and minority groups, receive fair treatment with regard to environmental and civil rights issues in the provision of publicly funded services. "Fair treatment" is defined by the U.S. Environmental Protection Agency to mean that ". . . no group of people, including racial, ethnic, or socio-economic group, should bear a disproportionate share of the negative environmental consequences . . ." resulting from federal, state or local programs (*22*). Environmental justice and other environmental (e.g., air quality) and equity-based efforts are increasingly affecting transit agencies' consideration of potential fare changes. As suggested above, such initiatives have resulted in legal challenges to proposed fare increases in several cities; moreover, even where such challenges have not proven successful—or have not actually entered the courts—they have certainly influenced the fare policy decision-making process. Notable examples of fare-related environmental justice and other environmental and equity-based efforts over the past few years include the following:

- The **Los Angeles County Metropolitan Transportation Authority** is currently bound by a consent decree that has legally limited the extent to which the MTA can raise fares over the past several years. This action resulted from a suit filed by a community-based coalition seeking to prevent implementation of a fare increase and the proposed elimination of monthly passes.
- In Philadelphia, a number of community-based lawsuits have led to changes in the process by which the **Southeastern Pennsylvania Transportation Authority** adopts fare changes. One of these suits also led SEPTA to introduce highly discounted tokens (only two tokens need be purchased to receive a 28% discount.)
- When the **New York Metropolitan Transportation Authority** proposed fare increases in 1995, several community organizations filed suit to block the changes. The suit claimed that the fact that the increase on subway and bus (20% increase) was higher than that on the commuter railroads (9% increase) was discriminatory.

- Following the June 2000 approval of a fare increase by the **Metropolitan Atlanta Rapid Transit Authority** Board of Directors, a coalition of community groups filed a discrimination complaint against the agency. The Atlanta City Council and the Fulton County Commission also adopted resolutions opposing the fare increase.
- Opposition by community and environmental groups in Boston to a Fall 2000 fare increase led the **Massachusetts Bay Transportation Authority** to introduce free bus-bus transfers as well as a low-price weekly pass for the first time.

While these examples share certain common themes, the outcomes—in terms both of legal rulings and the impact on the fare decision making of the transit agencies—have differed considerably. The initiatives and results in each city are summarized in Table 4-1 and described below.

Los Angeles

In September 1994, a coalition of several local community organizations and transit advocacy groups, including the Labor/Community Strategy Center and the Bus Riders Union, filed suit against the MTA. The plaintiffs sought to prevent the implementation of a new fare structure that would raise the bus fare (from $1.10 to $1.35) and eliminate monthly passes (priced at $42). The plaintiffs alleged that the MTA was trying to operate a "discriminatory two tier, separate and unequal system of public transportation—one for poor minority bus riders and another designed to serve predominantly white and relatively wealthy rail riders" in violation of the Fourteenth Amendment to the U.S. Constitution, the Civil Rights Act of 1866, Title VI of the Civil Rights Act of 1964, and U.S. DOT regulations. In filing the suit, the plaintiffs claimed that the MTA:

- Was spending 71% of its resources on rail projects, despite the fact that 94% of MTA patrons are bus riders,
- Refused to provide service to minority communities or to connect them to other areas,
- Provided inferior bus service,
- Imposed arbitrary transfers in minority communities, and
- Made racially motivated changes in rapid rail plans.

The U.S. District Court judge granted a temporary restraining order in October 1994 blocking the proposed fare change on the grounds that:

- Any harm to the defendants from being enjoined paled in comparison to the harm to plaintiffs if the fare changes were implemented; and
- The plaintiffs had presented more than sufficient evidence to meet their burden of showing that (1) the MTA's actions adversely affected minorities, (2) the MTA's actions were not justified by business necessity, and (3) the MTA had rejected less discriminatory alternatives.

In January 1995, the parties entered into a tentative agreement and the restraining order was lifted. Thus, in February 1995, the MTA implemented a modified fare change, raising the cash fare to $1.35, but keeping the monthly pass. The MTA initially increased the pass price to $49, but was subsequently ordered to return it to the original $42 price and to introduce a weekly pass ($11 per week).

TABLE 4-1 Equity and environmental justice challenges to fare increases

Location	Proposed Fare Change	Year	Lawsuit?	Outcome
New York City	20% increase (NYCTA) 9% increase (LIRR, MNCR)	1995	Yes	Fare increase upheld
Los Angeles	$1.10 to $1.35 eliminate passes	1995	Yes	Fare increase upheld, but passes retained (at lower price); consent decree imposed on MTA
Philadelphia*	$1.60 to $2	2001	Yes	Fare increase upheld
Philadelphia	$1.25 to $1.50	1990	Yes	Fare increase upheld, but SEPTA agreed to offer discounted token in 2-packs (had been only 10)
Philadelphia	$1 to $1.25	1986	Yes	Fare increase upheld, but plaintiffs given right to review all SEPTA public records
Atlanta	$1.50 to $1.75	2000	No	Fare increase retained
Boston	$0.85 to $1 (rail) $0.60 to $0.75 (bus)	2000	No	Negotiated introduction of free bus-bus transfers and 1-wk passes

*Only selected cases are included for Philadelphia; others are described in the text.

The litigation and negotiations continued until October 1996, when the court approved a consent decree (*23*). The consent decree provided for additional bus service in minority areas and established specific criteria to reduce crowding on buses, including target maximum passenger load factors and dates by which these targets must be met. The consent decree also called for the creation of a Joint Working Group (JWG), composed of an equal number of representatives of the MTA and the plaintiff's class. The MTA was required to consult with the JWG in formulating and implementing its plan for reducing overcrowding, although the MTA would have discretion in determining how the targets would be met. The MTA was also required to work with the JWG in the development and implementation of bus service improvement plans, on fare adjustment issues, and on the methodology and procedures for ridership surveys. The consent decree allowed the MTA to consider a fare increase after October 1, 1998. As of late 2002, the MTA had not raised fares, although the agency has considered possible changes.

Disputes under the Consent Decree on issues involving the JWG are initially addressed by the JWG. If the JWG cannot resolve the dispute, it is referred to the attorneys for the parties and then, if necessary, to a Special Master appointed by the U.S. District Court. The District Court is monitoring compliance for 10 years, although it may terminate the decree after 7 years if the MTA is found to be in compliance and has a service plan projecting compliance for the following 5 years.

Philadelphia

Beginning in 1970, SEPTA has faced legal challenges to most of its proposed fare changes; in fact, as indicated above, the 2001 fare change is currently being appealed in the courts. Several of the earlier challenges resulted in changes in the statutes governing SEPTA or in the process by which SEPTA adopts fare changes; these lawsuits and their results are briefly reviewed here.

1970. The City of Philadelphia opposed a proposed fare increase, was outvoted on the SEPTA Board, and then challenged the fare increase on the grounds that it violated a separate contract between SEPTA and the City. The trial court upheld the City's position, but the appeals court, after chastising both the City and SEPTA for acting as adversaries, held that SEPTA could not contract away its right to set fares and that SEPTA could not meet its obligations without a fare increase or some other source of additional revenue (*24*). This decision was upheld by the Pennsylvania Supreme Court on appeal (*25*), which emphasized that the statute governing fare increases by SEPTA limited review of these increases to "manifest and flagrant abuse of discretion or error of law" (*26*). Since neither of the parties could identify a specific alternative source of additional revenue, SEPTA's fare increase was upheld.

1977. In early 1976, SEPTA proposed a fare increase, to be adopted in May of that year, and public hearings were held. However, the fare increase was vetoed by the City of Philadelphia's representatives on the Board. The Board continued to discuss a possible fare increase during 1976 and early 1977. Following a 45-day strike in March 1977, the Board approved a fare increase smaller than what had been proposed in 1976. The Coalition for Better Transportation in the City filed suit, arguing that the original fare proposal and hearing had expired and that the Board could not adopt a fare increase without filing a new proposal and holding a new hearing. While this was sufficient to win the plaintiffs a temporary restraining order, at a hearing 2 days later the judge dissolved the restraining order and dismissed the lawsuit. This was affirmed on appeal, where the court held that the original proposal had not expired and that the 1976 public hearing, together with continued discussions of budgets and fare increases, met the requirements for public hearings and public participation (*27*).

1986. The Consumer Education and Protective Association asked for a broad range of documents prior to the public hearings on a proposed fare increase on the grounds that they needed the documents to prepare for the hearing. These documents included all the backup documentation for SEPTA's operating budget, all liability insurance policies and liability claims data, all documents relating to the proposed fare increase and all alternatives considered, and all documents describing SEPTA's efforts to get more county, state or federal subsidies. SEPTA provided only the operating budget proposal and those documents SEPTA planned to introduce into the hearing record. The plaintiffs claimed that they had a right to all documents to prepare for the hearing. While SEPTA won at the trial level, the plaintiffs were successful in part at the appeals level in 1989, where the court held that they had a right to review all public records (*28*). This included all data integral to developing SEPTA's budget proposal, SEPTA's liability policies, documents relating to the impact of the proposed fare increases, documents related to efforts to obtain more subsidies, monthly management reports, recent audits, and similar documents. In 1994, this decision was codified, making SEPTA specifically subject to the Pennsylvania Right-to-Know Act (*29*).

1988. The Committee for a Better North Philadelphia (CBNP) challenged a fare increase in federal court on the grounds that SEPTA's allocation of federal subsidies had a discriminatory impact on the minority community of Philadelphia. SEPTA admitted that the City Transit Division might have a higher percentage of minority riders than the Regional Rail Division and that the fares of the City Transit Division would be lower if SEPTA allocated subsidies in proportion to fare revenues rather than in response to operating deficits; however, the agency argued that its actions were necessary to accomplish its goals of stabilizing Regional Rail fares,

maintaining service to the area, luring back Regional Rail ridership, and keeping a balanced budget in all of its divisions. The trial court held that while CBNP had shown a disparate impact on the minority community and had presented two alternative plans that would maintain balanced budgets for all of SEPTA's divisions, these plans would not accomplish SEPTA's legitimate goal of supporting the Regional Rail Division. Summary judgment was therefore granted to SEPTA (*30*).

1989. The Association of Community Organizations for Reform Now filed suit claiming that SEPTA (1) had held an improper hearing because the hearing examiner curtailed some questions by the organization's attorney, (2) had not properly considered the impacts of its fare proposal; and (3) should not increase fares because the agency would be rescued by state and local government. The trial court accepted these arguments and vacated the fare increase. The appeals court reversed the trial court and permitted the fare increase to be implemented. The appeals court specifically stated that (1) SEPTA had provided adequate evidence that it had considered the social and economic impact of the proposed fare increases; and (2) the trial court did not have the right to assume that the Commonwealth of Pennsylvania would rescue SEPTA with additional subsidies if its fares did not increase or to substitute its opinion for that of SEPTA's Board regarding an appropriate level for SEPTA's fares (*31*).

1990. In early 1990, SEPTA proposed a fare increase, and public hearings were held in accordance with the statute and regulations. Following this, the Board adopted a fare increase with a lower increase in the price of tokens and the plaintiffs appealed, alleging that SEPTA needed to hold a new hearing regarding this lesser fare increase and that the Board had considered additional information in making its decision. The court held that because the Board has the ultimate authority and duty to set fares, under the facts of this case no new hearing was required. Thus, the proposed fare increase (to $1.50) was allowed to stand. However, complaints regarding the ability of low-income riders to pay the cost of a ten-pack of tokens ($10.50) upfront resulted in SEPTA agreeing to offer the same level of discount with the purchase of only two tokens, i.e., two for $2.10; a five-pack was also introduced ($5.25).

2001. In April 2001, SEPTA announced its intention to raise fares. The Board initially proposed increasing the base cash fare from $1.60 to $1.90; passes and other fare elements were also to be increased. Following a series of public hearings in May 2001, the Hearing Examiners upheld SEPTA's proposed increases despite complaints by various community groups that (1) the fare increase would place too great a burden on low-income riders and students, and (2) the increase effectively rejected recommendations from a fare study SEPTA had recently undertaken that the agency consider reducing fares. The Board then further angered the community groups—as well as three City Councilors—when it revisited the proposed increase and decided to implement a base fare of $2, rather than $1.90. A coalition of community groups and the City Councilors then sought an injunction blocking the July 1 fare increase, contending that the SEPTA Board illegally modified the fare increase after the public hearings; the plaintiffs claimed that this was in violation of the state's "sunshine laws" that require government agencies to deliberate and decide issues (such as the a fare increase) "in public." This suit was dismissed in the courts in July (*32*), and the $2 fare was allowed to stand. The plaintiffs subsequently appealed the decision, which was upheld on appeal (*33*).

Thus, since 1970, most of the fare changes that SEPTA has proposed have encountered legal challenges by community groups. In several cases, the suits led to changes in the statutes governing the agency or in the process by which fare changes could be adopted. For instance, as a result of these decisions, SEPTA has been required to provide additional information to residents of its service area when it is proposing a fare increase. At the same time, however, the courts have consistently supported SEPTA's "right and duty" to set fares at a level that will provide sufficient revenues and that will accomplish other agency goals.

New York City

In mid-1995, the New York MTA proposed a 20% increase in subway and bus fares to become effective in November 1995; at the same time, a smaller percentage increase (9%) was proposed for the Long Island Railroad (LIRR) and the Metro North Commuter Railroad (MNCR). In October, the New York Urban League, the Straphangers Campaign, the NYC Environmental Justice Alliance, and West Harlem Environmental Action filed a lawsuit in Federal District Court seeking a preliminary injunction to prevent the fare increase from going into effect. The plaintiffs claimed that the fare hike was being fueled by the state government's reduction in aid to city subways and buses by $86 million at the same time that it was providing a $12 million increase in aid to the commuter railroads. The plaintiffs also claimed that fares paid 60% of New York City Transit's operating costs and only 56% of MNCR's operating costs and 45% of LIRR's operating costs. The lawsuit was based on the Civil Rights Act of 1964 and alleged that the state was trying to close its budget gap by forcing minority city residents to pay a disproportionate share of the funds for mass transit. The specific claim was that the disparity in the share of costs borne by the two groups of passengers (minority city residents and white suburban residents) violated U.S.DOT regulations promulgated under Title VI. Along with the lawsuit, the plaintiffs and other transit advocates in New York City called on transit riders to boycott the $1.50 token that the MTA had put on sale.

In November 1995, the Manhattan Federal District Court held a hearing regarding a preliminary injunction to halt the

$1.50 fare. The District Court Judge granted the injunction on the grounds that he believed that the plaintiffs were likely to succeed on the merits of the case and that allowing the fare increase to proceed would cause immediate harm (*34*).

However, the District Court injunction was subsequently stayed by a Federal Appeals Court, and the fare hike went into effect November 12. A hearing on the District Court's ruling was held November 14 before the U.S. Court of Appeals. At the time, the defendants argued that the District Court had failed to address issues relating to the larger policy reasons for subsidizing commuter rail transportation, i.e., as a means to discourage suburban residents from driving into the city, thereby indirectly benefiting minority riders of the city mass transit system by (1) minimizing congestion and pollution, (2) encouraging business to locate in the city, and (3) providing additional fare-paying passengers for the mass transit system. The Court of Appeals vacated the injunction a few weeks later on the grounds that the District Court ruling was based on insufficient evidence (*35*). Specifically, the Court of Appeals stated that even if the record supported a showing of different impacts on individuals of different races ("disparate impact"), the District Court needed to examine whether the defendants had shown a substantial legitimate justification for the challenged allocation of subsidies.

The Court of Appeals also stated that, since the theory of the complaint was that mass transit users received a disproportionate subsidy—not that mass transit riders paid too high a fare—blocking the fare increase was an inappropriate remedy. Appropriate remedies could include reducing the subsidy to commuter rail or increasing the subsidy to mass transit, but neither of these was equivalent to (or would necessarily lead to) a reduction in the mass transit fare. Following the Court of Appeals decision, the MTA reached a settlement agreement with the plaintiffs. The agreement was that the MTA would fund a fare study and would then consider the recommendations. The study was completed and reviewed by the MTA; however, the MTA did not accept the recommendation—that the fare should not be increased. The $1.50 fare therefore remained in place. (The New York City Department of Transportation, the secondary transit system serving the City, similarly raised the peak period fare to $1.50 at this time, but reduced the off-peak *cash* fare from $1.25 to $1.00. However, due to limitations with MetroCard (also accepted by NYCDOT) and concerns with transfer policy between NYCDOT buses and MTA subways, MetroCard users must pay $1.50 at all times on NYCDOT.)

Atlanta

In June 2000, the MARTA Board approved a fare change, raising the base fare from $1.50 to $1.75 and increasing other elements of the fare structure as well. This proposal passed the Board despite strong opposition from local governments and community groups. The previous month, the Atlanta City Council (with a unanimous vote) and Fulton County Commission had both adopted resolutions opposing the fare increase; these resolutions claimed that the proposed fare change would have a ". . . disproportionately negative impact on low-income riders, the vast majority of whom reside in Atlanta, Fulton and DeKalb Counties, and who already pay a 1% sales tax, which subsidizes the other metro users" (*36*). Thus, "several MARTA Board appointees representing Atlanta and Fulton County apparently ignored the resolutions passed by the elected officials from these districts" (*36*).

Following the Board's approval of the fare hike, a consortium of community groups, the Metropolitan Atlanta Transportation Equity Coalition (MATEC), filed an administrative complaint with the U.S.DOT, charging MARTA with violating Title VI of the Civil Rights Act of 1964 and the Americans with Disabilities Act through "disparate treatment of minority and disabled riders" (*36*). This complaint addressed a range of service-related issues; however, the basis of the claim against the proposed fare change was as follows (*36*):

- The fare change would adversely affect minority residents;
- There was no documented business need for a fare increase; and
- The agency had available less discriminatory alternatives than a fare increase.

The complainants in this case included the NAACP, the Rainbow/PUSH Coalition, and several neighborhood and environmental groups. In preparing its case against MARTA, MATEC met with representatives of the coalition that had filed suit against the LACMTA to learn about their experience in the Los Angeles case. MATEC was also supported in its efforts by the Environmental Justice Resource Center (EJRC) in Atlanta, which conducted an analysis of the likely impact of the fare increase on low-income and minority riders. The EJRC's analysis concluded that ". . .any benefit to the agency is likely to be outweighed by the substantial losses of income and mobility for the transit dependent. . . ." (*36*)Nevertheless, MARTA's fare increase was allowed to remain in effect.

Boston

Whereas equity issues similar to those cited above have been raised over proposed fare increases in Boston, the MBTA's fare decision-making process has been affected primarily by concerns over the potential environmental (e.g., air quality) impacts of fare changes. In fact, the MBTA has long been required (through the Massachusetts Environmental Policy Act) to conduct an Environmental Impact Review (EIR) before implementing any fare change that is expected to result in system-wide fare increases of 30% or more during any three-year period. Due largely to the EIR requirement, fare changes in Boston have been infrequent, none occurring between 1991 and 2000.

In Fall 2000, the MBTA proposed a fare increase that would raise the bus cash fare from $0.60 to $0.75 and the rail fare from $0.85 to $1; pass prices would also rise accordingly. Nevertheless, the 2000 fare change was strongly opposed by various environmental and community groups (Conservation Law Foundation, Federation for Public Transportation, Alternatives for Community and Environment, Clean Buses for Boston, and Transit Riders Union), claiming it would worsen an already bad traffic congestion problem in the region and that the new fares would be too high for low-income riders. The MBTA, concerned that the opponents would pursue legal action seeking to halt the increase, negotiated with the groups and agreed to mitigate the impact of the higher fares by introducing free bus-bus transfers as well as a low-price weekly pass. Previously, there were no reduced-price transfers between buses or between bus and rail and no weekly passes. The new weekly pass actually represented a fare reduction, since the $12.50 pass is less than one-fourth the cost of a monthly pass ($57). Thus, in this case, fare policy was clearly driven by pressure from the community rather than being based solely on the agency's revenue objectives.

Summary

Thus, U.S. transit agencies have been increasingly faced with organized opposition to—or even lawsuits seeking to block—proposed fare hikes in recent years. In some cases, such challenges have resulted in modifications to fare proposals or legal restrictions on future changes. In others, they have merely required the agencies to go to great lengths to explain and defend their rationale for raising fares. Regardless of the formal outcomes, however, all of these equity or environmental justice–based initiatives have certainly affected the local agencies' fare policy decision-making processes. Moreover, the challenges in these cities have not gone unnoticed in other cities; many transit agencies, especially those in other large cities, feel that they must now pay greater attention to equity and civil rights concerns in considering possible fare structure changes.

UNIVERSITY PROGRAMS

Public transportation is an important travel option for many college students, faculty, and campus staff for traveling between the campus and off-campus housing—or for intracampus circulation on large campuses. Some universities provide their own campus area transit services, but many campuses are served by the local transit operator. Where the latter is the case, many universities have established partnerships with the local transit agencies to provide specially priced passes or other payment options to students; according to the *2001 APTA Transit Fare Summary,* 74 U.S. transit agencies have some type of "subsidized fare program for university students" (*37*). The basic types of programs are as follows:

- **Special pass and unlimited-access programs.** A number of universities have joined with transit agencies to establish special programs that provide free unlimited-access or low-cost passes for students (and sometimes faculty and staff).
- **Special reduced-fare arrangements.** Some universities have arranged with the local transit operators to provide for reduced single-ride fares for their students.
- **Joint transit agency-university electronic farecard programs.** As increasing numbers of universities introduce magnetic or smart cards for their students (for identification, building access, library usage, purchases at campus stores, etc.), local transit agencies have begun to pursue arrangements to enable transit payments using the same cards.

By providing a low-cost and convenient form of transit payment to the university community, the transit agency may well see increased ridership. Meanwhile, the university may be able to ease on-campus parking requirements by shifting some students and others to transit. The above types of university-transit partnerships and programs are discussed below.

Low-Cost Pass and Unlimited-Access Programs

The university pass/unlimited-access program represents one of the oldest types of fare-related transit partnership, with some (e.g., University of Massachusetts-Amherst, University of California-San Diego) dating back several decades. These programs, often called "U-Pass" or something similar, feature various formats. One option involves the university paying the transit agency an annual lump sum per student in return for unlimited transit use for each participating student, faculty, and staff member; this type of arrangement has been given the generic name "Unlimited Access" (*38*). In this option, students typically need only present their campus ID card to board a transit vehicle. A second option entails the university purchasing monthly—or perhaps longer-term—passes from the transit agency, either at the regular price or at a reduced price, and then selling them to interested students—usually at a significant price reduction. These may be flash passes or stickers affixed to campus ID cards.

There are also differences in terms of participation for students, faculty, and staff; three basic options are as follows (*38*):

- **Voluntary ("opt in") participation.** Students decide if they want to buy passes at the university's rate; for example, UC-Irvine buys passes from Orange County (CA) Transportation Authority for $33.50 per month and sells them to students for $13 per month.
- **Voluntary ("opt out") participation.** Students automatically receive passes unless they elect not to participate; for example, University of Washington (Seattle)

students are charged $33 per quarter and faculty and staff are charged $46.50 per quarter.
- **Mandatory participation.** Students automatically receive passes and cannot opt out of the program; for example, University of Colorado (Boulder) students are charged a mandatory transit fee of $19.52 per semester.

In some cases, arrangements involve a single university or college, while in others, the transit agency provides the same basic deal to any interested institution. In Chicago, for instance, the CTA's U-PASS program is available to any university/college in the area; as of mid-2002, 22 universities or colleges were participating. In Atlanta, the MARTA U-Pass program has expanded from 4 colleges/universities when it was introduced in 1998 to 25 in 2002.

With regard to the extent of university pass programs, 38 of 251 agencies (15%) reporting to APTA (*2001 APTA Transit Fare Summary*) offer multimonth passes to students; 32 of these have passes good for a semester/quarter, while the others have passes valid for periods of 3 months to 1 year (*37*). Where implemented, university pass programs have typically proven quite successful at increasing transit ridership, while also providing guaranteed revenue to the transit agency (*38*). For instance, an analysis of unlimited-access programs by researchers at UCLA's Institute of Transportation Studies found that (*38*):

- Unlimited access seems to have resulted in a net average ridership increase of over 7% per year at 13 transit agencies with university programs for the 2 years immediately following introduction of the program.
- At five universities that collected ridership data before the initiation of the pass program, the first year student transit ridership increased between 71% and 200%; in subsequent years, there were annual increases of 2% to 10%.

Regarding the cost and usage of these programs, the UCLA researchers found the following in their survey of 35 programs (*38*):

- The average cost per student per year for unlimited access is $30; the range among these programs is $4 (U. of Florida) to $99 (UC-Santa Cruz).
- The average cost per ride is $0.61, with a range of $0.19 (U. of Florida) to $3.50 (Western Michigan University).
- Eleven of the universities charge no student fee for the program, while the highest annual fee is $90 (U. Texas); the median annual student fee for the program is $24.
- The average number of rides per student per year is 50; the range is 8 (UC-San Diego) to 151 (U. Texas).

Thus, there is a considerable range in the financial parameters associated with university pass programs. Nevertheless, such programs have generally succeeded in shifting significant numbers of students (and sometimes faculty and staff) to transit, thereby improving access to—and perhaps around—the campus and easing demand for campus parking.

Reduced-Fare Arrangements

An alternative—or perhaps a complement—to providing passes to students is for the transit agency to offer reduced single-ride fares. The *2001 APTA Transit Fare Summary* indicates that 43 of the 249 (17%) transit agencies reporting offer reduced single-fare rides to students (*37*). In 11 of these (4% of the total), students receive free fares (see Table 4-2). In addition, three of the agencies offer free fares to all riders: UMass Transit Service, Skagit Transit, and East Chicago Public Transit. One free system not included in the table is Chapel Hill (NC) Transit, which recently (January 2002) eliminated fares for all riders. The University of North Carolina agreed to use student fees, parking permit fees, and

TABLE 4-2 Transit agencies with free fares for college students

Agency (Location)	Full Fare
Akron (OH) Metro RTA	$1.00
Altoona (PA) Metro	$1.25
UMass Transit Service (Amherst, MA)	$0.00
Eagle Co. RTA (Avon, CO)	$2.00
AppalCART (Boone, NC)	$0.50
Skagit Transit (Burlington, WA)	$0.00
East Chicago (IN) Public Transit	$0.00
Unitrans (Davis, CA)	$0.50
Transfort (Ft. Collins, CO)	$1.00
Kalamazoo (MI) Transportation Division	$1.00
Missoula (MT) Urban Transportation District	$0.85
Ventura County Transportation Comm. (Oxnard, CA)	$1.00
TALTRAN (Talahassee, FL)	$1.00
Kelley Transit Co. (Torrington, CT)	$1.00

SOURCE: *2000 APTA Transit Fare Summary,* 2000.

departmental funds to cover the cost of routes used primarily by students, faculty, and staff; the towns of Chapel Hill and Carrboro cover the remaining costs. The table also leaves out systems owned or operated by the universities themselves; many of these have free fares as well. (The Chapel Hill initiative, as well as the Akron program listed in Table 4-2, are described in case studies in Part II.)

An example of a reduced-fare program is that in Lansing, MI, where CATA, for several years, charged Michigan State University (MSU) and other local college students $0.25 for a single ride—versus the regular full fare of $1; students could also buy low-price semester passes, or reduced-price monthly passes. In this case, the low fare was first introduced (in 1996) as a special promotion for MSU students. The promotional fare was subsequently expanded to other area students (including elementary and secondary students) and was ultimately extended through Fall 2001; this agreement stipulated that student pass fares could not be changed until Spring 2002 and limited the extent of increases to both single-ride and pass prices. The student fare was raised to $0.50 in 2002.

Joint Transit Agency-University Farecard Programs

Many universities issue magnetic stripe or smart cards to students, faculty, and staff. Given the emergence of electronic payment at transit agencies of all sizes, transit agencies and universities in some areas have begun to consider arrangements through which transit payments can be made using these same cards. There are various possible forms of such partnerships, but the basic approaches can be summarized as follows:

- The university card is swiped or inserted in a farebox or faregate, and the number of student (and perhaps faculty and staff) rides is tracked by the fare system. The agency then bills the university for rides actually taken.
- The university card carries a stored value purse that can be used to ride transit, as well as for on-campus expenditures.
- The university card is a smart card (and includes a contactless interface in addition to or instead of a contact interface) that can be loaded with a transit application (e.g., stored value or some type of pass) usable on the transit system.
- The transit agency issues a smart card that can be loaded with certain university applications usable on the campus.
- A third party (e.g., a financial institution or system integrator or vendor) operates a smart card system that supports both the university and the transit agency.

In each case, it is likely that the transit agency would issue its own farecards for nonuniversity riders. The smart card options would require that both the university and agency—or the third-party operator—provide card loading devices as appropriate. Depending on the specific type of issuance, distribution and loading arrangements, it may be appropriate for the university or the transit agency to pay transaction fees (for processing fare transactions, as well as for loading applications or value to the cards) to the other partner; alternatively, both parties could have to pay fees to a third party administering the program (*11*).

An existing example of the first approach, the tracking of actual usage, is UCLA's BruinGO partnership with the Santa Monica Big Blue Bus. In this program, students swipe their university ID cards through readers on the bus fareboxes, and the agency then bills the university $0.70 per ride (the same discounted fare as is charged to regular riders using the stored-value Metrocard). The university card contains a chip that covers several campus applications, as well as a magnetic stripe that is used for transit and certain campus functions. BruinGO was inaugurated as an 8-month pilot program (September 2000–June 2001), but was subsequently adopted for the following school year (*39*). In early 2003, BruinGO was made a permanent program.

Smart card–based transit-university partnerships have been explored in several locations. For example, the Ann Arbor Transit Authority briefly accepted the University of Michigan's campus card (a contact card known as M-Card) for fare payment during a trial in 1997; however, the transaction time (nearly 4 seconds per boarding) was found to be too long to be viable in the bus environment, and the experiment was discontinued. Meanwhile, the Greater Cleveland Regional Transit Authority (GCRTA) developed an agreement with Cleveland State University (CSU) in 1999 under which students were issued dual interface smart cards, funded jointly by CSU and GCRTA. The plan was that GCRTA would then install smart card readers on the primary bus route serving the campus and students would be able to load their cards with a transit application (initially stored value only) and use the university cards to pay the fare on the designated route. The GCRTA went so far as to issue a request for proposals (RFP) for a smart card system, but never completed the procurement process, and the demonstration was never initiated.

Several transit smart card programs now in place or under development are exploring joint university-transit arrangements. For instance, the Ventura County (CA) Transportation Commission has been working with the new California State University-Channel Islands (CSUCI) campus to allow joint use of smart cards for university and transit functions (see case study, Part II). While CSUCI uses magnetic stripe cards for the primary campus functions (including ID and bookstore purchases), VCTC and the University have discussed the possibility of adding the magnetic stripe to the transit smart card. In this scenario, the smart card could also be used to supplement the applications included on the stripe (e.g., to maintain student's medical records, to pay for parking, and perhaps other uses). The smart card system being developed for the Seattle/Central Puget Sound region also

includes plans to establish a university-transit partnership with the University of Washington.

As suggested above, the university-transit relationship is a symbiotic one, as both parties stand to benefit. Given the capability of electronic payment media to address multiple functions, it is expected that a growing number of university-transit partnerships will be pursued in the coming years as the use of smart cards in both types of settings increases.

Impacts of University Programs on Case Study Agencies

Five of the case-study agencies have implemented partnerships with universities as described above:

- **Chicago Transit Authority** established its U-PASS program in 1998 and now has arrangements with 22 schools to provide reduced-price CTA passes.
- **Connecticut Transit** established its Upass program in 2000 and provides reduced-price transit passes to two Hartford-area colleges: Trinity College and Capital Community College.
- **King County Metro Transit (Seattle)** established its U-PASS program, which provides reduced-price transit passes to the University of Washington (UW), in 1991; neighboring Community Transit also participates with UW in the program.
- **Akron (OH) Metropolitan Regional Transit Authority** has operated a free-fare program for University of Akron students, faculty, and staff having valid University IDs since 1995.
- **Chapel Hill (NC) Transit** began its Free Fare Program in 2002; no fare is charged on any of the agency's regular fixed route service; the University of North Carolina helps pay the cost of providing service.

The full case studies are presented in Part II. It is useful to compare the results of these efforts in terms of their impacts on customers and agency operations. Table 4-3 summarizes the key impacts of the first three programs, Table 4-4 the latter two. These impacts are discussed briefly below.

Customer Impacts and Benefits

The major impacts on, and benefits to, customers from the case study programs include the following:

- "U-pass" arrangements provide members of the university community with low-cost, if not free, transit service. This has led to significant mode shifts at participating campuses. In Seattle, for instance, the number of single occupant vehicles commuting to the UW campus is significantly lower than prior to introduction of U-PASS. Transit service to the campus has also increased since the introduction of the U-PASS program, due to the growth in demand.
- Such programs have been well-received by students, faculty, and staff at participating schools: in Chicago, for instance, most survey respondents found the program very easy to use and 90% expressed the desire for the program to be continued; in Seattle, 90% of survey respondents were either "satisfied" or "very satisfied" with the program.
- The universities themselves have been able to avoid new parking lot construction (UW) or, at least, to better manage available parking (certain Chicago-area schools and, likely, Capital Community College when it moves to downtown Hartford) through the increased transit mode share for commuting students, faculty, and staff. In Seattle, 86% of eligible university students, faculty, and staff participate in the U-PASS program. In Chicago, more than 40,000 eligible college students are using the CTA's U-PASS program.

Agency Impacts and Benefits

The major impacts on, and benefits to, the agencies from the case-study programs include the following:

- These programs can be quite successful at increasing transit usage. In Chicago, U-PASS accounts for over 10 million rides per year; a quarter to a third of these are considered to be new transit rides, and half of total U-PASS ridership is felt to take place in midday and evening hours. In Seattle, U-PASS accounts for over 8 million rides per year (more than 10% of all Metro and Community Transit rides); 45% of these are estimated to be new transit rides. Ridership on Chapel Hill Transit is over 50% higher since the removal of fares compared to the previous year.
- These programs can build "brand loyalty" to the transit system. In Chicago, the vast majority of survey respondents said that they would continue to use CTA after graduation. In Chapel Hill, the introduction of free fares has significantly improved the overall public perception of Chapel Hill Transit.
- Depending on the specific pricing of the program, the transit agency risks losing revenue by providing rides for a lower fare than it had previously received from the same riders. The CTA's program, for instance, has likely resulted in some revenue loss; however, the estimated loss amounts to less than 0.01% of total annual fare revenue, and the agency feels that any such loss has been more than offset by the program's benefits (e.g., growth of off-peak ridership and the creation of a declared intention to use CTA after graduation). CT TRANSIT also lost revenue during the program's first 2 years, but subsequent adjustments to the funding formula resulted

TABLE 4-3 Case study comparison: university pass programs

Case-Study Agency/ Name of Program (Year Initiated)	Chicago Transit Authority/ U-PASS Program (1998)	Connecticut Transit/ Upass Program (2000)	King County Metro (Seattle)/ U-PASS Program (1991)
Nature of Program	Magnetic pass provided to all students at a school. Students pay for pass as part of fees. Each school pays CTA $.55/student/day.	Pass provided on request. Schools pay CT $.65/ride taken, up to ceiling of $20/full-time student.	Pass provided at registration to all students; if not returned, student charged $33/quarter. Faculty/staff can get pass for $46.50/quarter.
Other Participants	22 colleges; any accredited college eligible	Trinity College, Capital Community College (CCC)	U. of Washington (can also use Community Transit)
Transit Agency Goals of Program	Increase off-peak ridership, create brand loyalty for CTA	Increase ridership	Increase transit ridership, improve access to campus
Customer Impacts and Benefits			
Usage rates	1.27 rides/day/pass	1.3 rides/day/pass (CCC)	NA*
Attitude toward program/other benefits	Most survey respondents indicated U-PASS very convenient, easy to use; 90% want program continued	NA	65% of survey respondents "very satisfied," 25% "satisfied" with U-PASS program
Cost of travel	Much cheaper than full fare	Much cheaper than full fare	Much cheaper than full passes
Agency Impacts and Benefits			
Ridership	10.6m rides/year (2000–01); 25–38% are new rides; 50% of U-PASS rides during midday or evening hrs.	152,000 total rides (2001–02); 19,000/mo. (CCC); 1300/mo. (Trinity)	8.5m rides/year (2000-01); 45% new rides
Revenue	CTA receives about $.45/trip; loses about $2m/yr for rides that would be taken without U-PASS (<.01% total annual fare revenue)	CT lost revenue in first 2 yrs. For CCC, until ceiling rate increased; revenue/ride rose to $.65; no loss for Trinity	Metro receives $9.6 million/year from UW, compared to $5 million from UW community pre-U-PASS
Other Impacts/Benefits	Almost all survey respondents said they'd use CTA after graduation	NA	Metro's costs have risen with added service to meet demand; UW pays some costs of added service
Impact on/Benefits to Partners			
Market penetration	Used by >40k students ('01)	500 passes issued (CCC)	86% of students, faculty, staff
Other (e.g., need for parking)	Students consider it a key benefit of attending that particular school; schools can better manage parking	Access will be important for CCC (a commuter school) when it moves to downtown Hartford; will reduce amount of parking needed	Student transit commuting mode share 35%; UW able to avoid new parking construction despite large increase in population; without U-PASS, new parking would have cost $100m
Liability to agency			
Economic liability	See Revenue above	Depends on ceiling rate	Depends on pass pricing
Political/legal liability	None	None	None
Constraints and Barriers			
Technical	None	None	None
Institutional/Funding	Need to develop formula acceptable to colleges	Need to develop acceptable pricing agreement that protects agency against revenue loss	Need to develop acceptable pricing agreement that protects agency against revenue loss
Required Equipment and Technology			
	None, but AFC allows tracking U-PASS rides	AFC, to track rides	None

*NA = Not applicable.

TABLE 4-4 Case study comparison: university reduced-fare programs

Case-Study Agency/ Name of Program (Year Initiated)	Akron METRO RTA/ University ID/Pass Program (1995)	Chapel Hill Transit/ Free Fare Program (2002)
Nature of Program	Students, faculty, staff ride free when showing valid University ID. METRO also provides separate Campus Shuttle Loop Service	Free fare on all regular fixed route transit service in Chapel Hill and Carrboro
Other Participants	University of Akron	UNC-Chapel Hill, Towns of Chapel Hill and Carrboro
Transit Agency Goals of Program	Increase ridership, address parking/congestion problems at University	Address parking shortage in and around campus, increase access to and around campus, increase transit access for transit dependent in general
Customer Impacts and Benefits		
Usage rates	NA*	NA
Attitude toward program/other benefits	NA	Overall public perception of CH Transit has improved as a result of free fare
Cost of travel	Free with valid ID	Free
Agency Impacts and Benefits		
Ridership	151k rides/year (2001) in Pass and Shuttle service programs	400k rides/mo. (April, 2002), 54% higher than ridership in same month in prior year
Revenue	METRO receives approx. $350k/year for pass program and shuttle service; pass program varies (roughly $50k/year); contract generates about $.55/ride	No fare revenue (previous full fare had been $.75)
Other Impacts/Benefits	Reduces amount of cash METRO has to handle	Capital/operating costs have increased considerably to meet higher demand (13 new buses, 7 more next year)
Impact on/Benefits to Partners		
Market penetration	Available to anyone with valid ID	Free throughout system
Other (e.g., need for parking)	No reduction in demand for parking, but free service not marketed heavily	Enhanced mobility, lower demand for parking on campus, improved service (higher bus frequency to accommodate higher demand)
Liability to agency		
Economic liability	Limited loss, since most riders would otherwise walk, bike or drive	Increase in operating and capital costs, with no fare revenue to cover these costs
Political/legal liability	Complaints could arise from nontransit users regarding use of parking fees for transit	None
Constraints and Barriers		
Technical	None	None
Institutional/Funding	Originally Congestion Mitigation and Air Quality (CMAQ) funding; CMAQ funding ended in 1997; now funded from parking fees and University general funds	Required agreements among UNC and the two towns to significantly increase contributions to CH Transit; students pay $16/semester fee
Required Equipment and Technology		
	ID cards must be manually viewed, since current fareboxes can't read magnetic ID cards	None

* NA = Not applicable.

in no revenue loss in the latest year. In Seattle, the pricing formula has been carefully designed (i.e., including periodic adjustments) so as to protect the transit agencies from losing revenue.
- In the free-fare programs, the agencies obviously lose fare revenue; however, this loss should be offset through increased contributions from the universities and other funding partners, as is the case in Chapel Hill and Akron.
- Depending on the success of the university program (i.e., at attracting riders), there may be added costs to the agency, due to the need to provide additional service to meet the increased demand. In Seattle, Metro's costs have risen considerably with the provision of additional service to the UW campus; however, UW pays a portion of the increased costs, and Metro's revenue recovery rate for the new services has been comparable to its systemwide average. Chapel Hill Transit's capital and operating costs have increased dramatically as a result of the much higher demand following the elimination of fares. The level of usage has not been high enough in Hartford or Akron to increase operating costs, and the dispersed nature of the CTA's program (i.e., with more than 20 schools throughout the service area) has similarly had no significant impact on service requirements.

Thus, the case study findings suggest that university-transit agency partnerships are capable of generating significant increases in ridership, while also building interest in continuing to use transit after graduation. However, it is important to design the pricing parameters of university pass programs carefully so as to minimize the potential negative revenue impact on the agencies. In particular, the agreement should be structured so that it allows the agency to increase the amount paid per person to reflect actual usage rates.

EMPLOYER BENEFITS PROGRAMS

Transit agencies have long pursued partnerships with employers to facilitate, if not subsidize, employees' use of transit to commute to and from work. These partnerships were originally limited to the distribution of monthly passes by employers to their employees, often with at least a partial subsidy of the pass price; such programs remain an important strategy for facilitating and promoting employee transit use, although not discussed here as a distinct approach. The pass-distribution programs subsequently became more flexible with the introduction of transit vouchers that the employees could use to acquire the transit payment option of their choice. In the last decade, these basic approaches have evolved and broadened, fueled both by a steady increase in the tax-free transit benefit employees could receive and the emergence of electronic payment technologies. Key types of employer-oriented transit benefit programs and strategies now in place include the following:

- **Annual pass programs.** In these programs, employer buys passes for employees (at significantly less than the normal monthly cost of passes) based on a predetermined formula set by the transit agency.
- **Transit voucher programs.** In these programs, employees receive vouchers that can then be redeemed for transit passes or other payment options. In some cases, the vouchers are in the form of stored value farecards that can be used directly for fare payment.
- **Automated benefits distribution programs.** Other strategies for distributing transit benefits to employees are emerging as well, including the ability to download the value of the benefit to an employee's smart card automatically.

Examples of these types of strategies are described in the following section, following a review of the nature the current "commuter choice" benefits program.

The Commuter Choice Benefits Program

Commuter Choice is a provision of the Transportation Equity Act for the 21st Century (TEA-21) that was signed into law in June 1998. TEA-21, along with the Taxpayer Relief Act of 1997, amended Internal Revenue Code Section 132(f), which already provided certain commuter program tax benefits. This tax code amendment significantly improved the status of employer-sponsored commute incentive programs. Commuter Choice allows employers to let their employees set aside up to $100 a month, or $1200 a year, of their pretax salary to pay for transit or vanpool commuting, and $175 a month ($2100 a year) for qualified parking expenses. Prior to TEA-21, commuter benefits had been allowed only in the form of a direct employer subsidy to an employee.

Commuter Choice is the most recent federal tax code amendment related to qualified transit fringe benefits. The Deficit Reduction Act of 1984 provided the first commute benefit by allowing for limited tax-free benefits for transit costs, up to $15 a month. In 1991 this amount was increased to $21, and the Comprehensive Energy Policy Act of 1992 created new categories of qualified transportation benefits (e.g., vanpools) and raised the monthly benefit limit to $60; this Act also provided for annual changes to the tax-free benefit limit (tied to the Consumer Price Index). Indeed, the TEA-21 and federal tax code amendments required the maximum benefit to increase from $65 to $100 a month as of January 2002.

A number of states have also introduced their own legislation providing state tax credits to employers who offer Commuter Choice benefits to their employees; these states include Maryland, Delaware, Oregon, and Georgia. Moreover, several bills have been introduced before Congress in the last few years to improve the transit benefit. For instance, the Commuter Benefit Equity Act, introduced in both the House and Senate in 2001—and a similar bill introduced in 2003—proposed to amend the Internal Revenue Code of 1986 to equalize

the maximum amount of the tax-free transportation benefit allowed for transit and parking; as explained above, under the existing regulations, the allowable parking benefit is considerably higher than that for transit. While this bill did not pass, it is likely that similar bills will be introduced in the coming years.

Because employers benefit (e.g., through reduced payroll taxes) as well as their employees, the incentive for employers to participate in Commuter Choice will thus likely increase further. The methods through which employers have worked with transit agencies to provide transit benefits are reviewed below.

Annual Pass Programs

One type of program that has become increasingly popular in the last few years involves employers purchasing annual transit passes for each of their employees at a price much lower than the cost of a normal monthly pass. In most cases, the per employee price can vary from one company to the next, based on a formula that considers such factors as company size, location, and relative access to transit service. The transit agency can offer such a price since not all employees will actually use the pass. However, because all employees receive passes, the potential exists for a dramatic increase in commuter ridership.

The Denver Regional Transit District's (RTD's) Eco Pass program, started in 1991, was the first program of this type in the United States, with pricing based on the "group insurance" concept (i.e., spreading the cost of employees' transit use among all employees at a company). Since then, a number of agencies have adopted similar programs. These programs typically seek to increase commuter ridership while maintaining revenue neutrality. Examples of annual pass programs of this type are as follows:

- Dallas, TX (E-Pass)
- Minneapolis/St. Paul, MN (Metropass)
- Portland, OR (PASSport)
- Salt Lake City, UT (Eco Pass)
- San Jose, CA (Eco Pass)
- Seattle, WA (FlexPass)

These represent the range of current industry practices in the area of employer-subsidized annual unlimited use pass programs. Although a number of these agencies originally based their programs on the Eco Pass in Denver, most have subsequently modified their programs to better fit their individual goals or needs, while RTD itself announced in early 2003 its intention to terminate the Eco Pass program at the end of the year as part of a fare change proposed for 2004 to offset a serious revenue shortfall; RTD felt that it was losing too much revenue through the program, as the pricing formula was not insuring revenue neutrality. In general, the differences in the programs fall into the following categories:

- **Method of pass price determination,** e.g., ridership at each specific company, relative level of transit service a company receives, or, in some cases, company size.
- **Minimum contract requirements,** e.g., minimum number of employees for a company to participate or a minimum contract amount.
- **Goals of the program,** e.g., increase company participation and thus commuter ridership, or maintain revenue neutrality.

The differences in the above agencies' programs are shown in Table 4-5 and can be summarized as follows (*40*).

Method of Pass Price Determination. Five of these agencies (all except Minneapolis/St. Paul Metro and Tri-Met) base prices on zones determined by level of service (and, in some cases, company size). Minneapolis/St. Paul Metro and Tri-Met both base pass prices on the transit mode share at each specific company. As explained in a case study (Part II), Tri-Met recently changed from using a combination of geographic zones, zone-wide average transit mode splits, and individual transit mode splits. A principal reason for this change was the availability of data on the transit mode split of each company; Tri-Met uses a survey that companies with 50 or more employees are required by the Oregon Department of Environmental Quality to conduct each year.

In contrast to Tri-Met, King County Metro originally used the mode share approach but recently converted to a zone type of pricing structure (see case study in Part II). The primary rationale for this change, and the reason several other agencies originally adopted the zonal structure, is that the regular surveys required for individualized pricing are expensive and administratively difficult. Moreover, basing the pass price on changes in individual company mode share results in a higher level of uncertainty for the companies and may therefore limit participation. The advantage of the individualized pricing structure is that it is easier to measure the precise impact of the program on both ridership and revenue and, thus, to adjust pricing if there is a significant loss of revenue.

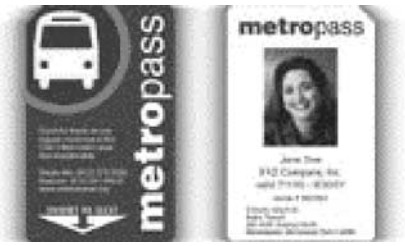


TABLE 4-5 Employer-based annual pass programs

Agency—Program	Method of Price Determination	Minimum Contract Requirement
DART (Dallas)—*E-Pass*	Zones/level of service, size of company	Minimum contract: $720 (equivalent of 1 pass for 12 mos.)
Denver RTD- *Eco Pass*	Zones/level of service, size of company	Minimum of 5 passes
Minn.-St. Paul Metro—*Metropass*	Transit mode share of company	None
Portland Tri-Met—*PASSport*	Transit mode share of company*	Minimum price per employee
UTA (Salt Lake City)—*Eco Pass*	Zones/level of service	Minimum of 35 employees (does not apply to state agencies)
SCVTA (San Jose)—*Eco Pass*	Zones/level of service, size of company	None
King Co. Metro (Seattle)—FlexPass	Zones/level of service**	None

* Tri-Met recently converted from a combination zone and mode share basis to mode share only.
** KC Metro recently converted from mode share to a combination zonal-level of service basis.

Minimum Contract Requirements. Four of the seven agencies have implemented a minimum contract requirement for companies to participate in the pass program. A major reason for this is to discourage very small companies—conceivably having very high transit mode shares—from joining the program. Such companies' participation could well produce revenue losses for the agency. If very small companies are permitted to join, they may be required to pay a premium for the pass so as to protect the agency from this potential revenue loss. Utah Transit Authority (UTA) requires that companies have a minimum number of employees, Denver RTD mandates a minimum number of passes, Dallas Area Rapid Transit (DART) imposes a minimum contract cost; and Tri-Met has a minimum price per employee for each zone.

Goals of the Pass Program. The final key aspect in which the programs differ is in the agencies' goals. In all cases, the primary reason for implementing the program was to increase commuter ridership. Where the agencies differ is in how they evaluate revenue recovery. Most of the agencies want their programs to be "revenue-neutral"; however, their definitions of revenue neutrality vary. Most of the agencies, including Denver RTD and Minneapolis/St. Paul Metro, define revenue neutrality as recovering at least as much revenue from the commuter market as was being collecting prior to program implementation. Tri-Met, on the other hand, defines revenue neutrality as recovering the same amount of revenue as would be collected from commuters paying full fare. If the program succeeds in generating additional riders, the Tri-Met definition leads to higher pass prices in order to recover revenue from these riders. On the opposite end of the spectrum is UTA, which has been relatively unconcerned with revenue recovery, at least in the initial stages of the program. For UTA, the primary concern is increasing commuter ridership; the agency feels that any initial revenue loss is worth the ridership gain and that revenue is likely to recover over time.

Based on the experiences of the above agencies, there are several key points that should be kept in mind in developing similar programs:

- The design and pricing of the program are highly dependent on the agency's goals and concerns. If an agency is concerned primarily with revenue recovery, it may opt to implement a program that focuses on surveying individual companies in order to set prices. This method will reduce the risk of revenue loss to the agency by directly monitoring increases in ridership. However, this type of design is difficult to administer and increases the risk to participating companies—since future program costs are uncertain. Therefore, if the primary agency goal is to increase company participation and thus commuter ridership, it may be advisable to consider a more regional pricing approach.
- Pricing assumptions should be updated regularly in order to account for ridership increases. Since all employees

at a company receive an unlimited-use pass, the transit agency can expect to see an increase in commuter ridership. However, since initial pass prices are normally based on preprogram transit mode share, the pass may become under-priced if mode share assumptions are not updated regularly. Denver RTD's announced intention to discontinue its Eco Pass program due to excessive revenue loss demonstrates the danger of failing to adequately update the pricing assumptions and formula.

- As electronic fare payment becomes more prevalent, it will become easier for transit agencies to design programs for specific companies and to monitor program effects. Agencies that do not currently have electronic payment must conduct individual company surveys in order to monitor changes in ridership levels. However, electronic payment may allow an agency to collect company-level data without the administrative burden of administering surveys. This data can then be used to set prices for individual companies more accurately and to assure the company of the program's success in increasing transit ridership, possibly even allowing the company to decrease its parking costs.

Finally, it should be noted that such programs have given rise to a variation on the employer-based pass program: neighborhood pass programs. Denver RTD has made subsidized annual passes available to groups of households in certain designated areas, and Santa Clara Valley Transportation Authority (SCVTA) has done this for certain residential complexes. For instance, neighborhoods in Boulder, CO, have been able to take advantage of RTD's Eco Pass arrangement. A "neighborhood" in Boulder consists of a group of contiguous city blocks containing at least 100 housing units. Using the program formula, RTD calculates a yearly fee per housing unit, based on all of the residents of the neighborhood participating in the program. In reality, the fee paid by each participating household depends on the proportion of housing units agreeing to participate in the program and on any agreements made among households in the neighborhood. For example, if the quoted cost per housing unit is $100 per year for all the housing units on a given block, but only 50% of households agree to pay for the program, the actual cost per household would be $200.

Transit Voucher Programs

Beyond the direct distribution of passes, employers can provide transit benefits for employees through strategies such as voucher programs. In programs such as TransitCheck (New York City area), CommuterCheck (San Francisco, Denver, Boston, elsewhere), and Metrochek (Washington, DC), employees are given vouchers that can be redeemed for transit passes or other payment options. In some cases (e.g., New York City and Washington), the vouchers are in the form of stored-value farecards and can thus be used directly for fare payment where accepted—or redeemed for fare options for other agencies in the applicable region; these two programs are covered in case studies, in Part II.

While voucher programs are present in some areas dominated by a single transit operator (e.g., Boston, Denver), they are particularly useful in multioperator regions (e.g., New York City/Northern NJ, Philadelphia, San Francisco, Washington), since employees at any given company in such locations may well use a range of transit systems. This significantly complicates the employer's ability to directly provide passes to each employee who uses transit. With a voucher program, the employer can instead provide a common voucher to all interested employees. An employee then uses the voucher to purchase a pass, tickets, tokens, or stored-value farecard. Many employers subsidize vouchers (i.e., provide them to employees at no charge or at a reduced price) and in fact purchase vouchers priced at the level they are willing to subsidize up to the maximum benefit described above.

Because voucher programs are relatively simple for an employer to administer, they tend to appeal to small and medium-sized companies; in the Washington, DC, metropolitan area, for instance, the average size of the private companies participating in the Metrochek program is 18—although federal agency participation there brings the overall per employer average to 57. A total of nearly 3,000 employers currently participate in the Metrochek program. In New York City, over 14,000 employers offer TransitCheck to more than 350,000 employees, the average number of employees using it being about 29.

New York's TransitCheck, introduced in 1987, was the first voucher program in the United States. TransitCheck is administered by a private nonprofit organization, TransitCenter, that was established with a demonstration grant from the federal Urban Mass Transportation Administration (UMTA, now the FTA) and was subsequently funded by the transit agencies in the region. Programs in other regions are typically administered by MPO's or transit agencies; but in many of these regions, fulfillment is provided by private for-profit companies (e.g., Commuter Check Services Corp. in San Francisco, Philadelphia, Boston, Denver and elsewhere). There are also several companies, such as WageWorks and Sodexho Pass, that handle all aspects of an employer's transit subsidy arrangements, including delivery of vouchers and passes.

Automated Benefits Distribution Programs

The emergence of electronic payment media such as smart cards has created new strategies for distributing transit benefits to employees. One approach, mentioned above, is the direct provision of stored-value farecards, as is done in Washington, New York, and Chicago. A variation introduced in 2000 in New York City is the Premium TransitCheck designed for City employees and other large employers. In this pro-

gram, TransitCenter issues employees special MetroCards once a year. The City or employer deducts the $63 cost of a 30-day pass from the employees' paychecks each month and transfers these funds, along with an active list, to TransitCenter; as long as an employee's payment status remains active, the card will remain active. As of early 2002, more than 30,000 Premium TransitChecks were in use.

The use of smart cards further expands the ability to automatically distribute transit benefits. The primary existing example of such a strategy is WMATA's "SmartBenefits" program, launched in September 2000. In this program, an employer establishes an account for each participating employee (and subsequently identifies any changes to an employee's status) via a WMATA website. Each month, the employee can then automatically download the value of the benefit to a SmarTrip smart card at any WMATA farecard vending machine. As of mid-2003, over 550 employers and 17,000 employees were participating in the SmartBenefits program; while participation was growing at a slower pace than the agency had anticipated, the concept should take greater hold as the number of employees at each company using the SmarTrip card increases and once SmarTrip is expanded to buses in the region and to transit service in Baltimore over the next few years.

A second example of an automated benefits distribution arrangement is that introduced in 2002 in the TransLink (San Francisco Bay Area) regional smart card program pilot. As described in the TransLink Case Study (in Part II), the "employer-based autoload" strategy was in use by about a dozen employers—for roughly 50 employees—as of the end of the pilot period (July 2002). Automated downloading of transit benefits was also available to Bay Area participants in the Commuter Check program by the end of the pilot period.

An alternative approach to that used in SmartBenefits and TransLink would be for an employer to provide some type of on-site download and revaluing device. This could either be attended (i.e., by a designated administrative employee) or self-service. In either case, the transit benefit would be downloaded to the employee's farecard each month. A self-service device could be considered, particularly at locations where employees' smart cards can also be used for purposes such as vending machine or cafeteria purchases.

A final approach that employers might consider for covering their employees' transit commuting costs is postpayment. With electronic payment media, a transit agency can track the transit usage of an employee's farecard; the agency could then invoice (e.g., monthly, bimonthly, or perhaps semi-annually) each employer for the actual cost of its employees' rides during the billing period. An existing example of this strategy is the BusCard Plus program at Valley Metro (Phoenix, AZ). In this program, launched in 1991 to help local employers meet the local Travel Reduction Ordinance, participating employees' transit usage is tracked by card readers in the fareboxes via their use of a magnetic monthly pass; employers are billed at the end of each month for their employees' transit use. The cost for each trip is the full cash fare, but the total monthly cost is capped at the cost of a regular monthly pass; some employers subsidize only the commuter trips (trips are identified by time of day and route number), requiring the employees to reimburse them for nonwork trips. The CTA also intends to introduce a postpayment option for its Chicago Card in 2003; the ability to establish transit accounts with the agency will facilitate postpayment by individual riders and employer billing based on actual use of the system.

Thus, the combination of commuter choice legislation and the emergence of electronic payment technologies has resulted in a range of distribution strategies that facilitate the provision of transit benefits to employees.

Impacts of Employer Benefits Programs for Case Study Agencies

Four of the case studies describe transit employer benefits programs such as those discussed above:

- **King County Metro Transit** introduced its FlexPass annual transit pass program for area employers in 1993.
- **Tri-County Metropolitan Transit District (Portland, OR)** introduced its PASSport annual transit pass program for area employers in 1997.
- **TransitCenter (New York City**) began issuing TransitCheck transit vouchers (or actual MetroCard farecards) to employees of participating employers in 1987. The recently established Premium TransitCheck program involves issuance of annual MetroCards to participating employees.
- **Washington Metropolitan Area Transit Authority** began to issue MetroChecks (for direct use on Metrorail or use as a voucher for other services in the region) in 1997. WMATA has also recently introduced the SmartBenefits program allowing automatic downloads of transit benefits via the Internet and employee access using a SmarTrip farecard.

The full case studies are presented in Part II. (Another case-study program, TransLink, also included an automated benefits distribution arrangement similar to WMATA's SmartBenefits; but it is not included in this discussion of program impacts because of the limited use of this option during the TransLink pilot project.) However, it is useful to compare the results of these efforts in terms of their impacts on customers and agency operations. Table 4-6 summarizes the key impacts of the first two programs, Table 4-7 the latter two. These impacts are discussed briefly below.

Customer Impacts and Benefits

The major impacts on, and benefits to, employees and employers from the case-study programs include the following:

TABLE 4-6 Case study comparison: annual employer pass programs

Case-Study Agency/ Name of Program (Year Initiated)	King County Metro (Seattle)/ FlexPass Program (1993)	Tri-Met (Portland, OR) PASSport Program (1997)
Nature of Program	Annual transit passes are provided to all employees at a participating company at a deeply discounted fixed cost	Annual transit passes are provided to all employees at a participating company at a deeply discounted fixed cost
Other Participants	Area employers	Area employers
Transit Agency Goals of Program	Increase ridership and revenues	Increase ridership and revenues
Customer Impacts and Benefits		
Usage rates	Employee transit use increases >90%, on average, in first year employer participates	57% increase in transit trips at participating employers after first year of program
Attitude toward program/other benefits	Provides for convenient, low cost (usually free) transit service	Provides for convenient, low cost (often free) transit service
Cost of travel	Only 10% of employers require employees to contribute to cost of FlexPass; employers can't charge more than 50% of employer's cost per pass	Even if employer requires some contribution, employees receive deep discount; maximum cost of pass is $362, compared to maximum (all-zone) full annual pass price of $615
Agency Impacts and Benefits		
Ridership	825k new rides generated by FlexPass (2000)	PASSport passes account for 7.6% of Tri-Met's overall ridership
Revenue	$651k in new revenue generated by FlexPass (2000)	Revenue based on actual transit usage, and usage has increased due to program
Other Impacts/Benefits	Administration of entire Commute Partnership Program (includes FlexPass) costs Metro $1.4m/year (45% covered by federal grants); cost of FlexPass will drop with new Area FlexPass program	Administration of program handled by 4 Tri-Met sales representatives and administrative assistants plus some management time
Impact on/Benefits to Partners		
Market penetration	122 employers, >80,000 employees	210 employers, 59,000 employees
Other (e.g., need for parking)	Helps employers address Commute Trip Reduction requirements; lower administration cost than a monthly program (because annual); may allow employers to reduce amount of parking needed	Helps employers address Employee Commute Options (ECO) Rule; lower administration cost than a monthly program (because annual); may allow employers to reduce amount of parking needed
Liability to agency		
Economic liability	Program designed to eliminate risk of losing revenue; new Area FlexPass has higher risk since based on average transit use in an area and companies with highest transit use may be most likely to adopt program	Program designed to be revenue neutral (i.e., employer pays same amount of revenue as would be collected if all riders were buying monthly passes)
Political/legal liability	Some equity concerns since focused on large employers; Area FlexPass designed to alleviate that concern	Social equity has been concern in establishing pricing (i.e., that commuters not pay less than other riders); this has led to revenue neutral pricing requirement
Constraints and Barriers		
Technical	None	None
Institutional/Funding	Need to develop acceptable pricing agreement with each employer has limited size of program (and size of employers); Area FlexPass represents attempt to provide more uniform pricing to attract smaller companies.	Since program grew out of ECO Rule, Tri-Met was able to move from being seen as an opponent of employers (because it's funded by payroll tax) to a partner in meeting ECO requirements
Required Equipment and Technology		
	None	None

- Both annual pass and the various forms of voucher programs provide employees with low-cost (often free) transit service payment options.
- Annual pass programs, provision of vouchers in the form of electronic farecards, and automated download options (like SmartBenefits) are particularly convenient for employees, since the options do not require the employees to go out of their way to purchase separate fare instruments.
- These programs also represent convenient mechanisms for employers to manage the distribution of commute benefits to employees. Besides providing a tangible ben-

TABLE 4-7 Case study comparison: transit voucher programs

Case-Study Agency/ Name of Program (Year Initiated)	TransitCenter (New York City)/ TransitChek, Premium TransitChek (1987)	WMATA (Washington, DC) Metrochek, SmartBenefits Programs (1993)
Nature of Program	TransitCenter (or employer) issues vouchers (or MetroCards, for NYCT riders) to employees of participating employers. For Premium TransitChek, once payroll deduction set up, TransitCenter issues annual MetroCard directly to employees	WMATA provides employers with Metrochecks; can be used directly on Metrorail or as vouchers for fare media for other services. In SmartBenefits, employer authorizes employee's benefit via Internet; employee downloads monthly benefit to SmarTrip card via TVM
Other Participants	NYMTA, other operators, area employers	Other operators, area employers
Transit Agency Goals of Program	Increase ridership, simplify agency and employer administration requirements for benefits	Increase ridership, simplify employer administration requirements for transit commute benefits
Customer Impacts and Benefits		
Usage rates	NA*	NA
Attitude toward program/other benefits	Direct receipt of MetroCards convenient; Premium TransitChek is annual pass	Direct use of Metrochek convenient for Metrorail riders; SmartBenefits very convenient
Cost of travel	Tax savings; also often subsidized (or provided free) by employer	Tax savings; also often subsidized (or provided free) by employer
Agency Impacts and Benefits		
Ridership	Results in increased transit use (average of >240 additional trips reported in 1994 survey)	NA
Revenue	Use by new riders increases revenue	$134m in Metrochek sales; 90% of Metrochek value used on WMATA (vs. other operators in region)
Other Impacts/Benefits	NYMTA pays commission for MetroCard distribution (less than that paid retail distributors)	NA
Impact on/Benefits to Partners		
Market penetration	>14k employers, >350k employees; current growth rate 2k employers/25k employees/year; Premium TransitChek used by >30k employees	Metrochek used by >2,500 private companies and 269 federal agencies; SmartBenefits used by >550 employers and >17,000 employees
Other (e.g., need for parking)	Employers get payroll tax savings; TransitCenter will handle distribution. Employers pay commission to TransitCenter	Employers get payroll tax savings; SmartBenefits allows employers to easily manage their benefit programs (via Internet)
Liability to agency		
Economic liability	None, since vouchers used to purchase fare media at full price	Due to outstanding Metrocheks that have not yet been used, WMATA must carry a contingent liability of >$10m on its books; SmartBenefits allows employers to remove unclaimed benefits from system. No risk for other operators since vouchers used to buy fare media at full price
Constraints and Barriers		
Technical	MetroCard (and thus Premium TransitChek) can only be used with agencies that have MetroCard AFC system (NYCT, NYC DOT; being implemented by PATH and others)	Metrochek can only be used directly on Metrorail, and SmartBenefits requires smart card; expansion of SmarTrip program will allow expansion of SmartBenefits, but not expanded use of Metrocheks
Institutional/Funding	Difficulty attracting larger employers, who perceive high administration cost; Premium TransitChek seeks to address this concern. TransitCenter now self-sufficient, but initially (first decade) funded by agencies and federal/state grants	Since ¾ of Metrocheks are distributed to federal employees, Transportation Administrative Services Center is involved in managing program for most agencies; due to magnitude of program, federal employer sales cycle lead time much longer than for private employers
Required Equipment and Technology		
	None for agencies (although MetroCard is AFC system)	Requires AFC: Metrochek is magnetic card, SmartBenefits uses contactless smart card

* NA = Not applicable.

efit to their employees, employers benefit from such programs through payroll tax savings and the potential to reduce parking requirements.
- Such programs help employers address state or local trip reduction ordinances; the existence of such requirements was a key factor leading to the establishment both King County Metro's and Tri-Met's annual pass programs.
- Monthly programs have higher administrative costs for employers than do annual programs, although automated strategies like SmartBenefits should reduce the employer's administrative requirements. In voucher programs, like TransitCheck, the voucher company (e.g., TransitCenter) handles distribution to employees, but employers pay a commission on each voucher.

Agency Impacts and Benefits

The major impacts on, and benefits to, transit agencies from the case study programs include the following:

- These programs typically result in increased transit usage. For instance, in Seattle, FlexPass has resulted in an average increase in employees' transit use in the first year of the company's participation of over 90%. In Portland, the average employee transit use increase has been measured at 57% during the first year; PASSport passes account for over 7% of Tri-Met's overall system ridership. In New York, a 1994 survey indicated an average of over 240 additional transit rides per year per TransitCheck recipient.
- Both of the annual pass programs are structured so as to prevent net revenue loss; in fact, both have generated additional revenue for the transit agencies.
- The voucher programs generate revenue for the local agencies in that the vouchers or farecards are sold to employers at the regular pass price.
- There are certain costs to the agencies for these programs. For instance, administration of the overall Commute Partnership Program, of which FlexPass is one part, costs King County Metro roughly $1.4 million per year; 45% of this is covered by federal grants. In Portland, the administration of the PASSport program is handled by four Tri-Met sales representatives, along with a portion of a manager's time. The New York MTA pays a commission to TransitCenter for the distribution of TransitCheck MetroCards; however, this is a lower commission than the MTA pays retail pass sellers.

Thus, employer pass and voucher programs have been shown to benefit employees, employers, and transit agencies. Clearly, the simpler—and less costly—it is for employers to administer these programs, the more likely they will be to participate. Similarly, the more convenient it is for employees to take advantage of commuter benefits, the more likely they will be to use transit to get to and from work. Annual pass programs have made participation convenient for both employers and employees. However, it is important in establishing these programs that transit agencies structure pricing in such a way that they protect themselves against losing revenue; the pricing should be able to capture at least some revenue from the new trips being generated.

In voucher-type programs, the direct provision of farecards and the emerging automation of benefits distribution are also greatly improving the convenience for all parties. As the use of electronic payment options spreads, more and more agencies will offer such mechanisms within their regions, thereby expanding the range of options available to allow both employers and employees to take advantage of commuter choice benefits.

ACCESS-TO-JOBS PROGRAMS

Federal welfare reform legislation, passed in 1996, radically changed the American welfare system, emphasizing the move of individuals from welfare-to-work. In implementing the resulting welfare reform programs, states and localities quickly realized the importance of ensuring access to reliable and affordable transportation services for residents attempting to make this transition.

Addressing welfare-to-work transportation issues has required creation of new collaborations among public agencies and private organizations, establishment of new transportation services, and development of innovative funding strategies. However, an important element of all access-to-jobs programs has been the provision of a mechanism for individuals to pay for these services, in terms of both subsidizing travel and furnishing the actual payment media. This has resulted in various types of special transit payment arrangements. The use of electronic payment media has also been proposed as a means of improving these arrangements. This section reviews examples of the following types of strategies currently in place or under consideration:

- **Special payment arrangements.** In some cases, welfare recipients are directly provided with transit passes (or other fare media) for specified periods of time. In other cases, recipients must purchase their own fare media; they may then be reimbursed (e.g., by the responsible social service agency). Finally, where new services are created specifically to address access-to-jobs needs, the service may be free to eligible users, whereas members of the general public using the service would have to pay a fare.
- **Use of electronic payment media.** Electronic farecards make it possible to track actual use of the service by an

individual and can also potentially facilitate combining the distribution of access-to-jobs transit benefits with electronic benefits transfer (EBT) programs.

These categories of fare-related strategies are discussed below, following a summary of the funding sources for these programs

Funding Sources

State and local agencies have used a variety of funding sources to cover welfare transportation-related costs. (For a more complete discussion of these funding sources and other aspects of welfare-to-work transportation services and issues, see Multisystems et al., *TCRP Report 64: Guidebook for Developing Welfare-to-Work Transportation Services*, Transportation Research Board, 2000.) Programs have been funded by a combination of federal, state, local and sometimes private sources. The primary federal funding sources have been the following:

- **Temporary Assistance to Needy Families (TANF)** block grants given to the states. Each state can use the grant money to finance transportation and other support services that will make it easier for welfare recipients to find and retain employment. TANF funds can be used for a range of transportation purposes, including reimbursement, a cash allowance for work-related transportation expenses, and purchase of transit passes or vouchers—by TANF recipients. (The TANF block grant program was established in the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 (Pub. L. 104-193) and is administered by the U.S. Department of Health and Human Services.)
- **Welfare-to-Work** program grants have been awarded (in FY1998–99) to states as well as individual communities. These grants were intended to benefit the hardest-to-employ TANF recipients and provided funds for various purposes, including transportation. (The Welfare-to-Work formula and competitive grant program was authorized by the Balanced Budget Act of 1997 (Pub. L. 105-33) amending Title VI-A of the Social Security Act, and is administered by the U.S. Department of Labor.)
- The **Job Access and Reverse Commute (JARC)** program was established to help develop transportation services to link welfare recipients and others to jobs and support services. Funds are awarded on a competitive basis, and projects must be the result of a coordinated human services/public transit planning process. Eligible types of projects include promotion of use of transit vouchers by eligible individuals and other activities to facilitate the use of transit for access to jobs by welfare recipients. JARC funds cannot be used to subsidize fares on existing services. (The JARC grant program was authorized under the Transportation Equity Act for the 21st Century (TEA-21) and is administered by U.S. DOT)

A number of states have used the above federal sources to support local or regional transportation projects. In New Jersey, for example, the state DOT established a Transportation Innovation Fund (TIF) to provide seed money for local or regional programs on a competitive basis. Several other states, including California, Connecticut, Michigan and Wisconsin, have set up similar programs, i.e., to provide competitive local grants (*2*). Finally, access-to-jobs programs have received grants and donations from a variety of private sources, including employers, community organizations, foundations and faith-based organizations.

Special Payment Arrangements

As suggested above, fare-related programs instituted to assist welfare recipients have taken various forms, including direct provision of passes or vouchers, reimbursement for purchase of fare media and even free transit. In some cases, programs essentially fall under the commuter benefits arrangements discussed previously.

- **State of New Jersey**. In order to address the requirements of a statewide welfare reform initiative known as Work First New Jersey (WFNJ), the New Jersey Departments of Transportation and Human Services, in conjunction with New Jersey Transit (NJT), mandated that each county in the state develop a Community Transportation Plan. Each county has thus developed services or programs aimed at meeting the transportation needs of welfare recipients. One of the key programs utilized by the counties has been *WorkPass*. In this program, NJT monthly transit passes are provided to participants—although at least one county (Essex) chose to provide up-front payments of the pass price rather than the passes themselves. For those WFNJ clients who must use an operator other than NJT (e.g., PATH or a private carrier), an end of the month transportation-related expense (TRE) reimbursement is provided (*41*). (The WorkPass program is discussed further in the New Jersey Transit Case Study, in Part II.)
- **Delaware Transit Corporation (DTC)**. DTC has established several access-to-jobs fare programs. *JobsWorks* provides eligible individuals free transit rides (through the statewide DART First State transit service) to and from job interviews. Once hired, individuals are eligible to receive free transit passes for up to three weeks through the *Get a Job Get a Ride* program (*42*).

- **Missouri Bootheel Transportation Outreach Program.** The Bootheel program was established in southeast Missouri to address access-to-jobs needs. Riders either purchase a pass for use on the service or employers withhold the price of the pass from workers' paychecks to cover the cost of transit. In either case, the riders are reimbursed for their travel by the State Department of Family Services. The routes are also open to the general public, although these riders must pay the full fare (i.e., without reimbursement).
- **San Luis Obispo County (CA).** A Universal Transit Pass valid on any of the six operators in the county was created based on a request from the County Department of Social Services (DSS). The DSS had previously been required to buy separate passes from the different operators to accommodate the differing needs of its clients. The Universal Transit Pass was seen as significantly simplifying both the DSS's administrative requirements and the use of transit by clients.
- **City of Philadelphia.** The Mayor's Office of Policy and Planning provides a transitional transit subsidy to eligible individuals once they've secured employment.
- **Akron (OH) Metropolitan Regional Transit Authority.** Under the Ohio Works First Pass Program, eligible county residents can ride fixed-route transit for free. (This program is discussed in the Akron METRO RTA Case Study, in Part II.)
- **Capital District Transportation Authority (CDTA).** As part of a comprehensive access-to-jobs program, CDTA (Albany, NY) operates a transit pass program providing "round the clock" access to various services provided and supported by the authority.
- **Suburban Mobility Authority for Regional Transportation (SMART).** SMART, which operates transit in the Detroit area, has a *Get a Job Get a Ride* program that provides new employees their first month's bus fare at no charge.
- **City of Bradenton (FL).** The statewide WAGES coalition buys and distributes monthly passes and multiride tickets to eligible individuals.
- **Rochester-Genesee Regional Transportation Authority (R-GRTA).** R-GRTA (Rochester, NY) uses personal computers as one means of distributing transit passes to program participants. Computers at more than twenty locations are networked to the authority's central computer and each is connected to a printer. R-GRTA invoices the county department of social services on a monthly basis for all TANF passes.

There are many similar programs throughout the United States, and, as suggested by the examples, such programs are administered by different types of entities or collaborations among multiple entities. With regard to transit agencies in particular, the *2001 APTA Transit Fare Summary* reports that 78 agencies (out of the roughly 250 reporting overall) have fare programs involving subsidies from social service agencies; 45 agencies report offering special fare media for "low-income persons" (*37*).

Use of Electronic Payment Media

The use of electronic farecards offers the potential to improve the efficiency and effectiveness of distribution of access-to-jobs transit benefits. For instance, these technologies make it possible to track actual use of a transit service by an individual; this can provide documentation for reimbursement purposes. Farecards also offer the opportunity to combine the distribution of access-to-jobs transit benefits with other electronic benefits (e.g., food stamps) to eligible individuals.

While the use of electronic media (magnetic in particular) is well established for general transit payments, its use in access-to-jobs applications is just beginning. Current examples of use of magnetic or smart card systems to track transit usage by program clients include transit agencies in Lubbock, TX, Rochester, NY, and Ventura County, CA. In the Ventura County Go Ventura project, for instance, six access-to-jobs centers have been equipped for the distribution and loading of Go Ventura smart cards with subsidized passes or e-purse value for eligible agency clients; the card readers track usage of the access-to-jobs cards, allowing the subsidizing centers to pay for their clients' rides and ensure that the clients are traveling to job sites as intended. VCTC provides smart cards to the centers at no cost.

Programs such as TRIP (Transportation Resources and Information Project) in Cincinnati and the WorkPlace in Bridgeport (CT) have also explored the possible use of smart cards to enable the tracking of client transit usage. TRIP undertook a study of paperless options, and the result was a recommendation for a smart card system. The WorkPlace recently participated in a study that considered the feasibility of implementing a regional farecard for use by all public transportation providers in southwestern Connecticut (*43*). The desire to provide an integrated payment option for access-to-jobs clients was one of the key drivers behind this study; in fact, one of the first access-to-jobs services established in that region (the Coastal Link) involves three different operators, which makes fare payment somewhat unpredictable and thus inconvenient. A regional farecard is thus seen as significantly improving the convenience of using this service.

The potential to provide the delivery of access-to-jobs benefits on the same card as EBT programs has not yet been demonstrated but is being explored in several locations. For example, the University of New Mexico (Albuquerque) is working on development of a public transportation farecard system that will utilize the NM Human Services Department's existing magnetic EBT card as the base card. Essentially, people whose transit use is sponsored (e.g., with TANF or Welfare-to-Work funds) will use the EBT card for fare

payment; however, rather than a pass or stored value residing on the card, the number of authorized transit trips for each client will be stored in a database. When the client boards a vehicle and swipes the card through the card reader, the client identification number will be stored in the reader's memory; information on the trips taken with each card will then be downloaded (at the end of the day) to a central computer. The validity of each trip for reimbursement (i.e., based on the restrictions of the specific funding program) will then be checked and the person's account updated. The University issued an RFP for this system in January 2001 and received two proposals; the project is moving forward, although, as of late 2001, a contractor had not yet been selected.

Cincinnati's TRIP has apparently looked at the possibility of tying into the State of Ohio Direction Card a smart card issued by the Department of Human Services to distribute food stamp benefits throughout the state. This card has also been considered for possible integration with transit fare payment in general (i.e., not specifically tied to access-to-jobs purposes) in a smart card feasibility study by the Greater Cleveland RTA. In both cases, linking other types of applications to the Direction Card was not deemed feasible given the current configuration of the card and the economics of converting to a different card platform under the existing contract (with Citibank).

Another project that sought to link transit and EBT applications was the Access NJ initiative proposed in the late 1990s. A pilot was planned for 2000 in Mercer County that would include a transit application on a dual interface EBT/identification card: EBT recipients and state employees would use the card ID with online terminals to access state programs and would also be able to use a stored-value transit purse to pay bus fares on designated routes. The long term plan was for Access NJ to support and share its program costs with many state and private sector applications, some directly on the card and some linked to the card ID and available only via online terminal access. The pilot had not been initiated as of mid-2002.

Thus, while there is widespread interest in the potential of electronic media for improving the delivery and use of access-to-jobs transit benefits, there has been relatively little testing of such applications to date. As smart cards in particular see more use in transit and various other applications, there should be greater opportunities for integrating transit and other types of human service benefits.

Impacts of Access-to-Jobs Programs for Case-Study Agencies

Two of the case studies describe access-to-jobs programs such as those discussed above:

- **Akron (OH) Metropolitan Regional Transit Authority** operates a free-fare program for eligible county access-to-jobs clients under the Ohio Works First Pass Program; clients ride free when showing a valid photo ID.
- **New Jersey Transit** operates the WorkPass Program as part of the statewide access-to-jobs initiative, Work First New Jersey. WorkPass provides monthly passes or single-ride tickets to eligible individuals.

The full case studies are presented in Part II. However, it is useful to compare the results of these efforts in terms of their impacts on both partner agencies and clients, as well as on the transit agencies. Table 4-8 summarizes the key impacts of the two programs. These impacts are discussed briefly below.

Customer Impacts and Benefits

The major impacts on, and benefits to, partner agencies and clients from the case study programs include the following:

- Convenient access to transit service for employment and training travel—as well as other types of trips—by eligible riders.
- Service for free (Akron) or at a fare significantly lower than the regular fare (NJT).
- Positive response by partner entities. In New Jersey, for instance, over 75% of the counties participate in the program, along with more than 40 social service agencies. More than 5,000 passes and tickets are distributed through the program each month.
- Considerable cost savings because of New Jersey Transit's WorkPass program for the participating social service agencies. An agency can save over 50% in comparison to the previous Transportation Reimbursement Expense (TRE) Program that covered access-to-jobs trips.

Agency Impacts and Benefits

The major impacts on, and benefits to, transit agencies from the case study programs include the following:

- Increased ridership from these programs. Akron METRO RTA provides an average of 50,000 rides per month through the program, and most of these are considered new rides. New Jersey Transit has also seen ridership increases.
- Improved public opinion of the agencies. For instance, New Jersey Transit has been seen as a key part of the development of a workable approach to addressing the state's access-to-jobs needs.
- For New Jersey Transit, considerable resistance at the county level in planning and implementing the WorkPass program; New Jersey Transit had to work closely

TABLE 4-8 Case study comparison: access-to-jobs fare programs

Case-Study Agency/ Name of Program (Year Initiated)	Akron METRO RTA/ Ohio Works First Pass Program	New Jersey Transit/ WorkPass Program (1997)
Nature of Program	Ohio Works First Department of Job and Family Services (DJFS) clients ride free when showing valid photo ID.	WorkPass provides monthly passes or single-ride tickets to eligible individuals through county welfare offices and social service agencies
Other Participants	Summit Co. (DJFS)	NJ Dept. of Human Services, NJ DOT, NJ Dept. of Labor, NJ Employment & Training Comm., county welfare offices and social service agencies
Transit Agency Goals of Program	Provide employment and training access to eligible DJFS clients	Provide safe, reliable, and convenient transportation to Work First NJ program clients and other transit dependents
Customer Impacts and Benefits		
Usage rates	NA*	NA
Attitude toward program/other benefits	Program clients are generally satisfied and are using transit on a regular basis; program is easy to use	Provides riders improved flexibility (i.e., unlimited transfers for entire month, for both work and other purposes)
Cost of travel	Free with valid ID	Free or lower than regular fare; extent of benefit depends on specific eligibility/status of client
Agency Impacts and Benefits		
Ridership	50k rides/mo.; most of these are new rides	Results in additional ridership (varies by county)
Revenue	METRO receives $200k/year from DJFS	Depends on specific WorkPass program
Other Impacts/Benefits	Program has apparently improved the public's opinion of METRO in general	NJT seen as part of the solution
Impact on/Benefits to Partners		
Market penetration	Available to anyone with valid ID	16 of 21 counties and >40 soc. service agencies participate, >5k passes/tickets distributed each month
Other (e.g., need for parking)	Facilitates provision of access to jobs and training; eliminates agency's concerns about the cost of this transportation	>$2m in cost savings for agencies over previous Transportation Reimbursement Expense (TRE) program; average TRE benefit had been $120 per month, while 1-month bus pass is <$60
Liability to agency		
Economic liability	METRO currently unable to limit free trips to work/training trips, but little economic risk since amount of contract can be adjusted to match ridership.	NJT provides free passes in some cases.
Political/legal liability	None	None
Constraints and Barriers		
Technical	None	None
Institutional/Funding	TANF, Title XX and DJFS funds	Program met resistance from counties over perceived obstacles. Funding from counties (using TANF or General Assistance funds through NJDHS)
Required Equipment and Technology		
	ID cards must be manually viewed, since they contain photos; plan is to ultimately provide magnetic cards that can be read in farebox.	None

* NA = Not applicable.

with the various partner entities to resolve the perceived obstacles; these included, for instance, concerns that WorkPass would mean more work for program representatives and that WorkPass would remove clients' flexibility to spend part of their transit payments on food for their families. (As indicated above, these and other obstacles were ultimately overcome, and counties and social service agencies have become participants in the program.)

Thus, access-to-jobs partnerships have been shown to benefit eligible riders by providing affordable access to employment and training sites. However, since these programs often involve participation by a number of different entities, it is important that the participants clearly understand—and be sensitive to—each other's goals and concerns in developing and implementing the program.

The key findings of this and the previous chapters are reviewed in the next chapter.

CHAPTER 5

SUMMARY OF FINDINGS

INTRODUCTION

In their efforts to maintain, if not expand, their share of the traveler market in recent years, transit agencies have faced both new challenges and new opportunities. While growing operating costs and dwindling subsidies have forced agencies to consider steeper or more frequent fare increases, organized community opposition to higher fares has grown as well. Moreover, the continuing dispersal of travel patterns within regions has forced agencies to continually refine service design and to target marketing efforts to specific market segments.

Perhaps no aspect of transit management and operations has been affected by these trends as fundamentally as fare policy. Over the last several years, transit agencies have increasingly considered fare policy and fare structure changes and new payment options that target the needs of specific user groups and make use of emerging subsidy arrangements—while at the same time needing to address local concerns pressed by community and environmental groups. In general, agencies have had to broaden the context in which they consider fare-related initiatives, and consequently they have sought to take greater advantage of opportunities to participate in new types of partnerships and funding programs linked to specific market segments (e.g., related to university, employer, and access-to-jobs programs).

At the same time, the expanded capabilities of electronic payment technologies (i.e., magnetic stripe farecards and smart cards) have benefited agencies by facilitating the provision of a range of flexible payment options and more efficient methods for distributing transit benefits and fare media to customers. Electronic fare media have also facilitated development of the aforementioned types of partnerships and provided a framework for regional multiagency fare integration. The capabilities of smart cards in particular have created potential opportunities for transit agencies to establish partnerships with nontransit entities such as parking authorities, toll operators, financial institutions, and retail establishments. Such multiapplication arrangements offer the potential to expand transit's market by increasing the convenience of paying fares and the establishment of loyalty programs; these new partnerships may also eventually offer the opportunity to share administrative costs and generate new revenues for the transit agency.

Key issues and emerging developments related to and affecting fare policy and pricing include the following:

- **Equity and environmental concerns.** Pricing and fare policy are increasingly being influenced by factors related to equity and environmental issues, including concerted opposition to proposed fare increases based on environmental justice.
- **New programs and partnership opportunities.** Transit agencies are increasingly entering into fare-related partnerships with a variety of entities, including social service agencies (e.g., for access-to-jobs benefits), employers, and universities, often to provide low-priced passes or other special payment arrangements. The introduction of smart cards presents opportunities to develop partnerships with other types of nontransit entities.
- **Focus on providing for "seamless travel."** There has been a growing emphasis on the development of multiagency agreements and integrated regional payment arrangements.

TCRP Project A-25 has investigated these areas within the context of the overall trends and developments related to fare policies, structures, and technologies over the past several years. This report presents the research methodology and results of the study. Key findings of the study are summarized below.

FARE POLICY AND STRUCTURE ISSUES AND TRENDS

Key trends and developments related to fare structures and payment options are as follows:

- **Increase in fare levels.** Fares have risen significantly over the past few years: roughly one-third of North American transit agencies had peak fares of $1 or more in 1994, while two-thirds of these agencies were at this level in 2000; the most common fare was $0.75 in 1994 (20% of agencies), $1 in 2000 (19%). In 2001, two agencies became the first (among noncommuter rail systems) to reach the $2 peak fare level, and one of these agencies announced in 2003 the intention to raise its

fare to $2.25. Of course, while few agencies directly link fare increases to inflation rates, many agencies have more or less simply tracked inflation in making moderate fare increases. For instance, a $1 fare in 1994 would have risen to $1.15 in 2000 if adjusted for inflation.

- **Simplification of fare structures.** Despite the growth of electronic fare systems, agencies continue to opt for simplified basic fare structures, generally choosing not to introduce fare zones or peak/off-peak differentials. In fact, the percentages of agencies using these strategies has declined in the last few years, as several agencies that already had such differentials have moved to reduce the complexity of their fare structures (e.g., eliminating or reducing the number of zones).
- **Elimination of transfers and introduction of day passes.** Some agencies have opted to eliminate the provision of free or low-priced transfers in conjunction with selling 1-day passes on buses and in rail stations. There has been an increase in the use of short-term passes (i.e., 1- to 3-day, as well as partial day) in general, both for visitors and regular riders.
- **Increase in market-based pricing strategies.** Agencies are increasingly offering a range of payment options that segment the market based on frequency of use and willingness to prepay. These options typically include one or more type of unlimited-ride pass as well as some form of discounted multiride option. However, the percentage discounts—or bonuses—offered with multiride options (tickets, tokens or stored-value farecards) has decreased somewhat, with fewer agencies providing "deep discounts": in 1994, 42% of North American agencies offered multiride discounts of more than 20%, while this percentage dropped to 29% of all agencies in 2000.

While transit agencies are raising fares and generally seeking to simplify their basic fare structures, they are expanding the range of payment options they are offering riders. This increase in payment options has been fueled in part by the introduction of electronic payment technologies, reviewed below.

FARE PAYMENT TECHNOLOGY DEVELOPMENTS

An increasing number of agencies are implementing electronic fare payment strategies and many are introducing—or at least strongly considering—smart cards. Key findings related to this area are summarized below.

Influence of Electronic Payment on Fare Policy and Payment Options

Electronic payment technologies have facilitated the introduction of a range of flexible new fare payment options, including various forms of stored-value, "rolling" time-based passes (activated on first use), frequency-based discounts, automated transfers and fare differentials, and guaranteed last ride (or "negative balance") policies. Some agencies are even considering a "guaranteed lowest fare" strategy, which essentially eliminates the need for the rider to decide on a specific payment method in advance.

In some cases (e.g., NYMTA's MetroCard program), the introduction of electronic payment has significantly influenced fare policy as agencies have taken advantage of the new capabilities to significantly modify their basic fare structures. Other agencies (e.g., CTA), on the other hand, have increased the range and flexibility of payment options offered but have not made significant changes in the basic fare structure.

Issues Associated with Use of Smart Cards

Contactless—or sometimes dual interface—smart cards are already in use in a number of locations and are planned for many others. In the United States, smart cards are now in use, at least on a trial basis, in Washington, DC; Chicago; Ventura County, CA; the San Francisco Bay area; Orlando, FL; and Newark, NJ. Other programs are planned for implementation in over a dozen other cities or regions over the next few years. Abroad, very large regional efforts have been in place for several years in Hong Kong, Seoul, and Pusan and are under development in London, Paris, Rome, Berlin, Tokyo, and a number of other world capitals.

Key issues related to the use of smart cards by transit agencies include the following:

- **Addressing the cost of smart cards.** One of the key concerns regarding smart card use is the relatively high cost of the cards themselves. Some agencies have sought to encourage retention of the cards—as well as to defray their purchase cost—by imposing a card issuance charge (e.g., $5); this charge typically allows the cardholder to register the card with the agency and receive balance protection in the case of loss of the card. Other strategies that have been developed (although not yet available for all vendors' systems) include (1) low-priced paper contactless tickets targeted for distribution to one-time or occasional riders, and (2) recycling systems designed to ensure that the smart card (or token, in one system) is returned to the agency after it has been used.
- **Addressing concerns regarding smart card standards and interoperability.** One of the major concerns within the transit industry has been how to promote standardization and interoperability among the different contactless card technologies. Vendors have begun to address this issue by developing cards and readers that combine multiple card interfaces. From the agency side, there are several efforts underway, in the United States and abroad, to establish industry-wide standards or guidelines for transit smart card applications.

- **Insuring compatibility with existing equipment.** In light of interoperability concerns, a major technical issue facing all of the agencies seeking to add smart card capability to an existing fare collection system is insuring compatibility with the existing system. For instance, in an effort to facilitate installation of the SmarTrip readers into the Metrorail faregates, WMATA opted to sole source the implementation to the existing rail fare collection vendor. CTA has avoided this issue, since smart card capabilities were built into the original AFC equipment; of course, in order to take advantage of the preinstalled card readers, CTA also had to sole source the provision of smart cards to the original vendor. In TransLink, developing a strategy for integrating one vendor's smart card system into the BART faregates being installed by a second vendor has proven to be a significant challenge.
- **Using electronic fare media in a proof-of-payment (POP) system.** Electronic farecards (either magnetic stripe or smart card) cannot be *directly* used in a POP environment, since POP requires the rider to display a validated ticket or a flash pass to a fare inspector. A faregate or farebox equipped to read electronic farecards automatically identifies the validity of the card and deducts the proper fare value (unless the card is an unlimited-ride pass). This is infeasible with a TVM and visual fare inspection. Therefore, use of farecards in a POP system requires special accommodations to allow the user to validate the card and the inspector to check the validity of the card. The most common approach being implemented in U.S. systems—planned for smart card systems in San Francisco, San Diego, Los Angeles, Seattle, Miami, Minneapolis, and Washington/Baltimore—is to provide in-station card processing units and to have the inspectors carry hand-held card readers.

Development of Regional Fare Integration Programs

As suggested above, electronic payment media are increasingly being introduced to serve multiple transit agencies in a region—i.e., to facilitate seamless travel using a single farecard. Regional fare integration should ultimately entail all agencies in a region adopting a common fare policy, based on regional passes along with free or discounted transfers. However, use of electronic fare media allows each agency to retain its own fare structure while accepting a regional farecard (e.g., with payments made from a common stored value purse). In a smart card-based system, a customer would presumably also be able to load individual payment options (e.g., a pass) from one or more agencies onto the same card.

As evidenced by the experiences of those regions that have developed integrated systems, this is invariably a rather complicated undertaking. Establishing a multiagency payment system is likely to require fundamental changes from the way each individual agency manages fare collection on its own. Complex partnership agreements are typically needed to establish responsibilities, ownership, and allocation of costs and revenues. While a separate clearinghouse or back-end payment settlement system can be developed to manage these processes, all participating agencies must come to agreement on revenue management policies and procedures. The types of issues and requirements that must be considered in developing a regional fare system generally fall under the following categories:

- **Overall Policy and Business Rules.** Establishing the financial and governance framework and system procurement strategy; addressing customer concerns; and setting fare policy for the region.
- **Technical Requirements.** Developing system architecture and technology standards, and identifying effective implementation staging.
- **Administrative and Customer Support Functions.** Establishing revenue settlement and data-sharing procedures, as well as customer service functions.

The regions pursuing regional fare integration to date have taken various approaches to addressing these requirements. The U.S. efforts are all in the early stages of implementation or testing; as these programs become operational in the next few years, their lessons will provide guidance to other regions considering such initiatives.

Potential for Developing Multiapplication Programs

The growing use of smart cards for various types of uses (e.g., electronic toll collection, parking, financial services, mobile commerce, loyalty programs and identification/access/security) provides opportunities to combine transit and other applications on one card. While most smart card programs focus on a single application, the goal of many issuers is to ultimately provide multiple functions on a card.

Transit fare payment is increasingly seen as a key application, regardless of the primary use and issuer of the card. Thus, a broad range of new types of transit agency partnerships can now be considered with entities that would issue a smart card, accept one for payment of their goods and services, or both. Indeed, agencies in Washington, DC; Orlando, FL; Ventura County, CA; and San Francisco are already testing—or at least plan on pursuing—multiapplication arrangements. Other regions developing new electronic payment systems (e.g., Seattle, Los Angeles, San Diego, and Boston) have also indicated that they will likely pursue multiapplication opportunities. Meanwhile, a number of transit smart card projects abroad (Hong Kong, Pusan, Paris, Curitiba, and elsewhere) have established multiapplication arrangements.

As the use of smart cards for all types of purposes expands in the coming years, the opportunities for establishing multiapplication programs will grow as well. A number of transit agencies have opted for dual interface (contactless/contact) cards so as to best position themselves to take advantage of such opportunities. Moreover, the recent announcements by Visa and MasterCard of specifications for contactless credit/debit applications could pave the way for transit's participation in multiapplication partnerships.

Benefits and Impacts of Electronic Payment Programs

Electronic payment programs have been shown to benefit both agencies and their customers. Some of these benefits result from an agency implementing electronic payment in general (i.e., magnetic or smart card), while others can be attributed specifically to use of smart cards. As revealed by the case studies undertaken for this report, the key types of benefits—and impacts—associated with electronic fare media are summarized below.

Customer Benefits and Impacts (All Electronic Media)

- A greater variety of, and more convenient, payment options, such as rolling activate-on first use passes, stored-value/stored-ride farecards, and 1-day passes sold on buses. Farecards have also reduced the cost of travel for many riders by offering low-price 1-day passes or a purchase bonus.

- Popularity with customers. About 95% of CTA's rail riders pay their fares with farecards, as do 68% of bus riders. At CT TRANSIT, overall pass use has increased by more than a third since the introduction of electronic payment, and the use of 1-day and 7-day passes in particular has grown steadily since their introduction.

Customer Benefits and Impacts (Smart Cards)

- **Current benefits:** (1) the availability of features such as registration/balance protection, autoload and negative balance; (2) the ability to use the same card with multiple agencies, if available; and (3) the improved convenience of the contactless interface (i.e., the card does not have to be removed from a wallet or purse).
- **Potential benefits:** (1) multiapplication capabilities and (2) innovative fare structure options, such as a frequency-based discount or even a guaranteed lowest fare strategy.
- **Customer satisfaction:** Users of smart cards have expressed high levels of satisfaction with the cards and programs. For instance, in Chicago, 93% of survey respondents were "satisfied" or "very satisfied" with the cards and 86% expressed willingness to continue using the card after the conclusion of the pilot period and to recommend the card to others. In the TransLink program, both survey respondents and focus group participants expressed a high level of satisfaction with the program. Moreover, two-thirds of noncard users surveyed said that they are "very likely" to try the card. Sales of the SmarTrip card in Washington have grown steadily since its introduction, despite the fact that WMATA has done very little marketing of the program.
- **Customer concern:** In contrast to the use of magnetic cards, customers must often pay an initial fee to acquire a smart card. This cost is $5 in Chicago and Washington, for instance. There is no charge in the Go Ventura and TransLink programs (at least for the TransLink pilot), but a customer must pay $5 for card replacement/balance protection in these programs. The $5 charge was the smart card aspect liked least by survey respondents in Chicago (cited by 30% of respondents). The card fee reportedly has not been an issue in Washington to-date, although expansion of the program to buses could conceivably produce some customer complaints (because, unlike the case on Metrorail, there will not be a magnetic farecard available without an initial charge).

Agency Benefits and Impacts (All Electronic Media)

- More careful tracking of ridership and revenue impacts of different fare initiatives and facilitated implementation of a greater range of fare options for customers.
- Considerably reduced use of cash for fare payment: At CTA, for instance, only 16% of boardings are currently made using cash, compared to 27% pre-electronic payment.
- Reduced or even eliminated tokens. For example, CTA was able to eliminate tokens altogether following the introduction of stored-value farecards, thereby removing expenses associated with their sale and redistribution. CT TRANSIT's token use dropped by almost half following the introduction of stored-ride cards.
- Reduced fare-collection costs associated with producing, selling, and distributing fixed-calendar period passes because of use of rolling passes. For instance, an agency no longer has to print weekly and monthly passes that may be discarded if they are not purchased.
- Reduced opportunities for fare abuse and evasion through automatic verification of validity of fare media, and by curtailing counterfeiting of passes. These systems can also reduce operator requirements for administering fare collection and the extent of rider-operator confrontations regarding the validity of passes and transfers.

- New costs associated with introducing a new technology. For example, CTA initially envisioned that implementation of electronic payment would result in a personnel cost savings since there would be a reduced need for rail ticket agents. However, the new program required a significant outreach and customer service effort on the part of the agency, and many of the rail ticket agents were converted to "customer assistants" located in the stations to help riders use the new system. Due to these and other new staff requirements, CTA has not realized the personnel cost savings originally expected.

Agency Benefits and Impacts (Smart Cards)

Due to the short operational period—and generally limited scope—of U.S. smart card programs to-date, it is difficult to identify significant agency impacts and benefits. However, beyond the above benefits associated with electronic payment in general, there are a number of benefits—and costs—associated with introducing smart cards:

- Faster boarding or throughput than with fare media that have to be inserted or swiped. This could ultimately translate into service reliability improvements as higher percentages of boardings are made using contactless cards.
- Facilitated consideration of innovative types of fare options and the use of data on card usage to improve service planning due to higher data capacity and processing capabilities of smart cards.
- Inclusion of convenience features such as autoload arrangements (including employer-based programs). For instance, the SmarTrip (through SmartBenefits) and TransLink programs both include employer autoload programs that make it easier for employers to provide commuter benefits to their employees.
- Multiapplication opportunities, as indicated above. For instance, the SmarTrip card can currently be used in WMATA parking facilities, and the agency has established multiapplication pilot projects with First Union Bank and GSA. VCTC has pursued Go Ventura partnerships with a university and with county social service agencies.
- Reduced equipment costs: Contactless card readers tend to be less costly to purchase than comparable magnetic units. Thus, an agency that accepts only smart cards (i.e., in addition to cash—at least on buses) should experience a lower capital expenditure than if it accepted only magnetic cards. However, many agencies deem it necessary or appropriate to accept both types of fare media, thereby neutralizing any net cost savings associated with the smart card equipment.
- Reduced maintenance costs: Contactless card readers should also have lower maintenance requirements than magnetic card readers, since the contactless units are sealed and have no moving parts; the extent of the impact on overall system maintenance costs will depend on the agency's mix of types of equipment (i.e., are there also electronic or validating fareboxes and magnetic card readers?).
- Cost and funding issues: the cost to an agency associated with smart card implementation and operation will depend on the specific nature of the program. If it is part of a regional system, most or all of the initial capital costs will in some cases (e.g., TransLink, Go Ventura) be covered by the initiating agency (i.e., MTC and VCTC in those two cases), using largely federal and state funds. In other regional models (e.g., SmarTrip), each agency is responsible for procuring its own equipment. If an agency is implementing a smart card system on its own, it will clearly be responsible for the full cost. However, planning ahead can minimize the capital cost of adding smart cards; for example, CTA procured its initial (magnetic) electronic payment system with smart card capability built into all of the new equipment.
- Agency costs: in any type of regional system, the individual agencies will have to cover at least some operating costs on their own (i.e., related to such areas as administration, reporting, and equipment maintenance). Moreover, each agency will ultimately have to pay for clearinghouse/support services associated with such activities as card management and revenue allocation; such payments may be in the form of a certain fee per smart card transaction or based on a percentage of smart card-based fare revenue.

Electronic payment technologies clearly offer a number of customer-related and operational benefits. Such systems improve customer convenience in terms of both purchase and use of fare media, while allowing agencies to offer a broader range of flexible payment options and to better manage the overall revenue collection function (including improving data collection and reporting capabilities and controlling revenue loss through fare evasion). However, while certain expenses should be lowered (e.g., through reduction of use of cash, replacement of at least a portion of existing payment media, or lower equipment purchase and maintenance requirements), agencies should understand that implementation of an electronic payment system will not necessarily result in an overall reduction of fare collection costs—particularly in the short term. There are costs associated with implementing any new technology, and, where an agency is participating in a regional smart card program, the costs related to the new system are likely to add to, rather than replace, the agency's existing fare collection costs. For this reason, those agencies that have developed smart card systems in particular tend to view them primarily as a means of better serving their customers—and hopefully attracting new

customers—while also improving revenue management. While cost reduction may well be a reasonable long-term goal, it should not drive an agency's interest in an advanced payment system.

EMERGING FARE-RELATED ISSUES AND PROGRAMS

A number of types of fare policy and pricing strategies and initiatives are emerging in response to (1) equity and environmental justice issues and (2) partnership opportunities through university, employer, and access-to-jobs programs.

Equity and Environmental Justice Issues

Environmental justice initiatives to insure that all population segments, including low-income and minority groups, receive fair treatment with regard to environmental issues are increasingly affecting transit agencies' consideration of potential fare changes. Such initiatives have resulted in legal challenges to proposed fare increases in several cities; moreover, even where such challenges have not proven successful—or have not actually entered the courts—they have certainly influenced the fare policy decision-making process. Major legal challenges over the past few years include the following:

- A suit filed by a community-based coalition sought to prevent implementation of a fare increase and proposed elimination of monthly passes by the **Los Angeles County Metropolitan Transportation Authority.** LACMTA is currently bound by a consent decree that has legally limited the extent to which the MTA can raise fares over the past several years.
- In Philadelphia, a number of community-based lawsuits have led to changes in the process by which the **Southeastern Pennsylvania Transportation Authority** adopts fare changes. One of these suits also led SEPTA to introduce highly discounted tokens (only two tokens need be purchased to receive a 28% discount). SEPTA's latest fare increase is currently being appealed in the courts by community groups.
- When the **New York Metropolitan Transportation Authority** proposed fare increases in 1995, several community organizations filed suit to block the changes. The suit claimed that the fact that the increase on subway and bus (20% increase) was higher than that on the commuter railroads (9% increase) was discriminatory.
- Following the June 2000 approval of a fare increase by the **Metropolitan Atlanta Rapid Transit Authority** Board of Directors, a coalition of community groups filed a discrimination complaint against the agency. The Atlanta City Council and the Fulton County Commission also adopted resolutions opposing the fare increase.
- Opposition by community and environmental groups in Boston to a Fall 2000 fare increase led the **Massachusetts Bay Transportation Authority** to introduce free bus-bus transfers as well as a low-price weekly pass for the first time.

In some cases, these challenges have resulted in modifications to fare proposals or legal restrictions on future changes. In others, they have merely required the agencies to go to great lengths to explain and defend their rationale for raising fares. Regardless of the formal outcomes, however, all of these initiatives have had a significant impact on the local agencies' fare policy decision-making processes. Moreover, the challenges in these cities have not gone unnoticed in other cities; many transit agencies, especially those in other large cities, feel that they must now pay greater attention to equity and civil rights concerns in considering possible fare structure changes.

University Programs

Public transportation is an important travel option for many college students, faculty, and campus staff for traveling between the campus and off-campus housing and for intracampus circulation on large campuses. Some universities provide their own campus area transit services, but many campuses are served by the local transit operator. Where the latter is the case, many universities have established partnerships with the local transit agencies to provide specially priced passes or other payment options to students. The basic types of programs are as follows:

- **Special pass and unlimited-access programs.** A number of universities have joined with transit agencies to establish special programs that provide free unlimited-access or low-cost passes for students (and, sometimes, faculty and staff).
- **Special reduced-fare arrangements.** Some universities have arranged with the local transit operators to provide for reduced single-ride fares for their students.
- **Joint transit agency-university farecard programs.** As increasing numbers of universities introduce magnetic or smart cards for their students (for identification, building access, library usage, purchases at campus stores, etc.), local transit agencies have begun to pursue arrangements to enable transit payments using the same cards.

By providing a low-cost and convenient form of transit payment to the university community, the transit agency should see increased ridership, while building brand loyalty to the transit system in terms of likely future use by students. Meanwhile, the university may be able to ease on-campus parking requirements by shifting some drivers to transit.

However, it is important to carefully design the pricing parameters of university pass programs so as to minimize the potential negative revenue impact on the agencies. In particular, the agreement should be structured so that it allows the agency to increase the amount paid per person so as to reflect actual usage.

Employer Benefits Programs

Transit agencies have long pursued partnerships with employers to facilitate, if not subsidize, employees' use of transit to commute to and from work. These partnerships were originally limited to the distribution of monthly passes by employers to their employees, often with at least a partial subsidy of the pass price. The programs subsequently became more flexible with the introduction of transit vouchers that the employees could use to acquire the transit payment option of their choice. In the last decade, these basic approaches have evolved and broadened, fueled both by a steady increase in the tax-free transit benefit employees could receive and the emergence of electronic payment technologies. Key types of employer-oriented benefit programs now in place include the following:

- **Annual pass programs.** In these programs, employers buy passes for employees at significantly less than the normal monthly cost of passes, based on a predetermined formula set by the transit agency. Examples of this approach include King County Metro's FlexPass and Portland Tri-Met's PASSport.
- **Transit voucher programs.** In these programs (e.g., TransitCheck in the New York City region, Metrochek in the Washington, DC, region, and CommuterCheck in various cities), employees receive vouchers that can then be redeemed for passes or other options. In some cases (e.g., in New York City and Washington, DC), the vouchers are in the form of farecards that can be used directly for fare payment.
- **Automated benefits distribution programs.** The first example of this approach is WMATA's SmartBenefits program, in which an employer can establish an account for each participating employee that enables the employee to automatically download the value of the benefit to the SmarTrip smart card; a similar approach is also being tested in the TransLink program in northern California.

Employer pass and voucher programs have been shown to benefit employees, employers, and transit agencies. The simpler—and less costly—it is for employers to administer these programs, the more likely they will be to participate. Similarly, the more convenient it is for employees to take advantage of commuter benefits, the more likely they will be to use transit to get to and from work. Annual pass programs have made participation convenient for both employers and employees. However, it is important that transit agencies establishing these programs structure pricing in such a way that they protect themselves against losing revenue; the pricing should be able to capture at least some revenue from the new trips being generated.

In voucher-type programs, the direct provision of farecards and the emerging automation of benefits distribution are also greatly improving the convenience for all parties. As the use of electronic payment options spreads, more and more agencies will be able to offer such mechanisms within their regions, thereby expanding the range of options available to allow both employers and employees to take advantage of commuter choice benefits.

Access-to-Jobs Programs

Addressing welfare-to-work transportation issues has required creation of new collaborations among public agencies and private organizations, establishment of new transportation services, and development of innovative funding strategies. However, an important element of all access-to-jobs programs has been the provision of a mechanism for individuals to pay for these services, in terms of both subsidizing travel and furnishing the actual payment media. This has resulted in various types of special transit payment arrangements. The use of electronic payment media has also been proposed as a means of improving these arrangements. This section reviewed examples of the following types of strategies currently in place or under consideration:

- **Special payment arrangements.** In some cases, welfare recipients are directly provided with transit passes (or other fare media) for specified periods of time. In other cases, recipients must purchase their own fare media and then may be reimbursed (e.g., by the responsible social service agency). Finally, where new services are created specifically to address access-to-jobs needs, the service may be free to eligible users, whereas members of the general public using the service would have to pay a fare.
- **Use of electronic payment media.** Electronic farecards make it possible to track actual use of the service by an individual and can also potentially facilitate combining the distribution of access-to-jobs transit benefits with EBT programs.

Access-to-jobs partnerships have been shown to benefit eligible riders by providing affordable access to employment and training sites. However, since these programs often involve participation by a number of different entities, it is important that the participants clearly understand—and be sensitive to—each other's goals and concerns in developing and implementing the program.

CONCLUDING REMARKS

In summary, transit agencies are faced with a growing array of both demands and opportunities that affect their decisions on fare structures and payment methods. Agencies are responding by entering into new types of partnerships and by introducing new types of payment options and pricing strategies. The availability of electronic payment technologies has facilitated partnerships with social service agencies, employers, and universities—as well as offering the potential to consider new partnerships with entities such as parking or toll operators, financial institutions, and government agencies. These technologies have also increased agencies' abilities to link payments with other agencies operating in the same region and have greatly increased the range of payment options that agencies can offer their riders. Agencies can now develop market-oriented pricing strategies based on a flexible new set of payment options. These options represent an opportunity to better serve the existing rider markets while also attracting new riders.

REFERENCES: PART I

1. Fleishman, D., N. Shaw, A. Joshi, R. Freeze, and R. Oram. *Fare Policies, Structures, and Technologies.* Transportation Research Board, TCRP Report 10, 1996.
2. D. Fleishman, C. Schweiger, D. Lott, and G. Pierlott. *TCRP Report 32: Multipurpose Transit Payment Media*, 1998.
3. Survey of agencies in Multisystems, Transit Fare Collection Decision Models for *Fare Policy and Cost Analysis—Final Report*, for USDOT/SBIR Program, November 1998.
4. Stern, R. *Passenger Transfer System Review*. TCRP Synthesis of Transit Practice 19, 1996.
5. Multisystems, Inc., Mundle & Associates, Inc., and Parsons Transportation Group, Inc. *A Toolkit for Self-Service Barrier-Free Fare Collection.* TCRP Report 80, September 2002.
6. Charles River Associates. *Evaluation of the TransLink Demonstration (Final Report)*, for Metropolitan Transportation Commission [Oakland, California], September 2002.
7. "Wave of the Future?" *Card Technology*, January 2002.
8. *Card Technology Magazine*, November 2002, pp. 20–23.
9. Integrated Transport Smartcard Organisation. *The ITSO Specification for Interoperable Public Transport Ticketing Using Contactless Smart Cards, Part 1: Overview and Business Model*, November 2000.
10. Lobron Consultancy, Ltd., *Develop a Recommended Standard for Automated Fare Collection for Transit—Scoping Study Final Report*, November 2002.
11. USDOT/Volpe Center and Multisystems, Inc. *National Guidelines and Technical Specifications for Electronic Payment Systems—Smart Card-Based Transit Fare Collection System Requirements (Overall Summary)*, August 2000.
12. Excerpted from USDOT/Volpe Center and Multisystems, Inc. *Transit-Financial Collaboration Requirements Module—Summary*, August 2000.
13. *Card Technology*, November 2002.
14. "MasterCard Tests a Faster Way to Pay," CardTechnology.com. Accessed December 13, 2002.
15. *Card Technology*, October 2002.
16. E-Squared Engineering. *Introduction to Electronic Payment Systems and Transportation*, ITS America, April 2000.
17. Boston Globe, December 9, 2002.
18. *Card Technology*, September 2001.
19. "Tollbooth Technology Meets the Checkout Lane," NY Times, July 7, 2002.
20. *Card Technology*, September 2002.
21. *Card Technology*, November 2001.
22. U.S. Environmental Protection Agency web site, available online at http://www.epa.gov/compliance/environmentaljustice/. Accessed May 29, 2003.
23. U.S. District Court for Central District of California (Western Division): Case No. CV 94-5936 TJH (Mcx), *Labor/Community Strategy Center et al. (Plaintiffs) vs. Los Angeles County MTA and Joseph Drew, MTA Acting CEO (Defendants)—Stipulation and Order re (Amended Proposed) Consent Decree* (October 24, 1996).
24. *Philadelphia v. Southeastern Pennsylvania Transportation Authority*, 1 Pennsylvania Commonwealth 101; 271 A.2d 504 (1970).
25. *Philadelphia v. Southeastern Pennsylvania Transportation Authority*, 441 Pa. 518, 272 A.2d 921 (1970).
26. 74 Pa. C.S. § 1741.
27. *Coalition for Better Transportation in the City v. Southeastern Pennsylvania Transportation Authority*, 6 Pa. D&C 3d 422 (1977).
28. *Consumer Education and Protective Assoc. v. Southeastern Pennsylvania Transportation Authority*, 125 Pennsylvania Commonwealth 125; 557 A.2d 1123 (1988).
29. 65 Pa. C.S. §§66.1–66.4.
30. *Committee for a Better North Philadelphia v. Southeastern Pennsylvania Transportation Authority*, 1990 WL121177 (E.D. Pa.) (1990), *affirmed without opposition* 935 F.2d 1280 (3rd Circuit 1991).
31. *Southeastern Pennsylvania Transportation Authority v. Association of Community Organizations for Reform Now*, 563 A.2nd 565 (Pennsylvania Commonwealth 1989).
32. Court of Common Pleas of Philadelphia County in an unreported decision.
33. *Association of Community Organizations for Reform Now v. Southeastern Pennsylvania Transportation Authority*, No. 1932 C.D. 2001 (Pennsylvania Commonwealth 2002).
34. *New York Urban League v. Metropolitan Transportation Authority*, 905 F. Supp. 1266 (S.D. N.Y. 1995).
35. *New York Urban League v. State of New York*, 71 F. 3d 1031 (2nd Circuit 1995).
36. *Transportation Equity*, a Newsletter of the Environmental Justice Resource Center at Clark Atlanta University, vol. 2, no. 1 (Summer 2000).
37. American Public Transportation Association. *2001 APTA Transit Fare Summary.* 2001.
38. "Unlimited Access," *Transportation.* Vol. 28, (233–267) 2001.
39. Brown, J., D.B. Hess, D. Shoup. "UCLA's BruinGO Pilot Program: An Evaluation," UCLA Institute of Transportation Studies, October 2001.
40. Conklin, J.M., R.D. Halvorsen, D.M. Fleishman, R.L. Oram, "Employer-Based Annual Transit Pass Programs: A Survey of Current Practice in the Public Transit Industry." Paper presented at the 81st Annual TRB Meeting, January 13–17, 2002.
41. Multisystems, Inc. *Community Transportation Plan—Essex County*, prepared for NJDOT, NJDHS and NJT; October 1998.
42. *Passenger Transport*, July 23, 2001.
43. Multisystems, Inc. and Howard/Stein-Hudson Associates. *Regional Transit Card Implementation Study, Final Report*, prepared for South Western Regional Planning Agency, November 2001.

PART II:
CASE STUDIES

INTRODUCTION TO PART II

SELECTING THE CASE STUDIES

The study team conducted a set of case studies of agencies that have recently put in place, or are in the process of introducing, various types of fare initiatives or programs. The goal in selecting case study sites was to choose agencies that represent both a range of system sizes and modes and a range of technological and structural characteristics. A set of 20 candidate sites was initially suggested; this list was then narrowed to a set of 13 recommended sites (as well as 4 backups, in case the recommended agencies chose not to participate). The recommendations were presented to the TCRP A-25 Panel at the Interim Panel Meeting in April 2002, and this list was approved by those Panel members in attendance.

The research team next prepared a data collection plan and interview form and contacted key staff at case-study agencies to determine willingness to participate in the case study effort and, if so, to arrange for site visits. A letter was sent to each agency, outlining the study and identifying the types of data/information needed.

CONDUCTING THE CASE STUDIES

The research team conducted a total of 13 case studies:

- Akron Metropolitan Regional Transit Authority (Akron, OH)
- Chapel Hill Transit (Chapel Hill, NC)
- Chicago Transit Authority
- Connecticut Transit
- King County Metro Transit (Seattle, WA)
- Maryland Mass Transit Administration (Baltimore, MD)
- Metropolitan Transportation Commission (San Francisco Bay Area)
- New Jersey Transit
- Orange County Transportation Authority (Orange Co., CA)
- TransitCenter (New York City)
- Tri-County Metropolitan Transportation District (Portland, OR)
- Ventura County Transportation Commission (Ventura Co., CA)
- Washington Metropolitan Area Transit Authority

A broad range of specific fare initiatives and programs identified in the study were represented by at least one case study. With regard to distribution by size, the case study systems included the following:

- 4 systems with more than 500,000 riders per weekday.
- 4 systems with between 100,000 and 500,000 daily riders.
- 4 systems with under 100,000 daily riders.
- 1 regional program covering a number of systems (TransLink in the Bay Area).

This list represents what the team considered a reasonable distribution of agencies by size, modes, and types of fare initiatives and programs. The case study sites and initiatives are summarized in Table II-1.

Each case study site was visited by at least one member of the research team. The first visit was made in May 2002, and the others were completed between June and August. Based on information compiled during the site visits, coupled with data and information from written reports related to various of these fare initiatives, the research team prepared the attached case study working papers. Each paper includes the following sections:

- **Introduction and Background.** Describes the agency in terms of services/modes provided, numbers of vehicles, annual ridership; and introduces the fare initiatives to be reviewed.
- **Development and Implementation of Fare Initiatives.** Discusses the process and issues involved in developing and implementing each of the fare initiatives under consideration.
- **Results and Impacts of Fare Initiatives.** Discusses the results of each initiative in terms of customer impacts and benefits, ridership and revenue impacts, and agency administrative and operational issues and impacts.
- **Conclusions and Lessons Learned.** Summarizes the findings in terms of the various evaluation criteria presented in Appendix D (see Table D-2) and the key lessons learned from the case study.

In conducting the case studies, the intent was to collect and present information pertaining to each of the evaluation criteria listed in Table D-2. However, detailed information was not available for all of these items in all cases. A number of the initiatives were still in the planning or implementation stages or were simply too new to be able to provide data on

TABLE II-1 Case study sites

Site/Agency	Focus of Case Study
Systems with > 500,000 riders/day	
Chicago/CTA	• AFC program (including stored value, rolling passes) • Smart card pilot (including guaranteed last ride feature) • U-PASS program
NY City/TransitCenter	• TransitCheck and Premium TransitCheck
New Jersey/NJ Transit	• WorkPass program • Development of fare increase
Washington/WMATA	• SmarTrip program (including First Union, GSA pilots) • Plan for regional expansion of SmarTrip • SmartBenefits and MetroCheck employer-based programs
San Francisco Bay Area/MTC	• TransLink regional smart card pilot
Systems with 100,000 – 500,000 riders/day	
Baltimore/MTA	• Elimination of transfer/onboard sale of day pass • Elimination of zones • Plan to implement SmarTrip/regional integration
Orange County, CA/OCTA	• Elimination of transfer/onboard sale of day pass • Implementation of validating fareboxes
Portland/Tri-Met	• "QuikTik" 6-hr. pass • PASSport annual employer pass program
Seattle/Kings County Metro	• U-PASS program • FlexPass annual employer pass program
Systems with < 100,000 riders/day	
Akron/METRO	• Free student fare program • Access-to-jobs program (free rides on METRO)
Chapel Hill, NC/CH Transit	• Elimination of fare on Chapel Hill Transit
Connecticut/CT TRANSIT	• AFC (including rolling passes, common farecard for all CT TRANSIT systems) • Elimination of zones • University pass program
Ventura County, CA/VCTC	• Smart Passport regional smart card demonstration • GoVentura regional smart card program • Joint transit-university (CSUCI) card program

impacts. Moreover, detailed operating cost data (e.g., for design and implementation costs, maintenance costs, revenue collection and management costs) were not readily available for most of the fare initiatives studied. Because we were, in most cases, focused on one or more of an agency's specific fare initiatives and programs—rather than on the overall fare collection system—the agencies typically could not easily break out the cost details pertaining to those particular initiatives. The limited scope and time frame of these case studies did not allow the researchers to track down information that was not readily provided by agency contacts.

The level of detail thus varies somewhat among the case studies. Nevertheless, we feel that we have been able to compile and present information and analysis for each of these fare initiatives that will prove useful to other agencies considering these types of programs.

All of the agency contacts, as well as additional staff interviewed on site or via telephone, were gracious with their time and very helpful in contributing to our understanding of the issues and impacts associated with these fare initiatives. In several cases, we were also able to take advantage of previous analyses undertaken by agency staff on certain initiatives.

CASE STUDY **1**

AKRON METROPOLITAN REGIONAL TRANSIT AUTHORITY

Fare Program/Initiatives

University pass program
Access-to-jobs pass program

INTRODUCTION

Akron Metropolitan Regional Transit Authority (METRO RTA) is a small public transit bus system that serves all of Summit County, Ohio, which encompasses the cities of Akron, Barberton, Cuyahoga Falls, and Stow. The transit agency has an active fleet of 204 passenger vehicles that includes 136 100 percent accessible full-size buses, 68 paratransit vehicles, and 4 trolleys. With an average weekday ridership of 22,200, the transit agency provides 6 million passenger trips annually. METRO RTA is funded by federal and state support and a local dedicated .25 percent sales tax. FY 2001 operating expenses were $27.1 million and operating revenues were $26 million, including $3.5 million collected in passenger fares.

METRO RTA fixed route bus service consists of 43 routes, including 32 fixed routes, 2 Neighborhood Circulator routes, 5 Town Center routes, and 2 express routes into Cleveland. METRO RTA SCAT provides Americans with Disabilities Act (ADA) complementary paratransit and demand-responsive transportation for older adults and people with disabilities. The passenger fare structure, summarized in Table CS1-1, includes cash, monthly passes, and a variety of multi-ride tickets.

This case study reviews two specific fare initiatives undertaken by METRO RTA:

- The University of Akron ID Pass Program
- The Ohio Works First Photo ID Pass Program

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

University of Akron Pass Program

METRO RTA serves the University of Akron with unlimited access via an ID Card/pass to regular route and Campus Shuttle Loop service. The loop service consists of four METRO RTA-operated vehicles traveling along six preset loops around the campus. The loop service transports more than 1,500 students during the school year. The Campus Shuttle Loop Service is not available during the summer.

The regular route service is also available free of charge to university students, faculty, and staff with a valid University of Akron identification card. The service is available Sunday through Saturday during METRO RTA regular hours of operation. The service is not available on holidays, during semester breaks or other times when the University is closed.

The goals of the University Pass Program are to:

- Increase access to and from the university
- Reduce on campus parking requirements
- Increase transit ridership

Traffic congestion mitigation in and around the University of Akron campus, adequate parking, and convenient access to the campus were concerns of the University as early as the mid-1990s. It became evident that public transportation services were needed to alleviate these concerns. The University applied for federal funding assistance through the Congestion Mitigation/Air Quality (CMAQ) Improvement Program, initially authorized under the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA). The request was funded, establishing a cooperative agreement among the University of Akron, the Ohio Department of Transportation, METRO RTA, and U.S. DOT. CMAQ funding covered the major costs of the transportation program, and the University funded the remaining amount through student, faculty, and staff parking fees and general budget funds.

In 1995, the University entered into a contract with METRO RTA to provide Campus Shuttle Loop Service and regular route transportation to and from the campus at no cost to University students, faculty, and staff. By showing a valid University identification card as a “pass,” students, faculty, and staff would have unlimited access to transportation to, from, and around the University without paying any additional fare.

Each year the University and METRO RTA negotiate a fixed contract amount based on student enrollment for the year. METRO RTA provides unlimited trips to individuals displaying the University identification card when school is in session. The driver codes University boardings using the

TABLE CS1-1 METRO RTA fares

General Fare	$1.00 each way
Older adults & persons with disabilities (proof of age, SCAT, D&S ID or Medicare Card)	$0.50 each way
SCAT Fare (Older adults & persons with disabilities)	$1.15 each way
General Monthly Pass	$32.00 per month
Older Adult/Disability Pass	$20.00 per month
Full-Service Ticket	$20.00
10-Ride Ticket	$8.50
Employee Pass Program	$29.00 per month
North Coast Express Fare (Cleveland)	$3.00 each way
North Coast 10 Ride Ticket (Cleveland)	$25.00

#7 on the farebox keypad. When school is not in session, riders pay $1 per trip, but during these periods ridership is at a minimum.

In 1997, the CMAQ funding period ended. The University eliminated the free regular route service (Pass Program) and continued the Loop Service with reduced funding (Figure CS1-1). However, campus building expansion subsequently provided the impetus for the restoration of the Pass program and increased Loop service in 2000. New construction required the relocation of parking lots and street closures, which significantly affected automobile use. In 2000, the University increased funding for the Loop service by 43 percent (nearly $99,000) and provided $50,000 for the Pass Program. Funding for the University Pass and Loop services is currently maintained at $350,000 annually.

Ohio Works First Pass Program

Utilizing a similar Identification Card/Pass model, METRO RTA has partnered with the Summit County Department of Job and Family Services (DJFS) to provide employment-related transportation for Ohio Works First (OWF) clients. In this program, DJFS contracts with METRO RTA for free client transportation through the use of a photo ID card as a bus pass. The program is intended to meet the transportation of needs of Summit County residents on public assistance who are transitioning into employment.

Prior to the OWF Pass program, the DJFS had purchased and distributed METRO RTA tickets to clients. Upon presentation of a nonphoto ID card, METRO RTA accepted the tickets as fare payment. Alleged abuse of the program was reported in numerous cases where individuals other than the OWF clients would use the ID cards. To ameliorate the situation, the program was revised. Currently, DJFS provides a photo ID card to eligible clients. However, plans are in process to transfer the production and distribution of the ID cards to METRO RTA. Through a supplemental contract of $36,000 (separate from the fare revenues budget), METRO RTA will purchase the necessary equipment to produce and distribute the OWF photo ID cards.

The OWF Pass program was intended to provide employment and employment training transportation only. However, in practice, eligible OWF clients have unlimited access to free transportation without trip-purpose restrictions. Discussions were held between DJFS and METRO RTA about allowing a specific number of work or education trips. METRO RTA recognized that attempting to identify and regulate trip purpose would be a formidable task. The County acknowledged that many trips may actually be employment-related but not directly identifiable as such. For example, a working parent might need to drop off children at daycare facilities or need to stop on the way home for food or medical supplies. It was decided that limiting the number of trips or trying to identify

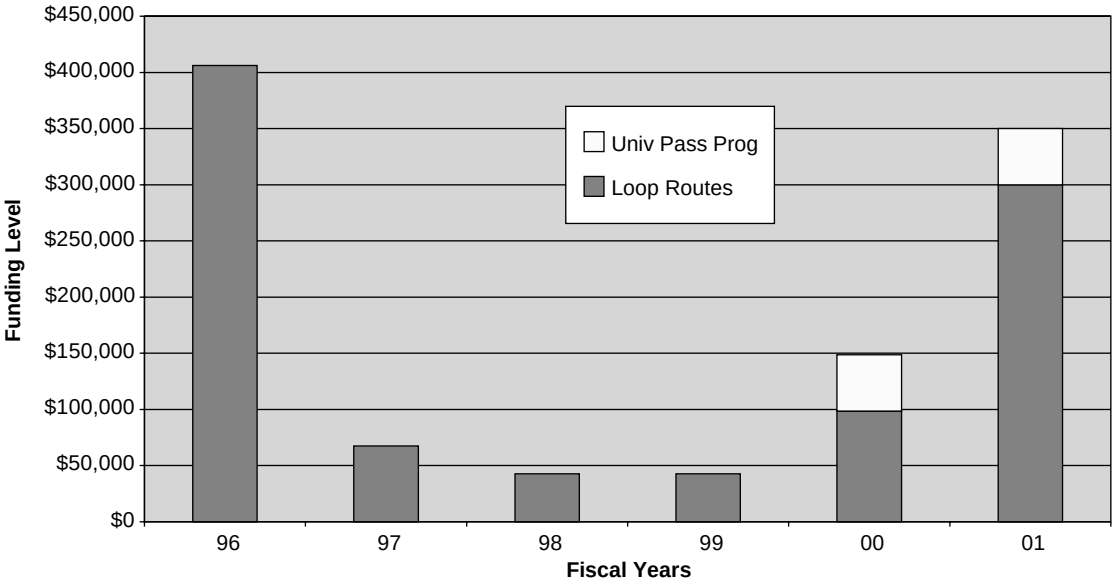


Figure CS1-1. Transit funding levels.

trip purpose would artificially encumber the passenger and prove counterproductive to the overall OWF program.

Ultimately the ID cards are intended to have a magnetic stripe that can be read at the farebox, allowing uses to be verified and tracked. The OWF pass program is very new and data is not yet available to establish comparisons with the former methods of fare collection and verification of eligibility.

RESULTS AND IMPACTS OF FARE INITIATIVES

University Pass Program

In the two years of the CMAQ-funded program, METRO RTA provided approximately 300,000–400,000 total trips annually. In 1997, when the CMAQ funding ended, ridership suffered a major decline due to elimination of the free fare initiative. As shown in Figure CS1-2, ridership recovered somewhat the following year. The subsequent restoration of the Pass Program and enhancement of the Loop service (2000) then resulted in a substantial ridership increase in 2001, although ridership did not reach the previous levels.

Another factor that influenced ridership was that the University changed traffic patterns on campus. Valuable land space previously in use as parking lots is now used for classroom and administrative purposes. The area for parking spaces has been consolidated and placed farther from the campus core. This construction and turnover in land use have created greater distances for automobile users to travel between their cars and their campus destinations. Corresponding transit use increases have been observed, though not analyzed as yet.

The University Pass program eliminates the need for METRO RTA to handle cash, which reduces the burden of carrying, sorting, counting, reconciling and depositing approximately $180,000 per annum. However, the Pass Program also reduces METRO RTA's revenue, because the contract amount is not directly tied to ridership levels; the amount varies from year to year. Prior to 1995, METRO RTA's revenue from the program was $3,000 to $4,000 per month; during the CMAQ funding period, revenue rose to $20,000 to $25,000 per month and since that time, it has dropped back to $8,000 to $9,000 per month.

In 2001, on bus routes other than the Campus Loop, the average fare per ride was $0.55. There is very little additional cost involved in providing the University trips since they occur on established public routes. The Loop routes that serve the campus are dedicated and the University pays the costs of operating those routes. Six Loop routes were provided in 2001 for a total cost of $300,000.

Ohio Works First Pass Program

As per the annual fixed dollar amount contract with the Summit County Department of Job and Family Services, METRO RTA is paid $200,000 a year for the provision of 50,000 trips a month for individuals on public assistance. As indicated earlier, METRO RTA will also receive $36,000 to buy equipment to allow it to produce and distribute the OWF photo ID cards. The contract specifies that costs will be recovered at a billable rate of $1,000 per month for 36 months.

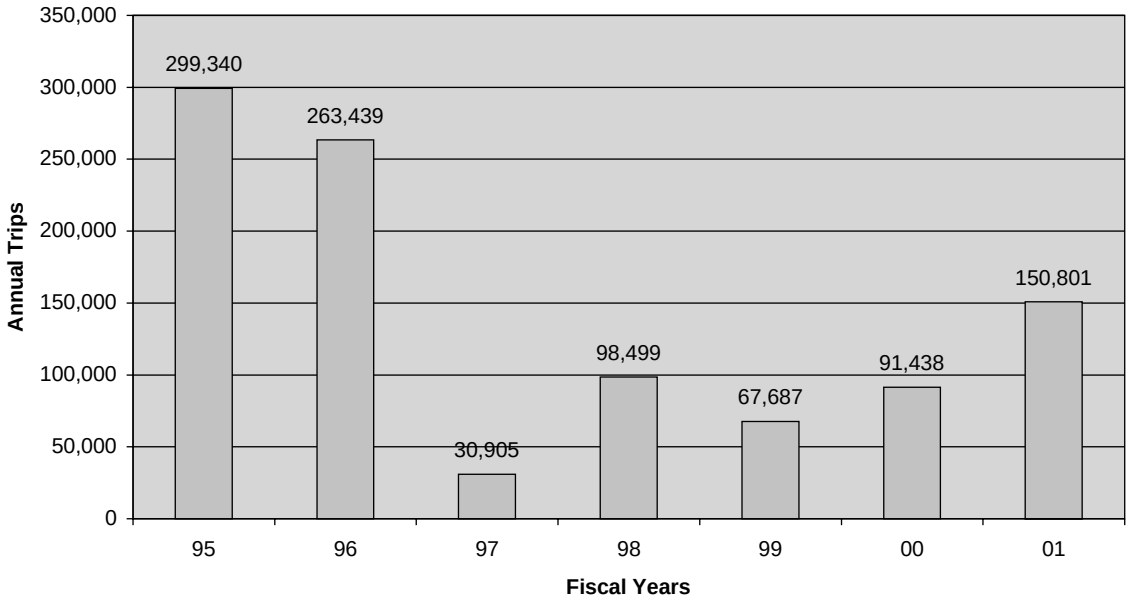


Figure CS1-2. University ridership.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

The University Pass initiative appears to have benefited the University students, faculty, and staff as follows:

- The Pass service is convenient and easy-to-use, and not having to pay an onboard fare has improved the ease of travel. Additional registration is not required, since all students and university personnel must obtain a multi-purpose photo ID card.
- Users with valid ID cards do not have to be concerned about transportation costs or cash on hand to ride the system.
- The Pass service increases access to and from the campus.

In general, riders appear satisfied with the program. However, ridership data suggests that the existing University riders may not use the service at the same levels if they had to pay.

The key customer impacts and benefits of the Ohio Works First Pass Program include the following:

- The pass program facilitates employment and generally increases the mobility of OWF clients who are working or in training.
- The program is easy to use and eliminates the need for cash as well as client concerns about the cost of employment-related transportation. The previous DJFS-managed distribution of trip tickets was more time consuming for both the customer and the agency.

Program clients are generally satisfied and are using the program on a regular basis. Moreover, the program appears to have improved the public's opinion of the transit agency in general.

Agency Impacts and Benefits

The impacts and benefits of the University Pass initiative for METRO RTA include the following:

- The program has no equipment costs, the university produces the identification cards and fare collection equipment is not needed.
- Revenue management has been reduced. The contract is an annual fixed dollar contract that requires no reconciliation of funds or ride counts.
- The program has reduced the use of cash for fare payment during the school year.
- When the CMAQ funds expired, ridership decreased because riders had to pay for the service, and service levels were accordingly decreased. With the restoration of the Pass program, ridership demonstrated a 60 percent increase in 2001, although it has yet to reach the levels of the CMAQ-funded years.
- There are no reported incidences of program abuse or inappropriate use of University ID cards.
- Eliminating the need to pay fares decreases boarding time somewhat, but the driver has to view an ID card. There has been no perceived impact on service reliability.

The impacts and benefits of the OWF Pass initiative for METRO RTA include the following:

- The program will incur equipment costs to produce the photo ID cards, but DJFS is covering these costs under a supplemental contract.
- Revenue management has been reduced. The contract is an annual fixed dollar amount and requires no reconciliation of funds. Currently METRO RTA is paid $200,000 a year for the provision of 50,000 trips a month to OWF clients.
- Ridership has increased; it currently averages 50,000 trips per month. For the most part, these are new regular riders to the system.

Impact and Benefits for Partner Entities

The University Pass initiative has had the following impacts on the University of Akron:

- Free transportation to, from, and around the campus is seen as a definite benefit the University provides to university students and personnel.
- The university has not reported a decrease in parking demand, but the free Pass service has not been heavily marketed.

The OWF Pass initiative has had the following impacts on the DJFS:

- The goals of the program have been achieved; OWF clients are receiving a free means of getting to work.
- Increased numbers of clients are obtaining ID cards, and the process will be further streamlined when METRO RTA initiates the production and distribution of the cards.
- Requiring a photo ID has helped to eliminate the fraud and abuse that was evident when DJFS administered the program. Drivers inspect the photo ID cards and are instructed to seize cards that are obviously fraudulent.

Liability to Agency

Potential liability issues can be summarized as follows:

- The transit agency does not risk losing significant revenue through the University Pass program. If the free

rides were not provided, most of the riders would either walk, bike, or drive instead of paying the daily fares.
- The student ridership and contract revenues generate about $0.55 per ride, as opposed to the $1.00 public fare. However, the $0.55 is created at much less expense than the baseline cost of service provided to the general public.
- Funding is currently derived from student, faculty, and staff parking fees and University general funds. It is possible that complaints could arise at some point from nontransit users about the University use of parking fees to pay for transit service.
- In the OWF Pass program, METRO RTA does not risk losing revenue because the agency can adjust the OWF contract to match ridership.
- The agency does not see any potential legal/political challenges to the OWF Pass program.

Constraints and Barriers

Issues related to constraints and barriers include the following:

- The University ID cards need to be manually viewed because the existing fareboxes cannot read the magnetic stripes on the cards.
- Timely payments on the OWF contract have been raised as an issue.
- Funding for the OWF program has not been an issue thus far; it comes from Temporary Assistance for Needy Families (TANF) block grant funds, Title XX, and DJFS.
- Due to the nature and location of some of the jobs, not all employment-related transportation needs can be served by public transportation.

Required Equipment and Technology

Because these are free fare programs involving photo IDs, there are no particular equipment or technology requirements. However, future plans include converting to some type of "smart card" to monitor and track usage. For the OWF program, METRO RTA will be purchasing photo ID card production equipment; these costs will be covered by DJFS.

Lessons Learned

Key lessons learned through the development and implementation of the University Pass program include the following:

- A free fare program can enhance transportation options for university students, faculty, and staff and offers the potential to reduce parking space requirements.
- It is important that the transit agency negotiate the contract with the University on an annual basis, based on student enrollment and potential usage, to prevent loss of revenue through the program.

Key lessons learned through the development and implementation of the OWF Pass Program include the following:

- Welfare reform has facilitated cooperative relationships with public transit agencies that can prove beneficial to the clients, the transit agency, and social service agencies. Results include increased ridership, increased revenue and increased numbers of individuals who are employed. METRO RTA has already demonstrated a major impact in terms of meeting the transportation needs of OWF clients in Summit County.
- To ensure that the transportation benefits reach the individuals who really need them, controls must be in place to monitor and identify fraud.

CASE STUDY CONTACTS

Information presented in this case study was collected from transit agency staff interviews. The following individuals were interviewed at the METRO RTA offices:

Robert Pfaff, General Manager
METRO Regional Transit Authority
416 Kenmore Boulevard
Akron, Ohio 44301-1099
330-762-7267

Dean Harris, Director of Finance
METRO Regional Transit Authority
416 Kenmore Boulevard
Akron, Ohio 44301-1099
330-762-7267

Alan Smith, Manager of SCAT
METRO Regional Transit Authority
416 Kenmore Boulevard
Akron, Ohio 44301-1099
330-762-7267

CASE STUDY **2**

CHAPEL HILL TRANSIT

Fare Program/Initiative

Elimination of transit fares

INTRODUCTION

Chapel Hill Transit operates public transportation services within the towns of Chapel Hill and Carrboro, NC, and on the campus of the University of North Carolina-Chapel Hill. Chapel Hill Transit is a municipal department within the Town of Chapel Hill and was established in 1974. The Town of Carrboro and the University of North Carolina are partners with the Town of Chapel Hill in the operation of the transit system.

Chapel Hill Transit provides fixed route and demand-responsive service within a roughly 25 square mile service area, located in the southeast corner of Orange County, North Carolina. The system produces over 100,000 annual hours of service, has a $7 million annual budget, and carries over 3 million passengers per year. The total ridership per month, including fixed route and demand-responsive service, for the Fiscal Year ending June 30, 2000, was approximately 300,000.

Chapel Hill Transit currently has a fleet of 57 buses, 43 of which are lift-equipped, as well as 7 lift-equipped vans and 2 trolley buses. The transit agency operates 15 routes that provide coverage throughout most of the community. There are 11 arterial bus routes, 2 campus shuttle routes, and 2 Park/Ride routes. Night service includes 4 routes. On Saturdays, 5 routes are operating, and 2 routes operate on Sundays. There is also an interface with Triangle Transit that provides some additional shuttle and commuter services.

Shared Ride services are used on evenings and Sundays when there is not enough demand to warrant a fixed route. That service is operated from bus stop to bus stop anywhere in the service area that normally has Sunday or evening service. Bus stop-to-door and door-to-door service is available for an additional surcharge.

Weekday Shared Ride Feeder is available for areas that do not receive regular bus service. Transportation is provided between the service zone and designated transfer points, where connections can be made with fixed route bus service. Trips can also be taken within the Feeder zone. Transfers to the buses are issued free of charge. Chapel Hill Transit also operates EZ Rider service, which provides demand-responsive service for the area's senior citizens and persons with disabilities. EZ Rider is available to Chapel Hill and Carrboro residents who cannot use the regular fixed route service.

Effective January 2, 2002, all regular routes became fare free; fares are still charged for use of the Tarheel Express service to campus sporting and entertainment events. This case study reviews the process of establishing this Free Fare program and discusses the results to-date.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVE

Transit in Chapel Hill began with a student government-operated shuttle service. As the student population grew and the University expanded, it became evident that service demands far exceeded the capability of the shuttle. In the early 1970s a Public Transportation Study Committee was formed to apply a federal Technical Studies grant to examine the feasibility of a permanent community system. Town voters approved a $350,000 bond referendum for local match for capital funding and an ad valorem tax to support transit operations. Chapel Hill Transit began operation in August 1974 as a department of the town government. As a town agency, the department is responsible to the Council, the Mayor, and the Town Manager.

The three partners in funding public transit in and around Chapel Hill are the towns of Chapel Hill and Carrboro and the University of North Carolina-Chapel Hill. Continuing increases in University enrollment and the size of the physi-

cal plant, coupled with the relatively small amount of land available in the town—as well as the desire to minimize air pollution and traffic congestion—were the driving factors in the creation of Chapel Hill Transit and continue to guide transit development. Transit's goal is to provide service to at least 90 percent of the town's residents within a quarter mile of a bus route. A Comprehensive Plan adopted by the Town Council in 1977 included a set of transportation goals that specifically encouraged transit over automobile use in central areas of Chapel Hill.

As the system grew, so did expenses. The means to fund the system—and particularly the amount each of the partners had to pay—thus became an increasingly contentious issue. The partners therefore developed a Memorandum of Understanding that detailed the benefits to each partner and the cost associated with providing those benefits.

In 1996, discussions were initiated to radically alter the method of computation used in the partnership. Once all the federal and state contributions were deducted from the system's operating costs, the partners would split the remaining costs based on their relative populations. The University would pay based on its student and employee head count. The towns of Chapel Hill and Carrboro would use census data to determine their shares. This simplified process also provided that any of the partners could request new routes, although that entity would be responsible for paying the entire cost of operating that route during the first year.

Sources of revenue for the system are shown in Figure CS2-1. Using a cost allocation formula, expenses on some routes were to be paid fully by the University, while other routes were paid for entirely by the towns. Costs of shared ride service would be borne by only two of the partners, as long as the third partner received only limited service. Revenues were tracked accordingly and credited against the corresponding operating costs. The number of riders using University-issued passes also needed to be factored into the equation. Federal and state operating assistance was to be allocated in the proportions each partner contributed to the actual local cost. The partners also paid capital costs in the same allocation manner, based on the value of equipment and anticipated service life.

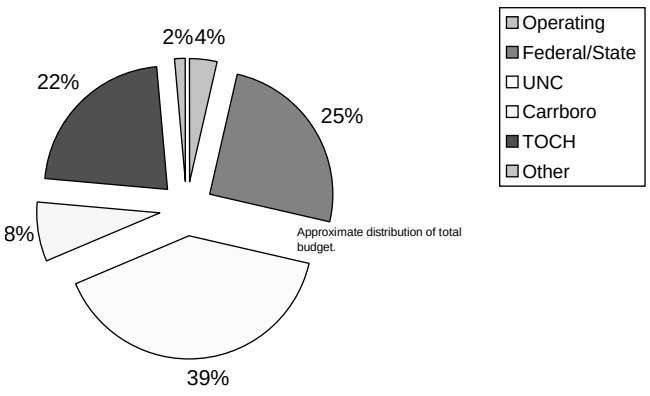


Figure CS2-1. Sources of revenue.

Beginning in 2000, the University and hospital facilities were increased in size and the amount of space for student, staff, and visitor parking was reduced accordingly. The expansion and construction program was also causing parking lots to be moved, placing the remaining available parking further away from the center of campus. The University thus sought increased use of transit service, leading to preliminary discussions regarding conversion to a free fare system; the idea was that no fares would be charged for bus rides anywhere in the system. In support of the proposal, University students mobilized to pass a referendum that created a $16 per semester fee that would generate $500,000 per year.

Thus, with the primary goal of addressing on-campus parking shortages, the University (and its students) became the champion of the program to create the free fare policy. However, it was widely recognized that the free fare transit service would benefit all of the region's residents, not only those affiliated with the University. Although Chapel Hill has one of the highest per capita income figures in the state, a number of the area's residents live at or near the poverty range and are heavily transit dependent. Fares prior to the implementation of the free fare initiative were only $0.75, with various discounted fare mechanisms. However, the towns recognized that accessibility to free public transportation would permit easy access to jobs and educational and recreational ventures to students and the public alike. Thus, the three funding partners agreed to make all regular routes fare free as of January 2, 2002.

The goals of the free fare initiative are to:

- Increase access to and around the University and decrease parking demand
- Increase the region's access to public transportation

RESULTS AND LESSONS LEARNED

Customer Impacts and Benefits

The customer impacts and benefits of Chapel Hill Transit's free fare initiative to date can be summarized as follows:

- Not having to pay a fare—or even present an identification card—has improved the ease of travel.
- The free fare has eliminated the cost of travel, thereby increasing transportation access, enhancing mobility, and increasing the convenience of travel.
- Overall satisfaction among riders is high. The overall public perception of Chapel Hill Transit has improved as a result of the program. There have been very few complaints thus far.

Agency Impacts and Benefits

The impacts and benefits for the agency of the free fare initiative are as follows:

- System ridership has increased considerably since the elimination of fares, As indicated in Figure CS2-2, monthly ridership for 2002 has been as much as 50 percent or more higher than for the same month the previous year, reaching a high of roughly 400,000 rides in April 2002; in April 2001 (and 2000), the ridership had been about 260,000.
- The free fare policy has resulted in improved bus frequency, as headways were cut in half on some routes to accommodate the higher demand.
- Service was increased on some routes that were already at carrying capacity.
- A possible decrease in overall schedule adherence has been reported, due to greater numbers of boardings and alightings in general—and at a greater number of stops. Some routes required adjustments to accommodate the greater demand. Some drivers have reported riders riding for as little as two stops and exiting the buses. Without the disincentive of paying a fare for a short trip or for several linked trips in succession, people are using the system more spontaneously and for shorter trips.
- Both capital and operating costs have increased due to the need for additional vehicles and drivers, as well as the concomitant increase in maintenance, fuel, etc.
- The elimination of fare media such as passes has allowed a reallocation of some administrative resources toward service provision. For example, with free fares, passengers are no longer reporting missing or lost passes that require administrative time and expense to replace.
- The number of worker's compensation claims has been reduced, since there are no heavy moneybags to lift.
- No additional fare equipment is necessary; although automatic passenger counting is now needed. Manual buttons are currently used on all existing fareboxes to count passengers.

Impact and Benefits for Partner Entities

The primary benefit to the partner entities has been the increased access within the area, including to and from the University of North Carolina, and the easing of demand for parking at the University.

Liability to Agency

The primary liability to the agency is the increase in costs—with no fare revenue to cover these costs—to serve the much higher demand that has resulted from the free fare program. In the case of Chapel Hill Transit, however, University parking, student, and other relevant fees are available to subsidize the service. In addition, the towns of Chapel Hill and Carrboro contribute through a transportation tax.

Constraints and Barriers

The establishment of Chapel Hill's free fare initiative has required development of agreements among three funding partners, the University of North Carolina, the Town of Chapel Hill, and the Town of Carrboro. Funding the program required that the three partners all significantly increase their contributions.

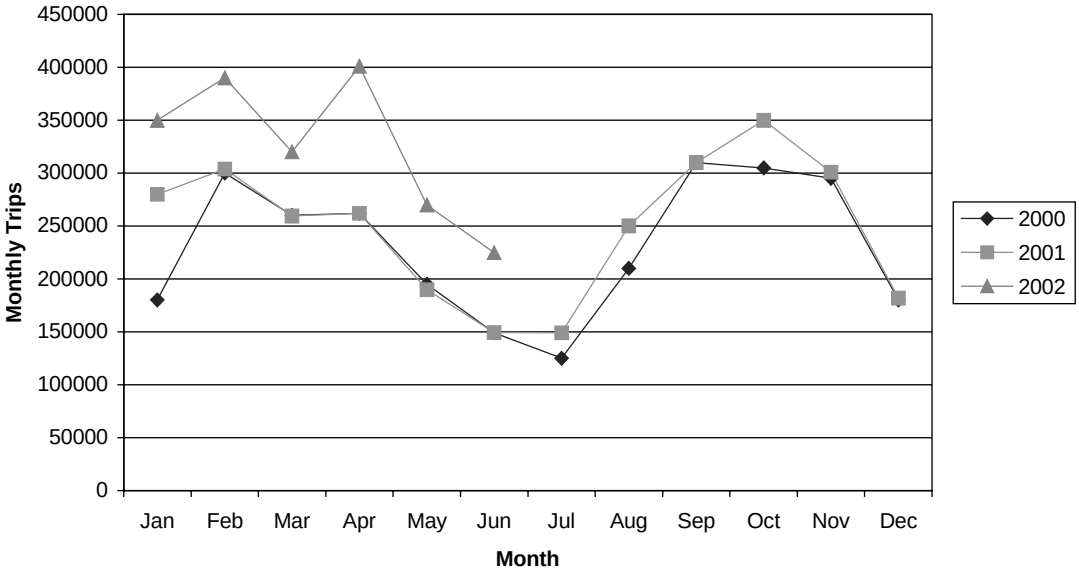


Figure CS2-2. Monthly ridership, 2000 to 2002. Free fare program initiated January 2002.

Required Equipment and Technology

There are no particular technology requirements associated with a free fare program. However, the program has had the following equipment impacts in Chapel Hill:

- New vehicles were necessary: 13 new buses have been purchased, while 7 more are scheduled for purchase next year.
- New buses have been ordered with fareboxes, in the event that the policy is changed during the 12-year service life of the vehicles.
- No new technology is needed for fare collection. However, automatic passenger counting is an indirect need. In the meantime, manual counting is being utilized.

Lessons Learned

- The Chapel Hill free fare initiative demonstrates the potential of intergovernmental cooperation to develop an innovative approach to addressing a specific mobility issue—in this case a campus parking shortage—as well as increasing mobility in general within a community.

- Free fare transit can produce a large increase in ridership due to the reduction in the cost of travel and the increased convenience, but it can also lead to a substantial increase in capital and operating costs to serve the greater demand. Funding mechanisms must be available to cover these additional costs.

CASE STUDY CONTACT

Information presented in this case study was collected from Chapel Hill Transit. The following individual was interviewed at the Chapel Hill Transit office:

Mary Lou Kuschatka, General Manager
Chapel Hill Transit
306 North Columbia Street
Chapel Hill, North Carolina 27516
919-968-2755

CASE STUDY **3**

CHICAGO TRANSIT AUTHORITY

Fare Program/Initiatives

Automated Fare Collection system: stored value farecard, rolling passes

University pass program

Smart card pilot program

INTRODUCTION

The Chicago Transit Authority operates bus and rail rapid transit service in the City of Chicago and 38 surrounding suburbs. Because there are separate suburban bus and commuter rail operators in the Chicago region as well as CTA, some elements of the CTA fare structure are somewhat complex. Table CS3-1 summarizes the current fare structure at the CTA.

CTA has approximately 1,900 buses (1,620 in peak service) that operate over 140 routes and 1,937 route miles, serving 12,000 posted bus stops. Buses carry roughly 1 million passenger trips a day. CTA's approximately 1,200 rapid transit cars operate over seven routes and 222 miles of track and serve 144 stations. On an average weekday, 1.47 million rides are taken on the CTA's system. Total system ridership (unlinked trips) in 2001 was approximately 455 million.

CTA has raised cash fares and experimented with different types of passes and reduced fare tickets starting in 1992. This case study addresses pass, farecard, and smart card initiatives that were introduced beginning in 1997, when CTA implemented automated fare collection (AFC). The initiatives reviewed here are as follows:

- Introduction of stored value farecards, featuring a 10 percent purchase bonus
- Replacement of the monthly flash pass with a 30-day rolling pass (i.e., activated on first use) and implementing 1-, 2-, 3-, 5-, and 7-day rolling passes
- Introduction of a smart card pilot program
- Introduction of a university pass ("U-PASS") program

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

Introduction of Automated Fare Collection System

In 1995, CTA began the 27-month implementation of an Automated Fare Collection system on both its bus and rail networks. The total cost of implementing the AFC system was approximately $106 million. For the CTA's 141 rail rapid transit stations, the project included installation of automated vending machines (AVMs) and automated turnstile equipment. Installation on buses involved integrating new farecard readers with the existing fareboxes. The introduction of AFC at CTA was not accompanied by a major fare restructuring. Rather, the stored value farecard merely represented a new fare medium, which was essentially an alternative to tokens.

When the farecard was introduced in 1997, it was initially available only for use on the rail system. It was later extended to the bus system as well. Within 3 months of full implementation, one third of all boardings were made with farecards. Some of the factors contributing to the rapid acceptance of the farecards were:

- Concurrent elimination of discounts on token multipacks
- Extensive availability of AVMs
- Reduced availability of turnstiles for coins and tokens, resulting in longer queues at those turnstiles
- Implementation of the same technology at the suburban bus operator (Pace), enabling "seamless" transfers between the two systems
- Introduction of the card only after the system was fully installed
- Prior CTA rider experience with prepayment (i.e., passes and discounted token multipacks)

TABLE CS3-1 Current CTA fare structure

Fare Media	Cost to Riders	Implementation Date	Notes/Characteristics
Cash Fares			
Full Fare	$1.50	1991	Off-peak bus fares were somewhat lower until 1995, when the off-peak bus fare was raised to the peak fare.
Reduced Fare	$0.75	1995	Reduced base fares are available based on rider disability and/or age.
Transfer	$0.30	1991	Transfer allows rider to make another 2 trips within 2 hours. Prior to 1997, transfers were offered on paper slips with hand punched expiration times. With the implementation of AFC, magnetic stripe paper transfer cards were introduced.
Reduced fare transfer	$0.15	1995	
Stored Value Farecards			
Basic farecard	$1.50 min.	1997	Riders can either purchase new cards or add value to existing cards at vending machines located in CTA rail stations. A bonus of $1 is awarded for each $10 of value purchased.
10-trip package (regular)	$15.00	1999	Package of 10 one-way transit cards.
20-trip package (reduced)	$13.50		Package of 20 one-way reduced fare transit cards.
Prevalued farecards	$10.00/ $20.00		Prevalued farecards are sold at currency exchanges, select grocery stores, and over the Internet. There is a 10 percent discount built into these cards ($10 card worth $11, $20 card worth $22). Prior to 1999, the cost of these farecards was $13.50 and $16.50.
Passes			
1-day "Fun Pass"	$5.00	1999	1-, 2-, 3-, 5-, and 7-day passes allow for unlimited rides on all CTA buses and trains for the time period specified (days must all be consecutive). The pass is activated the first time it is inserted into a bus farecard reader or a rail turnstile. Passes are sold at numerous city outlets, or can be ordered in advance via phone or Internet.
2-day Visitor Pass	$9.00		
3-day Visitor Pass	$12.00		
5-day Visitor Pass	$18.00		
7-day rolling pass	$20.00		
30-day rolling pass	$75.00	1999	Allows riders to make unlimited rides over any 30-day period beginning with the first use. Prior to implementation of rolling pass, a regular 1-month pass was available.
30-day reduced fare rolling pass	$35.00	1999	Allows reduced fare riders to take unlimited rides over any 30-day period beginning with first use.
U-PASS	$0.55/ student/day	1999	Sold to full-time students by participating universities and colleges. The U-PASS is valid for one term and students can make unlimited trips on CTA at all times. Students pay for the pass as part of their regular tuition and fees assessed by the participating institution.

The new AFC system was provided by Cubic and is very similar to the Cubic MetroCard system implemented in New York City. The CTA Transit Card was introduced with a purchase bonus, offering $15 of stored value for $13.50 (11 percent bonus); the purchase and bonus parameters were later changed (late 1998) in order to increase rider convenience. At that time, the minimum purchase necessary to obtain a bonus was reduced from $13.50 to $10 and the bonus was lowered to $1 (10 percent). The new price reflected the need to pay with a $10 or $20 bill at AVMs.

At the same time that the purchase and bonus parameters were changed, CTA also implemented a number of other fare initiatives, as follows:

- Monthly passes were converted to 30-day rolling (activate on first use) passes and reduced in price from $88 to $75. Monthly reduced fare passes were also converted to 30-day passes, and the price reduced from $44 to $35.
- 7-day rolling passes were introduced at a price of $20. Additionally, 1-, 2-, 3-, and 5-day rolling passes were introduced; these were targeted primarily at the tourist/visitor market.
- CTA replaced the prepaid $13.50 and $16.50 farecards with $10 and $20 prepaid farecards. A 10 percent bonus was incorporated into these farecards (i.e., they are worth $11 and $22, respectively).
- The minimum vend requirement for a farecard was reduced from $3.00 to $1.50, which was consistent with the cost of a single ride on bus or rail.
- Metal tokens were replaced with single-ride Transit Cards. Packs of 10 regular farecards were available for $15, and packs of 20 reduced farecards were available for $13.50. Sales of tokens ceased completely in January 1999, and acceptance of tokens ceased in April 1999.

Installation of AFC facilitated the implementation of these fare options and has allowed CTA to track more carefully the ridership and revenue impacts of the various fare initiatives.

Introduction of the U-PASS Program

CTA introduced its U-PASS program in 1998, about a year after AFC implementation. In three years, 22 colleges/universities had joined the program, which requires them to enter into a contractual agreement with CTA to provide the U-PASS to all full-time students. Any accredited, postsecondary, degree-granting institution in CTA's service area is eligible to participate in the program. The pass enables the students to make unlimited trips on all CTA buses and trains during the academic year. Students pay for the pass as part of the regular tuition and fees assessed by the participating institutions. The institutions are charged for the U-PASS based on a daily per student charge that was initially set at 50 cents but raised to 55 cents in 2001. Note that the equivalent daily cost of a 30-day CTA unlimited ride pass is $2.50, or nearly five times the U-PASS cost.

Each U-PASS contains the name of the student and a photo identification, the name and logo of the school, dates of validity matching the academic year, and a magnetic stripe encoded with a unique identification number that can be read electronically by the AFC equipment.

CTA's overall goals of the U-PASS program are to:

- Stimulate an increase in ridership during off-peak hours.
- Create a sense of brand loyalty and transit travel patterns among students who will be prospective customers in their postcollege years.
- Measure and assess ridership changes, mode choice, and travel behavior among college students to evaluate program effectiveness.

In addition, CTA had a number of specific goals for the U-PASS program, including the following:

- Creating greater visibility and acceptance for U-PASS among colleges.
- Building experience with U-PASS and assisting the participating schools with implementation and administration.
- Establishing a basis for deeply discounted passes to be offered to college students.
- Identifying the savings that accrue to students and colleges with the program.

Smart Card Pilot Program

CTA's smart card pilot program began in August 2000 and operated for 6 months. The program was designed to test both the technological feasibility and the customer acceptance of a contactless smart card for fare payment. CTA had planned in advance for eventual use of smart cards. When the magnetic AFC system was installed, all fare equipment was also equipped with card readers and touchpads that could later be used with Cubic's proprietary contactless smart cards. (These cards are technologically the same as the SmarTrip® cards now in use on WMATA's rail system.)

The pilot program was developed with the following features:

- A $5 purchase price with a $0 starting balance; value could be added to the smart card at CTA AVMs.
- Customers who enrolled in the smart card pilot program agreed to have their contact information entered into a database; this information would be accessed if a lost or stolen card was returned to CTA.
- Each participant had a user-defined PIN, which was used if a replacement card was needed. Replacement

cards could be purchased for $5, and the PIN would allow for transfer of the remaining balance on the lost or stolen card.
- The smart card was programmed to operate like a normal farecard, including the same bonus features.
- Multiple riders could use a single card. However, on buses, drivers were required to push a special key on the farebox to let more than one person use the smart card. This step was added to prevent a smart card holder standing close to the farebox from being accidentally charged for multiple trips.
- Smart cards provided for a "negative balance" or guaranteed last ride: a ride was guaranteed, regardless of the remaining value on the card; the card could carry a negative balance up to the value of a single ride, and the next time value was added to the card, the amount of the negative balance would be deducted from the value added.

During the pilot program, CTA distributed 3,500 smart cards at 16 sites, including selected high-volume rail stations and over the Internet. The cards were valid for a 5-year period. Surveys were carried out by mail and Internet after 3 months had passed. A 37 percent response rate was achieved, providing a rich data set on customer satisfaction. It should be noted that the participants, although geographically diverse, were a self-selected group of frequent riders who had been using farecards and thus do not constitute a random group of riders whose opinions can be extrapolated to the total rider population. The results of this survey are discussed in the Results and Impacts section.

Based on the results of the pilot program, CTA decided to move forward with a broad rollout of the "Chicago Card" program. CTA planned to make an initial purchase of 300,000 smart cards for approximately $1.8 million ($6 per card). The smart cards were issued with the same features as in the pilot program. CTA originally sought to contract with a private company to launch and manage the smart card distribution and customer support process and issued an RFP for a system support vendor; the vendor was expected to take responsibility for such functions as marketing, project implementation, and operations management—including order processing/fulfillment, customer service, and reporting. (The selection of a system support vendor had not been made as of the end of 2002, as the CTA was reconsidering the support strategy.)

RESULTS AND IMPACTS OF FARE INITIATIVES

AFC Program

Customer Usage

The introduction of AFC has significantly affected how CTA riders pay their fares (*1–3*). The magnetic Transit Cards, carrying stored value or unlimited ride payment options, have become extensively used—although a significant number of riders, particularly on the bus system, still use cash. This is primarily due to less opportunity for these riders to encounter AVMs.

Ridership trends for the first few years of AFC are shown in Figure CS3-1. Once AFC was implemented, token use decreased steadily (i.e., prior to its discontinuation in 1999), likely due to the elimination of the 11 percent token discount (and subsequent transfer of this discount to farecards). Farecards gained immediate popularity upon implementation of the AFC system and accounted for an even higher proportion of ridership after the 1999 initiatives. While the use of cash has decreased since 1996, it still remains a popular—though declining—fare medium (accounting for roughly 18 percent of rides in 1999). As described above, the use of passes became increasingly popular after the introduction of the 30-day rolling pass, the various shorter-duration passes, and the U-PASS. The increase in pass use has also been accompanied by a decline in the use of transfers, suggesting that riders who had been paying cash and transferring, or transferring with a farecard, began using passes after the changes in 1999.

Figure CS3-2 shows the breakdown of CTA rail and bus ridership by fare payment option. From this graph, one can see that the use of Transit Cards is much more prevalent among rail riders than bus riders. Nearly 60 percent of CTA's rail riders used stored value farecards in June 2002, while only 14 percent of bus riders used this option. As suggested earlier, this is primarily because the opportunities for bus riders to purchase transit cards are much more limited than for rail riders, who have AVMs available at all rail stations. Note that the percentage of bus riders using passes is actually higher (28 percent) than rail riders (17 percent). With regard to overall use of the AFC system (i.e., including stored value, pass, and transfer farecard options), 95 percent of rail riders were using some version of the magnetic farecard; on bus, the total was 68 percent. These figures have grown steadily; in 1999, the totals were 80 percent for rail and 44 percent for bus.

This farecard availability issue is further underscored when one looks at the proportions of bus and rail riders paying with cash. Figure CS3-2 indicates that the proportion of cash fare customers is much higher on CTA's bus system than on rail. Whereas a quarter of the bus riders pay with cash, only 1 percent of rail riders do. The use of cash on rail decreased from 6 percent to 1 percent between 1999 and 2002.

CTA has also found that the use of fare media varies by frequency of transit system use. Among regular riders (riding 5 or more days a week), 55 percent use a farecard and 13 percent use cash. Among infrequent riders (riding 1 to 4 days a week), cash is a more popular option: 42 percent of these riders use a farecard and 49 percent use cash.

Naturally, CTA has also been interested in understanding the shift in fare media use with AFC implementation and the related fare initiatives. CTA's analysis to date indicates that former token users have primarily switched to either cash or stored value farecards, including the nondiscounted 10-pack

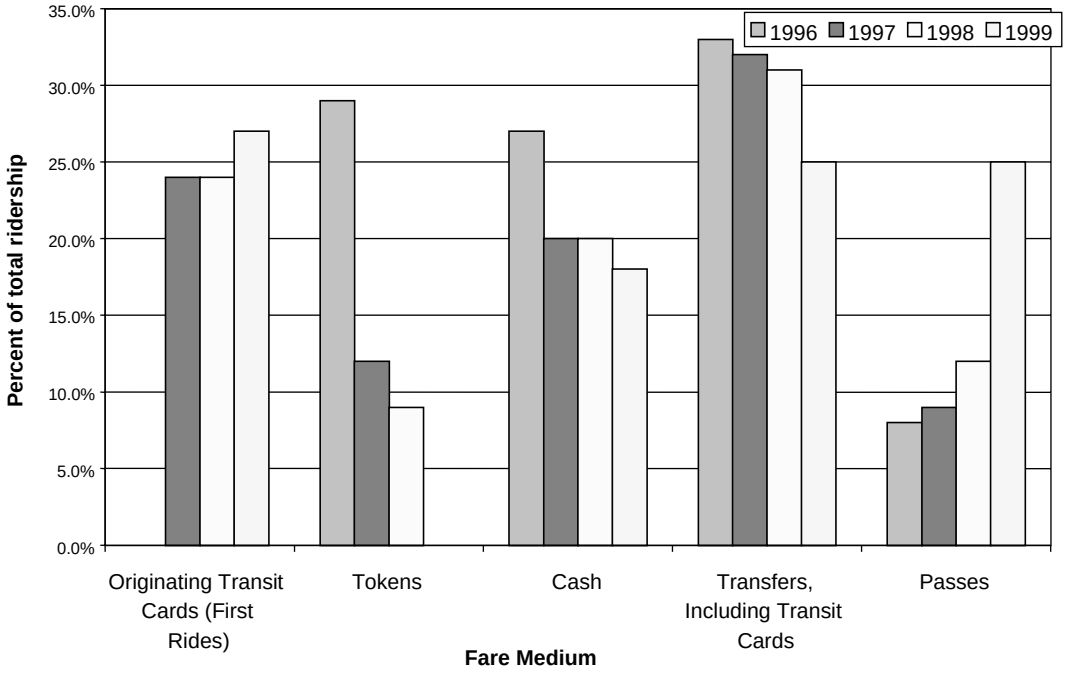


Figure CS3-1. Monthly system ridership, October 1996 to October 1999.

of one-ride farecards. Estimates are that as many as one-third of former token users may have switched to multipacks. Studies also show that the 7-day pass, to which much of the pass use increase is attributed, has been successful in diverting many users of cash and tokens to pass use. It is estimated that as many as 60 percent of 7-day pass users were previously using cash or tokens. Moreover, surveys reveal that this pass has been successful in increasing travel on CTA by 31 percent for its users.

Studies have also shown that reduced fare riders (students, seniors, and disabled riders) have converted more slowly to AFC fare payment than have regular riders. At the system-wide level, reduced fare riders are still using cash as a means of fare payment more frequently than farecards. As with full-fare riders, this pattern is more predominant among bus riders than rail riders.

As described previously, part of the 1999 fare initiative was to decrease the minimum required purchase price for farecards from $3 to $1.50 at AVMs. Figure CS3-3 shows that this change had a dramatic effect on the average initial sale and the average added recharge amounts. Between 1998 and 1999, the average initial farecard sale dropped from $6.58 to $3.83, while the average added recharge dropped from $5.49 to $4.78. As shown earlier, the ridership accounted for by farecards increased during this time. Therefore, it appears that lowering the minimum purchase price may have had a signif-

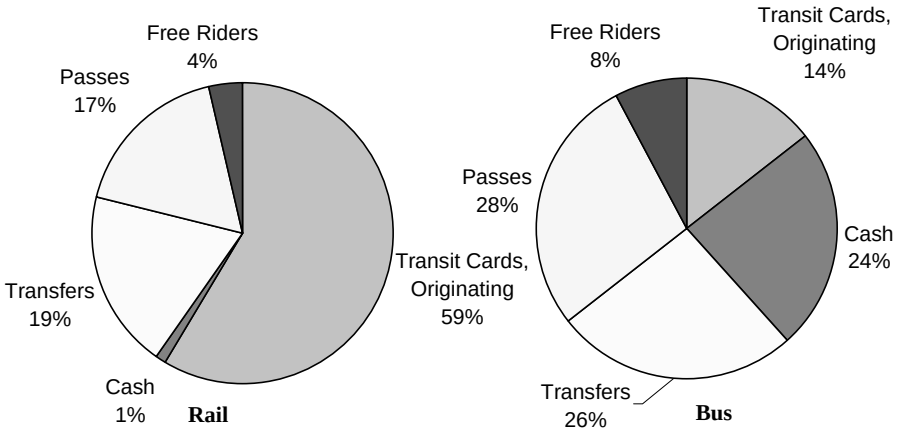


Figure CS3-2. Typical weekday rail and bus ridership by fare medium, June 2002.

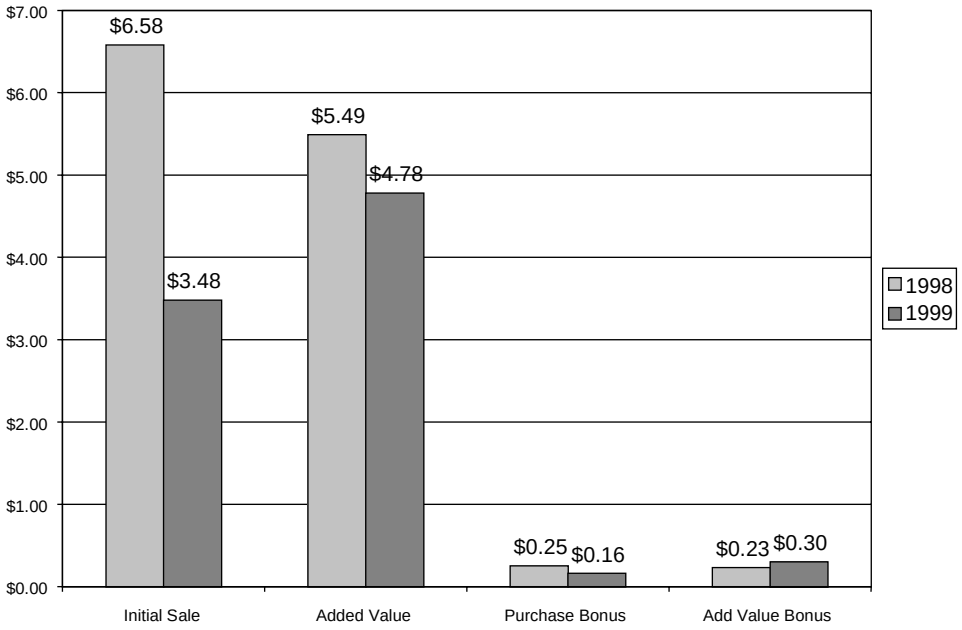


Figure CS3-3. AVM farecard sales, daily average, October 1998 and 1999.

icant impact on the use of farecards. Moreover, once the price of 30-day passes was lowered, some of the riders who had been purchasing higher value farecards may have switched to using passes instead.

CTA found that, in 1999, 34 percent of CTA's initial farecard sales were valued at $2 or less, while 26 percent were valued between $2 and $3. For recharged added value, 41 percent of users recharged their farecards with a value below $2. In fact, it was found that 55 to 60 percent of CTA's customers who purchase farecards at AVMs purchase them on a one-trip basis. Therefore, many of the farecard users were not taking advantage of the built-in bonus and were essentially using a farecard as a proxy for token or cash. This pattern is seen again in Figures CS3-4 and CS3-5, which show a clear

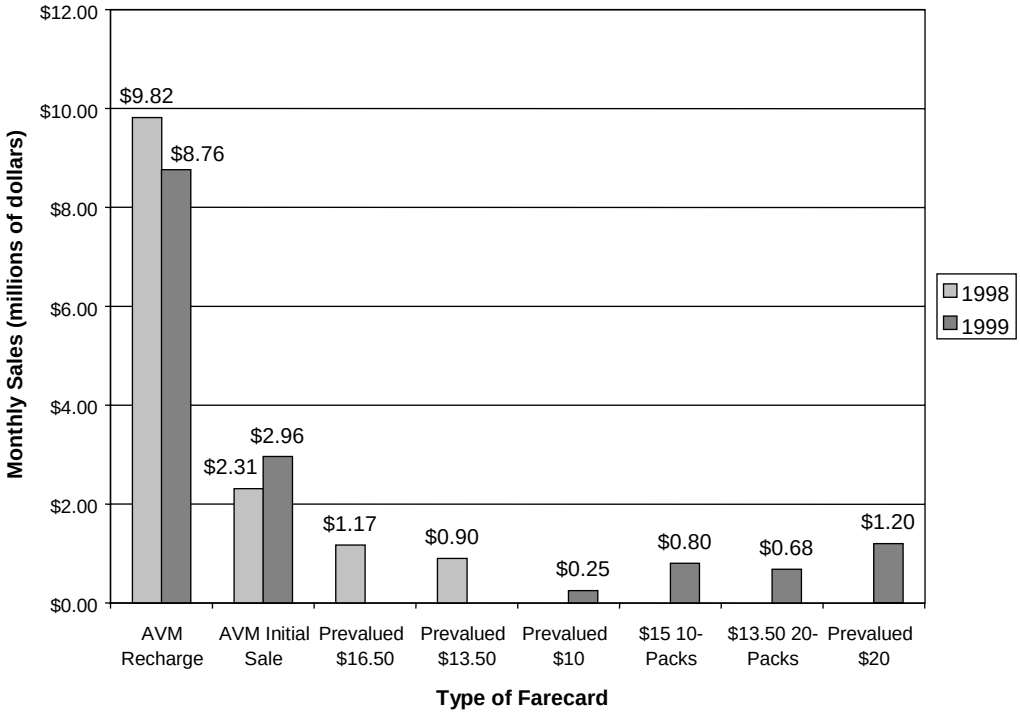


Figure CS3-4. Monthly farecard sales, October 1998 and 1999.

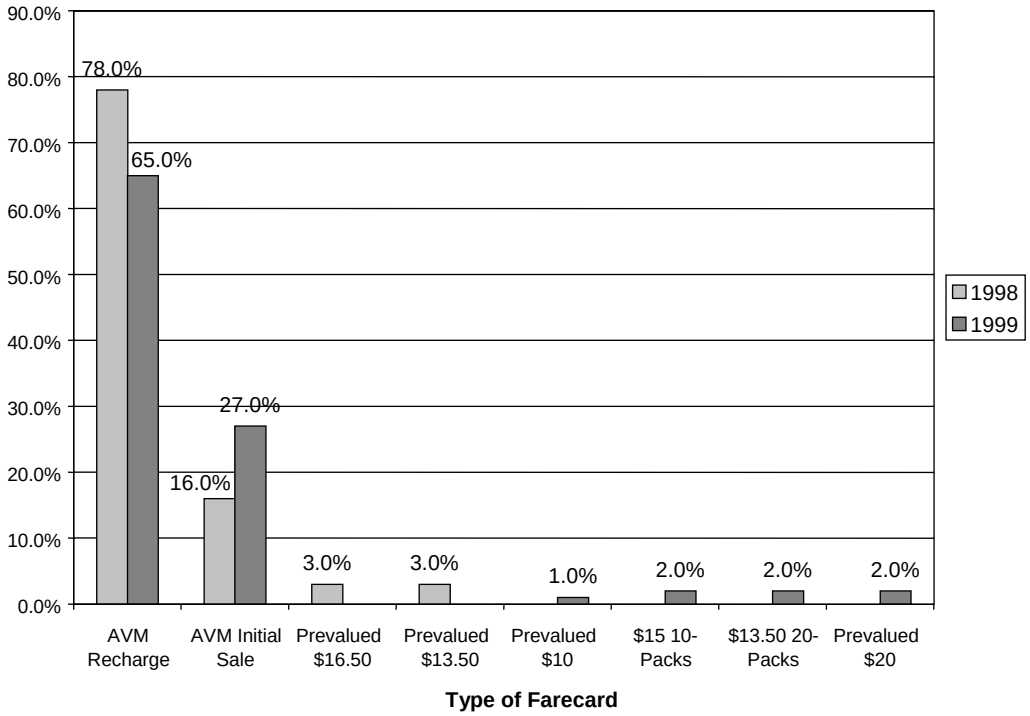


Figure CS3-5. Monthly farecard transactions, relative share, October 1998 and 1999.

shift towards initial card sale from recharge between 1998 and 1999, both in terms of the number of transactions and their value.

As stated previously, one of the fare initiatives undertaken by CTA in 1999 was the implementation of a 7-day pass. While longer-term passes can offer a cost savings to frequent riders, some of these riders (particularly low-income riders) may not necessarily be able to afford the cash outlay required to purchase a monthly pass. Therefore, the implementation of a 7-day pass offers these riders a viable option for economizing on their frequent use of the transit system. In fact, since implementing the 7-day pass, CTA has found it to be extremely popular. Among total pass users, the distribution by type of pass is as follows:

Type of Pass	*Percent of all pass users*
7-day	39
30-day	33
U-PASS	5
Visitor (1-day) and Fun (2-, 3-, or 5-day)	5
Other (such as Pace or Metra)	18

This distribution varies by frequency of use. However, CTA has also found that the 30-day passes are still the most commonly used among regular riders. Among these riders, 30-day passes account for almost half of pass purchases, while among infrequent users, the U-PASS is the most common.

Operational and Administrative Impacts

As indicated earlier, the total cost of implementing the AFC system was approximately $106 million. The percentage costs, rounded to the nearest whole number, for the different elements of the program were as follows:

- AFC equipment—74 percent
- Station construction—13 percent
- Field forces—5 percent
- Consultants—4 percent
- CTA engineering and administration—2 percent
- Marketing and start-up—1 percent

The implementation of AFC represented a dramatic change for CTA and its customers. For instance, implementing the new system required a shift in duties for some CTA staff, including converting former rail ticket agents into customer assistants and increasing the number of customer service staff to deal specifically with AFC-related inquiries. (CTA had originally envisioned that the implementation of AFC would result in personnel cost savings, through the elimination of the need for the rail ticket agents. However, these savings did not materialize, due to the decision to convert these employees to customer assistants.) Many of these customer service staff were positioned in the newly formed AFC Express Unit, which handles complaints about the AFC system. The AFC Express Unit has the ability to process refund requests and Fare Discrepancy Reports prepared by customer assistants at rail stations and bus operators who are involved in fare-related dis-

putes. At the stations themselves, customer assistants have the ability to provide assistance on the spot and to process refunds when appropriate.

U-PASS Program (*4–5*)

Program Usage and Customer Benefits

Through the AFC system, CTA has been able to track U-PASS ridership, providing a good indication of the program's ridership characteristics. Approximately 85 to 90 percent of the U-PASSES distributed to students at the participating colleges in 2000–01 were activated and used. In 2000–01, U-PASS ridership reached approximately 10.6 million trips among the more than 40,000 students at the 22 participating schools. CTA estimates that 2.6 to 4.0 million of these trips are new trips credited to U-PASS. Surveys indicate that about three-quarters of the new trips made on CTA as a result of the U-PASS were previously made by automobile. The remainder of the new trips were apparently additional trips made by students once they obtained a pass.

Table CS3-2 shows annual U-PASS ridership, by mode, for the first three years of the program's implementation. Student travel is estimated to have increased by 25 to 38 percent for both school and nonschool purposes compared to that in previous, non-U-PASS school years. This is a measure of the combined impact of diverted trips and latent demand among the student population. In the first school year of the program (1998–1999), when 14 institutions participated, the U-PASS generated 1.7 to 2.6 million new rides. In the second school year, when 19 institutions participated, ridership increased by 43 percent, bringing the new ride estimate to 2.4 to 3.7 million. Total CTA ridership increased over this same two-year period by 21.5 million. Thus, U-PASS contributed an estimated 11 to 17 percent share of this growth.

Table CS3-2 also shows that more U-PASS rides are taken on rail than on bus. During the 2000–01 academic year, 59 percent of the U-PASS ridership was on rail and 41 percent was on bus. This contrasts with overall CTA ridership, where approximately two-thirds of all trips are made by bus. Of course, the split between bus and rail for U-PASS users is influenced by many factors, including the locations of participating schools and student residences. However, CTA did find that location next to a rail station was not a necessity for a school to produce high U-PASS ridership. While most of the schools with access to a rail station did produce high U-PASS ridership, other schools, not located near a rail station but served by bus service, also saw above-average student ridership.

TABLE CS3-2 Annual U-PASS ridership, by mode

	Millions of Student Rides		
Year	Bus	Rail	Total
1998–1999 School Year	3.3	3.5	6.8
1999–2000 School Year	4.3	5.4	9.7
2000–2001 School Year	4.3	6.2	10.6

Figure CS3-6 illustrates how U-PASS ridership varies throughout the academic year. As one would expect, U-PASS ridership is higher during months in which school is in session. During the summer and holiday seasons, U-PASS ridership tends to be lower, as many students may be out of town during this time.

Using the capabilities of its AFC system, CTA has been able to measure the number of rides per day per U-PASS. In February 2001, the average number of rides per day for each U-PASS was 1.12 for 4-year colleges, 1.73 for 2-year colleges, and 1.27 for all schools. Thus, it is over 50 percent higher for 2-year college students than for 4-year students, even though *total* ridership levels are higher for 4-year college students. The most important variable influencing the difference in trip rates appears to be the daily orientation of typical student activity patterns at the two types of institutions: 2-year students are more likely than 4-year students to commute between home and school on a daily basis. Most 4-year institutions have residential campuses with student housing, so students at these schools have less of a need for daily travel on CTA.

CTA has also analyzed data on the time periods in which U-PASS users ride transit, as shown in Figure CS3-7. A significant share of the ridership (36–38 percent) occurs during the midday period (9 AM to 3 PM). This is slightly higher than the 32 percent of all CTA ridership that occurs during this time period. In contrast, only 17–18 percent of U-PASS ridership occurs in the AM peak (6 to 9 AM), compared with 27 percent for total CTA ridership. Higher levels of student ridership also occur in evening hours, when capacity is generally available to serve more riders. This higher concentration of trips in the off-peak is consistent with one of the main U-PASS program goals.

CTA conducted rider surveys at three schools in May 2000. The survey asked students about their usage of U-PASS and included a number of questions about aspects of the program and about their satisfaction with U-PASS. The survey data on trip-making, adjusted to reflect over-reporting of trips compared to system information (illustrated in Figure CS3-8), indicates that U-PASS users were primarily making school and work trips. Consistent with previously shown data, 2-year students use the U-PASS more frequently for these purposes than 4-year students, probably because they are more likely to have jobs and live off-campus. The data also shows that students are using U-PASS for a significant number of non-work or school trips, including social, shopping, and personal business trips.

The survey of participating students also provided a basis for evaluating user benefits of the U-PASS program. Students were asked to rate 12 factors according to their importance. Saving money was the most highly rated benefit, with 86–93 percent of students at the three schools surveyed rating it as "very important." The next highest ratings were given to

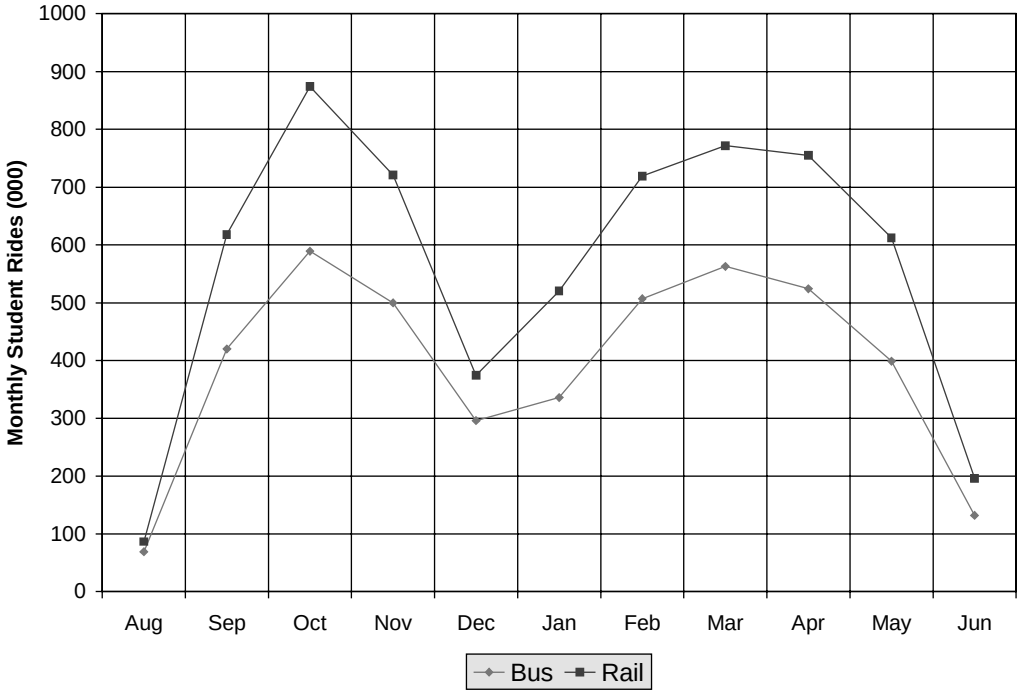
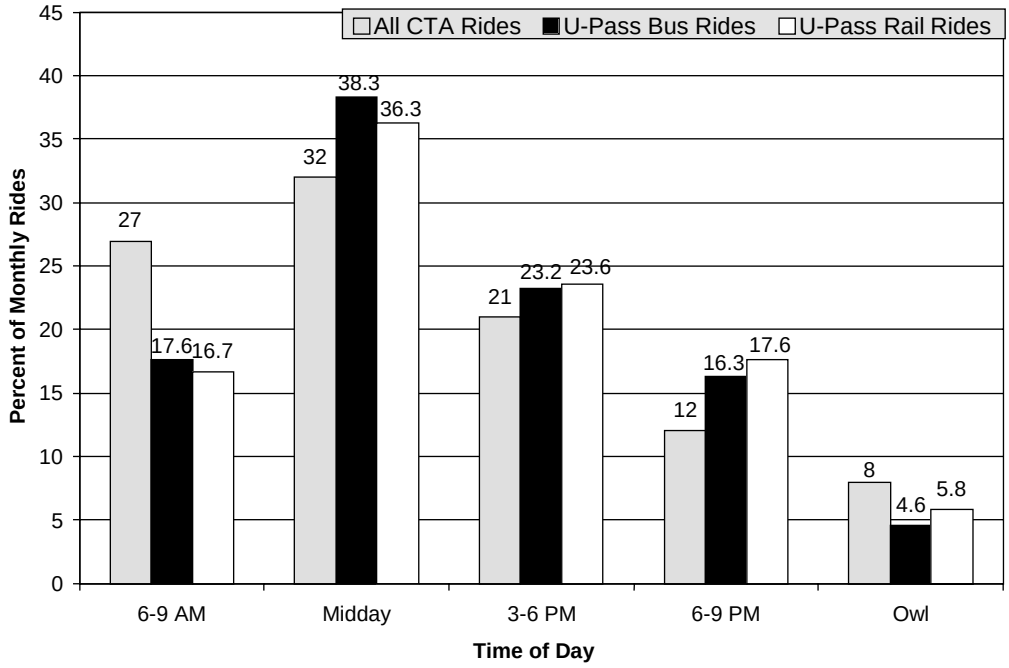


Figure CS3-6. Monthly U-PASS CTA rides, 2000–01 school year.

bus/rail stop close to home, convenience, and avoid driving/parking, each of which was rated as "very important" by 50 to 70 percent of students at one or more schools. Third in importance were have no car, have no license, and to avoid heavy traffic. Rated last were environmental concerns, bad weather, extra time to study and extra time to relax.

Students were also asked about their satisfaction with various U-PASS features. Specifically, they were asked the extent to which they agreed with statements about the pass. Almost all indicated they "would continue riding CTA after graduation," indicating that U-PASS may be successful in creating longer-term "brand loyalty." Overall, the vast majority felt



NOTE: U-PASS data are drawn from all CTA bus routes and rail lines for February, 2001.

Figure CS3-7. Time distribution of student U-PASS ridership.

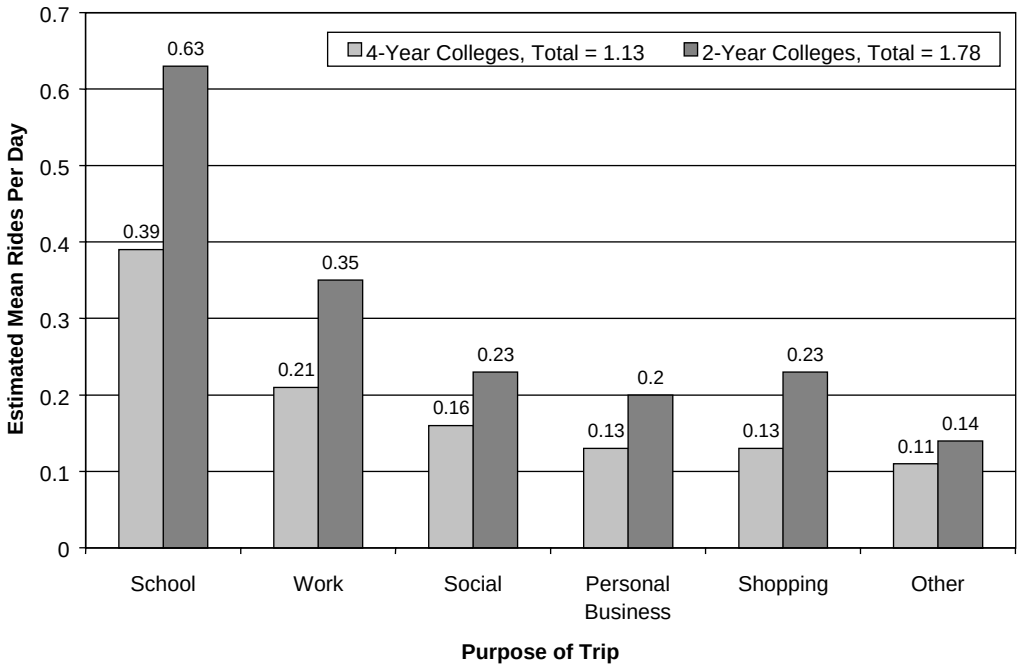


Figure CS3-8. U-PASS rides per pass per day, by trip purpose and type of college, February 2000.

"the program should be continued" (87 to 90 percent strongly agreed). A large majority (64 to 82 percent) strongly agreed that U-PASS "helps me to get around to more places" and "saves me money on my personal transportation needs." Many students (52 to 71 percent) also strongly agreed with the following statements: "I consider the U-PASS among the advantages of attending the school I have chosen" and "It's easy to use the CTA bus/rail system." Many also strongly agreed that the U-PASS helped them find or keep a job while in school, find and/or travel from a cheaper place to live, or visit friends. Fewer, but still significant shares, felt that the U-PASS affected their decision not to purchase a car.

An added feature of the U-PASS program is the "U-PASS, U-SAVE" promotional discount program. Under this program, U-PASS holders are offered price discounts at museums, theatres, restaurants, and other cultural attractions. The majority of students (52 to 71 percent) reported that they had not taken advantage of the U-PASS, U-SAVE discounts; however, CTA concluded that enough students did take advantage to suggest it is worthwhile. CTA agreed that the program would benefit from more marketing on the part of CTA, the schools, and the entities offering the discounts.

Revenue Impact

Based on the above usage data, we have estimated the order of magnitude revenue impact of the U-PASS program. In 2000–01, 10.6 million trips were made with the U-PASS. CTA estimates that 25 to 38 percent of these trips were new trips, indicating that 62 to 75 percent (6.6 to 8 million) of the trips would have been made on CTA even if the U-PASS were not available. These riders would have either paid full fare ($1.50), used a transfer ($0.30), or used a pass. Based on FY2000 data, the average fare paid by CTA riders (fixed-route only) was roughly $0.77.

Under the U-PASS program, the fee for a pass is $0.55 per student per day. Assuming 2 semesters and 118 days per semester, the CTA receives approximately $130 per student per year. During the 2000–01 school year, CTA distributed approximately 40,400 U-PASSes, 90 percent of which were activated (36,360 passes). Assuming that each U-PASS user makes approximately 291 trips per year (10.6 million trips/ 36,360 passes), CTA is receiving approximately $0.45 per trip made by U-PASS users. For students who would have used CTA without the U-PASS program, this results in a net revenue loss of $0.32 per trip. As stated previously, 6.6 to 8 million trips were not new trips on CTA. Therefore, based on this simplified analysis, it can be estimated that CTA might be losing on the order of $2 to $2.6 million annually with the U-PASS program. While this is a significant figure, it must be noted that this represents a very small percentage of CTA's over $370 million total annual fare revenue. Moreover, the program has dramatically increased student ridership, particularly during off-peak periods when capacity is available to carry more riders and has apparently generated considerable brand loyalty pointing to future use of transit by the students.

Smart Card Pilot Program

A survey of smart card users was designed to obtain customer ratings of 22 different features of the program, as well as customer willingness to try—and ratings of—20 potential smart card features (*6–8*). As shown in Table CS3-3, nearly all (93 percent) of the respondents were "satisfied" or "very satisfied" with the new fare medium. The vast majority (86 percent) were "willing" or "very willing" to continue to use the card and to recommend it to others.

When asked which attribute they liked best about the smart card, respondents overwhelmingly responded that they liked the convenience compared to regular farecards (21 percent of respondents), the use of the smart card on the train (15 percent), and the time to register the rail fare (13 percent), as shown in Figure CS3-9. Figure CS3-10 shows that the $5 purchase fee for the card was the single attribute liked least (30 percent). Other negative attributes included adding value to the card and getting the correct (purchase) bonus. Regarding the former, some respondents commented that they did not understand when they purchased the card that they would have to add value before trying to use it, and some had problems trying to add value at the vending machines. Regarding the bonus issue, several respondents experienced procedural problems that resulted in their obtaining a smaller bonus than expected. While respondents rated the use of the smart card on rail favorably, there was some dissatisfaction with its use on bus. About 10 percent to 15 percent of respondents were dissatisfied with operator assistance on the bus, bus touch pad operation, use on the bus, and time to register bus fare. Dissatisfaction with these

TABLE CS3-3 Smart card customer satisfaction

Level of Satisfaction and Willingness to Recommend the Card to Others	Overall Satisfaction (percent)	Likelihood of Continued Use (percent)	Willingness to Recommend to Others (percent)
Very Satisfied or Willing	67.3	77.3	68.3
Somewhat Satisfied or Willing	25.8	8.3	17.7
Neutral	3.2	2.4	4.6
Somewhat Unsatisfied or Unwilling	2.3	1.9	2.4
Very Unsatisfied or Unwilling	1.4	10.1	7.1

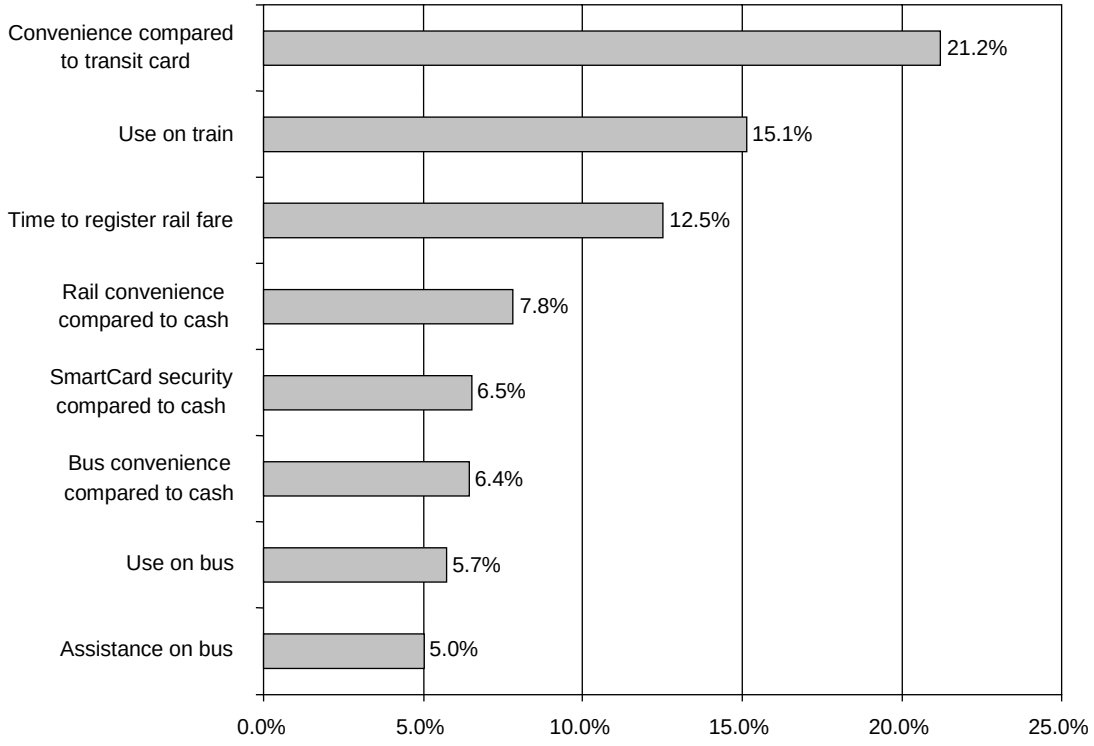


Figure CS3-9. Single smart card attribute respondents liked best.

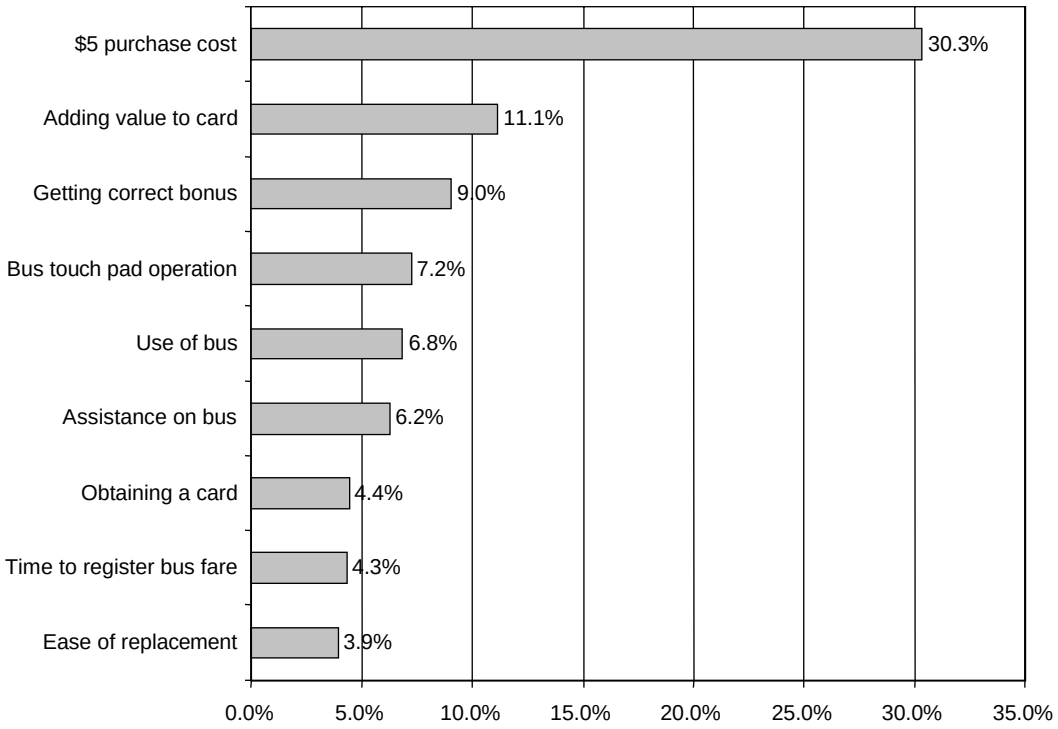


Figure CS3-10. Single smart card attribute respondents liked least.

aspects provided useful information to CTA about customer information and employee training needs.

When asked about "specific problems with the smart card program in the last 30 days," the most common problem cited was assistance on the bus (15 percent) followed by use on the bus (13 percent). Other problems cited included ease of replacement (11 percent), time to register bus fare (9 percent), hotline assistance (9 percent) and assistance on rail (9 percent). CTA attributes some of these problems to the scale of the pilot and believes that employee training, as part of a more extensive program, would rectify most of these problems. Ease of replacement was affected by the need to go to a single location downtown to replace a card. This could be addressed by providing additional locations or methods of replacement.

As indicated in Figure CS3-11, program participants responded positively to all potential new features of the smart card except those relating to the use of the card as a bank card, credit card or Internet payment tool. Regarding these features, more than 60 percent of respondents were either unwilling to participate or neutral. The most desirable new features included showing the card for discounts (78 percent of respondents were willing to try this feature), recharging at ATMs (75 percent willing), using it on Metro Commuter Rail (74 percent), recharging via phone (73 percent), moving value from a farecard (73 percent), and recharging via Internet and credit card (69 percent). About two-thirds of respondents were willing to try using the card to pay for phone calls, to pay for park-n-ride, or to pay for on-street parking, indicating some potential for a multiapplication card.

Comments from users about why they would be likely or unlikely to use the smart card in the future related largely to perceived benefits, such as convenience; speed; better, faster and more durable than farecards; can get replacement if lost; safer to use; and don't have to open purse or wallet.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

Implementation of AFC has proven very popular with CTA's customers. Within 3 months of initial implementation, one-third of all boardings were being made with farecards. At present, 95 percent of rail riders pay their fares with farecards, as do 68 percent of bus riders. Customers have benefited from the AFC system and the related fare initiatives in a number of ways, including the following:

- Riders now have a greater variety of fare payment options available to them.
- Farecard users receive a $1 bonus for each $10 purchase or recharge.
- With rolling passes, riders can purchase and activate their passes at any time, rather than being constrained to a particular calendar timeframe.
- The 7-day rolling pass allows customers to reap the benefits of an unlimited use pass without having to make the cash outlay required with a 30-day pass.

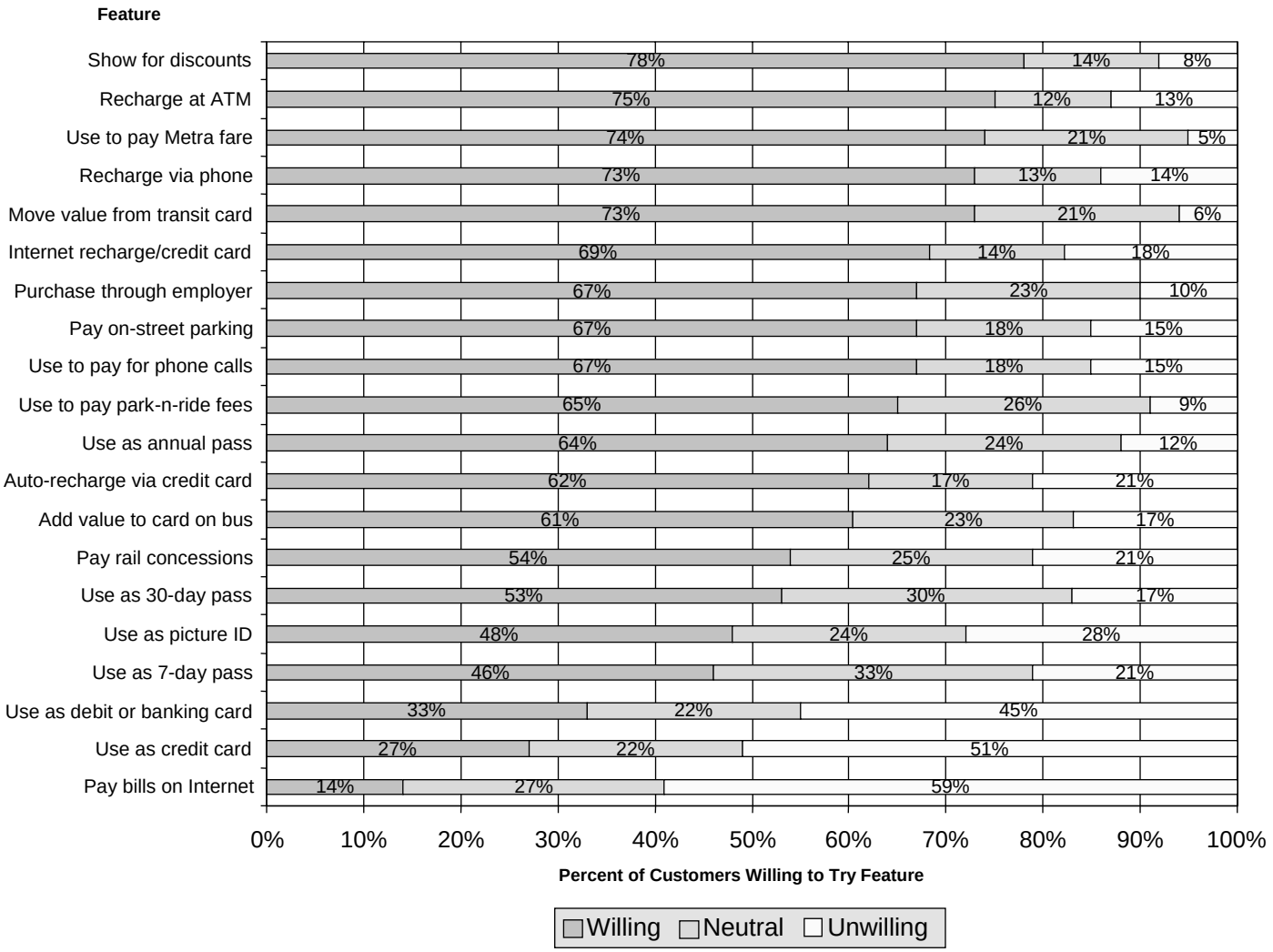


Figure CS3-11. Smart card customer willingness to try new features.

- CTA riders can make seamless transfers to and from Pace buses (since Pace installed the same AFC technology)

The U-PASS program has had the following impacts and benefits for students:

- Students receive a convenient means of using public transportation for both school and nonschool purposes.
- Passes are provided, at very low cost, for unlimited rides on the CTA system at all times; this gives all students greater access to higher education.
- Nearly 90 percent of survey respondents feel that the program should be continued, and most indicated that they would continue to use CTA after graduation.

The smart card pilot and the use of smart cards at the CTA have had the following types of customer impacts and benefits:

- Smart cards offer improved convenience and ease of use, as the card does not have to be inserted but only passed near the reader.
- Smart cards provide guaranteed security of the card's value, as each card is registered when it is obtained, enabling a lost or stolen card to be replaced with the remaining value restored (for a $5 card replacement fee).
- Smart cards provide for a negative balance or guaranteed last ride: a ride is guaranteed, regardless of the remaining value on the card; the card can carry a negative balance up to the value of a single ride, and the next time value is added to the card, the amount of the negative balance is deducted from the value added.
- Smart cards carry a higher cost to customers, given the requirement to pay $5 to purchase the card.
- Nearly all (93 percent) of survey respondents were "satisfied" or "very satisfied" with the cards; the vast majority (86 percent) were "willing" or "very willing" to continue to use the card and to recommend it to others.
- When asked which attribute they liked best about the smart card, respondents overwhelmingly responded that they liked the convenience compared to regular farecards (21 percent of respondents); the $5 purchase fee for the card was the single attribute liked least (30 percent).

Agency Impacts and Benefits

The agency-related impacts and benefits associated with the implementation of the AFC system include the following:

- The total cost of implementing the AFC system was $106 million. Of this total, 74 percent was for equipment, 13 percent for station construction, 5 percent for field forces, 4 percent for consultants, 2 percent for CTA engineering and administration, and 1 percent for marketing and start-up.
- CTA initially envisioned that implementation of AFC would result in a personnel cost savings since they would have a reduced need for rail ticket agents. However, the new fare technology required a significant outreach and customer service effort on the part of the agency and many of the rail ticket agents were converted to customer assistants. Therefore, CTA did not realize the anticipated personnel cost savings.
- With the introduction of rolling passes, CTA no longer needs to print monthly passes that may be discarded if they are not purchased. Therefore, this initiative has reduced some of the printing costs associated with regular monthly passes.
- The AFC system has considerably reduced the use of cash for fare payment: 16 percent of boardings are currently made using cash, compared to 27 percent pre-AFC.
- AFC allows the CTA to carefully track ridership and revenue impacts of different fare initiatives.
- AFC has significantly reduced opportunities for fare abuse and evasion.
- AFC has facilitated the implementation of more fare options for customers, many of which are more convenient and cost-effective. Moreover, the popularity of the farecards has enabled CTA to eliminate tokens completely.

The actual or expected agency-related impacts and benefits of the U-PASS program are as follows:

- The program has been very successful in increasing ridership. CTA estimates that the U-PASS program has generated between 2.6 and 4 million new trips since its inception, three-fourths of which would have otherwise been taken by automobile. Furthermore, close to one-half of U-PASS ridership is during midday or evening hours, when excess capacity exists on the system.
- U-PASS has helped CTA create a sense of brand loyalty and transit travel patterns among students, who will be prospective customers in their postcollege years. The U-PASS program has also helped CTA develop important partnerships with colleges and universities in the community by helping them with implementation and administration of the program.

The agency-related impacts and benefits associated with the smart card pilot and the use of (contactless) smart cards in general include the following:

- Faster boarding and throughput than with magnetics.
- Lower maintenance requirements—and higher reliability—of the card reading devices, since they have no moving parts and are sealed (i.e., no slots/openings that can become jammed).
- Opportunities for new types of fare options, autoload arrangements (including employer-based programs), and

the opportunity to include nontransit applications (e.g., parking or retail payments, university or employer ID and access, or other functions) on the same card; while multiapplication scenarios were not pursued as part of the pilot program, they may be considered as CTA rolls out a full-scale smart card system.

Smart cards were also seen as having a disadvantage:

- Higher cost of the cards themselves, at least a portion of which ends up being passed along to customers. The cards provided to the CTA thus far cost $6 apiece, compared to $.035 for a magnetic stripe farecard. In the pilot program, CTA charged $5 to initially purchase a smart card with no initial balance. Value then had to be added at an AVM.

Impacts and Benefits for Partner Entities

In addition to benefiting CTA and student riders, the U-PASS program can also benefit the participating colleges and universities. A survey of students using the U-PASS indicated that most students considered it an important benefit of attending their chosen school. Therefore, participation in the U-PASS program can give colleges and universities an advantage in the increasingly competitive college market. Benefits may also accrue to the institutions to the extent that they can better manage on-campus parking and reduce total parking demand.

Liability to Agency

Because the fare payment and pricing options offered with AFC essentially represent automated versions of the previous manual payment and pricing options, the new system has presented little risk of fare revenue loss. In fact, the AFC system has reduced the agency's overall revenue liability by reducing opportunities for fare evasion and abuse. There is some potential revenue loss related to actual equipment card-reading failures, as well as to complaints over alleged failures and the need to provide refunds when appropriate.

The U-PASS program, on the other hand, has likely resulted in at least some revenue loss to CTA, as some U-PASS users presumably had previously paid higher fares to ride CTA. However, the agency feels that any revenue loss has been more than offset by the program's benefits, including a significant increase in student ridership, particularly during off-peak hours, and the creation of a commitment to ride CTA after graduation.

Constraints and Barriers

The major challenges encountered in implementing and operating AFC have been as follows:

- Retrofitting the new system (including a complex communications/data network, as well as new faregates and AVMs) into the existing rail station infrastructure.
- Integrating the new Cubic farecard readers with the existing GFI fareboxes; CTA technicians had to develop the physical connections between the two pieces of equipment. (Since implementation of the AFC program, Cubic and GFI have begun to collaborate on selected AFC system proposals and installations.)
- Promoting the use of farecards (especially in the stored value mode) on bus, due to the lack of convenient sale/reload points: farecard use is significantly higher among rail riders, who have the convenience of the AVMs in the rail stations, than bus riders.
- The need to retrain staff, including converting rail ticket agents into customer assistants.

Required Equipment and Technology

For the CTA's 141 rail rapid transit stations, the AFC project included installation of AVMs and automated turnstile equipment. Installation on buses involved integrating farecard readers with the existing GFI fareboxes. The magnetic stripe read-write system was provided by Cubic and is very similar technologically to the MetroCard system implemented in New York City. Installation of the AFC system enabled CTA to introduce the U-PASS program, as well as a number of other fare initiatives. Additionally, CTA had planned in advance for eventual use of smart cards by equipping the turnstiles and bus card readers with touchpads that could later be used with Cubic's contactless smart cards.

Lessons Learned

Key lessons learned from CTA's implementation of AFC include the following:

- The introduction of AFC can significantly affect how riders pay their fares; the convenience of using a farecard, coupled with the discounts available, has resulted in 95 percent of rail riders paying their fares with farecards, as well as 68 percent of bus riders.
- Providing convenient locations for purchase and reload of farecards for bus riders is a major challenge.
- The nature of the minimum farecard purchase level and the recharge requirement can have an impact on the use of farecards. When these requirements were lowered at CTA, the revenue and ridership accounted for by farecards increased. However, CTA has found that more than half of farecard users purchase the cards on a one-trip basis. Thus, they are using farecards as a proxy for

cash or tokens and are not taking advantage of the bonus. This experience indicates that bonuses may not have as significant an effect on purchase behavior as might be expected.

Lessons learned from CTA's U-PASS program include the following:

- A university pass program can be very effective at generating increased ridership, especially during midday and evening hours, when there tends to be excess capacity on a system. Such programs can also result in establishment of significant "brand loyalty" to the transit system in terms of students planning to use the system after graduation.
- Location near a rail station is not necessary for a school to produce high student ridership with the U-PASS program. Participating schools that are served by buses only still generated high student ridership levels.
- Usage of the passes is likely to be higher with 2-year college students than 4-year college students, since the former are less likely to live on campus and may have a job outside of school.

The smart card pilot provided sufficient support for CTA to expand its smart card program to full implementation in 2002. The program was well received by customers—93 percent of survey respondents reported being "satisfied" or "very satisfied" with the program and 86 percent were "willing" or "very willing" to continue to use the card and recommend it to others. During the smart card pilot, CTA learned the following lessons:

- Customers need better upfront explanation of the rationale for an initial purchase fee.
- Customers particularly like the security offered by having the capability to restore their card balance in the case of loss or theft of the card.

CASE STUDY CONTACTS AND SOURCES

The following individuals were interviewed at CTA headquarters:

Darwin Stuart
CTA
120 N. Racine Ave.
Chicago, IL 60607
312-733-7000, ext. 6848
dstuart@transitchicago.com

Peter Foote
CTA
120 N. Racine Ave.
Chicago, IL 60607
312-733-7000, ext. 6848
pfoote@transitchicago.com

The following documents (in addition to ridership and revenue summaries and other sales and operational data) were used in preparing the case study:

Darwin Stuart. *University and College Student Ridership Growth in Chicago U-PASS Program*. Paper presented APTA Rapid Transit Conf., Boston, June 2001.

CTA Market Research Department, 2000–01 U-PASS Student Ridership, Technical Report MR/DSD01-22, August 2001.

CTA Market Research Department, 2001 Customer Satisfaction Survey, Technical Report MR02-05, April 2002.

CTA Market Research Strategic Planning Department, *CTA Smart Card Pilot Program: Customer Satisfaction Survey*, Technical Report MR01-03, Feb. 2001.

Peter Foote and Darwin Stuart, *Testing Customer Acceptance of Smart Cards at the Chicago Transit Authority.* Paper presented at Transportation Research Board Annual Meeting, January 2002.

Peter Foote, Ross Patronsky, Darwin Stuart. *Customer Impacts of CTA's Automated Fare Collection System*. Paper presented at Transportation Research Board Annual Meeting, January 1999.

P. Foote and D. Stuart, *Impacts of Transit Fare Policy Initiatives Under an Automated Fare System.* Transportation Quarterly, Vol. 54, No. 3, Summer 2000.

P. Foote, R. Patronsky, D. Stuart. *Transit Customer Acceptance of Automated Fare Collection Systems*. Journal of Public Transportation, Vol. 2, No. 3, 1999.

CTA Smart Card Pilot Program, A Presentation by Technology Management and Finance Division, CTA, February 2001.

CASE STUDY **4**

CONNECTICUT TRANSIT

Fare Program/Initiatives

Fare simplification: elimination of zones

Introduction of AFC: common farecard, rolling passes (7- and 31-day), 1-day pass sold onboard

Introduction of university pass program

INTRODUCTION

Connecticut Transit (CT TRANSIT) operates state-owned transit systems serving Hartford, New Haven, and Stamford. The three operations have a total peak fleet (FY 1999) of 341 buses: 189 in Hartford, 110 in New Haven and 42 in Stamford. Total system ridership (FY 1999) was approximately 27 million: 15 million in Hartford, 9 million in New Haven, and 3 million in Stamford.

This case study reviews a program introduced in June 1998 called the New Fare Deal (*10*). This program included the following individual elements:

- Eliminating local fare zones
- Introducing an electronic 1-day pass that could be issued onboard buses
- Introducing a 7-day rolling pass (i.e., activated on first use)
- Replacing the monthly flash pass with a 31-day rolling pass
- Introducing an electronic 10-ride (i.e., stored-ride) farecard

The New Fare Deal program created a uniform fare structure for the three CT TRANSIT operations, as well as several other state-contracted local services in Waterbury, New Britain, Bristol, Meriden, and Wallingford. Any of these electronic payment options could be used on any of the participating services. The payment options were—and continue to be—based on GFI's TRiM magnetic read-write technology.

This case study reviews the implementation process and discusses issues and impacts related to the above fare initiatives. The case study also discusses a university pass (Upass) program the agency runs with two local colleges.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

Elimination of Local Fare Zones

The New Fare Deal program was intended to simplify and increase the convenience of fare payment for Connecticut transit users. The fare structure at CT TRANSIT had previously been quite complicated, with a range of fares based on distance traveled and type of service (i.e., zone charges for both local and express routes). Each city served by CT TRANSIT had its own zonal structure, with the base fare ($1) charged within each urban core area and concentric zones radiating from these core areas. Each zone carried a $0.50 surcharge. The maximum fare for a local trip was $2.50, or the core area plus three zones. However, roughly 90 percent of all trips were within the central urban core zones (*9*).

While the concentric zone structure was reasonable at a time when transit travel focused on the downtown areas, market research conducted by CT TRANSIT in 1996 determined that "'downtown' was no longer the destination for a majority of transit customers" (*10*). The increase of suburb-to-suburb trips resulted in increasing inequities in trip costs; for instance, someone traveling along a radial route and crossing a zone boundary would pay a zonal surcharge despite making a relatively short trip, while someone making a crosstown trip could travel a much longer distance without crossing a zone boundary.

Adding to the complexity of the zonal structure was the fare payment process itself. On boarding, a rider paid the base fare and was given a "zone check." On exiting, the rider was expected to hand the zone check to the operator and pay the applicable zone surcharge. This system was apparently confusing to riders and difficult for operators to administer, since they had to remember where individual riders had boarded. This apparently resulted in numerous confrontations, as some riders would argue that they did not owe a zone surcharge.

The 1996 market research concluded that "The current CT TRANSIT approach to fares has created a fare structure that is overly complex, not strategically aligned with the opportunities in the marketplace, and inconvenient to use" (*10*). One of the key recommendations of this study was that CT

TRANSIT make the fare structure "appear less complex to the first time user" (*9*).

Another rationale for eliminating local fare zones was to remove the negative impact of that structure on welfare-to-work trips. The routes bringing inner city residents to jobs in suburban areas (i.e., reverse commuting) typically required that riders pay zone surcharges, meaning that these people were often paying higher fares than riders making intra-suburban trips. The surcharges were seen as a definite barrier to encouraging reverse commuting.

Finally, CT TRANSIT saw an opportunity to reduce its fare collection costs by eliminating local zones. The zones required the agency to produce multiple denominations of passes, for full fare riders as well as for other rider categories, such as students, seniors, and persons with disabilities. (CT TRANSIT did decide to retain the express zonal structure, since much of that service continued to be focused on the downtown areas.)

CT TRANSIT's goals and objectives in eliminating the local zone system can be summarized as follows:

- Improve rider ease of understanding and payment of fares, and thus increase ridership.
- Reduce operator requirements for administering fare collection, and eliminate rider-operator confrontations.
- Support welfare-to-work/reverse commute initiatives.
- Reduce administrative costs associated with production of zone-based passes.

The fare zones were eliminated in June 1998, and the change was marketed using the slogan "One Fare Everywhere."

Introduction of New Passes and Stored-Ride Tickets

In addition to eliminating the local fare zone structure, CT TRANSIT decided at the same time to take advantage of the automated processing capabilities of its GFI TRiM units and introduce a series of electronic payment options:

- A 1-day pass ($2.50) that can be purchased onboard buses or at any sales outlet; this pass is activated when purchased, if onboard, or when first used, and is then valid for the remainder of the service day.
- A 7-day rolling (i.e., activate on first use) pass ($12).
- A 31-day rolling pass ($38), which replaced the monthly flash pass.
- A stored-ride farecard good for 10 rides ($9, representing one free ride).

Elimination of free transfers was also considered as part of this fare initiative, but CT TRANSIT opted to retain this element of the fare structure. The agency's chief goals and objectives in introducing the new fare options were as follows:

- Improve customer convenience.
- Reduce the administrative burden and cost associated with the sale of passes.
- Avoid disputes regarding the validity of passes—by validating passes and farecards electronically.
- Reduce the use of tokens: eliminate the Zone 2 token; have the farecard replace the token 10-pack. (While individual tokens can still be purchased and used, they are discounted only in rolls of 50; tokens tend to be bought only by social service agencies and schools.)

CT TRANSIT conducted an extensive marketing campaign in implementing these initiatives. The effort included flyers distributed on buses and at transit agency information and sales locations, press releases, print ads, notices posted inside vehicles, inserts in all mail orders for passes the month prior to their introduction, and flyers distributed through employers.

Upass Program

In 2000, CT TRANSIT began a pass program with two colleges in Hartford, Trinity College (approximately 1,900 students) and Capital Community College (approximately 3,000 students). The Upass is magnetically encoded, allowing the number of rides to be tracked (by pass) when inserted into the TRiM unit. Each school's Upass shows the name of the school and the semester in which it is valid. Students are sometimes asked to show a school ID when boarding in order to limit sharing of a pass with a nonstudent.

Under the terms of this program, each college pays a CT TRANSIT fare of $0.65 per ride by students carrying the Upass—up to a ceiling of an amount equivalent to $20 per full-time student per semester. In other words, assuming 3,000 students, the ceiling amount for Capital students would be calculated as follows: $3{,}000 \times \$20 = \$6{,}000$. Thus, at $0.65 per ride, Capital students would have to take 92,308 rides in a semester to reach the ceiling amount. Once the number of rides in a semester exceeds that figure, the school is not charged for additional rides during that semester—meaning that CT TRANSIT effectively "loses" the revenue it would have collected for each ride. The per student ceiling price started at $12, then rose to $18, before rising to the current level; the ridership and revenue impacts of the program are discussed below.

RESULTS AND IMPACTS OF FARE INITIATIVES

New Fare Deal Program

Ridership and Revenue Impacts and Customer Benefits

The ridership and revenue totals for the period since the introduction of the fare initiatives are summarized in Table CS4-1. Figures CS4-1 and CS4-2 show the distribution of types

TABLE CS4-1 Ridership and revenue totals

Fare/Revenue Category	Annual Total (Percent Change from Previous Year)				
	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002
System Total	27,422,144	26,875,449 (2.0 percent)	27,341,448 (1.7 percent)	27,342,986 (0.0 percent)	26,832,700 (1.9 percent)
Local Cash	12,562,281	11,842,086 (5.7 percent)	11,847,596 (0.0 percent)	11,748,858 (0.8 percent)	11,392,780 (3.0 percent)
Local Tokens	850,900	438,780 (48.4 percent)	418,191 (4.7 percent)	472,516 (13.0 percent)	448,060 (5.2 percent)
Local 10-Ride Tickets	83,064	505,451 (508.5 percent)	456,383 (9.7 percent)	424,397 (7.0 percent)	422,000 (0.1 percent)
Local 1-Day Pass	0	1,223,813 (new)	1,628,306 (33.1 percent)	1,810,642 (11.2 percent)	1,982,150 (9.5 percent)
Local 7-Day Pass	0	184,197 (new)	244,338 (32.7 percent)	280,200 (14.7 percent)	321,945 (15.1 percent)
Local 31-Day Pass	4,452,720	3,976,301 (10.7 percent)	3,779,498 (4.9 percent)	3,967,506 (5.0 percent)	3,652,830 (7.9 percent)
Other Fare Categories*	9,473,179	8,704,821 (8.1 percent)	8,967,136 (3.0 percent)	8,638,867 (3.7 percent)	8,612,935 (0.0 percent)
Total Fare Revenue	$20,567,663	$20,405,803 (0.8 percent)	$20,025,189 (1.9 percent)	$20,037,469 (0.1 percent)	$19,195,730 (4.2 percent)
Revenue per Mile	$1.85	$1.80 (2.7 percent)	$1.71 (5.0 percent)	$1.72 (0.6 percent)	$1.67 (2.9 percent)
Avg. Fare per Rider	$0.75	$0.76 (1.3 percent)	$0.73 (3.9 percent)	$0.73 (0.0 percent)	$0.72 (1.4 percent)
Fare Recovery	37 percent	36 percent (2.7 percent)	35 percent (2.8 percent)	33 percent (5.7 percent)	30 percent (9.1 percent)

SOURCE: CT TRANSIT *Ridership and Financial Statistics.*
* Other Fare Categories include Commuter, Student, Sr./Disabled, and Transfers.

of fare payment in 1998 and 2002. As indicated in the table and the figures, the fare program changes described here have had a significant impact on the distribution of fare payment mechanisms. These impacts can be summarized as follows:

- The use of cash (as a percentage of overall fare types) dropped by 6 percent within a year of the introduction of the New Fare Deal; in 2002, the use of cash is roughly 9 percent below the 1998 percentage.
- Following the introduction of stored-ride cards, the use of tokens dropped by 48 percent, although token use rose somewhat again in 2001.
- The use of both the 1-day pass and the 7-day pass have grown steadily since their introduction.
- Overall pass use in 2002 has been 34 percent higher than pass use in 1998 (i.e., limited to a monthly pass), although the number of monthly pass users has declined (down 18 percent in 2002 from the 1998 monthly pass total).

As indicated in Table CS4-1, CT TRANSIT's overall ridership has been relatively steady during this period, although ridership was 2 percent lower in 2002 than in 1998. Demand actually dropped by 2 percent in the first year following the introduction of the New Fare Deal, although fare revenue

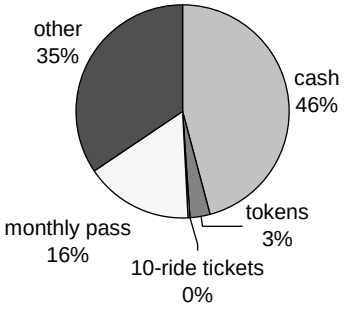


Figure CS4-1. Types of fare payment, 1998.

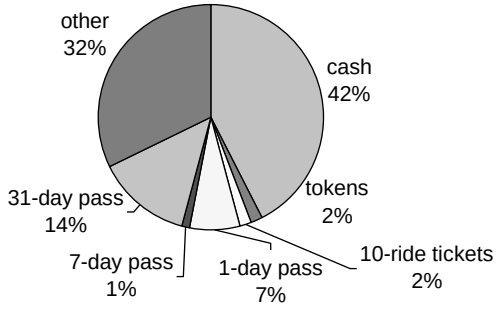


Figure CS4-2. Types of fare payment, 2002.

experienced a smaller decrease (0.8 percent); this resulted in a small increase in the average fare per rider (from $0.75 to $0.76). Fare revenue has declined further since that point, though: the 2002 total was 4 percent below the 1998 total. This revenue loss is most likely at least partially attributable to the increase in pass sales and usage, particularly the steady growth in the use of 1-day and 7-day passes.

The agency could recover some of this revenue loss by raising the price of the 1-day pass and may consider such a move at some point in the future. This pass is currently used an average of roughly 4.25 times per day. Assuming that most of these uses represent boardings that would otherwise cost $1 apiece (because riders who can use free transfers presumably do not buy passes), the average user of the 1-day pass would still receive a substantial discount if paying $2.75 or $3 per day.

Operational and Administrative Impacts and Issues

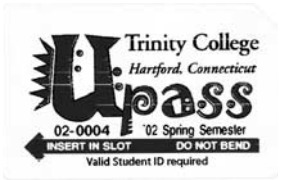
CT TRANSIT's fare initiatives have had a number of operational and administrative impacts; the key impacts and issues or problems can be summarized as follows:

- *Elimination of local zones.* This has benefited operators by reducing the requirement to issue and collect zone fare checks and by eliminating confrontations with riders regarding the payment of zonal surcharges. It has also benefited the agency by eliminating the need to (1) print different denominations of passes, (2) print and issue zone checks, and (3) administer two denominations of tokens.
- *Onboard sale of 1-day passes.* There has been a small but consistent incidence of failed transactions involving the onboard sale of 1-day passes. Roughly 2.5 percent of all onboard sales cannot be completed because riders fail to inform the operator of their intention to buy a pass before inserting money into the farebox. The operator must initiate a day pass transaction before any money is deposited. Instructions are posted on each bus, but a significant number of riders fail to follow these instructions. In such cases, a road supervisor subsequently locates the would-be day pass buyer and gives him/her a day pass. CT TRANSIT estimates that this requires 40 to 60 hours per month in road supervisor time.

- *Introduction of rolling passes.* This has significantly reduced the administrative requirements and costs associated with selling and distributing passes. Previously, thousands of calendar-month passes (considerably more than the number actually sold) had to be printed and distributed to employers and sales locations each month, and the sales/reconciliation effort was concentrated into a short period from the last few days of a month through the first few days of the following month. The use of rolling passes has allowed bulk distribution (i.e., since passes are no longer tied to a particular month) and has eliminated the waste associated with printing extra monthly passes and the need for reconciliation and shredding of unused passes each month. The use of electronic media has also eliminated the counterfeiting of passes, and has made operators' jobs easier by no longer requiring them to visually inspect each pass.

Thus, despite the operational issue related to sale of 1-day passes, the fare initiatives described here have generally benefited CT TRANSIT and its operators. (There has been a significant increase in equipment maintenance costs associated with the use of the electronic registering fareboxes and card processing (TRiM) units. However, since CT TRANSIT had installed the new fareboxes and TRiM units before deciding to introduce the new fare options, these costs should not be attributed to these fare initiatives.)

Upass Program



Program Usage

The usage and revenue impacts of each college's Upass program are summarized in Tables CS4-2 and CS4-3. As indicated in Table CS4-2, Capital Community College (CCC) students used the passes for an average of roughly 19,000 rides per month during February–April 2002. Usage was down slightly from previous semesters; the highest use occurred in the Fall 2000, at over 23,500 per month. Ridership failed to reach the ceiling level for the first time in Fall 2001. The revenue impacts are discussed below.

Thus far, CCC has distributed on the order of only 500 passes to students; therefore, each of these students is using a pass over 40 or more times per month. Since CCC is a commuter school, this is a reasonable level of usage. The number of passes requested and the resulting usage is expected to jump once the school makes its planned move into a downtown Hartford location served by many of CT TRANSIT's Hartford routes. At that point, CT TRANSIT will have to establish a much higher per student ceiling rate or lose considerable revenue.

In contrast, Table CS4-3 shows that Trinity College students used the passes for only 1,300 rides per month during February–April 2002; this represents a significant drop from the highest use—over 2,400 rides in October 2001. In general, Trinity College usage has displayed considerable fluctuation over the last two years. Trinity students primarily live on or near campus, and thus use CT TRANSIT for off-campus travel (e.g., to reach community service assignments), rather than for commuting.

TABLE CS4-2 Upass ridership and revenue totals (Capital Community College)

	1999-2000			2000-2001			2001-2002		
	Usage	Revenue Collected	Lost Revenue	Usage	Revenue Collected	Lost Revenue	Usage	Revenue Collected	Lost Revenue
Fall Semester									
Aug	983	$639		0	$0		231	$150	
Sept	19509	$12,681		23358	$15,183		18162	$11,805	
Oct	22499	$14,624		27073	$17,597		23136	$15,038	
Nov	21661		($14,080)	24659	$16,028	($209)	19859	$12,908	
Dec	18899		($12,284)	19043		($12,378)	13613	$8,848	
Semester total	**83551**	**$27,944**	**($26,364)**	**94133**	**$48,808**	**($12,587)**	**75001**	**$48,749**	**$0**
Average fare/ride		**$0.33**			**$0.52**			**$0.65**	
Spring Semester									
Jan	8758	$5,693		9807	$6,375		6445	$4,189	
Feb	23089	$15,008		20664	$13,432		18377	$11,945	
Mar	23512	$5,299	($9,983)	21572	$14,022		18418	$11,972	
Apr	20254		($13,165)	21253	$13,814		20595	$13,387	
May	18951		($12,318)	13250	$8,613	($4,055)	na	na	
Semester total	**94564**	**$26,000**	**($35,466)**	**86546**	**$56,256**	**($4,055)**	**63835**	**$41,493**	**$0**
Average fare/ride		**$0.27**			**$0.65**			**$0.65**	
Rate/student:		$ 12.00			$ 18.00			$ 20.00	

Revenue Impact

With regard to revenue impact, the Upass program has had mixed results to-date. As shown in Table CS4-2, CT TRANSIT lost revenue each semester of the first two years on the CCC portion of the program, although the amount of the loss was reduced considerably once the per student rate was raised from $12 to $18 in 2000–01. The revenue collected per ride grew from a low of $0.27 in the Spring of 1999–2000 to the full $0.65 the following Spring. With the increase to $20 in 2001, coupled with a 20 percent drop in usage in the Fall semester (compared to the previous Fall), CCC did not reach the ceiling in either semester. As suggested above, however, a major rise in the usage level will require a concomitant increase in the per student rate if CT TRANSIT is to avoid a substantial loss of revenue.

With a much lower rate of usage, the Trinity portion of the program has not come close to reaching the ceiling level thus far. For the Spring 2002 semester, for instance, the ceiling amount was approximately $38,000 (i.e., 1,900 students × $20). Through April, the revenue collected for rides taken was just over $3,000.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

The New Fare Deal initiatives appear to have significantly benefited CT TRANSIT's riders, as follows:

- Simplified the fare structure through elimination of fare zones.
- Provided more convenient fare options, including rolling passes, stored-ride cards, 1-day passes sold onboard buses, and semester passes to college students.
- Reduced the cost of travel for many riders by offering low-price, 1-day passes and via the Upass for participating college students.
- Provided opportunities for seamless travel on any of eight participating transit systems in the state (i.e., 51 local routes operated by CT TRANSIT in Hartford, Stamford and New Haven, as well as local service operated by other Connecticut DOT contractors in five other towns), as all fare media are accepted on any of these services, regardless of which system issued the pass or farecard.

Finally, while CT TRANSIT has not surveyed its riders regarding their satisfaction with the fare initiatives, the usage of the new options suggests that riders have embraced them. The 7-day pass and the 1-day pass in particular have experienced steady growth, and overall pass use has increased by more than a third since 1998.

The Upass program has also benefited its customers, two local colleges, and their students.

Agency Impacts and Benefits

The New Fare Deal initiatives have also had a generally positive impact on CT TRANSIT's administrative and operational fare collection requirements:

TABLE CS4-3 Upass ridership and revenue totals (Trinity College)

	1999-2000			2000-2001			2001-2002		
	Usage	Revenue Collected	Lost Revenue	Usage	Revenue Collected	Lost Revenue	Usage	Revenue Collected	Lost Revenue
Fall Semester									
Aug	75	$49		0	$0		333	$216	
Sept	1499	$974		1351	$878		1586	$1,031	
Oct	1611	$1,047		1657	$1,077		2414	$1,569	
Nov	1353	$879		1270	$826		2266	$1,473	
Dec	1053	$685		902	$586		1674	$1,088	
Semester total	**5591**	**$3,634**	**$0**	**5180**	**$3,367**	**$0**	**8273**	**$5,377**	**$0**
Average fare/ride		**$0.65**			**$0.65**			**$0.65**	
Spring Semester									
Jan	581	$378		744	$483		880	$572	
Feb	1299	$844		1174	$763		1310	$851	
Mar	1478	$961		998	$649		1361	$885	
Apr	1081	$703		1143	$743		1302	$846	
May	984	$639		652	$424		na	na	
Semester total	**5423**	**$3,525**	**$0**	**4711**	**$3,062**	**$0**	**4853**	**$3,154**	**$0**
Average fare/ride		**$0.65**			**$0.65**			**$0.65**	
Rate/student:		$ 12.00			$ 18.00			$ 20.00	

- Reduced operator requirements for administering fare collection and eliminated rider-operator confrontations regarding (1) payment of zonal surcharges and (2) validity of passes; however, a new type of operator-rider dispute has arisen, associated with the onboard purchase of 1-day passes (i.e., some riders do not realize that they must inform the operator of their intention to buy a pass before depositing money in the farebox).
- Reduced fare collection costs associated with (1) selling and distributing fixed-calendar monthly passes, (2) printing different zone denominations of passes, (3) printing and issuing zone checks, and (4) administering two denominations of tokens.
- Reduced the use of cash (9 percent drop since introduction of fare initiatives) and tokens (47 percent drop since introduction of fare initiatives).
- Resulted in a small revenue decline, although the average fare per rider increased in the year following the fare initiatives.
- Reduced the extent of fare abuse and evasion through automatic verification of validity of fare media and by curtailing counterfeiting of passes.
- Increased fare structure flexibility (i.e., the agency's ability to add or change fare strategies).
- Had no significant impact on service reliability; while the use of electronic media has slightly reduced boarding times, confusion related to purchase of 1-day passes has offset that improvement on some runs.

The Upass program has had the following impacts on CT TRANSIT:

- Attracted new riders to the system, as transit usage by students is reportedly higher than prior to implementation of the Upass program.
- Under the terms of the pricing agreement, CT TRANSIT receives a lower fare per rider than it receives from other students; moreover, given the nature of the agreement—with a ceiling based on a fixed rate per student—the agency lost revenue during the first two years from CCC, although the loss lessened considerably once the rate was increased in 2000 (from $12 to $18).

Impacts and Benefits for Partner Entities

CT TRANSIT's Upass program has benefited the colleges taking part in the program, as follows:

- Allows the colleges to provide their students unlimited use of transit service; this will become particularly important for Capital Community College once the school relocates to downtown Hartford (i.e., since CCC is a commuter school, the Upass program should reduce the amount of parking the school needs to provide).
- The basic per ride fare charged the colleges ($0.65) is discounted significantly from the full cash fare ($1), and is even lower than the normal student fare ($0.75); however, given the nature of the payment agreement for the program—with a ceiling based on a fixed rate per student—CCC was able to provide its students rides at a very low rate (as low as $0.27 per ride) before the rate was adjusted.

Liability to Agency

CT TRANSIT risked losing revenue in eliminating its zonal surcharges. However, as indicated above, the loss was minimal. This was due to two key factors: (1) the vast majority of rides occurred within a single zone to begin with; and (2) the agency offered a variety of new fare options that increased overall customer convenience. CT TRANSIT also risked losing revenue—and in fact did suffer some loss—in its Upass program; however, the agency was able to limit further exposure by including in the pricing agreement the ability to raise the per student rate in subsequent years.

With regard to equity considerations, changes in the route structure and types of trips (i.e., reducing the focus on radial trips from the suburbs into downtown areas) had made the zonal structure inappropriate for the service areas. The zones had actually introduced a level of inequity into the system, and the structure was inconsistent with several of the agency's primary goals (including promotion of welfare-to-work/reverse commute initiatives).

Constraints and Barriers

There were no significant constraints or barriers to the successful implementation of CT TRANSIT's fare initiatives. The necessary equipment had already been installed at each of the operations, thereby allowing for the introduction of electronic fare options, as well as the use of these options on any of the participating services (i.e., CT TRANSIT's three services and several others across the state).

The establishment of the Upass program did require the development of a pricing agreement between CT TRANSIT and the participating colleges; however, as discussed elsewhere, the colleges agreed to allow increases in the per student rate once the usage level had been established.

Required Equipment and Technology

CT TRANSIT was able to introduce rolling passes and a stored-ride farecard because it had installed electronic registering fareboxes equipped with electronic (magnetic) farecard read-write equipment, GFI's Cents-a-Bill fareboxes and TRiM units.

Lessons Learned

Key lessons learned from the case study include the following:

- *Elimination of zonal surcharges* will not necessarily result in a significant loss of fare revenue, as the simplification of the fare structure—perhaps coupled with introduction of new customer-oriented fare options—can attract new riders and thus offset the loss of zonal surcharge revenue.
- In the *onboard sale of 1-day passes* (or any type of fare instrument), riders must be given clear instructions as to the procedure for purchasing the pass. Even with such instructions, however, an agency can expect some riders to fail to read—or to forget—the instructions, and therefore must be prepared to deal with the resulting problems.
- In establishing a *university pass program* structured such as CT TRANSIT's Upass (i.e., with payment per ride taken, up to a ceiling based on a fixed rate per student), it is important to establish a per student rate that the transit agency can adjust to reflect the actual usage of the passes. If the agency is held to an initial rate (derived based on predicted usage), and usage proves to be much higher than the original estimate, the agency will experience a considerable revenue "loss" from the arrangement. CT TRANSIT has been able to increase the rate twice already, and has thereby limited the extent of its lost revenue.

CASE STUDY CONTACTS AND SOURCES

The following individuals were interviewed at CT TRANSIT headquarters (Hartford) as part of this case study:

Philip Fry, Assistant General Manager
CT TRANSIT
100 Leibert Rd.
Hartford, CT 06141-0066
860-522-8101
860-247-1810 (Fax)
pfry@cttransit.com

Nicholas Mangene, Division Transportation Manager
CT TRANSIT (Hartford Division)
100 Leibert Rd.
Hartford, CT 06141-0066
860-522-8101
860-247-1810 (Fax)
nmangene@cttransit.com

A CT TRANSIT (Hartford) operator

The following documents (in addition to ridership and revenue summaries and other sales and operational data) were used in preparing the case study:

David A. Lee, *Introducing Fare Simplification and New Convenience Fares at Connecticut Transit*. Transportation Research Record 1669 (1999), pp. 109–112.

Ilium Associates, *CT TRANSIT Marketing Project: Recommendations*. Prepared for CT TRANSIT, June 1996.

Connecticut Department of Transportation. *Bureau of Public Transportation—Biennial Report (SFY 1998/99)*.

CASE STUDY **5**

KING COUNTY METRO TRANSIT

Fare Program/Initiatives

University pass program

Annual employer pass program

INTRODUCTION

King County Metro Transit (Metro) is a division of the King County Department of Transportation. Metro provides public transportation throughout Seattle, Washington, and the surrounding King County. It operates a fleet of about 1,300 vehicles—including standard and articulated coaches, electric trolleys, dual-powered buses, and streetcars—that serves an annual ridership of 100 million within a 2,134 square mile area. Metro serves riders who are disabled with accessible fixed route service (all Metro buses have wheelchair lifts and all routes and trips are accessible), as well as paratransit van service and a taxi scrip program. Metro also operates the largest publicly owned vanpool program in the country, with more than 700 vans, serving 5,000 people daily, making more than 2.9 million trips per year. The regional Ridematch system helps commuters form and sustain new carpools and vanpools in seven counties by matching names in a computer data base. Finally, Metro operates a 1.3 mile electric bus tunnel underneath downtown Seattle.

This case study reviews two related programs:

- A university pass program (U-PASS), introduced in 1991.
- An annual employer pass program (FlexPass), introduced in 1993.

Both programs involve making deeply discounted passes available to all members of a group (e.g., students and employees of a university or employees of a company), providing benefits for pass users and revenue guarantees for Metro. This case study reviews the development and marketing of these two programs—including the steps that were taken to address internal concerns—as well as their results and impacts.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

U-PASS Program

The U-PASS is an arrangement between the University of Washington (UW) and Metro (and other operators in the region) in which a discounted transit pass is made available to students, faculty, and staff. The U-PASS provides unlimited access to transit service (Metro, as well as Community Transit in Snohomish County, and Sound Transit's Sounder commuter rail service), vanpool subsidies, carpool subsidies, discounted parking incentives for high occupancy vehicles (HOVs), and a guaranteed ride home.

The U-PASS grew out of the UW's traffic and parking problems of the late 1980s. In 1983, the UW had (pursuant to an agreement with the City of Seattle) created a Transportation Management Plan (TMP) that specified that the UW would not add parking spaces, increase current traffic levels, or increase the number of vehicles parking in nearby neighborhoods. Despite this, by the late 1980s, campus parking lots were reaching capacity, students increasingly sought street parking in surrounding neighborhoods, and all types of HOV use had also declined. In addition, the UW had adopted a new development plan that would increase the number of students, faculty, and staff coming to campus and require up to 3,600 new parking spaces—at a cost of up to $100 million. Neighbors of the UW were strongly opposed to the addition of parking spaces, and the UW faced tremendous legal and political pressure to reduce the amount of traffic it was generating.

The UW, Metro, and other transit agencies in the region created a task force, including representatives of university faculty, staff, and students, to seek solutions to the University's transportation and parking issues. One program that was of considerable interest was the type of student pass program offered by the University of Oregon (and other universities) in which students could ride local transit buses by presenting their student IDs. The task force proposed a similar program that would also serve the UW's employees.

The proposed program included several key elements:

- *Revenue Neutrality*. Metro's finance group raised the concern that any discounted pass could result in Metro

losing money. The program therefore provided that the UW would guarantee Metro that it would receive at least as much revenue from UW pass holders as it was currently receiving from selling retail-priced passes to the campus community.

- *Increased Service Levels.* While many buses to the university district ran with empty seats, the UW and Metro assumed that deeply discounted bus passes would increase ridership on some routes beyond existing capacity. The program therefore provided for a 20 percent increase in service to the UW, with the cost of that service to be split evenly between the UW and Metro.
- *Opt Out Procedure for Students.* Each UW student would receive a bus pass in his or her registration materials. Unless the student returned the pass, the UW would add a small charge to his or her tuition bill ($20 per quarter when the program started in 1991).
- *Faculty and Staff Option.* Faculty and staff were given the option to purchase subsidized passes. To encourage them to try U-PASS, faculty and staff were guaranteed that if they decided that they did not like the U-PASS within 6 months, they could get back their parking permit and lot assignment, without being sent back to the bottom of the waiting list.
- *Additional Benefits.* U-PASS holders were provided with a variety of other services designed to discourage single-occupancy vehicle (SOV) commuting. These included bicycle lockers, free rides on a night shuttle, free carpool and vanpool parking, and discounts from local merchants. Faculty and staff who opted to turn in their parking permits could purchase discounted single day permits for days when they needed to drive (70 percent discount for U-PASS holders, 50 percent discount for others). Faculty and staff U-PASS purchasers also received a reimbursed ride home benefit. (Faculty and staff who have an emergency and whose usual means of transportation is unavailable may call a taxi and be reimbursed for 90 percent of the fare for up to 50 miles of travel each quarter.)
- *UW Funding.* As part of both managing SOV travel and funding the U-PASS program, the UW raised SOV permit parking prices by 50 percent when the U-PASS program was first implemented.

In March 2001, a new benefit was added to the U-PASS, Flexcar. Flexcar, a private membership-based carsharing program, provides vehicles for occasional use on a per-hour basis. The UW signed an agreement allowing Flexcar to base three vehicles at its Seattle campus in return for providing a discount on Flexcar membership to U-PASS holders. Since that time, 311 U-PASS members have taken advantage of this option.

FlexPass Program

Following the success of U-PASS, some Metro staff suggested that other employers be given the opportunity to participate in a similar plan, i.e., having an employer guarantee Metro's existing fare revenue from its employees in return for Metro providing deeply discounted passes to all interested employees. In the short term, this would result in significant ridership growth, filling some of Metro's existing empty seats. In the long run, the increased ridership would allow Metro to raise the price of the FlexPass in the future, thereby increasing Metro's revenue. However, other Metro staff were concerned about the possibility that employees not using their subsidized passes could give them to others who would otherwise pay the full retail price, thereby decreasing Metro's total revenue. In 1993, Metro's management authorized a 20-employer demonstration of the new FlexPass.

FlexPass was designed to provide annual transit passes to all employees at a participating company at a deeply discounted fixed cost. Metro began by conducting a survey at each participating employer to determine the number of transit-riding employees at the company. Metro would then use the following formula to determine the company's initial FlexPass cost:

$$\text{Annual FlexPass price} = \text{Current bus riders} \times \text{Average system fare (annualized)}$$

Because Metro fares are based on zones and time of day, the system fare was calculated as a weighted average of the cost per ride and therefore took into account these differentials. The price calculated in this way would entitle the company to passes for all of its employees, regardless of company size.

Metro planned to increase the price annually to reflect increased ridership. In order to determine the revised price, Metro surveyed the employees at the demonstration sites toward the end of the first year. To the surprise of many, the survey indicated that employees' transit use increased by an average of 90 percent after receiving the FlexPass. Anticipating that the employers would not accept a price increase of 90 percent, Metro adopted a policy of phasing in the cost increase over a four-year period; it was felt that this would allow the employers enough time to adjust to, and budget for, the increased cost. The final pricing policy was as follows:

- First year. Employer pays the full cost (as explained above) of pre-FlexPass transit ridership by its employees, minus an incentive (usually 10 percent of the price) provided by federal grant money.
- Second year. Employer pays the first year price plus one-third of the entire increase in price associated with new transit rides.
- Third year. Employer pays the first year price plus two-thirds of the entire increase in price associated with new transit rides.
- Fourth and all subsequent year(s). Employer pays the full price associated with employees' actual ridership.

This pricing structure has resulted in a 95 percent renewal rate for FlexPass. In addition to companies being given enough time to budget for the program, Metro also attributed the high renewal rate to the fact that, by the fourth year, employees

viewed the FlexPass as an important benefit. Therefore, employers did not want to upset their employees by eliminating the program. Moreover, the annual surveys allowed companies to keep track of usage, so that they could reevaluate parking supply and other transportation-related issues. In this way, companies were able to better quantify the advantages of participating in the FlexPass program.

Initially, FlexPass differed from U-PASS in two major ways. First, the program focused on increasing ridership on existing services rather than incorporating new subsidized bus service. Second, the program did not include any other elements to decrease SOV use, such as increased parking prices. Over the next several years, however, Metro experimented with offering a variety of services and products, including vanpool and carpool matching, Home Free Guarantee—a guaranteed ride home benefit for transit, carpool, and vanpool riders—and Commuter Bonus Plus—vouchers to subsidize the cost of vanpools, carpools, and alternative modes of travel (e.g., the cost of walking shoes or a bicycle at a recreational equipment store). These services and products were offered both separately and in combination with FlexPass, depending on the needs of each individual employer. Metro generally subsidized employers' first year's cost, using a combination of ISTEA funds and a small allocation of Metro's operating funds.

As FlexPass and the other options grew, administration of these programs became a significant burden, especially since each employer had a customized agreement with the specific combination of service and products that it felt useful. Furthermore, small employers were generally excluded from the program since they did not have the resources available to handle the employee surveys necessary to calculate the annual FlexPass price. (Large employers were required by state law to conduct a survey on commute modes which could be used to calculate the annual FlexPass price.) The result was that Metro began experimenting with a new program designed to establish a less complex combination of services and price for employers with between 25 and 499 employees; this program became the Area FlexPass.

The goals of the Area FlexPass are the following:

- Increase ridership and revenues to King County Metro and Sound Transit.
- Simplify the FlexPass concept for internal and external customers.
- Integrate transit, vanpool, Home Free Guarantee, and Commuter Bonus Plus into a per-employee pass price.
- Reduce staff time requirements for the program.

The most recent pricing guidelines for the Area FlexPass are the following:

- The Metro service area is divided into 10 pricing areas.
- Separate prices are set for new companies and ongoing (or prior) participants based on the average HOV use within each group in each pricing area.
- Employers are charged for 50 percent of the growth in trips over two years.
- After two years, new employers are moved to the participant group.
- The state Commute Trip Reduction survey and vanpool ridership data will be used to update prices.
- Employers receive a discount of one-twelfth of the cost of the annual pass, matching the discount provided by the retail annual pass.

Another variant on the FlexPass is the Downtown Seattle Access Project, designed to help alleviate access issues for downtown employers, employees, and building managers. Under this project, Metro teamed with the Downtown Seattle Association to extend trip reduction options to the smaller employers in downtown Seattle, including selling transit passes. Metro also cooperated with building managers to develop building-wide trip reduction initiatives.

One element aiding the success of FlexPass is that, in 1990, King County was on the edge of being required to implement steps under the Clean Air Act to improve air quality. In response, the state in 1991 passed the Commute Trip Reduction Act, requiring employers with more than 100 employees in the state's largest counties to survey employees regarding commute habits and strive to reduce SOV commuting. In 1995, the state added a carrot to this stick—employers would receive a tax credit of 50 percent of their commute trip reduction expenses, up to $60 per year per employee and a total cap of $100,000 per year. Public and nonprofit employers could receive a grant in place of the tax credit. The State of Washington ruled that implementing a FlexPass complied with the Commute Trip Reduction Act and that the cost of the FlexPass program qualified for the tax credit. The tax credit was eliminated in 2000 due to Washington State's fiscal crisis.

RESULTS AND IMPACTS OF FARE INITIATIVES

U-PASS Program

Ridership and Revenue Impacts and Customer Benefits

The U-PASS has made transit and other HOV use more affordable and convenient for students, faculty, and staff at the UW. In the first year of operation, more than 70 percent of students and employees participated in the program. SOV use by students dropped from 25 percent to 14 percent, while total SOV access to the UW dropped from 33 percent to 23 percent. Transit commuting by students rose from 21 percent to 35 percent, while total transit commuting increased from 21 percent to 33 percent. Even with an increased number of students and staff on campus, parking utilization had decreased. By the third year of the program, total campus transit ridership had grown 60 percent.

The U-PASS program has now been in existence for over ten years. During this period, the total number of faculty, staff, and students who work or attend classes has grown by 19 percent (although because of telecommuting and schedule changes the daily population of campus has only grown by 16 percent). There are currently approximately 37,400 students and 23,500 faculty/staff at the UW Seattle campus. U-PASS prices have grown significantly, increasing from $20 per quarter for students in 1991 to $33 per quarter in 2001; the price for a faculty or staff member is $46.50 per quarter. Despite the price increase, participation in the U-PASS program has also grown, reaching a record high of 86 percent in the 2000–2001 school year. SOV commuting has grown slightly since the first few years of the program, with student SOV commuting having risen to 16 percent and overall SOV commuting having risen to 25 percent, which is still significantly lower than prior to the implementation of U-PASS. Student commuting by transit has remained fairly constant at 35 percent; however, total commuting by transit has fallen to 31 percent—again still significantly above the level prior to the U-PASS.

Total U-PASS transit ridership is now approximately 8.5 million, compared with 4.7 million transit trips to the UW prior to the U-PASS. Approximately 10 percent of all transit rides provided by Metro and Community Transit are U-PASS trips. The overall revenue impact of U-PASS has been positive. The UW currently pays Metro $9.6 million per year for U-PASSes and additional service to UW campuses. In comparison, Metro received less than $5 million in revenue from the university and students prior to U-PASS. Metro's costs have increased with additional service to campus, but its revenue recovery rate for these services is comparable with its systemwide average.

The U-PASS program has high levels of support on campus. In surveys conducted in 1996, 1998, and 2000, between 63 percent and 65 percent of respondents stated that they were "very satisfied" with the program. An additional roughly 25 percent of respondents were "satisfied" with the program.

Administrative Impacts and Issues

The administration of the U-PASS program is conducted predominantly by the UW; therefore, there is little administrative impact on Metro. With 10 percent of Metro's rides paid for with the U-PASS, farebox wear and revenue collection costs are believed to be slightly lower than if U-PASS did not exist. A similar minor positive impact is believed to exist with regard to the speed of boarding and disembarking on the routes serving the UW.

The U-PASS is also believed to contribute to Metro's generally high approval rates. Previous U-PASS users are believed to retain a good opinion of Metro, and the sight of full buses serving the UW helps to demonstrate to nonriders that Metro is successful at providing a public benefit.

Impact on the University of Washington

Largely due to U-PASS and the related transit service improvements, the UW has been able to maintain a constant number of parking spaces despite significantly increasing the population of the campus and the average number of daily trips to the campus. The UW's total program cost, including payments to transit agencies for the U-PASSes, was $10.9 million in FY 2001–2002. Approximately 47 percent of this is paid for from user fees (payments from students, faculty, and staff), and another 41 percent is paid for by the increase in the cost of parking permits and daily parking implemented with and after the start of U-PASS. Only 12 percent of the cost of the program, approximately $1.3 million per year, comes from other UW sources. This compares with the up to $100 million it would have cost the UW to provide sufficient parking without the U-PASS.

FlexPass Program

Ridership and Revenue Impacts and Customer Benefits

Information on the number of employers, FlexPass riders, and transit revenue is summarized in Table CS5-1. Ridership and revenue are both divided between base and new, with base representing the previous year's trips among both participating and nonparticipating companies and new representing the new revenue and ridership generated each year by the FlexPass.

By 1999, over 80,000 employees were covered by the FlexPass program. Employee transit use increases over 90 percent, on average, in the first year of FlexPass. In addition, over 2,300 vanpool riders receive an employer subsidy via their Flex Pass.

For employees, the FlexPass has resulted in a dramatic reduction in the cost of commuting. Only 10 percent of employers offering a FlexPass require the employee to contribute to the cost of the FlexPass, and these employers cannot charge the employee more than 50 percent of the employer's cost per pass.

For Metro, the FlexPass has resulted in significant new ridership and revenue, predominantly accommodated by existing capacity and regular service increases.

Administrative Impacts and Issues

Administration of the entire Commute Partnership Program, which includes FlexPass, currently costs Metro approximately $1.4 million per year, 45 percent of which is paid for by federal grants. Costs have not been specifically allocated between FlexPass and other products. However, the introduction of the Area FlexPass is anticipated to reduce the cost of administering FlexPass significantly.

TABLE CS5-1 FlexPass ridership and revenue impacts

Year	Employers	Base Revenue (dollars)	New Revenue (dollars)	Base Ridership	New Ridership
1994	3	$49,173	$24,351	23,640	23,191
1995	7	$60,326	$13,342	45,183	37,526
1996	16	$550,614	$24,827	502,082	45,929
1997	32	$1,317,412	$184,016	1,056,148	466,456
1998	63	$2,928,112	$462,388	2,302,221	653,303
1999	104	$5,024,324	$1,069,637	3,417,749	924,522
2000	122	$5,128,711	$650,978	4,486,118	825,410

FlexPass is also believed to contribute to Metro's generally high approval rates. Metro receives virtually no complaints regarding the program and does receive a significant number of requests for additional service to FlexPass employers.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

U-PASS and FlexPass appear to have significantly benefited Metro's riders at the participating sites, as follows:

- Provided more convenient fare payment, utilizing student or employee IDs valid for one year (FlexPass) or one quarter (student U-PASS).
- Reduced the cost of travel for many riders (both FlexPass and U-PASS are deeply discounted when sold to the employer or University, and employees pay no more than 50 percent of the employer's cost of the pass).
- Reduced commute costs for carpool and vanpool riders.
- Increased service to the UW and, therefore, the convenience of riding transit.

Surveys of UW students, faculty, and staff have shown consistently high satisfaction with the U-PASS, which is reflected in the increased participation in the program and increased use of transit serving the UW.

Agency Impacts and Benefits

The U-PASS and FlexPass have also had a generally positive impact on Metro, including the following:

- Significant increases in both ridership and revenue.
- Reduced use of cash and fare collection costs, by converting riders to these fare instruments in place of cash and tickets.
- Possibly improved service reliability through the increased use of passes (compared with payment with cash and tickets).

Impacts and Benefits for Partner Entities

Metro's U-PASS program has benefited the UW as follows:

- Allows UW to provide its students unlimited use of transit service at a deeply discounted price.
- Reduces UW's need for parking, greatly reducing the need to build additional expensive parking spaces.

The FlexPass program impacts and benefits for employers were as follows:

- Helps them address Commute Trip Regulation requirements.
- Facilitates distribution of commute benefits to employees at a lower administrative cost than in a regular monthly pass program—because it is an annual program.
- Encourages employees to use commute alternatives to driving alone and, therefore, may allow employers to reduce the amount of parking required.

Liability to Agency

Both U-PASS and FlexPass were carefully designed to eliminate the risk of losing revenue from the specific customer being dealt with, although there was still the potential of lost revenue from fraud (e.g., sharing of passes). Use of student and employee IDs helps to reduce the risk of fraud, and Metro has not noticed any significant fraud associated with either of these projects.

The new Area FlexPass, however, involves a higher risk of revenue loss than the original FlexPass program. The pricing of the Area FlexPass is based on average transit use in a specific area. Those companies that have the most transit supportive policies, and consequently the highest transit use, may be the most likely to adopt the Area FlexPass. Since those companies' transit use is above average, their cost for the Area FlexPass would be below the current amount they, and their employees, pay, resulting in a net loss of revenue for Metro. This will need to be monitored as Area FlexPass expands.

FlexPass has given rise to some equity concerns, since it is focused on serving large employers. The Area FlexPass program is designed to alleviate that concern. Of course, the Area

FlexPass gives rise to its own equity concern, since prices for the pass can be significantly different on opposite sides of what is, in many cases, an arbitrary service area boundary.

Constraints and Barriers

The establishment of the U-PASS and FlexPass programs has involved development of agreements among Metro, other regional transit agencies, and the UW or other employers. For the FlexPass, the need to negotiate separate agreements with each employer ultimately limited the size of the program, as well as the size of the firms that could participate.

For both the U-PASS and the FlexPass programs, actions by the City of Seattle, King County, and the State of Washington to reduce SOV commuting significantly assisted in the implementation of the programs. Metro was able to promote these programs as ways of addressing requirements imposed by these other governmental entities, assisting the UW and the employers rather than trying to sell them solely on the benefits of promoting transit use.

Required Equipment and Technology

No special equipment or technology was required for either program.

Lessons Learned

Finally, key lessons learned from the case study include the following:

- University pass arrangements can result in significant increases in ridership and revenue, as well as general goodwill toward an agency. However, it is important that the agency take steps to protect itself against losing revenue through these programs. In particular, the ridership generated by a university pass can result in the need for a significant increase in service, and an agency should take steps to insure that revenue increases with the increase in service (e.g., by cost-sharing provisions or increases in the university pass pricing).
- Increases in parking pricing can contribute to the success of the university pass. Providing discounted parking for occasional trips by U-PASS users, providing late night service and allowing pass users to surrender the pass and get back their parking permit are all steps that can relieve concerns associated with obtaining the university pass and increase the willingness of individuals to try the pass.
- In establishing an annual employer pass program, such as the FlexPass, agencies need to protect themselves against losing revenue and should insure that they can capture at least some revenue from the new trips being generated. The dramatic increase in ridership that can result from these programs means that phasing in cost increases tied to ridership should be considered.
- In designing employer programs, a trade-off needs to be established between the ability to customize offerings for each employer (thereby facilitating sales) and the provision of uniform product offerings at a lower administrative cost for the agency. Metro chose to begin with a highly customized program for large companies and recently implemented a uniform product, at uniform pricing, for smaller companies. While the customized program has been highly successful, the success of the new program remains to be seen.

CASE STUDY CONTACTS AND SOURCES

The following individual was interviewed at Metro headquarters as part of this case study:

Matt Hansen, Market Development Planner
Metro Transit Division
Department of Transportation
400 Yesler Way
Seattle, WA 98104-2615
206-263-3598
206-684-2058 (Fax)
matt.hansen@metrokc.gov

The following documents (in addition to ridership and revenue summaries and other sales and operational data, contracts, and pricing guidelines) were used in preparing the case study:

The Gilmore Research Group, *The U-PASS Telephone Survey*. Prepared for the King County Department of Transportation and the University of Washington, January 2001.

University of Washington. *U-PASS Annual Report 2000–2001.*

Serena Dolly, *Commute Partnerships*. A case study prepared for the University of Washington's Daniel J. Evans School of Public Affairs.

CASE STUDY **6**

MARYLAND MASS TRANSIT ADMINISTRATION

Fare Program/Initiatives

Fare Simplification: elimination of zones and transfers and introduction of Day Passes

Regional Fare Integration: implementation of integrated smart card technology

INTRODUCTION

The Maryland Mass Transit Administration (MTA) is an agency of the Maryland Department of Transportation. The MTA operates transit services throughout the State of Maryland, with most of its service concentrated in the Baltimore metropolitan area. MTA services consist of five modes: fixed-route Bus (Local and Commuter), heavy rail (Metro), light rail (MTA Light Rail), commuter rail (MARC), and paratransit.

MTA's core services include Bus, Metro, and Light Rail. Together these modes account for nearly 95 percent of MTA's systemwide ridership, which is approximately 100 million passengers annually. In FY 2001, MTA carried 71 million passengers by Bus, 14 million by Metro, and 9 million by Light Rail. MARC Commuter Rail ridership for the same period was nearly 6 million passengers. MTA's paratransit service carries a little more than 650,000 patrons annually.

This case study focuses on two fare initiatives:

- Fare simplification attained through the elimination of zones and transfers and the introduction of the day pass. The initiative was implemented in 1996.
- Regional fare integration through the implementation of a smart card technology. This has yet to be fully implemented.

The implementation issues and impacts of these fare initiatives are further described below.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

Fare Simplification

In the years prior to 1996, MTA's ridership and revenue had decreased. Since MTA is required to recover 50 percent of its operating costs through fare revenues, this situation had become problematic. Rather than simply institute a fare increase, MTA reevaluated its entire fare structure and fare policy. Prior to 1996, MTA's fare structure had slowly evolved over the course of more than 100 years in response to numerous pressures and constraints (*11*). As a result, MTA's fare structure had become very complex, making it confusing for patrons to understand and difficult for employees to enforce.

To correct these problems, MTA launched a market research effort involving both its patrons and members of its staff. The objective of the research effort was to develop an understanding of the best and worst attributes of MTA's fare system (*11*). The results of the research were as follows (*11*).

MTA's customers responded positively to the following fare system components:

- Weekly and monthly passes
- Fare payment options
- Fare payment locations
- Flat fare on Light Rail

The fare system components that customers did not like included:

- Zone fares (complex, too many)
- Transfers confusing
- No integration between MARC/WMATA
- Evasion perceived high

In response to the research results, MTA considered many different fare structure options, including different zone configurations, premium fares for different types of services (e.g., commuter and express bus) and different times of the day, flat fares, various discounts, different prepayment options and different transfer options. Each individual alternative was assessed based on its ability to support MTA's ridership and

revenue goals and its 50 percent recovery ratio requirement. Based on the findings of the analysis, the following changes to MTA's fare structure were made:

- The five zones in MTA's core service area were eliminated.
- Transfers were eliminated.
- A day pass was implemented.

These changes were implemented in March 1996. In conjunction with the fare simplification, MTA also reduced service by 4 percent (*11*). Although other changes were also implemented as a result of the fare simplification—reduction of the monthly pass discount, increase in Commuter Bus and MARC fares, and increase in the discount for senior and disabled patrons—these changes were minor compared to the three that are the focus of the case study.

Regional Fare Integration

MTA's service area overlaps with that of numerous other operators. As a result, MTA's services interface with many of these other transit systems. The largest of these is the Washington Metropolitan Area Transit Authority (WMATA), which operates the Washington, D.C., area's Metrorail and Metrobus services. MTA's Commuter Bus service and MARC Commuter Rail service provide service to Washington, D.C. As such, there are many opportunities for MTA passengers to take advantage of WMATA's Metrobus and Metrorail services. In addition to WMATA's services, MTA also interfaces with a number of other transit providers in the Baltimore-Washington region. Table CS6-1 lists the various operators that have connections with MTA services.

In December 2000, the State of Maryland published the Maryland Comprehensive Transit Plan (MCTP). The goal of the MCTP is to double ridership by 2020. Towards this end, the MCTP developed numerous recommendations, which are organized according to "Nine Themes for Success," including regional integration and coordination of transit services. Among the recommendations for promoting regional integration were two related to a "unified fare collection system" (*12*). These were:

- Initiate a "Smart Card" unified fare collection system by completing the purchase and beginning the installation of smart card readers on MTA, WMATA, and other selected local transit system vehicles in the Baltimore-Washington region.
- Expand the smart card program statewide, including commuter bus and rail services.

The MTA has subsequently undertaken three projects that are designed to make a regional smart card fare collection system a reality. Two of these projects are joint procurements with WMATA:

- **Regional Bus Fare Collection System.** This is a joint procurement involving MTA and WMATA. The vendor, Cubic Transportation Systems, is providing a common validating farebox with smart card capabilities, as well as all supporting garage and central computer systems and software. In addition to MTA and WMATA, many of the smaller Maryland and Virginia bus operators in the Baltimore-Washington-Northern Virginia region also will be purchasing equipment through this procurement. The Baltimore "style" of the farebox includes dual smart card and magnetic farecard capabilities. In addition, the procurement includes a Stand Alone Smartcard System (SASS) for MTA's Commuter Bus operators. The SASS will be capable of reading smart cards, but will only be able to add value through "autoload" transactions (described later in this report).

  Currently, MTA is conducting the first article testing (FAT). Upon completion of the FAT, MTA will com-

TABLE CS6-1 MTA inter-operator transit connections

Operator	MTA Local Bus	MTA Commuter Bus	MTA Metro	MTA Light Rail	MARC Commuter Rail
WMATA Metrorail		✓			✓
WMATA Metrobus	✓	✓		✓	✓
Howard Co. CTC	✓	✓		✓	✓
Connect-A-Ride	✓	✓		✓	✓
The Bus (P.G. County)					✓
Ride-On (Montgomery Co.)		✓			✓
PRTC-Omniride		✓			
Annapolis Transit	✓	✓			
Harford Co. Transp. Services			✓		
Frederick Transit				✓	✓
Virginia Railway Express					✓

mence in-service quality testing (ISQT). ISQT is expected to last approximately 3 months. Following ISQT, MTA will begin installing the new fareboxes on its entire fleet. Once the installation on its own system is complete, MTA will begin assisting the Maryland locally operated transit systems with the installation of the new equipment on their systems.

- **Smart Card AFC System.** This project involves only MTA. MTA is procuring the necessary equipment to outfit its rail modes (Metro, Light Rail and MARC Commuter Rail) with smart card capabilities.
  - Metro. All of Metro's TVMs and faregate arrays will be replaced. The TVMs will issue magnetic fare cards and allow smart card loading. The TVMs will accept coins, cash, credit cards, and debit cards as payment. The faregates will be outfitted with both smart card and magnetic read-write units.
  - Light Rail. All Light Rail TVMs will be replaced. The TVMs will issue magnetic fare cards and allow smart card loading. The TVMs will accept coins, cash, credit cards, and debit cards as payment. While inspection of fare cards on Light Rail will still be done visually, inspectors will have Hand Held Units (HHUs) to read and validate smart cards.
  - MARC. Rather than TVMs, MARC station platforms will be outfitted with smart card only Express Recharge Machines (ERMs). The ERMs will allow patrons to add value to their smart cards using credit cards or debit cards or through an autoload transaction. ERMs will not accommodate cash transactions. MARC conductors will be issued HHUs to inspect and validate smart cards onboard.

  This project also includes the necessary computer systems to integrate all of MTA's modes.
- **Regional Customer Service Center.** WMATA is spearheading the effort to establish the Regional Customer Service Center (RCSC). Once fully implemented, the RCSC will provide the following services to the Baltimore-Washington region:
  - Customer Service Center to respond to customer questions, complaints and disputes, as well as setting up account information and processing smart card registrations and special transactions.
  - Clearing, settlement and financial management functions in order to process smart card transactions and move funds to the appropriate participants in the regional smart card program.
  - Establishing a point-of-sale network to distribute smart cards and provide locations where patrons can load value.

  In January 2003, WMATA selected the ERG Group to install and operate the RCSC. ERG plans to use its existing central computer system, installed in the San Francisco Bay Area to support the TransLink project, to perform the clearing, settlement and financial management functions for the Washington-Baltimore region. Local smart card management, distribution and customer service will be performed by ERG's subcontractor, Northrup-Grumman IT.

Once the bus farebox, AFC system, and RCSC projects are complete, the entire system will enable passengers to transfer seamlessly among any of the participating operators in the Baltimore-Washington-Northern Virginia region.

RESULTS AND IMPACTS OF FARE INITIATIVES

Fare Simplification

Customer Impacts and Benefits

One of the immediate benefits of the fare simplification for a number of MTA's patrons was reduction in their base fare. As shown in Table CS6-2, passengers in outlying zones saw a reduction in their base fare of as much as 40 percent. Passengers in Zone 2 experienced no change and passengers in Zone 1 experienced a modest increase.

The second immediate benefit to customers was the introduction of the Day Pass. With the elimination of the 10¢ transfer, the Day Pass provided passengers a means to meet their travel needs where a linked trip was involved. Priced at $3.00, the Day Pass permitted unlimited travel and was not restricted to any time period (e.g., off-peak only). As shown in Table CS6-3, for many passengers the Day Pass proved to be more economical than their fares had been under the previous fare structure.

One of the unforeseen impacts of the introduction of the Day Pass was the increased truancy among students that resulted (*11*). Prior to the fare simplification effort, students were issued serialized tickets by the Board of Education.

TABLE CS6-2 Comparison of base fare before and after simplification

Old Zone	Previous Fare (dollars)	New Fare (dollars)	Percent Change
1	1.25	1.35	8.0
2	1.35	1.35	0.0
3	1.55	1.35	-12.9
4	1.85	1.35	-27.0
5	2.25	1.35	-40.0

TABLE CS6-3 Comparison of day pass to previous fare for linked round trip

Old Zone	Previous Fare (dollars)	Day Pass (dollars)	Percent Change
1	2.70	3.00	11.1
2	2.90	3.00	3.4
3	3.30	3.00	-9.1
4	3.90	3.00	-23.1
5	4.70	3.00	-36.2

NOTE: Previous fare includes two one-way fares and two transfers.

MTA accounted for all tickets used and billed the Board of Education for the trips taken. After the fare simplification, a student Day Pass was implemented in addition to the Adult and Senior/Disabled Day Passes. However, it soon became apparent that the students were abusing the pass privileges.

In order to solve this problem, MTA discontinued the School Pass and Student Tickets were reintroduced. To accommodate students requiring a linked trip, MTA introduced a "Continuation Pass," which permitted additional travel for 60 minutes after issuance.

Agency Impacts and Benefits

The most significant operational impact of the fare simplification was the introduction of the Day Pass. The issues associated with the new ticket type were how it would be issued and used on each of MTA's core service modes (i.e., Bus, Metro and Light Rail). The strategies pursued for each mode were as follows:

- **Bus.** At first, MTA planned to give operators books of Day Passes to be sold on board. However, bus operators were concerned with risks associated with handling what was perceived to be a valuable commodity, thus making them targets for robbery (*11*). MTA solved the problem by purchasing Almex machines, which consist of a control panel connected to a thermal printer. These were installed onto the bus fareboxes. A passenger wishing to purchase a Day Pass would insert cash into the farebox and the operator would then issue the pass using the Almex machine. These machines are also used to issue Continuation Passes to students. On subsequent trips, the Day Pass or Continuation Pass holder simply flashes the pass on boarding.
- **Metro.** The Almex machines (and fareboxes) were also installed at the station attendants' booths at each Metro station. These worked the same as on the buses; however, the station attendant would also issue a pre-encoded magnetic "Exit Ticket" so that patrons could exit the system at their destinations. This procedure is necessary since the Day Pass issued by the Almex machines does not have a magnetic stripe and is unusable at the Metro turnstiles.
- **Light Rail.** Since the TVMs were easily reconfigured to issue Day Passes, Light Rail did not pose as much of a challenge as the other two modes. Day Passes issued at Light Rail TVMs are also non-magnetic and must be used as flash passes. Passengers using these passes on Bus and Metro follow the same procedures as passengers using the Almex-issued Day Passes.

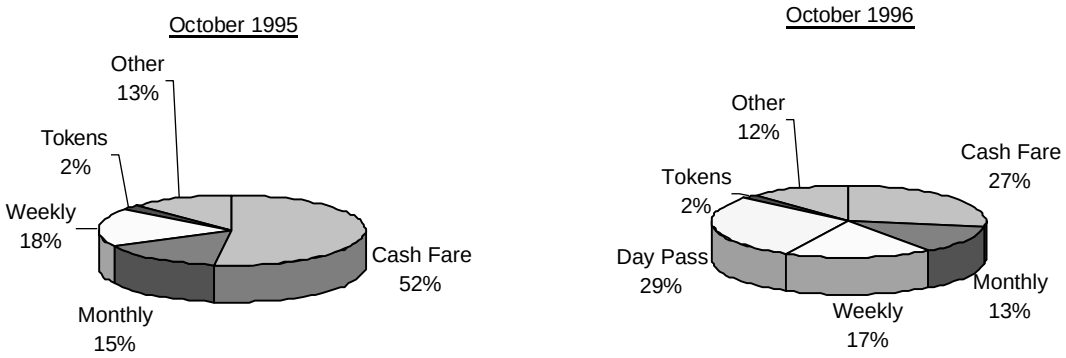
Several operational improvements were identified as a result of the fare simplification. It was noted, for instance, that fare disputes between patrons and operators decreased, boarding times improved (especially in the evening peak) and ridership increased in the off-peak periods (*11*).

A comparison of ridership before and after the fare simplification effort is shown in Table CS6-4. The time periods used are roughly 6 months before the simplification (October 1995) and 6 months after (October 1996). Overall ridership increased by more than 6 percent, with the largest percentage increase occurring on Metro. This increased level of ridership has generally been sustained. Between FY1997 and FY2000, MTA's core service ridership increased approximately 11 percent, from 98 to 109 million.

TABLE CS6-4 Ridership by mode, before and after fare simplification

Mode	October 1995	October 1996	Percent Change
Bus	6,634,891	6,957,215	4.9 percent
Metro	1,013,774	1,176,864	16.1 percent
Light Rail	516,653	549,687	6.4 percent
Total	*8,165,318*	*8,683,766*	*6.3 percent*

SOURCE: MTA Finance Division, Monthly Revenue and Passenger Statistics.



SOURCE: MTA Finance Division, Monthly Revenue and Passenger Statistics.

Figure CS6-1. Comparison of fare revenue by category, October 1995 and 1996.

A comparison of fare revenue collected before and after the fare simplification effort is shown in Figure CS6-1. This comparison shows a significant reduction in the amount of cash fare revenue. In October 1995 cash fare revenue accounted for 52 percent of fare revenues collected, while in October 1996, cash fares accounted for 27 percent of revenue.

At first glance, this may appear to have had the desirable effect of reducing the amount of cash handled. Considering that the majority of MTA passengers are bus riders, this seeming reduction in cash riders would have the double benefit of reducing fare collection costs as well as reducing boarding times. However, since the Day Pass is sold onboard and the cash is collected via the farebox, the amount of cash handled through the farebox would remain virtually unchanged. As shown in Figure CS6-1, the share of fare revenue attributed to cash in October 1995 (52 percent) is roughly equivalent to the share of cash and Day Pass revenue combined in October 1996 (56 percent). However, this explains the reduction in evening boarding times, since many transactions (i.e., Day Pass purchases) are concentrated in the morning peak.

All other categories of fare revenue showed little change following the fare simplification. Token revenue remained the same, while Weekly and Monthly Passes exhibited slight decreases.

Overall, MTA's fare simplification did have the desired effect of increasing fare revenues. As shown in Table CS6-5, total revenue increased by more than 12 percent, with the largest gains occurring on Metro. As a result, in the years immediately following the fare simplification MTA revenues were sufficient to meet the state-mandated fare box recovery ratio (*11*). Since 1996, passenger fares have remained steady. Between FY1997 and FY2000, systemwide passenger revenue changed less than 1 percent, from $72.8 million in FY1997 to $72.7 million in FY2000. The apparent disconnect between the growth in ridership and the lack of growth in revenue since the fare simplification appears to be largely the result of the heavy use of Day Passes throughout the MTA's core services.

Regional Fare Integration

Customer Impacts and Benefits

Although MTA has not yet implemented the regional smart card system, there are a number of features associated with the use of smart cards that can be expected to benefit customers. Key potential benefits include the following:

- **Ability to restore the card's remaining value if the card is lost or stolen.** This will require customers to register their cards with the MTA.
- **Ease of use.** The contactless technology allows for easier and faster access to the system at fare gates, particularly for many passengers with disabilities.
- **Multiple payment options and seamless travel.** The technology has the capability to accommodate multiple payment options (as well as multiple modes and operators). Since the smart cards will be used throughout the Baltimore-Washington-Northern Virginia region, they

TABLE CS6-5 Comparison of revenue by mode, October 1995 and 1996

Category	October 1995 (dollars)	October 1996 (dollars)	Percent Change
Bus	4,960,873	5,533,654	11.5
Metro	789,447	936,058	18.6
Light Rail	386,299	437,212	13.2
Total	6,136,619	6,906,924	12.6

SOURCE: MTA Finance Division, Monthly Revenue and Passenger Statistics.

will have the ability to store more than one type of fare product. For example, a MARC patron with a smart card monthly pass may wish to add a WMATA stored value application to the smart card. As such, the patron would only need one card to use many different services. (A MARC monthly pass currently permits passengers unlimited rides for the calendar month on MTA Bus, Metro and Light Rail.) When the card is used on each system, the fare collection equipment will identify its own fare product if loaded on the card.

- **Autoload Functionality.** This feature enables a smart card user to have value automatically loaded on to the card from virtually any fare collection system component (i.e., fareboxes, faregates, TVMs, and point-of-sale devices). The types of autoload envisioned include the following:
  - Commuter Benefits. Employees receiving a qualified transit benefit could arrange with the employers to have these benefits loaded onto their smart cards at the start of each month.
  - Minimum Value Replenishment. Smart card users could establish an account tied to their credit cards or bank accounts that would automatically load a predetermined value when the user reached a minimum threshold.
  - Directed Load. Smart card users could purchase value via the phone or Internet using their credit or debit cards. The value would then be added the next time the patron boarded a bus or used a faregate or TVM.

The smart card technology also offers the opportunity to introduce innovative fare structure and payment options. For instance, MTA is considering the following strategy:

- **"Best Fare" Strategy.** This option would enable a smart card user to enjoy the benefits of an unlimited ride pass without buying a pass. A counter on the card keeps track of each card's use within a certain time period, and the fare system is programmed so that the rider pays the lowest possible fare, based on usage. For instance, once a cardholder has taken a certain minimum number of rides during a day, the card is automatically treated like an unlimited use day pass, and all subsequent rides that day become free. Even at this point, however, rides continue to be tracked; thus, if the cardholder uses the card a sufficient number of times in a 7-day period, the card becomes treated like a weekly pass (and subsequently a two-week pass) The flexibility of the software further permits the Best Fare to be implemented on either a calendar or a rolling period basis. Moreover, future policies and interagency agreements could even extend the Best Fare practices to include multiple operators. Best Fare could attract new riders, as it essentially guarantees that a rider will pay the lowest possible fare for a particular trip.

Unlike the new WMATA fareboxes, the new MTA fareboxes will include both a Smart Card Processing Unit with the ability to read and write to contactless smart cards and a Magnetic Card Processing Unit with the ability to read, write, and issue magnetic fare cards (ISO size). This will permit the agency to consider offering the following capabilities, neither of which will be feasible on WMATA's buses:

- **Credit card acceptance.** MTA would have the option to accept credit card payment onboard.
- **"Change card" issuance.** The farebox has a change card capability, which is a magnetic stored value card that can be issued to a passenger in lieu of change, thus eliminating the need for passengers to have exact fare.

Among the possible negative impacts facing customers are the following:

- **Privacy concerns.** There could be concerns among some customers regarding the registration of cards with the agency. However, this has deterred very few SmarTrip card purchasers at WMATA. Privacy concerns have apparently not been an issue with customers; WMATA has established a very strict privacy policy, promising its SmarTrip customers that their personal information will never be sold or released to a third party. As a result, more than 98 percent of all SmarTrip customers choose to register their cards.
- **Plan to charge $5 for initial purchase of smart card.** MTA plans on transferring some of the cost of the smart cards to its passengers by having them purchase their cards. Currently, the plan is to charge $5 per card, as is done in the current WMATA SmarTrip system. Preliminary MTA focus groups have indicated that passengers are willing to pay this fee, although the presumption of these passengers is that the smart cards will provide them with a better value than other fare media. As is the case with SmarTrip on Metrorail, MTA passengers will have a choice to use magnetic farecards and will presumably receive at least some of the benefits that will be provided with smart cards. (In contrast, WMATA is not providing a magnetic option on its bus system.) However, the concern that passengers will have to purchase the $5 smart card in order to take advantage of most of the aforementioned benefits could lead to equity-related complaints from lower-income passengers or, more likely, from organizations representing these riders. It will clearly be important that MTA conduct an effective marketing campaign, educating passengers as to the nature of the benefits of buying the card (e.g., registration and replacement of value).

Operational and Administrative Impacts and Benefits

One of the main benefits that MTA expects to derive from implementing the regional smart card program is the flexi-

bility and opportunities that the technology provides. Besides the ability to provide seamless connections to other operators in the region, these opportunities include, for instance, the Best Fare strategy or the ability to develop an automated commuter transit benefit program (i.e., like WMATA's SmartBenefits).

Operationally, use of contactless smart cards allows faster payment than other media. Reduced maintenance costs are generally considered another key benefit of contactless smart card technology due to their having fewer moving parts since transports and thermal printers are not needed. However, MTA has not estimated the operating and maintenance cost impacts of the new program as yet. Indeed, as is the case with WMATA, MTA sees smart cards and regional integration as a way to provide improved customer convenience via a flexible state-of-the-art technology rather than as a means of reducing operating costs.

Meanwhile, depending on the fare policy and pricing changes MTA implements, there could potentially be negative revenue impacts. In particular, the Best Fare strategy under consideration could well have a negative impact on fare revenue—though it should also result in some increase in ridership. The strategy essentially converts rides that would otherwise have been paid for (i.e., from stored value) to free rides (i.e., once the rider has exceeded the threshold usage level to turn the card into a pass). The extent of revenue loss, if any, will depend on the exact structure and pricing of the program (e.g., number of rides needed to reach certain pass levels, pass break-even levels) and the number of riders using Best Fare versus purchasing passes from the outset. MTA has not yet analyzed the revenue impacts of different smart card-based pricing strategies.

Beyond the impacts of introducing smart cards, the implementation of the regional payment system will also likely have a range of impacts on MTA's operations and administration. The development of partnership agreements among the participants, particularly regarding the establishment of the Regional Customer Service Center, has been challenging. It has been necessary to resolve a range of issues in developing the structure of the proposed RCSC, including overall policy and business rules, technical requirements, and administrative and customer support functions. Moreover, even if the RCSC handles the bulk of the responsibilities for managing and supporting the regional program, MTA and the other agencies in the program may have increased internal fare collection and data reporting responsibilities.

With regard to costs, the most immediate impact on MTA will be the capital cost associated with the new system. The bus farebox project is estimated to cost $23.3 million for all of the equipment (i.e., fareboxes, computer systems, receiver vaults, smart card readers, spare parts and warranty). The overall AFC system for MTA Rail is projected to cost nearly $41 million. Included in this amount are the costs of equipment (i.e., faregates, TVMs, computer systems, etc.), and software for the various features that MTA is considering. The actual cost will depend on which of these features MTA chooses to implement.

Finally, there will also be costs associated with MTA's use of the RCSC (e.g., some type of transaction or revenue-based fee arrangement), as well as ongoing costs associated with maintaining the equipment and with any agency personnel needs in participating in the program (including adding staff where necessary and training operators and other support staff).

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

The MTA's Fare Simplification effort resulted in several types of benefits to MTA's customers, including the following:

- Less confusion regarding fare payment through the elimination of fare zones and transfers.
- Improved convenience of fare payment with the implementation of the Day Pass.
- Reduction in cost of travel for many customers through the elimination of fare zones and the introduction of the Day Pass.
- Greater flexibility in multivehicle and multimodal travel.
- Faster boarding times in the afternoon and evening peaks.

The Regional Smart Card Program is expected to have the following customer benefits and impacts:

- Improved ease of use via contactless interface.
- Ability to travel seamlessly using public transit throughout the Baltimore-Washington-Northern Virginia region regardless of mode or operator.
- Improved flexibility through ability to carry more than one agency's fare medium on the card and through potential for innovative fare structure and payment options (e.g., Best Fare strategy).
- Improved convenience, through (1) ability to register the card and restore value if card lost or stolen, (2) ability to accommodate multiple payment options, and (3) autoload capability.
- Slightly higher cost to customers, given expected requirement to pay $5 to purchase the smart card; passenger acceptance of this charge remains to be determined, although focus groups indicated a willingness to pay; also, such a charge has been readily accepted by WMATA's Metrorail customers.

Agency Impacts and Benefits

Generally, the impacts of the fare simplification effort on MTA were positive. The impacts and benefits to MTA include the following:

- Reduced fare disputes between operators and customers.
- Increased ridership, particularly in the off-peak periods; overall ridership grew by more than 6 percent in the 6 months following the change; among the different modes, the greatest increase was on Metro (16 percent), with 5 percent on Bus and over 6 percent on Light Rail; overall ridership has continued to grow since then.
- Increased revenue; overall system fare revenue grew by more than 12 percent in the 6 months following the change.
- Reduced cash fare category by nearly 50 percent, but did not really lower amount of cash collected on buses—since most Day Passes are purchased (with cash) onboard; share of fare revenue attributed to cash before fare change was 52 percent, and combination of cash and Day Pass after change was 56 percent.
- Made boardings in the downtown area easier and faster in the afternoon and evening periods (because Day Pass purchases are concentrated in the morning peak period).

Increased ridership and efficiency in fare collection are among the benefits that MTA and the other participants are anticipating as a result of the implementation of the Regional Smart Card Program. Some of the other impacts and benefits may include the following:

- There may be improved flexibility in terms of the ability to add new fare structure and payment options (e.g., Best Fare strategy).
- While the plan is for the RCSC to maintain overall responsibility for managing and supporting the regional program, internal fare collection and data reporting responsibilities may increase since the new AFC equipment will be capable of storing and tracking more data than existing equipment.
- There may be some revenue loss if the Best Fare strategy is implemented. The extent of revenue loss will depend on the pricing of the program and the number of riders using Best Fare versus purchasing passes from the outset.
- The cost impacts on MTA include (1) the capital cost associated with the program (an estimated $23 million for all of the new bus equipment, and about $41 million for rail equipment); (2) fees associated with the agency's use of the RCSC; and (3) ongoing operating and maintenance costs, including training of personnel, hiring new personnel, and maintaining the equipment.

The Regional Smart Card Program is a complex undertaking, entailing a range of institutional, operational and financial challenges. MTA and the other agencies have addressed one of the major challenges in developing a common technology procurement strategy; in order for full regional integration to occur, it is now necessary to complete the process of establishing the clearinghouse.

Impacts and Benefits for Partner Entities

The introduction of smart card technology offers the potential to establish partnerships with various types of entities. For instance, as described in the WMATA case study, WMATA has entered into several types of partnerships related to its SmarTrip card; these include a bank (First Union) and a large government agency (the GSA). While these pilots have been quite limited in scope, they have demonstrated the feasibility of establishing multiapplication card arrangements; such arrangements offer the potential to significantly improve market penetration, for both transit riders and users of the partner applications.

Other key potential partners are employers. Automated benefits programs, along the lines of WMATA's SmartBenefits, can benefit employers in several ways. These programs provide payroll tax benefits and also provide employers convenient means of distributing transit commuter benefits to employees. For instance, SmartBenefits allows employers to easily manage their benefit programs via the Internet.

Liability to Agency

The MTA risked losing revenue in the fare simplification effort through the elimination of the fare zones. However, as indicated above, the combination of the elimination of zones with the elimination of transfers and introduction of Day Passes resulted instead in a substantial revenue increase. One ongoing potential liability noted by MTA staff is the ease with which Day Passes can be abused. Since the Almex machine is not wired to the farebox, operators have the ability to print as many as 15 Day Passes at one time without it registering in the farebox. As such, fraudulent transactions would not be reflected in the farebox reports. Although there have been cases in which employees have stolen Day Passes in this manner, there seems to be no evidence that this sort of activity is rampant.

The Regional Smart Card Program carries some economic liability in terms of the potential loss of revenue associated with the Best Fare strategy. While any such loss is not expected to turn out to represent a substantial percentage of the overall system revenue, the possible impacts should be kept under consideration if the MTA decides to pursue that strategy. In addition, there may be some political liability for the agency associated with the plan to charge an initial fee for obtaining a smart card. Since a rider will have to pay for a smart card to take advantage of the full range of potential benefits, this policy could conceivably generate equity-related complaints from riders or from community organizations representing riders. Hopefully, MTA will be able to avoid such complaints by educating riders as to the benefits to be received by buying the card (e.g., registration and replacement of value) and, perhaps, by providing free (or very low-cost) cards to low-income riders.

Constraints and Barriers

Before implementing the fare simplification project, MTA conducted an intensive visioning process, which included stakeholder meetings, public outreach, and public information campaigns. By using the visioning process to develop the new fare policies and structures, MTA minimized many of the barriers they might otherwise have encountered in implementing such significant fare structure changes. As a result, both internal and external reactions have been positive.

Given the number of parties involved and the complexity of the necessary agreements, there are many potential constraints and barriers related to implementation and operation of the Regional Smart Card Program. In order for the program to reach fruition, the participating entities will need to develop and agree on a broad range of processes that will enable all participants to interface with each other in a seamless manner. The participants will need to make substantial changes in some of their current business practices in order to make the program work. Among the issues that need to be resolved are those related to governance (e.g., how will the regional program be controlled and managed), cost allocation details (e.g., the nature of the participant fee structure), revenue allocation and settlement procedures, operator reporting requirements, and operator customer service responsibilities.

Required Equipment and Technology

Apart from the Almex Day Pass-issuing machines, MTA did not require any additional equipment to implement the elements of the fare simplification project. MTA had originally planned to give operators books of Day Passes to be sold on board. However, the operators expressed concern that handling what was perceived to be a valuable commodity would make them potential targets for robbery. MTA addressed this concern by installing the Almex units.

The Regional Smart Card Program will rely on a regional standard for fare collection equipment and smart cards. The joint farebox procurement will ensure that all bus operators in the region will have a common farebox; and the rail AFCS project will ensure that MTA's rail equipment will be compatible not only with the bus fareboxes but also with the existing fare collection equipment in use on WMATA's Metrorail system. Finally, one of the requirements of the RCSC procurement is to ensure that the systems associated with the customer service, clearing, settlement functions, and point-of-sale network are fully compatible with the fare collection equipment deployed throughout the region.

Lessons Learned

The key lessons learned from the Maryland MTA's fare simplification effort are as follows:

- A financially driven fare increase can serve as an opportunity to examine existing policies and structures in order to develop alternatives that not only meet the agency's financial needs but also provide tangible benefits to its customers and staff.
- By using a strategic planning approach, an agency can minimize the barriers to implementing a major fare change, while at the same time identifying the needs of its customers and stakeholders and developing beneficial solutions.
- By balancing fare simplification (e.g., elimination of fare zones) with new initiatives (e.g., elimination of transfers and introduction of onboard sale of day passes), an agency can meet its goal of increasing revenues in order to meet the required recovery ratio, while at the same time increasing ridership across all of its core service modes.

CASE STUDY CONTACTS AND SOURCES

The following individuals assisted in providing information included as part of this case study:

Collin Davidson
Maryland MTA
1515 Washington Boulevard
Baltimore, MD 21230
410-454-7035
410-454-7037 (Fax)
cdavidson@mdot.state.md.us

Simon Taylor
Maryland MTA
William Donald Schaefer Tower
6 St. Paul Street
Baltimore, MD 21202
410-767-3778
staylor@mdot.state.md.us

The following documents (in addition to ridership and revenue summaries and other data) were used in preparing the case study:

Taylor, Simon, and Douglas Carter. *Maryland Mass Transit Administration Fare Simplification: Effects on Ridership and Revenue,* Transportation Research Record 1618, pp. 125–130.

Getting On Board: The Maryland Comprehensive Transit Plan, Volume I Executive Report, Maryland Mass Transit Administration, December 2000.

CASE STUDY 7

METROPOLITAN TRANSPORTATION COMMISSION

Fare Program/Initiatives

Implementation of integrated regional farecard program

INTRODUCTION

The Metropolitan Transportation Commission (MTC) is responsible for the allocation of transportation resources among the more than 26 public transportation operators in the San Francisco (CA) Bay Area. These systems together operate over 3,000 peak vehicles, carrying an average of 1.5 million weekday riders (or more than 465 million trips per year).

In February 2002, the MTC launched the first phase (the pilot project) of the TransLink® regional smart card program. The project is being implemented and managed through a design-build-operate-maintain (DBOM) arrangement with the system integrator, ERG. The six-month pilot involved six of the region's operators: AC Transit, BART, Caltrain, Golden Gate Transit, San Francisco Muni and Santa Clara Valley Transportation Authority (VTA). Based on the successful completion of the pilot, the ultimate plan for full rollout is to serve approximately 26 of the region's transit providers with a single farecard. This case study reviews the development of the overall TransLink program and issues associated with the implementation of the initial pilot phase of the program.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVE

Development of the TransLink Program

A plan to develop a regional farecard for the Bay Area dates back to the late 1970s, when MTC first proposed the idea of a universal payment instrument as a way to improve transit access among the many transit systems. MTC began by working with the transit operators to develop interim multiagency passes and tickets. System design for a regional program was initiated in the mid-1980s, and the original TransLink farecard, using magnetic technology very similar to BART's stored value system, was tested at BART and two bus operators (BART Express and Central Costa County Transit Authority) beginning in 1994. However, following a trial period, it was decided not to proceed with the original plan. MTC commissioned a study to determine the most appropriate technology and implementation strategy (*13*). This effort, completed in December 1995, evaluated technology and clearinghouse options, including the potential for private involvement. This study led to recommendations that (1) the regional system should be based on contactless smart cards and (2) private entities should be invited to participate in a range of system management and operational elements, particularly those related to clearinghouse and equipment maintenance functions.

An RFP was subsequently issued, and a contract was awarded to a consortium led by Motorola and ERG in 1999. (Subsequent to the award of the contract, Motorola made a corporate decision to get out of the smart card business. Nevertheless, Motorola is still the Prime Contractor for the project; moreover, the cards being used are those developed by Motorola.) The contract was structured to consist of two phases. The initial phase, the pilot project, is intended to address the following basic goals (*14*):

- Validate that the system meets the contractual requirements and specifications.
- Provide transit operators experience with new equipment and systems.
- Provide data for assessment of program's fiscal impact.
- Test consumer satisfaction with services and systems.

The second phase would entail systemwide rollout throughout the region.

Implementation of the Pilot Project

Installation of equipment for the pilot phase of TransLink was completed in late 2001. By the end of the pilot period, the TransLink card could be used on the following services/locations:

- 8 Golden Gate Transit bus routes and 3 Golden Gate ferry terminals. On buses, a card reader is mounted near

the farebox; stand-alone devices such as that shown below have been installed in the ferry terminals.
- 9 BART stations. A card reader is installed in the fare-gates.
- 18 AC Transit bus routes. A card reader is mounted near the farebox.
- All 6 Muni light rail lines. The stand-alone device shown below is used in stations and on some platforms; a bus-type card reader is also mounted inside the vehicles.
- 3 VTA light rail lines and 4 VTA bus routes. On light rail, only cards carrying monthly passes can be used; on buses, a card reader is mounted near the farebox (thus, both e-cash and passes can be used).
- 9 Caltrain stations. The stand-alone device is installed on platforms, and conductors carry hand-held devices to check the cards for proof of payment (i.e., that the card carries a valid pass or that the proper cash fare has been deducted from e-cash).

The system was initially tested by several hundred transit agency employees who were given TransLink cards in late 2001 for use in getting to and from work. Recruitment of general public card users began in the summer of 2001. Transit riders were intercepted in stations or at bus stops and asked if they would be willing to participate in the pilot project. A total of about 4,000 cards were subsequently sent to those individuals who had expressed interest; each card was preloaded with $3 in e-cash value. The system went live in February 2002. Another 1,700 cards were distributed through a second recruitment effort, beginning in March 2002.

The equipment utilized in the pilot project consists of contactless smart card readers. However, the cards are "dual interface," operating in both a contactless and contact mode. At present, the contact interface is being used for all add value transactions (i.e., at Add-Value Machines, Ticket Office Terminal, and third party merchant locations) and in conjunction with hand-held card readers by Caltrain conductors. However, the contact interface will provide future flexibility in allowing for the addition of nontransit functions early in Phase II of the project; these may include, for instance, payment for parking, telephone calls, retail or purchases or other applications.

Farecard Purchase and Usage Parameters

- A card can be loaded with three forms of fare payment: up to $200 of stored value (called "e-cash" in TransLink marketing literature); an unlimited-ride pass for one or more specific agencies, or stored rides (for those agencies that offer multiride tickets or tokens).
- Any applicable usage discount offered by an individual agency (e.g., comparable to pricing for multiride tickets or tokens) is applied with use of the TransLink card; this is currently in place at Golden Gate Transit and VTA. At present, however, there is no purchase bonus or discount (e.g., $11 value for payment of $10); a purchase bonus will only be considered if all participating agencies agree on the parameters.
- The card keeps track of all rides and automatically processes any applicable transfer discounts (i.e., between operators or within a single operator's service).
- A rider is allowed to complete a trip even if paying the fare results in the TransLink card's value falling below $0 (i.e., the value in the e-cash purse is allowed to go negative for one transaction). The rider must then fund the negative transaction the next time value is added to the card.
- Cards can be loaded at designated Add-Value Machines (AVMs) in stations, at retail sales outlets, at participating transit agency ticket offices, and at the TransLink Customer Service Center (by telephone, mail or e-mail request).
- Users can also enroll in the "Autoload Program" by paying a $5 fee. In this program, whenever an enrolled cardholder's e-cash or stored-ride balance falls below a designated level—or when a pass is due for renewal—the card is automatically reloaded via a secure electronic funds transfer from an authorized bank account or credit card the next time it is used.
- An employer-based autoload program is also available. An employee of a participating employer goes to a designated website (managed by Wage Works, Inc.) and specifies the type of transit payment option (i.e., pass, e-cash, or stored rides) desired. The payment option is automatically loaded onto that person's TransLink card the next time it is presented to a card reader. Employees of employers participating in the Commuter Check transit benefit program will also now be able to opt for automated downloading of the monthly transit benefit, although this program provides e-cash only.
- At present, there is no fee for initial acquisition of a card, but there is a $5 charge to register a card for "balance protection" (i.e., replacement of the card and restoration of the value remaining on the card at the end of the day on which it is reported lost or stolen). If a cardholder has not signed up for Balance Protection, the card is still registered and will be blocked from further use if reported lost or stolen; however, remaining value will not be restored. (In Phase II, cards not signed up for Balance Protection might be kept anonymous; as of this writing, a decision had not yet been made about "hot listing" anonymous cards).

- Remaining card value is displayed each time a fare is paid, but it can also be checked at an AVM, at a retail outlet or ticket office, or by calling the Customer Service Center.

All clearinghouse functions, including customer support, data reporting, card distribution and management, revenue allocation and settlement, and funds pool management are provided by the system vendor. ERG carries out these functions at a dedicated TransLink service center, which is staffed by 20 to 25 people. For the pilot phase, MTC is covering all TransLink costs. In full operation, though, the system is designed to be supported through fees paid by the individual transit agencies to ERG. The exact fee structure had not yet been established as of this writing, although the final structure will likely comprise a mixture of two or more types of fees (e.g., a fee per TransLink transaction or a fee based on revenue collected).

As suggested above, MTC and ERG are also seeking to secure nontransit uses of the TransLink card (e.g., parking), both to minimize the amount needed in transit agency fees and to expand penetration of the card within the region. Moreover, the plan is to achieve cost efficiencies through using the TransLink clearinghouse to support other regions' transit payment programs; in particular, ERG has proposed this strategy for the Seattle/Central Puget Sound program now under development, and the Ventura County program will likely be transitioned from its current arrangement (settlement is handled by the Ventura County Transportation Commission) to the TransLink service center as well (see Ventura County case study).

MTC has developed a comprehensive set of marketing materials in implementing the pilot phase of the program. For instance, the TransLink Welcome Package distributed with the card contains a User's Guide that explains the overall program and the above features; and a Transit Guide for each participating operator, explaining how and where to use the TransLink card in that system. The system is also described on a special TransLink website, www.translink.org.

RESULTS AND IMPACTS OF FARE INITIATIVES

The pilot project was completed in July 2002. The evaluation contractor subsequently submitted an evaluation report on this first phase in September 2002. The evaluation assessed the extent to which the pilot met or exceeded the expected outcomes for a series of objectives related to (1) system performance, (2) program costs and fiscal impacts, and (3) customer acceptance.

As of the end of the pilot project, five of the six operators had agreed to continue using the equipment past the end of the six-month pilot period. BART was unable to make such a commitment at that time because it was in the process of replacing its faregates and thus had to remove the TransLink card readers along with the old faregates; MTC and BART had not yet settled on a strategy for facilitating the reading of TransLink cards in the new faregates. (The primary options under consideration included (1) installation of ERG's card readers in the Cubic faregates, and (2) adapting Cubic's Tri-Readers to be able to process the TransLink card.) Nevertheless, MTC was optimistic that a satisfactory solution would be developed and that TransLink would be extended throughout the region. Indeed, based on the successful completion of the pilot project, MTC decided in early 2003 to order $8 million in card reading equipment and 400,000 cards, which will allow the program to move toward a full-scale rollout; this rollout was scheduled for April 2004. As of this writing (March 2003), the six agencies that had participated in the pilot had yet to approve their participation in the full rollout, but MTC expected the agencies to approve rollout plans within the coming months.

Customer Usage and Benefits

Including those given to agency employees, a total of 7,500 cards had been distributed by the end of the pilot period; roughly 3,000 of these (40 percent) eventually turned up in the system. The MTC project manager feels that there was probably too long a delay between recruitment of initial card users and the opening of the system, that many of the envelopes mailed out likely were never even opened. This contention is supported by the fact that a much higher percentage, nearly 60 percent, of the 1,700 cards distributed through the follow-up recruitment (once the pilot system was in place) showed up in the system.

The distribution of numbers of general public cardholders and usage by operator is summarized in Table CS7-1. As can be seen in the table, the Golden Gate Ferry has received the most usage to-date, with nearly thirty rides per card. BART and Muni have actually received fares from more cardholders than has the Ferry, but at a lower rate of usage. At the other end of the spectrum, VTA has seen very little use of the cards, with an average of only three rides per card. Overall, the table indicates that the average TransLink card has been used more than 24 times, and that the average e-cash balance was just under $15 per card.

TransLink has been developed with a focus on customer service. Seamless travel using multiple transit operators is clearly a key objective, as is convenience in obtaining and loading the farecards—as demonstrated by the range of loading and usage parameters mentioned earlier. With regard to the numbers of operators used per card, MTC reports that, through mid-June, 64 percent of cards had been used on a single operator, 27 percent on two operators, and 9 percent on three or more operators.

With regard to use of the different loading options, Table CS7-2 displays the distribution of payment and load methods. As shown, the average load value per card (including passes and stored rides, as well as e-cash) was approximately

TABLE CS7-1 TransLink card usage,* by operator

Operator	No. of Cards**	No. of Rides	Avg. Rides/Card	Avg. Fare
AC Transit	192	2,717	14.2	$1.17
BART	1,167	19,247	16.5	$2.64
Caltrain	295	2,553	8.7	$2.28
Golden Gate: Bus	150	2,341	15.6	$2.51
Ferry	835	24,626	29.5	$2.45
SF Muni	1,147	12,242	10.7	$0.65
SCVTA	100	297	3.0	$1.44
Total Number of General Public TransLink Cardholders				2,640
Total Number of Rides using Cards				64,023
Average Number of Rides per Card				24.3
Average E-cash Balance				$14.92
Average Fare Paid using Card				$2.09
Total Fares Paid using Cards				$134,010

*Includes only general public (i.e., non-agency employees); data through June 16, 2002.
**Overlap between no. of cardholders per operator because some cards used by more than one operator.
SOURCE: MTC.

$27, with the largest average load value ($67) coming via remote loading. "Periodic autoload" accounted for an average load of $63, while the average for "threshold autoloads" was $44. Cash was used in over half (56 percent) of all load transactions; the average load value using cash was just over $17. Credit (15 percent) and debit (13 percent) accounted for the next most popular methods.

While the autoload options have not seen extensive use thus far, their availability represents an important benefit to card users in terms of facilitating ease of use of transit. The employer-based arrangement offers particular potential in that it offers an easy way for both employers and employees to take advantage of the Commuter Benefit program, which provides a tax-free benefit to commuters of up to $100 per month. Employer-based autoload is just beginning to be used in the Bay Area, with the program managed by Wage Works currently in use by about a dozen employers and an estimated 50 employees; MTC alone accounts for nearly half of these employee participants. As indicated earlier, a second program, involving Commuter Check participants, has recently arranged to participate in TransLink as well.

Regarding customer attitudes toward the program, a telephone survey and four focus groups were undertaken as part of the evaluation effort. The results of these efforts were documented in the evaluation report, which stated: "The demonstration has shown that the trial user satisfaction with TransLink is very high. Despite the fact that large proportions of the users have at some time experienced problems of one sort or another, they have viewed them as 'teething troubles' that did not distract from their overall high levels of satisfaction with the system. Moreover, there is indirect and circumstantial evidence suggesting that Bay Area transit customers generally would be drawn to using TransLink, primarily because of the extra convenience that it will provide" (15).

TABLE CS7-2 TransLink card load transactions*

Method of Payment	No. of Transactions	Average Load Value*** (dollars)	Percent by No. Transactions
Cash	3,478	17.17	56
Check	131	51.66	2
Credit	949	36.45	15
Debit	811	34.72	13
Periodic Autoload*	20	63.38	0
Threshold Autoload**	552	43.99	9
Remote Reload**	222	38.57	4
Remote Load**	45	67.27	1
Total/Average	6,208	26.80	

* Includes only general public (i.e., non-agency employees); data through June 16, 2002.
** All autoloads and remote loads are also paid using either credit/debit or through an employer program.
*** Includes passes and stored rides, as well as e-cash.
SOURCE: MTC.

Operational and Administrative Benefits and Impacts

Potential Benefits

The limited time frame and scope of the pilot project make it difficult to assess the nature of TransLink's operational and administrative impacts on the participating agencies. However, a number of potential longer-term benefits have been identified; these will have to be determined once the system has been fully deployed on a wider scale and has achieved significant market penetration. The key potential benefits to operators include the following (*14*):

- Additional data for service planning, marketing and financial accounting.
- Additional flexibility in setting fares (time of day, innovative discounts).
- Decrease in operating losses due to fare evasion and fraud.
- Possible reduction in costs of collecting fares.
- Better equipment reliability with contactless system.
- Minimum operator intervention to operate system.
- Increased throughput.
- New marketing opportunities (including employers and social services).
- Save on long-term capital cost due to regional standardization and procurement economies of scale.
- Provide customers with single point of interface, which is understandable and marketable, to make transit more competitive with other forms of travel.

The TransLink evaluation report did present potential cost savings estimates for several of the transit agencies involved in the pilot phase. In each case, these savings assumed extensive system-wide usage of the smart cards and replacement of much, if not all, of the agency's existing paper fare media. The savings would thus result from eliminating the agency's own cost of producing and distributing fare media in favor of central procurement and distribution by the privately operated service center or clearinghouse. The estimates of potential annual savings for each agency reported in the evaluation are as follows (*14*):

- AC Transit. $475,000 (out of total cost of $860,000) for fare media manufacture, sales commissions and security related to current fare collection, as well as up to $240,000 (2.85 full-time equivalent employees) in labor related to pass sales/delivery.
- BART. $500,000 in printing of current paper magnetic farecards.
- VTA. $600,000 (out of total of $1 million for current fare media procurement/distribution cost).
- SF Muni. $1.16 million, to a maximum of $2.14 million if TransLink cards replace all current fare media (and if cash use is reduced by 60 percent).
- GGT and Caltrain. None provided.

Of course, it must be kept in mind that not all of the agencies' own costs will be completely eliminated in these cases, but rather replaced by some type of fee (e.g., per transaction) paid to the service center. Thus, it remains to be seen how realistic these estimates prove to be.

Potential Impacts and Issues

The above cost-related benefits raise issues associated with the extent and treatment of capital and operating costs: what are these costs, and how will they be allocated among the participating agencies (i.e., MTC, as well as the operators)? Several of the participating operators expressed a concern over the ultimate costs: how much will participation in TransLink increase their overall fare collection costs given that they will still have to continue operating their existing fare systems as well.

As explained earlier, the type of fee payment arrangement for operating costs has not yet been developed for the full program rollout. It will be necessary to identify a fee scenario that feels equitable to all participating operators and that reflects their relative level of participation (e.g., the expected usage of the TransLink card on their services, as well as their administrative and reporting requirements associated with the program). Indeed, there are differing views on the most appropriate fee basis; some operators have expressed a preference for a fee per card transaction, while others prefer a fee based on revenue. As suggested above, the eventual payment structure will likely involve a combination of two or more types of fees.

The capital cost (i.e., including system development and provision of initial equipment) through the end of the pilot phase was roughly $22 million; the capital cost for full system rollout is expected to total another $25–30 million. The operating expense for the pilot was on the order of $750,000; the total full-system operating cost is projected at $8–14 million per year, depending on the level of usage of the cards and the nature of the fees collected. While MTC has covered all capital costs and the bulk of the operating costs to-date, most of the individual transit agencies have reported some expenses as part of their participation. As noted in the evaluation of the pilot program, the types and levels of detail on costs reported by the agencies varied widely and did not necessarily correlate with either the types of equipment installed or the level of usage of TransLink cards (*14*). These costs ranged from under $2,000 per month (Golden Gate Transit) to approximately $20,000 per month (BART). Agencies' costs were predominantly listed under categories such as "equipment-related," "administrative," and "revenue and financial services."

Other financial and governance issues and operating rules that will have to be addressed as the program is rolled out include the following:

- Pricing of card-based services to riders and refund/replacement policies (e.g., whether to charge for the card initially, or simply for replacement).
- Funds pool management (e.g., how to share revenue from float among the participants).
- Fare policies among the operators (i.e., related to such areas as interagency transfer policies, uniform purchase or usage discounts associated with the TransLink card, and whether or not to move toward some type of regional pass that can be administered through the TransLink clearinghouse).
- Treatment of nontransit revenues (e.g., use to reduce costs to agencies or, perhaps, share revenues among agencies).
- Governance of the program: should MTC continue to be the lead agency or should it be led by some type of new or existing joint organization (e.g., along the lines of the Joint Powers Board that oversees Caltrain)?

Operationally, TransLink is a stand-beside or overlay system; the card readers are not fully integrated into the operators' existing fare collection. For instance, on buses, the TransLink readers are mounted separately from the fareboxes; the above photo shows the card reader installed in a BART faregate. Thus, data from card use is maintained separately from records on other fare payment methods (e.g., flash passes, cash in fareboxes, BART's magnetic farecards, or proof-of-payment tickets). Most of the equipment used in the pilot project (e.g., the various types of card readers) apparently worked quite well. The exception to this was the hand-held devices provided to conductors on Caltrain; the original units did not operate reliably with any reasonable consistency. ERG has had to replace these with a different unit.

The stand-beside nature of the system raises interface issues such as the following:

- Each operator's maintenance responsibilities for TransLink equipment and the technical capabilities needed for this maintenance. These responsibilities have been defined in the maintenance plan for Phase I and have proven to be minimal thus far.
- Data access and reporting requirements for each operator. There is a comprehensive set of reports now, but one issue is how to provide more customized reporting and data access to each operator.
- Requirements for monitoring and/or direct use of TransLink equipment (e.g., driver log-in and device monitoring on buses; or fare inspector use of hand-held card reader devices on light rail or commuter rail).
- Customer service responsibilities for each operator.

These and related issues have been addressed to the extent possible through the pilot project; however, some policies and procedures will have to be modified before the program can realistically be extended to other operators in the region.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

The fare initiative discussed in this case study has had—or is expected to have—the following customer-related impacts and benefits:

- Improved ease of transit usage through ability to use single farecard for seamless travel within the region; also improved ease of use due to contactless nature of cards.
- Greater flexibility of fare payment through ready access to payment options (e.g., passes, stored rides) provided by individual agencies, as well as e-cash for use on any participating agency.
- Improved customer convenience through features such as allowance of a negative balance (in e-cash), range of pass or e-cash loading options, optional balance protection (i.e., guaranteed replacement of the pass or e-cash balance if the card is lost or stolen), optional autoload capability, and employer-based autoload arrangements. Autoload can take three basic forms: value limit (e.g., when the e-cash value drops below $5), periodic (e.g., load pass at the beginning of each month), or one-time autoload.

Agency Impacts and Benefits

The agency-related impacts and benefits of the TransLink program experienced to date, or anticipated as a result of full system rollout, include the following:

- All capital costs and most of the operating costs thus far have been covered by MTC, although each agency experienced some costs as part of its participation in the pilot. In the full system rollout, the operators will have to pay their shares of system operating costs through some type of fee structure (e.g., per transaction or based on revenue).
- Usage of the TransLink cards has been relatively limited to date. However, the pilot project was intended to test the

systems and the overall concept; thus, there was no major push to generate a high level of usage. Usage has been greatest on the Golden Gate Ferry, with an average of nearly thirty rides per card. BART and Muni have received the highest number of cards, though both have recorded many fewer uses per card than has the Ferry. Caltrain, AC Transit, Golden Gate Bus and SCVTA have each seen little use of TransLink cards to-date. The total number of TransLink rides (as of mid-June) was just over 64,000, producing revenues of $134,000.

- The limited use of the TransLink cards suggests that the pilot project had minimal impact on the agencies' use of cash; however, as card penetration expands in the full system rollout, the use of cash should eventually decrease. Moreover, participating agencies should be able to reduce their expenses associated with production and distribution of paper-based fare media.
- The TransLink pilot project effectively addressed its basic goals. It "validated that the system meets the contractual requirements and specifications," "provided transit operators experience with new equipment and systems," "provided data for assessment of the program's fiscal impact," and "tested consumer satisfaction with services and systems." In terms of other objectives for a regional multiagency project, the pilot project "created a seamless universal fare medium" and "demonstrated the feasibility of implementing a multiagency payment system" (*15*).
- The revenue reconciliation/settlement system worked very well in the pilot project. The system (including the missing transactions/claims process) proved to be extremely accurate, reportedly keeping track of every transaction and every cent. This ensured that the operators knew exactly what they were owed—unlike the case with current multioperator payment arrangements (e.g., the BARTPlus pass), which estimate the allocation of revenue.
- The limited level of usage suggests that the TransLink pilot project did not have a significant impact on fare abuse and evasion to date. However, the use of any type of electronic fare payment offers the potential to control abuse and evasion; therefore, over time, TransLink would likely reduce participating agencies' extent of fare abuse and evasion.
- TransLink provided greater flexibility to the operators in terms of the ability to offer additional fare options (e.g., e-cash as well as passes).
- MTC assigned a full-time project manager, as well as three support staff for implementation and management of the program. The project has not resulted in any additional personnel for the operating agencies to date. The privately run service center will ultimately have a staff of 20 to 25.
- The limited level of usage suggests that the TransLink pilot project did not have a significant impact on service reliability to date. However, use of contactless cards can speed boardings; thus, extensive usage of TransLink cards could eventually reduce dwell times somewhat and therefore contribute to service reliability improvements.

In short, the TransLink pilot project demonstrated the general feasibility of developing and implementing an integrated regional payment system through a private-public design-build partnership. However, the true test of the program will come in the effort to expand it to the other twenty operators in the region and to generate extensive usage among riders.

Impact and Benefits for Partner Entities

TransLink seeks to enlist other (nontransit) partners and applications, including parking payments and retail uses. Partnerships with employers have already been initiated, and the employer-based autoload arrangement benefits both employers and their employees by facilitating distribution of commuter benefits. Partnerships with all such entities should also serve to increase the market penetration and overall usefulness of the TransLink cards.

Liability to Agency

As long as each agency maintains its own fare structure, there should not be a risk associated with losing fare revenue.

Perhaps the major area of liability to MTC associated with the pilot project was the potential loss of interest in cooperating on the full rollout on the part of one or more of the participating transit agencies. The pilot project apparently demonstrated sufficient promise to convince the six pilot agencies to continue accepting the cards for payment after the close of the pilot period. However, the agencies had yet to approve full rollout plans as of early 2003.

Constraints and Barriers

TransLink is an extremely ambitious and complicated endeavor. Any multiagency integrated payment project must overcome a broad range of technical, operational, institutional and financial constraints and barriers; in TransLink, the effort to include as many as 26 different agencies significantly compounds these challenges. Some of the major issues the project has faced to-date and will have to address as it expands are as follows:

- A strategy for integrating TransLink card readers into BART's new faregates has been a challenge; as of the end of the pilot period, an agreement on such a strategy had not yet been reached.
- Significant problems have occurred with the hand-held devices provided to conductors on Caltrain, although most of the equipment has worked well. ERG had to

replace these units with a different unit. The operators' responsibilities for maintenance of TransLink equipment is also an issue.
- A structure for the payment of fees by the operators to cover system operating costs had yet to be established as of the end of the pilot period. At issue was (1) the basis for fees (e.g., transactions, revenues, perhaps a combination of these), and (2) the level of the fee(s).
- There were other financial, governance and operating rules, such as the following: (1) allocation of nonfare system revenues (e.g., from float or fees from nontransit applications), (2) regional fare policies, (3) pricing of card-based services to riders, (4) operators' data access and ability to receive customized reports, (5) operators' customer service responsibilities, and (6) the overall governance of the program (i.e., which agency should serve as the lead in the full system).
- Early in the development and implementation process, there was considerable turnover among contractor staff. This was partly due to the fact that Motorola withdrew from the smart card business after being awarded the contract. The situation stabilized once the pilot project was underway.

These and related challenges will have to be addressed if there is to be a successful rollout of the full TransLink program

Required Equipment and Technology

The TransLink program is based on use of a contactless, dual interface smart card technology. The first test of the concept was done using magnetic technology, but there were significant operational problems with this system, and a comprehensive assessment determined that smart card technology would better serve the goals of the program.

Lessons Learned

A number of key lessons have been learned from the development and early testing of the TransLink project; these include the following:

- A complex undertaking, such as a regional farecard program, needs a local champion to spearhead the effort.
- Staff resources and capabilities need to be commensurate with the scope and complexity of the project and need to be in place at the beginning of the project.
- Regular and open communication is needed among all the stakeholders throughout the development and implementation process to promote buy-in. Even with such an approach, however, reaching agreement among multiple participants on key issues is extremely challenging and will not always be possible.
- A private-public design-build partnership can be a reasonable approach to developing and operating a project such as this.
- Even with a "stand-beside" system, integrating the new equipment into existing fare collection systems can be challenging.
- Using smart card technology enhances the program's ability to offer a range of automated loading methods, thereby maximizing card users' convenience. Employer-based autoload arrangements can be beneficial to both employers and employees.
- Using smart card technology offers opportunities to bring in nontransit partnerships and applications and thus either (1) hold down the operating cost to the transit participants or (2) generate additional revenues for these participants.
- Recruiting card users for a pilot project as closely as possible to the actual initiation of the service is advantageous. If there is too long a gap between distribution of cards and the ability to use them, many people will lose the cards, forget they received them, or, perhaps, no longer be using transit.

CASE STUDY CONTACTS

This case study is based on discussions with the following individuals:

Russell Driver
TransLink Project Manager
MTC
101 Eighth Street
Oakland, CA 94607
510-464-7808
510-464-7848 (fax)
rdriver@mtc.ca.gov

Carol Lawson
Caltrain
Peninsula Joint Powers Board
1250 San Carlos Ave.
San Carlos, CA 94070
650-508-332

Dan Rosen
SF Muni
401 Van Ness Ave.
San Francisco, CA 94102
415-554-1741

Aaron Weinstein
Bay Area Rapid Transit District
800 Madison St.
Oakland, CA 94604
510-464-6199

Alan Zahradnick
Golden Gate Bridge, Highway and Transportation District
Presidio Station, P.O. Box 9000
San Francisco, CA 94129
415-257-4475

The following documents (in addition to various TransLink program usage reports) were used in preparing the case study:

Benton International, *TransLink Program Plan*. Prepared for the MTC, December 1995.

Russell Driver, presentation on TransLink (at MBTA Stakeholder Workshop), November 1, 2000.

Charles River Associates, *Evaluation of the TransLink Demonstration—Final Report*, September 2002.

Multisystems, Inc. et al. *Fare Policies, Structures and Technologies* (TCRP Report 10), 1995.

Transactions, MTC newsletter, December 2001.

TransLink website: www.translink.org

CASE STUDY **8**

NEW JERSEY TRANSIT

Fare Program/Initiatives

Fare increase and policy changes: programmed increases

Access-to-jobs: transit benefit payment arrangements

INTRODUCTION

New Jersey Transit (NJ TRANSIT, or NJT) is a public transit corporation created by the Public Transportation Act of 1979. NJ TRANSIT operates transit services throughout the State of New Jersey, covering a service area of 5,325 square miles. NJ TRANSIT operates several modes of transit services: fixed-route bus, paratransit, light rail, and commuter rail.

NJ TRANSIT is the nation's third largest transit service provider, with 238 bus routes and 12 rail lines statewide. It provides transportation links to major New Jersey cities and destinations and commuter services to New York City and Philadelphia. NJ TRANSIT serves more than 380,000 customers daily, providing almost 224 million passenger trips each year.

This case study focuses on two fare initiatives:

- Programmed fare increases for all NJ TRANSIT services beginning in 2002.
- An access-to-jobs transit benefit program, increasing the transit opportunities of welfare-to-work participants.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

Fare Increase and Policy Changes

In its 5-year plan, NJ TRANSIT's Call to Action, a cumulative funding gap of $3.1 billion was projected over the next 5 years (*16*). As a result, a multiyear fare policy initiative was developed in order to achieve the following:

- Generate additional revenue (approximately $44 million annually).
- Address the estimated budget shortfall for FY2003.
- Provide a more secure source of revenue.
- Reduce the agency's reliance on capital funds to pay for a portion of operating costs, thus enabling capital projects to advance as programmed.
- Streamline some fare administrative procedures.

Numerous fare change proposals were developed by NJ TRANSIT staff. Through its public hearing and internal review process, a number of proposed changes were eliminated. Table CS8-1 identifies the proposed changes, as well as those subsequently approved by the NJ TRANSIT Board of Directors for final implementation.

The fare increase implemented on April 1, 2002, was the first fare increase in 11 years (i.e., since FY1991). This fare change was the first step in a multiyear fare policy initiative approved by the NJ TRANSIT Board of Directors earlier in the year. The initiative established a 10 percent increase the first year, followed by subsequent increases in the next 5 years (FY2003 through FY2007) based on an inflation index.

The April 2002 changes represented an average increase of 10 percent on all bus, rail, Newark City Subway, and bus services under contract to NJ TRANSIT, including Access-Link. The new Hudson-Bergen Light Rail Line was not subject to this increase but will be included in subsequent increases in the plan.

Subsequent increases are tied to the Zone of Rate Freedom (ZORF) index, which is approved annually by the New Jersey Commissioner of Transportation. The ZORF is established by state law and is applied to the fares that private bus carriers charge. With this multiyear authorization, NJ TRANSIT can increase fares annually according to the ZORF or apply the cumulative increase if fare increases are implemented less frequently. However, NJ TRANSIT must hold public hearings prior to implementing these changes.

In addition to the pricing changes, a number of other fare policy changes were implemented in the April 2002 initiative. For example, round trip excursion tickets are no longer accepted on weekday evening peak trains leaving New York, Newark, and Hoboken; the onboard surcharge for rail was increased from $3 to $5 to encourage use of NJ TRANSIT's investment in ticket technology; and the fares were standardized from the Newark stations. An equal number of proposals did not survive the iterative deliberations on the fare change proposals.

TABLE CS8-1 Proposed and approved fare changes

Proposed Change	Board Approved
Five-year package (10%, then inflation)	✓
Eliminate/Modify Rail Round Trip Excursion	✓
Standardize Newark, New York, and Hoboken rail fares	✓
Restore Route 126 bus fares	✓
Increase Rail onboard surcharge	✓
Restrict refunds to commuter tickets	✓
Authority to set fares for new services	✓
Restore G.W. Bridge bus fares	✓
50% senior discount	
Create Rail & Bus Weekend Round Trip	
Combine bus zones 1 & 2	
One-Way fare considered standard	

It was essential that a new fare policy be adopted in order to protect the agency's fiscal integrity, and to enable the system to respond to capital and operating needs over the next several years.

Access-to-Jobs Transit Benefits

As part of the State of New Jersey's access-to-jobs initiative, Work First New Jersey (WFNJ), NJ TRANSIT joined together with the New Jersey Department of Human Services (NJDHS) and the New Jersey Department of Transportation (NJDOT) to develop innovative solutions to the transportation problems facing New Jersey's welfare-to-work participants. The objective was to develop a comprehensive transportation program that provided safe, reliable, and convenient transportation to WFNJ participants, as well as to low-income and transit-dependent persons. One of the key results of their efforts was the NJ Transit WorkPass Program.

The goal of the WorkPass Program is "to make accessible and reliable transportation available to individuals making the transition from welfare to work" (*17*), and to provide welfare case managers and WFNJ staff with transportation information and training. WorkPass achieves this goal by providing monthly commuter bus and rail passes and one-way tickets to welfare participants and other eligible individuals through county welfare offices and social service agencies throughout the state.

Elements of the WorkPass Program include the following:

- WorkPass and Extended WorkPass
- Get A Job, Get A Ride
- Get A Job, Get A Ride Corporate Partners

These elements are outlined in Table CS8-2 and described below:

- **WorkPass Program.** During their pre-employment phase WFNJ participants who receive Temporary Assistance to Needy Families (TANF) and General Assistance (GA) can obtain a NJ TRANSIT Monthly Pass or One-Way Tickets for their transportation needs. The program is administered by county social service agencies and funded through TANF and GA transportation funds. The local agency evaluates clients, purchases passes based on estimated demand, and distributes passes and tickets as needed.
- **Extended Work Pass.** This program is available only to TANF recipients at the beginning of their employment. Passengers are provided checks made payable to NJ TRANSIT. The program provides transportation assistance for 6 months. For the first 3 months, the checks cover the full cost of a NJ TRANSIT bus pass. For the last 3 months, the checks cover 50 percent of the cost. These checks are mailed directly to the recipients. Local case managers determine eligibility.
- **Get A Job, Get A Ride.** This program is available to TANF and GA recipients. Individuals must have permanent employment of at least 20 hours per week in order to qualify. Qualifying participants receive one free monthly pass from NJ TRANSIT.
- **Get A Job, Get A Ride Corporate Partners.** Employers that hire individuals leaving public assistance, or those who have been unemployed for at least 30 days, can extend the program benefits to these employees by enrolling in the NJT Get A Job, Get A Ride Corporate Partners program. New employees of the Corporate Partners who are 18 years of age or older, have been unemployed 30 or more days, are not full-time students, work 20 or more hours per week, and earn $10 an hour or less can receive one free monthly pass from their employer through NJ TRANSIT. The free pass provides transportation access for eligible employees awaiting their first paycheck. Enrollment in the Corporate Partners program is free.

In addition, NJ TRANSIT provides WorkPass assistance to welfare and social service agencies and public and private employers in the form of transit training to clients and employees, transit information to agencies and employers, service development plans that provide clients better services, and assistance to public and private nonprofit organizations in identifying and applying for grants.

WorkPass was implemented in 1997. Prior to WorkPass, WFNJ participants were eligible for a $6 per diem Travel Reimbursement Expense (TRE) to cover transportation costs incurred during their participation in WFNJ and job search or job training activities. In most cases, WorkPass replaced the TRE with a monthly bus or train pass or one-way bus and train tickets appropriate for the participants' needs and destinations. Substituting WorkPass for the TRE created signif-

TABLE CS8-2 WorkPass program elements

Program	Eligibility	Benefit(s)	Funding	Implementation
WorkPass	Temporary Asssistance to Needy Families (TANF) and General Assistance (GA) recipients	NJT Monthly Pass or One-Way Tickets; Travel Reimbursement Expense (TRE) still available as needed	Counties—TANF, GA transportation funds through New Jersey Department of Human Services (NJDHS)	Agency evaluates clients, purchases and distributes passes/tickets as needed
Extended Work Pass	TANF recipients only	6 months transportation assistance (3 months free, 3 months 50 percent cost)	NJDHS	Case manager determines eligibility; client receives check made out to NJ TRANSIT
Get A Job, Get A Ride	TANF and GA recipients; 20 hour minimum work week	One free monthly pass	NJ TRANSIT	Case worker provides application to individual; Individual mails application to NJT; NJT mails pass to eligible user
Get A Job, Get A Ride Corporate Partners	New employees of NJT Corporate Partners (18+ years old; unemployed 30+ days; not full-time students; work 20+ hours/week; earn $10/hour or less)	One free monthly pass	NJ TRANSIT	Free enrollment in Corporate Partners for employers; NJT provides Partners with monthly passes for eligible employees

icant cost savings for the service agencies. The monthly TRE benefit was approximately $120; a monthly bus pass costs $54 to $59. NJDHS allowed the agencies to keep those savings and use them to develop supplemental transportation services or use the savings as matching funds for transportation grants such as WFNJ Transportation Block Grants, FTA Jobs Access and Reverse Commute Program, and the NJ Transportation Innovation Fund. However, the TRE is still provided on an as needed basis.

RESULTS AND IMPACTS OF FARE INITIATIVES

Fare Increase and Policy Changes

Customer Impacts

The fare increase initiative has established fare increases as modest, routine changes over the next 6 years. In the past, fare changes were very infrequent, meaning that, when changes were made, the amount of the increases tended to be substantial. Moreover, the future increases will be tied to an inflationary index, assuring riders that the fare changes are based on economic trends in the state. Though there is authority for a multiyear program of changes, no change will be implemented without a public hearing.

Agency Impacts

The authority to increase fares based on inflationary impacts gives NJ TRANSIT a more certain level of passenger revenue for the current and subsequent fiscal years. The agency also now has the authority to set fares for new services being introduced and to include them in the overall plan. Thus, with a multiyear program, NJ TRANSIT can proceed to program these fare revenues over the next few years for existing services as well as possible service improvements. The first fare increase was implemented April 1, 2002; data are not yet available to determine the overall impact of the changes on NJ TRANSIT ridership and revenue.

More certain passenger fare revenue, combined with sufficient state general fund appropriations, would allow NJ TRANSIT to safeguard its capital funds for capital projects. In the past, without a regular program of fare increases, it was sometimes necessary to use funds designated for capital projects to balance the operating budget.

Access-to-Jobs Transit Benefits

Customer Impacts

The NJ TRANSIT WorkPass Program has provided numerous benefits for WFNJ individual customers. Key benefits for individuals/clients include the following:

- Improved reliability. WorkPass monthly passes and one-way tickets give WFNJ participants access to a reliable transportation source.
- Improved flexibility. Passes give participants unlimited use of transit services for the entire month, allowing use for both employment and personal needs.

- Life skills. Encouraging the use of public transportation teaches valuable commuting skills useful for finding and keeping jobs.

Agency Impacts

The WorkPass Program also provides important benefits to NJ Transit, such as:

- Additional ridership.
- Valuable information and understanding of county demographics and existing local transportation services and needs; this information can enhance NJ TRANSIT's service planning efforts.

Also, by taking a visible role early in the development process, NJ TRANSIT has been seen as "part of the solution, rather than part of the problem."

CONCLUSIONS AND LESSONS LEARNED

Customer and Agency Impacts and Benefits

The fare increase initiative clearly raises the costs of travel for riders. However, the program of inflation-based increases will mean that future increases should be less substantial than the past, infrequent changes. The increases will also benefit NJ TRANSIT by generating a more predictable level of revenue growth and by allowing the agency to raise fares as needed.

The access-to-jobs initiative has had numerous positive impacts on and benefits for both WFNJ participants and service agencies, as well as for NJ Transit. After overcoming some initial resistance, WorkPass has been positively accepted by both intermediate and end users of the program. Some indications of the program's success as of 1999, when the program's impacts were last reviewed, include the following:

- 16 of the 21 New Jersey counties participate in the program.
- Over 40 social service agencies participate in the program.
- Over 5,000 passes and tickets are distributed each month.
- Over 500 county and social service agency personnel have received WorkPass training.
- Over $2,000,000 in cost savings have been realized over the TRE per diem program.

Impacts and Benefits for Partner Entities

The NJ TRANSIT WorkPass Program has provided numerous benefits for social service agency institutional customers. Key benefits include the following:

- **Cost savings.** Agencies can save over 50 percent versus the cost of TREs. Savings may be recycled into supplemental transportation services or as matching funds for transportation grants.
- **Transit training and education.** NJ TRANSIT provides agencies with transit training and materials to help both agency personnel and customers better understand how to access and use public transportation.

Liability to Agency

Should NJ TRANSIT determine that additional revenues are needed at some point beyond what can be generated through an inflation-based increase, the fare increase initiative and its reliance on the inflation index to determine the extent of increase will limit the agency's ability to raise fares as high as necessary for the duration of the initiative.

Constraints and Barriers

Implementing the fare increase proposal required extensive public input and staff and Board discussion; for instance, a series of public hearings was held statewide. Certain fare change proposals had to be modified or eliminated throughout the iterative process. Moreover, implementing the subsequent fare increases is not automatic. A public hearing must precede each change.

NJ TRANSIT faced several obstacles, both major and minor in nature, in planning and implementing the WorkPass Program. Most of the resistance to the program occurred during the county-level planning and implementation phase; the program encountered few department-level barriers and no legal barriers. By working closely with its partner entities, NJ TRANSIT was able to overcome most of the barriers to ensure the program would succeed. Some of the biggest obstacles centered on the following perceptions:

- *WorkPass means more work for program representatives*. Many county social workers believed that the WorkPass Program would mean more work for them. Many felt that they were already overburdened with caseloads and the last thing they wanted was another program layer to administer. NJ TRANSIT was able to overcome this barrier by starting small. The agency implemented the pilot program in Gloucester County, then used that success, and the caseworkers who were won over, to help sell the program to the rest of the counties.
- *Transit is not accessible to everyone*. This barrier still exists to a certain extent. WorkPass was never intended to be the end-all solution to the state's transportation problems, just a reasonable alternative for the majority of consumers. Some participants in the program simply cannot access public transit for various reasons. For

those individuals, other aspects of the WorkPass Program can help, such as identifying or establishing alternative means of transportation (van/carpools, shuttle services, feeder services, etc.). Also, the TRE program still exists for those who cannot access any other transportation alternative.

- *WorkPass diverts economic resources from those most in need*. This perception was difficult to overcome. Though the TRE per diem was designated for transportation-related expenses, many caseworkers believed that participants often used their per diem (up to $120 a month) to supplement their family's food budget. Once the TRE check was cut to the participant, there was no accountability for how the funds were actually spent. Some representatives therefore felt that WorkPass would be taking food away from disadvantaged children. Fortunately, this barrier proved to be less serious than originally thought. Most WorkPass participants were pleased with the new program, and very few complaints were received about replacing the TRE with the monthly transit pass.

Other barriers to implementation that were encountered included:

- The concern that Work Pass does not address child care needs or problems.
- Pass distribution problems in counties with large caseloads.
- Difficulties in estimating the number of passes to order in advance.
- Some conflicts in the goals and objectives of partners and agencies.
- Certain NJ TRANSIT fare policies and procedures that needed to be changed to make it work.

Another problem that arose with WorkPass was solved by the implementation of a new fare category. WFNJ participants expressed concern about the cost of transporting children on public transportation to childcare centers, schools, and other transit destinations. NJ TRANSIT responded by establishing a discounted child fare equal to one half the regular adult fare. NJ TRANSIT produced discounted children's tickets for children aged 5 to 11: children under 5 ride free with an adult, while those 12 and older must use existing adult fare media.

Required Equipment and Technology

No changes in equipment or technology were needed to implement either the fare increase initiative or the WorkPass Program.

Key Factors and Influences

The fare increase initiative was prompted by a strategic planning effort, which identified needs and funding gaps (i.e., it was not an independent fares-only initiative). The development and approval of a multiyear fare increase was tied to raising funds to protect the agency's fiscal integrity and to enable it to proceed with the strategic plan. The inflation index relies on an existing approach, currently in use for private bus carrier fares; the index is thus codified in New Jersey law.

Lessons Learned

Several key lessons emerged from the development of the WorkPass Program, but perhaps the most important was the need for effective partnerships. NJ TRANSIT partnered with the NJDOT, NJDHS, New Jersey Department of Labor, New Jersey State Employment and Training Commission, and each individual county in planning and developing the WorkPass Program. Two particularly important elements in developing successful partnerships were stressed:

- Understanding each partner's goals and objectives in setting common goals
- Sensitivity to the needs and concerns of each partner

Other important lessons noted by those interviewed for this case study include the following:

- **Be persistent.** Change is never easy; don't give in to resistance.
- **Be patient.** Give the program enough time to work out. Gradually build the program and avoid unattainable goals. NJ TRANSIT started WorkPass as a pilot program in one county, Gloucester, and used that experience—including the success there—to sell the program in the rest of the state.
- **Be flexible.** Be ready and able to make changes to the program to meet the needs of the partners and users. In this case, the WorkPass Program was adapted to meet each county's specific demographics and needs.
- **Stay focused.** Keep all partners focused on the program's mission and common goals.

CASE STUDY CONTACTS AND SOURCES

The following individuals were interviewed, either on-site or via telephone, and assisted in providing information included as part of this case study:

Jim Redeker
NJ TRANSIT
One Penn Plaza East
973-491-7750
JRedeker@njtransit.com

Marianne Stock
NJ TRANSIT
One Penn Plaza East
973-491-7102
mstock@njtransit.com

Jeremy Colangelo Bryan
NJ TRANSIT
One Penn Plaza East
973-491-7750
cedojcb@njtransit.state.nj.us

Alan Tillotson
NJ TRANSIT
One Penn Plaza East
973-491-7748
cplnajt@njtransit.state.nj.us

Carol Duffy
NJ TRANSIT
One Penn Plaza East
973-491-7112
cduffy@njtransit.com

The following documents were used in preparing the case study:

NJ TRANSIT Fare Policy Proposal, December 12, 2001.

"NJ TRANSIT's Call to Action: An Investment for the Future, Fiscal Years 2002 through 2006 and Beyond," NJ TRANSIT, 2001.

Louis V. Capadonna, "*WorkPass Works for Everyone,"* Act '99/Hyperlink to Mobility (1999).

NJ Transit WorkPass Program: "The Program that Works for Everyone," New Jersey Transit, June 2002.

CASE STUDY **9**

ORANGE COUNTY TRANSPORTATION AUTHORITY

Fare Program/Initiatives

Elimination of free transfers, and introduction of 1-day pass (sold onboard)

Installation of validating fareboxes/TRiM units, and plan to replace calendar-month passes with 30-day rolling passes

INTRODUCTION

Orange County Transportation Authority (OCTA) operates transit service throughout Orange County, California. OCTA has a total peak fleet (FY 02) of 441 buses, and provides over eighteen million miles of revenue service per year.

This case study focuses on a recent OCTA fare initiative:

- Elimination of free transfers, in conjunction with introduction of 1-day passes that are sold on buses.

The case study also discusses a second initiative that is in the process of being implemented:

- Installation of GFIGenfare validating fareboxes with electronic read-write capabilities (i.e., TRiM units), and the replacement of calendar-month passes with 30-day rolling passes (i.e., that are activated on first use).

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

Due to its largely grid-oriented route network, OCTA traditionally experienced a considerable volume of transferring. A 1994 fare study found that over 30 percent of local boardings were transfers, and moreover, " . . . on the order of 47 percent of people who pay cash fares or use coupons transfer to another vehicle" (*18*). The agency had modified its transfer policy several times in the years preceding this study. Changes included the treatment of stopovers and round-tripping, the length of time for which the transfer would be valid, and the transfer price; for instance, a $0.05 transfer charge had been implemented in 1991. Since OCTA sought to determine the most appropriate transfer policy, this study explored various strategies for improvement and for reducing the number of transfers in the system. Among the options considered were eliminating free/low-priced transfers and selling 1-day passes on the buses.

OCTA subsequently eliminated the nickel transfer charge and made other changes to transfer validity parameters. However, the agency later revisited possible transfer strategies, and, seeking to reduce the extent of transfer abuse and to eliminate confrontations between operators and riders, decided to eliminate free transfers in conjunction with beginning to sell a day pass onboard the buses in July 1999. The pass price was initially set at $2.50, but with a $0.50 discount for the first 6 months. Given that the cash fare was (and continues to be) $1, a $2 pass translated into two paid boardings—or two paid boardings and two free transfers. The pass price was then raised to its "full" price of $2.50 in January 2000.

The day passes were initially paper tickets packaged in pads of 20. Each morning, operators would take as many pads as they felt they needed that day; however, operators did not have to sign for the pads, meaning there was a decided lack of control in terms of monitoring pass distribution. This inevitably resulted in (undocumented) abuse on the part of some operators, who would hand passes to friends at no charge. The process was later changed in an effort to impose better controls: each operator was given a certain number of passes each day, based on the general rate of demand on the particular route. Each operator's allotment was thus generally tracked, although the actual sale of passes was not reconciled with the daily number distributed to and returned by each operator.

The next change in the sale of day passes occurred on July 1, 2001, with a shift to use of magnetic swipe day passes. With the installation of the new fareboxes, day passes had to be swiped on boarding, rather than just shown to the operator. In order to minimize maintenance requirements, OCTA decided not to dispense day passes from a stack inside the TRiM unit. However, in selling a day pass, the operator now must feed each pass through the TRiM unit in order to activate it. This

facilitates electronic tracking of the sale of passes, thus making it much harder for an operator to give away free passes. This shift to dispensing magnetic day passes has also eliminated the need to "bag and tag" passes (the previous distribution process). Beginning in July 2002, the agency also converted fare vouchers that are distributed by social service agencies to their clients to Prepaid Day Passes; these too are swiped on boarding.

With the installation of the new fareboxes in early 2002, OCTA had converted the monthly passes from flash passes to magnetic swipe (i.e., read-only) passes. This was an interim step, prior to the introduction in July 2002 of rolling 30-day passes. A pass must be inserted into the TRiM unit on its first use in order to activate it. On subsequent boardings, however, the pass is swiped instead. Like the decision not to dispense day passes directly from the TRiM unit, OCTA seeks to minimize use of the TRiM unit, hoping to hold down maintenance costs; the TRiM unit is relatively complex machine, and typically requires considerable preventive maintenance repair work. GFI's Odyssey farebox has the capability to issue a stored value card containing the rider's change (e.g., if the rider pays the fare with a bill of $5 or higher). OCTA, however, decided not to use the change card feature, having decided not to use stored value as a payment option at all. In addition to the desire to minimize use of the TRiM unit, management felt that issuing change cards would have a negative impact on boarding times. OCTA is, however, considering the possibility of adding 7-day rolling passes to its mix of fare options at some point.

RESULTS AND IMPACTS OF FARE INITIATIVES

Ridership and Revenue Impacts and Customer Benefits

The ridership and revenue totals for 1999–2001 are summarized in Table CS9-1. As indicated in the table, ridership and revenue have both been growing during this period, with pass revenue representing the largest area of increase (more than a 50 percent rise in 2000, and another 18 percent rise in 2001). Since the elimination of transfers and introduction of day pass occurred in 1999, these actions were not likely a direct factor in any increases in ridership or revenue after 2000. However, the elimination of free transfers can be considered a key factor in the increased sale of passes in general. Moreover, the elimination of free transfers does not appear to have had any significant dampening effect on demand.

Table CS9-2 present the revenue trends, for (1) the period before and after the introduction of the day pass and elimination of transfers, and (2) the period before and after the increase in the day pass price from $2 to $2.50. (The monthly totals are also shown in Figure CS9-1.) The day pass was offered beginning on July 9, 1999, and the price was raised exactly 6 months later, on January 9, 2000. As indicated in Table CS9-2, farebox revenue—which represents cash fares only prior to July 1999 and both cash fares and purchase of day passes beginning at that point (because OCTA has not, to this point, tracked onboard day pass sales separately from cash fare payment)—increased significantly in the period starting in July; the 6-month average for July–December is more than 13 percent higher than the previous 6-month average. Meanwhile, monthly pass revenue rose even more, showing an increase of almost 19 percent. Overall fare revenue grew by nearly 17 percent following the July 1999 fare structure change.

The January 2000 day pass increase produced (or at least contributed to) a major shift to monthly passes: the 6-month average for January–June 2000 is nearly a third higher than that for the previous 6 months. In contrast, the increase in farebox revenue following the day pass price change was much smaller, at under 3 percent. As shown in the table, the overall revenue average for January–June 2000 was over 6 percent greater than that for July–December 1999. With regard to day pass purchases, OCTA reports that the price increase resulted in a sharp decline—from an average of roughly thirty-five thousand per day to around twenty thousand per day after the price change (i.e., a drop of more than 40 percent). While most of the riders shifting from the day pass apparently began to use monthly passes, some clearly shifted to paying cash (i.e., those making only two trips per day, some of whom doubtless purchased day passes at the $2 price). The average use of a day pass following the price increase has been 4.6 boardings; this has increased from an average of about 4 per day at the original price.

Based on the feedback the agency has received to date, the elimination of transfers has apparently had minimal negative impact on customers. It had been anticipated that there could be complaints from riders making only one-way trips and thus unable to benefit from a day pass; however, OCTA reports that there were virtually no complaints following the change. The agency's marketing campaign surrounding the fare structure modification was apparently effective at explaining the change and the procedure for purchasing and using day passes. Staff reports that, within a week of the change, riders had by and large adapted to the new structure; in fact, riders were apparently "helping each other out" in buying the new passes. As explained below, the removal of transfers also eliminated what had been the primary source of arguments with operators, and this has in turn contributed to a major reduction in rider complaints in general.

Operational and Administrative Impacts and Issues

The major operational and administrative impacts associated with the elimination of free transfers and introduction of day passes change have been as follows:

TABLE CS9-1 Ridership and revenue totals

Category	Annual Total (dollars)/Percent Change from Previous Year)		
	1999	2000	2001
Total Fare Revenue	32,443,586	36,907,066	38,135,963
	4.6%	13.8%	3.3%
Farebox Revenue*	27,759,446	29,670,923	29,726,019
	NA**	6.9%	0.2%
Monthly Pass Revenue	4,281,847	6,476,911	7,654,523
	NA	51.3%	18.2%
Voucher Revenue	402,294	759,231	755,421
	NA	88.7%	-0.5%
Ridership (Unlinked)	54,904,000	55,417,000	60,851,000
	4.7%	0.9%	9.8%
Avg. Fare per Rider	0.59	0.67	0.63
	-0.1%	12.7%	-5.9%

SOURCES: OCTA Revenue reports, APTA *Ridership Reports*, *National Transit Database.*
* This includes cash and day pass revenue.
** Not applicable.

TABLE CS9-2 Fare revenue before and after day pass introduction and day pass price increase

Month	Farebox Revenue	Pass Revenue	Voucher Revenue	Total Revenue
	Cash fares			
Jan-99	$2,061,907	$301,895	$0	$2,363,803
Feb	$2,007,503	$328,841	$0	$2,336,344
Mar	$2,283,018	$337,782	$0	$2,620,800
Apr	$2,099,401	$332,153	$0	$2,431,554
May	$2,278,342	$335,650	$0	$2,613,992
June	$2,273,232	$320,766	$0	$2,593,998
6-mo. average	*$2,167,234*	*$326,181*	*$0*	*$2,493,415*
	Cash fares and onboard day-pass sales	*$2 day pass introduced*		
July-99	$2,334,709	$375,296	$161,125	$2,871,130
Aug	$2,523,413	$378,296	$94,700	$2,996,409
Sep	$2,539,767	$383,749	$37,031	$2,960,547
Oct	$2,604,064	$402,217	$61,400	$3,067,681
Nov	$2,411,279	$408,990	$26,013	$2,846,282
Dec	$2,342,810	$375,814	$22,025	$2,740,649
6-mo. average	***$2,459,340***	***$387,394***	***$67,049***	***$2,913,783***
1999 average	***$2,313,287***	***$356,787***	***$33,525***	***$2,703,599***
		Day pass price raised to $2.50		
Jan-00	$2,534,474	$412,318	$77,019	$3,023,811
Feb	$2,294,987	$491,611	$45,775	$2,832,373
Mar	$2,680,286	$520,279	$121,906	$3,322,471
Apr	$2,466,645	$532,157	$56,169	$3,054,971
May	$2,677,343	$566,243	$26,481	$3,270,067
June	$2,484,242	$547,545	$52,056	$3,083,843
6-mo. average	*$2,522,996*	*$511,692*	*$63,234*	*$3,097,923*
Jul-00	$2,635,717	$539,864	$75,088	$3,250,669
Aug	$2,592,927	$553,909	$83,925	$3,230,761
Sep	$2,109,641	$559,162	$71,294	$2,740,097
Oct	$2,574,950	$589,767	$95,294	$3,260,011
Nov	$2,373,846	$604,710	$12,044	$2,990,600
Dec	$2,245,867	$559,346	$42,181	$2,847,394
6-mo. average	***$2,422,158***	***$567,793***	***$63,304***	***$3,053,255***
2000 average	***$2,472,577***	***$539,743***	***$63,269***	***$3,075,589***

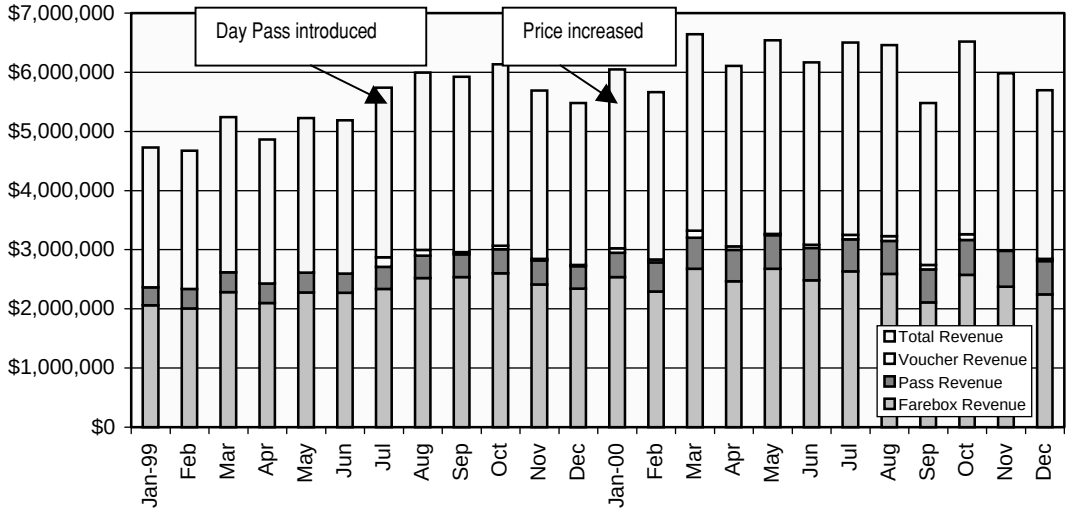


Figure CS9-1. Fare revenue trend.

- Elimination of operator-rider arguments regarding the validity of transfers.
- Need to retrain operators when the day pass was introduced.
- Elimination of abuse of transfer policy (i.e., riders using expired transfers, or requesting transfers and then giving them to other people); however, there was apparently still some incidence of operators handing out day passes to some riders for free—this had resulted from the lack of controls over the distribution/return of pads of paper day passes, and the agency subsequently instituted greater controls (i.e., each operator was given a certain number of passes each day, based on the general rate of demand on the particular route).
- Increased accounting and administrative costs (i.e., in "bagging and tagging" bundles of passes for particular operators and routes).

As mentioned above, the later shift to dispensing magnetic day passes has eliminated the need to bag and tag passes, as the operator must now feed each pass through the TRiM unit in order to activate it. This will facilitate electronic tracking of the sale of passes, thus making it much harder for an operator to give away free passes. This will also reduce the administrative cost associated with day passes.

The installation of the new fareboxes and the shift to electronic fare collection has also had the following impacts:

- Need to show riders how to properly use the fareboxes (e.g., how to insert day passes into the TRiM units and how to insert bills and coins into the farebox); due to the need to validate each bill, the new fareboxes do not readily accept old (i.e., soft) or torn bills; toward this end, the operators interviewed felt that better signage is needed on the fareboxes (although OCTA provides video instructions on its website, many transit riders may lack access to the Internet). These operators also felt that difficulties in proper insertion of bills and coins have slowed down boarding times somewhat.
- Need for operator training; in this regard, the operators interviewed felt that they should have received more training than was provided—and that the training should have been done closer to the actual installation of the new fareboxes.

The issues associated with the new fareboxes should diminish as operators and, particularly, riders become more used to their operation. For instance, staff claim that many riders are already getting used to the fact that they need to use crisp bills on the bus (i.e., as they would have to use in a vending machine).

Finally, the use of rolling passes is expected to have certain new impacts, including the following:

- Reduce the administrative requirements and costs associated with selling and distributing calendar-month passes. Prior to introduction of rolling passes, thousands of calendar-month passes (considerably more than the number actually sold) had to be printed and distributed to employers and sales locations each month, and the sales/reconciliation effort was concentrated into a short period from the last few days of a month through the first few days of the following month. The use of rolling passes will allow bulk distribution (i.e., since passes are no longer tied to a particular month) and will eliminate the waste associated with printing extra monthly passes each month.

- Eliminate the need for operators to visually inspect passes. The interim strategy, using magnetic swipe monthly passes, has already had this impact. The introduction of rolling passes has at least initially added somewhat to operators' responsibilities; however, as riders are required to insert the card to activate it on the first use and then swipe it on subsequent uses, it seems likely that some riders will be unsure when to insert and when to swipe—and that the operators will have to spend time explaining the proper procedure. Depending on how well this change is explained, there could well be a considerable incidence of disagreements and complaints with this method of pass use.

Despite the transitional problems associated with the new fareboxes, OCTA's fare initiatives have generally had a positive impact on the agency and the operators—chiefly in terms of reduction of operator-rider confrontations and reduction of fare abuse associated with free transfers.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

The fare initiatives discussed in this case study have had the following customer-related impacts and benefits:

- Reduced the cost of travel for many riders (i.e., by offering low-price 1-day passes).
- Provided more convenient fare options, in the form of 1-day passes that can be purchased onboard buses and rolling 30-day passes.
- Eliminated what had been the primary source of arguments with operators, the validity of transfers.

Moreover, the fact that ridership and revenue continued to grow following the elimination of transfers—coupled with the virtual absence of complaints about the elimination of transfers—suggests that riders have readily accepted the changes.

Agency Impacts and Benefits

OCTA's fare initiatives have also had a generally positive impact on the agency's administrative and operational fare collection requirements; the impacts and benefits include the following:

- Reduced operator requirements for administering fare collection, and eliminated rider-operator confrontations regarding validity of transfers.
- Reduced the extent of transfer abuse.
- Reduced fare collection costs associated with selling and distributing fixed-calendar monthly passes; however, required training of operators (first, when day pass introduced, then when new fareboxes installed).
- Resulted in an overall increase in fare revenue (17 percent after elimination of transfers, then an additional 6 percent rise following increase in day pass price); also increased average fare per rider.
- Resulted in a large increase in the use of monthly passes (19 percent after elimination of transfers, 32 percent higher after increase in day-pass price).

Liability to Agency

OCTA risked losing revenue through the introduction of day passes because of the lack of controls over day pass distribution to operators. Indeed, the agency did experience some revenue loss through this procedure and had to institute more stringent administrative controls. The shift to electronic coding/distribution of the passes has introduced further controls, making it much more difficult for operators to give away passes.

OCTA also risked receiving equity-related complaints in eliminating transfers. However, as indicated above, there have been virtually no complaints over this issue. Riders needing to make frequent transfers instead began to buy day passes—or even monthly passes—rather than paying full single ride fares for each boarding.

Constraints and Barriers

The major constraint on the successful implementation of OCTA's fare initiatives was the aforementioned lack of controls over the distribution of day passes. It was not until the agency procured new equipment that proper controls could be implemented.

Required Equipment and Technology

OCTA originally implemented its major initiative, the sale of day passes and elimination of transfers, without acquiring any new technology; however, there were administrative limitations with the manual procedure, as discussed above. However, with the subsequent procurement of new fareboxes, the agency was able to (1) shift the day pass from a paper instrument to a magnetic one and thus improve control and achieve the other types of benefits discussed above; and (2) shift monthly passes to a rolling, activate on first use basis.

Lessons Learned

Key lessons learned from the case study include the following:

- The sale of day passes onboard vehicles can effectively offset the loss of ridership—as well as complaints from riders—that would normally be expected with the elimination of free (or low-cost) transfers.
- The elimination of free (or low-cost) transfers can greatly reduce the incidence of rider-operator confrontations.
- Use of electronic fare technology can greatly improve an agency's ability to control operator distribution of day passes (i.e., to minimize abuse).

CASE STUDY CONTACTS

The following individuals were interviewed at OCTA headquarters (Orange, CA) as part of this case study:

James Ortner, Manager Transit Technical Services
OCTA
550 S. Main St.
Orange, CA 92863-1584
714-560-5579
jortner@octa.net

Dale Cole, Manager Accounting Operations
OCTA
550 S. Main St.
Orange, CA 92863-1584
714-560-5732
dcole@octa.net

Panel of six OCTA operators

CASE STUDY **10**

TRANSITCENTER (NEW YORK CITY)

Fare Program/Initiatives

Distribution of prepaid fare media for multiple agencies through employers: TransitChek® and Premium TransitChek®

INTRODUCTION

TransitCenter is a public benefit corporation operating in the New York City (NYC) region. It develops, markets, and operates programs to increase transit ridership through building fare media distribution relationships with employers.

TransitCenter distributes MetroCards®, for use with New York City Transit (NYCT) and affiliated transit operators that accept MetroCards. TransitCenter also distributes its original TransitChek® vouchers, accepted for fare media purchases by most transit operators in the greater NYC region (including operators in New York, New Jersey, southwestern Connecticut, and northeastern Pennsylvania).

TransitCenter offers some additional programs, although this case study focuses on the fare media distribution programs. These related efforts include the TransitLink transit information program, general transit advocacy to employers, and advice to other transit agencies nationwide about initiating similar programs.

TransitCenter has been instrumental in establishing practical methods for employees and employers to make use of the available transit tax benefit, and has also played a role in the success of the MetroCard program.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVE

The origins of TransitCenter date to 1984, with initial partnering efforts between transit agencies and employers. The nature and range of its programs have evolved considerably since then, but a driving force from the beginning has been the emergence and growth of the transit tax benefit. The evolution of the TransitCenter programs can be considered in three distinct stages:

- *Stage 1. Distribution of TransitChek vouchers:* The TransitCenter was founded essentially for providing vouchers to employers; these vouchers, then distributed to employees, could be used to purchase transit fare media from any transit agency in the region.
- *Stage 2. Distribution of MetroCards:* With the emergence of the NYMTA's MetroCard magnetic stripe farecard program, TransitCenter expanded into distributing MetroCards through employers as well.
- *Stage 3. Introduction of Premium TransitChek program:* To promote its programs to larger employers, the recently added Premium program allows employers to outsource to TransitCenter the distribution of TransitChek products.

This section provides an overview of the TransitCenter programs and how they have been developed and implemented.

Distribution of TransitChek Vouchers (1986–1996)

The initial impetus for the TransitChek vouchers program was the 1984 passage of a $15 transit tax benefit provision in the Federal Tax Code. Many employers were already providing free parking as a tax-free benefit to employees, and this measure was intended to help balance an inherent incentive for automobile commuting. Employers were now allowed to provide up to $15 per month for transit use as a tax-free benefit to each employee. The benefit was also exempt from payroll taxes for the employer. If the value of the benefit exceeded $15 per month, the entire amount of the benefit would be considered taxable income.

Many employers expressed initial reluctance to provide the benefit. It was necessary to show that the employee was using the benefit for transit, so the options were:

- Reimburse employees for documented transit expenses. The employee would submit a receipt for purchasing a

transit pass or tokens, and the employer would reimburse up to $15. This represented an ongoing administrative expense for the employer and was cumbersome for the employee as well.
- Sell the transit passes or tokens to the employees. If the monthly cost exceeded $15, the employer would cover $15 as a tax-free benefit and have the employee pay for the remainder through a payroll deduction. While more streamlined administratively, employers still had the burden of determining each month how many fare media of each type to purchase from each transit agency in the region.

In 1984, the Port Authority of New York and New Jersey (PANYNJ) established the Employer Liaison Transportation office (ELTO) to work with employers on addressing such issues as participating in the transit tax benefit program. In addition to operating a transit service (i.e., Port Authority Trans-Hudson—PATH—trains), PANYNJ, being a bi-state agency, would represent NJ Transit (NJT) and the NY Metropolitan Transportation Authority (MTA)—which comprises NYCT, Long Island Rail Road (LIRR), Metro-North Commuter Railroad (MNCR), and Long Island Bus3—in dealing with employers from both states.

Employers indicated the greatest interest in distributing vouchers, which employees could then use to purchase fare media from any agency in the region. A voucher system operates as shown in Figure CS10-1. Employers purchase the vouchers, and the voucher provider sets the funds aside. Transit agencies accept a voucher as if it were a check from the voucher seller. Like a check, the voucher is then turned in by the agency for reimbursement. A voucher scheme simplifies administration, since employers no longer need to deal with multiple transit agencies to purchase and distribute multiple fare media types. Since the use of vouchers was not explicitly enabled under the original 1984 Federal Tax Code provisions, a clarification was added through 1986 Federal legislation.

In 1986, PANYNJ, MTA and NJT agreed to jointly create and fund a new organization—TransitCenter—to promote transit to employers and operate a voucher scheme.

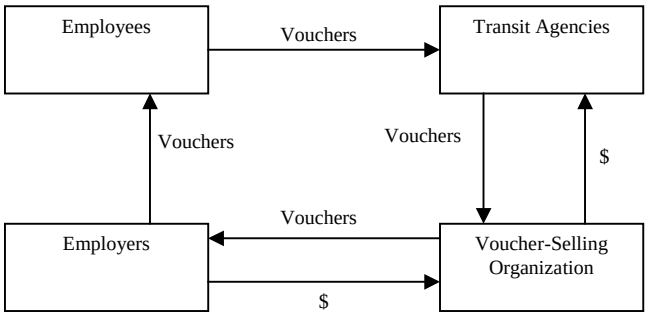


Figure CS10-1. Original transit benefit vouchers scheme.

TransitCenter acquired additional seed funding from the FTA as a two-year demonstration program. TransitCenter was established organizationally as an operating division of the PANYNJ. Various facilities and support services were therefore provided by PANYNJ, which helped minimize initial operating costs.

TransitCenter's governing Board of Trustees had representatives from the three founding transit agencies, private bus operators in NY and NJ, the NYC Department of Transportation, and the NY Chamber of Commerce and Industry. The last representation was particularly important, making TransitCenter a joint operation between the transit agencies and employers.

The transit voucher program was launched as TransitChek in 1987. PANYNJ hired contractors on behalf of TransitCenter to operate and market TransitChek. The initial TransitChek voucher was offered in a single $15 denomination. Later, increases in the maximum tax benefit led to introducing additional TransitChek denominations:

- 1991. The benefit cap was increased to $21. TransitChek was offered in both $15 and $21 denominations beginning in 1992.
- 1993. The benefit cap was increased to $60. In addition, the tax benefit for parking was capped—for the first time—at $155. TransitCenter added a $30 denomination and phased out the $21 denomination.

The program charged a fee to employers for voucher purchases from the outset. This fee structure evolved through the early years of the program, but has always incorporated a fixed shipping charge per order coupled with a variable per voucher charge, as summarized in Table CS10-1. The 1989 fee structure change involved switching to a "volume discount" strategy. The 1993 pricing change (which remains in place today) coincided with the 1992 introduction of multiple voucher denominations.

Distribution of MetroCard (1997–2001)

By 1997, TransitCenter had achieved revenue self-sufficiency. Two important changes in the TransitChek program during this period helped support continuing growth:

- Further legislative enhancements to the transit tax benefit program.
- Direct distribution of fare media for the new NYCT MetroCard program.

Beginning in 1998, further federal legislation expanded the transit tax benefit once again. The monthly cap increased to $65, and, for the first time, it was no longer mandatory that the employer fund the entire benefit. The employee could also fund the benefit through monthly payroll deduction, with the

TABLE CS10-1 Evolution of the TransitChek fee structure

Period	Fixed Shipping Charge	Per Voucher Charge
1987-88	• 12-50 vouchers: $11 • 50+ vouchers: $20	• Unseparated in sheets of 3: $0 • Separated: $0.08
1989-92	• $10	• 12-35: $0.75 • 36-100: $0.60 • 101-750: $0.45 • 750+: $0.30
1993-present	• $12	• 4 percent of value

deducted amounted treated as pretax income. Alternatively, the funds could come from a combination of employee-funded payroll deduction and employer-funded fringe benefits. However the benefit was provided, the employee and the employer were exempted from income and payroll taxes, respectively. In conjunction with this change, TransitCenter introduced a $35 voucher denomination to complement the $15 and $30 denominations.

NYCT began implementing the MetroCard automated fare collection system on a limited basis in 1994, and systemwide implementation for subway and bus was completed in 1997. MetroCard is a magnetic stripe farecard. The cards can be loaded with either stored value or a rolling pass (1, 7 or 30 days). The rider swipes the card when entering the subway or inserts the card on boarding a bus to have the fare deducted from the card balance or to indicate that the card carries a valid pass.

MetroCard was initially provided only in stored value mode, but its usage began to grow significantly in the late 1990s, once the card could be used systemwide and after several pricing innovations were introduced. These included free transfers between bus and subway, a 10 percent bonus on loads of at least $15, and the aforementioned unlimited ride passes.

MetroCards are distributed and revalued at subway stations by token booth clerks and automated vending machines. A factor limiting MetroCard market penetration is that many bus users are not subway users and thus do not find it convenient to revalue at subway stations. Third-party distribution of MetroCards is an important part of the NYCT strategy. One such distribution channel is the sale of pre-encoded MetroCards through retailers. NYCT typically pays such distributors a commission of about 3 percent. TransitCenter arranged with NYCT in 1997 to offer an additional distribution channel, through employers that participate in the TransitChek program.

TransitCenter distributes distinctive MetroCards, carrying both the MetroCard and TransitChek logos. TransitChek stored value MetroCards were originally offered in $15, $30 and $35 denominations, matching the denominations of TransitChek vouchers. Later, when NYCT introduced unlimited ride MetroCard passes, these were also distributed through TransitChek, in $17 (valid for 7 days from first use) and $63 (valid for 30 days from first use) denominations. The TransitChek stored value MetroCards were modified as well when NYCT introduced the 10 percent bonus (e.g., the $15 card carries $16.50 stored value), and were then referred to as "bonus value cards."

In January 2001, TransitCenter was spun off as an independent public-benefit corporation and is thus no longer an operating division of PANYNJ.

Introduction of Premium TransitChek Program (2002)

Since the beginning of 2002, two major changes suggest that the TransitCenter initiative is entering a third significant stage in its development:

- The maximum monthly value of the transit tax benefit increased to $100. At this point, a $50 TransitChek voucher denomination was added.
- The Premium TransitChek program was initiated, aiming to attract more large employers to TransitChek.

A pilot program was initiated with the NYC government in 2000 to distribute TransitChek to some of its unionized employees under a program known to the employees as TransitBenefit. After some expansion of the pilot program, it was made available in June 2002 to any interested employer. By the general launch, the Premium program had enrolled about 30,000 NYC employees and a few thousand employees from other employers.

From the employee perspective, the Premium TransitChek MetroCard is an unlimited ride MetroCard that is issued only once per year. The Premium TransitChek MetroCard remains valid as long as the corresponding $63 per month payroll deduction remains in place.

The card has a serial number, and a lost or stolen card will be voided and replaced.

From the employer perspective, the Premium program relieves any responsibilities for purchase of TransitCheks or distribution to employees. Once the payroll deduction is set up, TransitCenter takes care of issuing the card directly to the employee annually. The cost to the employer increases to 5 percent for the Premium program. Alternative arrangements are available for employees who use transit agencies other than NYCT and are thus unable to use MetroCard:

- Employees with ticket-by-mail accounts receive their passes by mail each month from the transit agency, typically paying by pre-authorized credit card. Under the Premium program, these employees can have TransitCenter credit their payroll deductions to their ticket-by-mail accounts each month. Transit agencies in the region offering ticket-by-mail arrangements include LIRR, MNCR, NJT, and PATH.
- Employees without ticket-by-mail arrangements can have TransitCenter periodically send them TransitChek vouchers in bulk by mail.

RESULTS AND IMPACTS OF FARE INITIATIVES

This section reviews TransitCenter's growth over the years and the resulting impact on funding requirements. The most significant change in the latter was the transition, over a ten-year period, from predominantly outside funding to self-sufficiency through program revenues. Initially, funding was almost entirely based on grants from transit operators and government agencies, as well as some private sector in-kind support; over time, however, the contribution of revenue from TransitCenter's programs increased considerably.

According to a marketing study completed for TransitCenter in 1994, the TransitChek program showed a steady annual growth rate in sales revenue between 1987 and 1992 of about 25 percent to 35 percent. The substantial increase in the maximum benefit in 1993—from $21 to $60 per month—accelerated these increases. In 1993, sales revenue increased 200 percent over 1992. Comparing the 1986–87 inaugural operating budget with that for 1993–94 shows an increase from about $2 million to about $6.3 million, with the share generated by TransitCenter programs increasing from 0 percent to about 53 percent. As this growth trend continued, TransitCenter was able to achieve self-sufficiency—with no further funding required from government or transit agencies—by 1997.

In general, TransitCenter has found that program revenue growth occurs through (1) increases in the number of participating employers and (2) gradual increases in the number of participating employees at a given employer over a 3–5 year period (i.e., due to "word of mouth"). However, a 1997 Audit Report from the Office of the New York State Comptroller (tracking the TransitChek program between 1992 and 1995) indicated that new enrollees actually dropped, from 1,579 employers in 1993 to 1,089 employers in 1995. While the increase in the maximum monthly benefit from $21 to $60 in 1993 had made the TransitChek program much more attractive to employees, the ability to attract new employers into the program was limited by the fact that only the employer could fund the benefit. The additional flexibility incorporated into the transit tax benefit in 1998—allowing the employee to contribute as well—helped address this issue.

The 1998 tax benefit change, coupled with the introduction of MetroCard distribution in 1997, led to an acceleration of the growth of the TransitChek program. Over the first decade of the program, enrollment reached roughly 100,000 employees. Since 1997, though, enrollment in TransitCenter programs has grown to around 350,000 employees—representing over 14,000 employers. The current growth rate is about 25,000 employees—and about 2,000 employers—per year.

Much of the participation in the TransitChek programs comes from smaller employers, however, and TransitCenter has been concerned for years with the reluctance of larger employers to participate—despite substantial marketing efforts targeting these organizations. The marketing report completed for TransitChek in 1994 revealed that 80 percent of the participating employers had 25 employees or fewer. This is despite provisions of the 1990 Clean Air Act Amendments, which require employers with 100 or more employees to develop a program to significantly reduce single vehicle occupancy commuting. TransitCenter had been marketing to larger employers on this basis.

Discussions with larger employers have long revealed that the administrative time needed for purchasing TransitChek MetroCards and vouchers and then distributing them to employees was considered an impediment. While a smaller firm simply has one or more existing employees cover these needs informally as an adjunct to their normal workloads, the perception in larger firms has been that dedicated staff and changes to administrative procedures would be needed. The Premium TransitChek program has been developed largely to respond to these issues. TransitCenter hopes that it will significantly improve TransitChek market penetration with larger employers.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

The TransitChek program has two types of benefits for transit customers in the NYC region:

- For NYCT riders, the availability of MetroCard transit fare media through employers has increased, which is

more convenient than purchasing MetroCards directly from NYCT.
- For riders with all transit agencies in the region, TransitChek has provided practical mechanisms to increase the number of employers making the transit tax benefit available. The resulting employee tax savings have offset transit commuting costs.

To illustrate typical employee tax savings, Table CS10-2 offers an example from the TransitCenter website (*19*), demonstrating how a typical NYC commuter's take-home pay might effectively be increased by about four hundred dollars per year.

Agency Impacts and Benefits

TransitChek has two types of benefits for participating transit agencies:

- Enhanced market penetration for fare media distribution through employers.
- Improved commuting modal share for transit.

The $400 annual income tax saving discussed above was achieved by spending $1,200 per year on transit. Employees who need to increase their annual transit expenditure to take full advantage of the transit tax benefit will likely seek to decrease nontransit travel expenses to compensate. This increases transit ridership, in particular for those switching to a monthly pass. Survey results from the 1994 marketing report completed for TransitCenter indicated increases in reported annual transit trips as shown in Table CS10-3.

With regard to agency costs, TransitCenter would not reveal the specific terms of its MetroCard distribution arrangement with NYCT but indicated that its commission is less than the 3 percent commission NYCT pays to retail distributors. (The commission paid by NYCT supplements the regular fees TransitCenter receives from employers for these MetroCards.) NYCT also benefits from TransitCenter bearing the costs of card production and distribution.

The transit agencies made substantial financial investments in TransitCenter until it became financially self-sufficient in 1997. Table CS10-4 shows the order of magnitude of these contributions for the inaugural 1986–87 budget and for the 1993–94 budget.

TABLE CS10-2 Sample of annual employee tax savings

	Without Pretax TransitChek	With Pretax TransitChek
Annual Salary	$48,000	$48,000
Pretax TransitChek Deduction	$0	-$1,200
Salary Subject to Payroll Taxes	$48,000	$46,800
Payroll Taxes (35 percent)	-$16,800	-$16,380
Annual Transit Expense	-$1,200	$0
Take-home Pay	$30,000	$30,420

TABLE CS10-3 Reported increases in transit trip making

Changes in Transit Usage	Work Trips	Nonwork Trips
Use transit more often	11 percent	15 percent
Average claimed additional annual trips	139.2	104.4

TABLE CS10-4 Contributions to sample TransitCenter budgets

Budget	MTA, NJT, PATH	Federal/State Government	Total
1986-87	$354,800	$3,509,000	$3,863,800
1993-94	$1,500,000	$1,430,000	$2,930,000

Impacts and Benefits for Partner Entities

Before the TransitChek program, many employers were reluctant to distribute fare media to employees because of the administrative impacts. Prepaid fare media differed for each transit agency and had to be issued every month. Employers that did not canvass their employees each month on the fare media needed would have to purchase a variety and then return those not needed. Even when the employer knew the exact mix of fare media required, it was still often necessary to purchase from multiple transit agencies. TransitChek has addressed these issues.

Employers have an incentive to participate based on the payroll tax savings available. To illustrate typical employer payroll tax savings, Table CS10-5 offers an example from the TransitCenter website (*19*), demonstrating how two hypothetical employers could see substantial net savings.

Liability to Agency

The transit agencies do not risk losing revenue through the TransitChek program, since TransitChek is used to purchase each agency's own fare media.

Constraints and Barriers

The primary barrier faced by TransitCenter has been its limited ability to attract participation from larger employers, as discussed earlier. TransitCenter seeks to address this issue through the introduction of the Premium TransitChek program, allowing employers to substantially outsource the purchase and distribution of transit fare media to employees.

With regard to funding, TransitCenter was fortunate in being supported for its first decade—i.e., until it reached a point at which it could sustain itself through its own revenues—through contributions from the three major transit agencies in the region, as well as from the federal and state government.

Required Equipment and Technology

The TransitChek program requires no new equipment or technology on the part of the participating transit agencies. Some agencies opted to purchase devices for their fare media sales locations so their sales clerks could examine anti-counterfeit security features built into the vouchers.

The TransitChek program itself requires considerable equipment and technology for the fulfillment of the fare media orders. These requirements have increased with the introduction of Premium TransitChek. Individual cards must now be sent directly to customers in addition to the established need to send bulk fare media orders to employers. From the outset, TransitCenter has responded to this challenge by outsourcing these technology-intensive aspects of its operation to private-sector fulfillment contractors that were already equipped for this role.

Another technology development has been the introduction in recent years of electronic commerce for fare media orders through the Internet. TransitCenter now has two Information Technology staff to support this aspect of its operations.

Lessons Learned

Key lessons learned from the development and evolution of TransitCenter and its programs include the following:

- It was important that the program be separate from the day-to-day operations of any one transit agency, especially in a case like TransitCenter, where there was a need to represent multiple agencies to the employers.
- It was important to charge a processing fee to employers from the start. This provided a mechanism for moving towards financial self-sufficiency within a reasonable period, and it also avoided the difficulty of introducing a fee to employers later (i.e., after a no-fee precedent had been established).
- A dedicated marketing/sales group and extensive use of marketing campaigns have been essential in understanding the needs of different employer categories and in marketing to both employers and employees.
- A key to acceptance of TransitCenter's initiatives by the agencies and employers was the development of the initial TransitChek program as a partnership between the transit agencies and organizations representing employers in the region.

TABLE CS10-5 Samples of annual employer cost savings

Number of Employees	Annual Payroll	Annual TransitChek Purchases	Annual TransitChek Cost (based on 4 percent commission)	Company Tax Savings	Net Savings
100	$2,200,000	$120,000	$4,800	$10,400	$5,600
100	$4,400,000	$120,000	$4,800	$9,700	$4,900

CASE STUDY CONTACTS AND SOURCES

The following individual was interviewed at TransitCenter headquarters (NYC) as part of this case study:

Larry Filler, President and CEO
TransitCenter, Inc.
1065 Avenue of the Americas, 16th Floor
New York, NY 10018
212-329-2032
212-719-1822 (fax)
lfiller@transitcenter.com

The following documents were used in preparing the case study:

Volpe National Transportation Systems Center, *TransitChek in the New York City and Philadelphia Regions*. Prepared for the Federal Transit Administration, 1994.

Office of the New York State Comptroller, *Report 96-S-8, Port Authority of New York and New Jersey: Administration of the TransitChek Program*. 1996.

Charles River Associates, *The TransitChek Program, 1994: A Summary of the Results of Participating Employers and Employees*. Prepared for TransitCenter, January 1995.

CASE STUDY **11**

TRI-COUNTY METROPOLITAN TRANSPORTATION DISTRICT

Fare Program/Initiatives

Annual employer pass program
Short-term (6-hour) pass

INTRODUCTION

The Tri-County Metropolitan Transportation District of Oregon (Tri-Met) is a municipal corporation that provides public transportation for much of the three counties in the Portland, Oregon, metropolitan area. Tri-met operates a 38-mile light rail line (MAX), 97 bus routes and services for seniors and persons with disabilities. It has also entered into partnerships to provide innovative services. Tri-Met operates a total of 701 buses serving 8,435 bus stops, as well as 78 light rail vehicles serving 54 stations (FY 2001). An additional 186 buses provide door-to-door paratransit service. Total system ridership (FY 2001) was approximately 84.3 million boardings, a 3.8 percent increase over the prior year.

For general fare purposes, the Tri-Met district is divided into three concentric zones. Most fares and passes are sold as valid either for any two zones or for all zones (e.g., a 1-month-two-zone pass for $45 or a 1-month-all-zone pass for $56). Day Tickets, the 6-hour QuikTiks, and special fare media (e.g., Event Fares and Convention Pass Fares) are only sold as valid for all zones.

This case study reviews two distinct Tri-Met fare initiatives:

- The PASSport annual employer pass program
- The QuikTik short-term pass

The PASSport program is Tri-Met's principal annual pass program for employers and is part of a package of programs that Tri-Met offers to employers. There is also a related college PASSport program. The QuikTik is a special 6-hour, all zone pass.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

PASSport Program

The PASSport program is the centerpiece of a set of programs that Tri-Met has designed for employers. This program allows an employer to provide an all-zone annual pass at a reduced rate per employee to all qualified employees. The pass itself consists of the employee's photo identification card with a Tri-Met validation sticker.

In the early 1960s, employers generally had not been supportive of Tri-Met. This was due, in part, to the fact that Tri-Met is partially funded by a payroll tax on employers. Thus, they already saw themselves as paying for Tri-Met service, and it was difficult for Tri-Met staff to convince them to take further efforts to support transit. In 1996, the Oregon Department of Environmental Quality (DEQ) implemented the Employee Commute Options (ECO) Rule in order to improve regional air quality. This rule asks Portland metropolitan area employers that employ over 50 people at any single work site to reduce employee auto trips by 10 percent or more over three years. Employers are to implement programs that encourage employees to use alternatives to driving alone and must conduct annual surveys to identify how employees commute to work.

Tri-Met perceived the ECO rule as an excellent opportunity to increase ridership, revenue, and public support by building better relationships with employers and offering new pass programs. Tri-Met began by offering employers general assistance in complying with the ECO Rule, including assistance in understanding the requirements of the rule and developing a plan for reducing employee trips, as well as actually conducting and analyzing the employee surveys, all at no cost to the employer. Tri-Met also developed new employer pass programs, including PASSport, designed to simplify the process of providing transit incentives for employers.

In developing the PASSport program, Tri-Met began by looking for similar programs around the country and identified three: (1) Denver RTD's EcoPass and university passes in (2) Eugene, Oregon (University of Oregon) and (3) Seattle, Washington (University of Washington). These programs took two basic approaches to pricing the pass: RTD divided

the city into a set of zones and set a flat price in each zone, while the universities priced their passes based on actual transit use. Tri-Met decided to implement two separate experimental projects, one using each pricing scheme. The flat rate experiment was implemented in the Lloyd District, an area east of downtown that includes the Convention Center, Lloyd Center (a large shopping mall), and many hotels and offices. To support the PASSport program, and transit generally, the Lloyd District eliminated free on-street parking when the PASSport program was introduced.

The other PASSport experimental program started by using the ECO Rule survey data to establish 14 zones within which average mode splits were similar. Some of the zones included two or more discrete areas within the region, with the result that the map of the PASSport fare zones divided the region into a total of 26 different areas. Within each zone, Tri-Met defined a set of 7 ranges of transit mode splits and established a separate price for each range, creating a matrix of 98 possible prices for a company. The price matrix is presented as Table CS11-1.

Tri-Met's efforts to assist employers in complying with the ECO Rule were successful in convincing many employers to support Tri-Met. The PASSport program itself also met with considerable support, especially once the Oregon DEQ ruled that adopting a PASSport program is prima facie evidence of compliance with the ECO Rule. However, the PASSport pricing matrix proved unsatisfactory. Employers complained that it was confusing and that the steps were inequitable since they made some small changes in mode split significantly more important, and expensive, than others. Equity concerns were also raised regarding the boundaries of the fare zones, since the specific lines were generally arbitrary. Tri-Met also found that over time too many companies were ending up in step 7, with mode splits significantly above average. Such companies were paying less, in some cases much less, per employee actually using transit than companies in the lower steps, contributing further to the appearance of inequity and thus reducing Tri-Met's potential revenue.

To alleviate these concerns, Tri-Met has decided to convert the PASSport program to a price per employee based solely on the transit mode split at each company and the price of the all-zone pass ($615, as of mid-2002). Despite concerns that it is underpriced compared to the rest of the Tri-Met district, the Lloyd District will continue to have its separate flat rate program because of the additional efforts it has made to increase transit use. The airport will also have a flat rate zone to address its own transportation concerns.

One of the primary goals for Tri-Met's PASSport program is to be revenue-neutral. At many agencies, being revenue-neutral implies that no revenue is lost on the program. In other words, if the agency was collecting $200,000 in revenue from commuters before implementation of the program, it is not collecting less than $200,000 after implementation, even though each commuter is paying less for a transit pass. The reason revenues may not decrease is that under the program, a pass is purchased for every employee at a company, even those who do not ride transit, whereas prior to the program only transit riders would have purchased passes.

However, Tri-Met's definition of revenue neutrality differs in that it does not consider revenue prior to program implementation as the initial comparison point. Rather, the agency considers the program to be revenue neutral if it is collecting the same amount of revenue from PASSport participants as it would have been collecting had all of the current riders been purchasing regular monthly passes. In other words, the companies should be paying full price for all employees who are actually riding (since the price is based on actual ridership). This concept is what determines the different price levels.

Tri-Met allows employers to charge employees for passes, up to the price per pass paid by the employer. Tri-Met also assists employers that do not have photo ID badges to produce such badges and affix the annual validation stickers.

It is interesting to note that both Tri-Met and King County Metro have similar programs in which employers purchase passes for all employees, and that both agencies have recently changed their pricing mechanisms to simplify their programs. Metro moved from pricing companies based on their individual transit mode splits to pricing companies based on geographic zones and a zone-wide average transit mode split. Tri-Met moved from using a combination of geographic zones, zone-wide average transit mode splits, and individual transit mode splits to just using the transit mode split of each individual company. A principal reason for this is the availability of data on the transit mode split of each company. Tri-Met uses a survey that companies with 50 or more employees are required by DEQ rule to conduct each year. In King County, only companies with more than 100 employees must do a survey, and that survey is only required every other year. Metro therefore found it had to conduct its own surveys at least every other year.

The results and impacts of the PASSport program are discussed below.

QuikTik

QuikTik is a 6-hour ticket that is valid for all zones. It is priced at $3, a significant discount from the $4 all zone Day Ticket, and a slight discount from the $3.10 it would cost for a single all zone round trip paying the cash fare. Like the Day Ticket, QuikTik is sold at the light rail TVMs and on board buses. Drivers use standard paper transfers to represent both the QuikTik and the Day Ticket: the QuikTik is essentially a 6-hour transfer (compared with the normal 1-hour free transfer), and the Day Ticket is punched as an all-day transfer.

QuikTik was implemented in September 2001 and was designed to serve people who generally do not use transit but might be willing to use it for going to an event, a show, or

TABLE CS11-1 PASSport pricing matrix

PASSport Zone		Pricing Cell						
		1	2	3	4	5	6	7
A	Comp.* Mode Split	0-0.6 percent	0.7-1.1 percent	1.2-1.7 percent	1.8-2.3 percent	2.4-2.8 percent	2.9-3.4 percent	3.5-100 percent
	Price / Employee	$10	$10	$10	$13	$16	$19	$21
B	Comp. Mode Split	0-0.7 percent	0.8-1.5 percent	1.6-2.2 percent	2.3-2.9 percent	3.0-3.7 percent	3.8-4.4 percent	4.5-100 percent
	Price / Employee	$10	$10	$12	$17	$21	$25	$27
C	Comp. Mode Split	0-1.0 percent	1.1-2.0 percent	2.1-3.0 percent	3.1-3.9 percent	4.0-4.9 percent	5.0-6.2 percent	6.3-100 percent
	Price / Employee	$10	$10	$16	$22	$28	$34	$35
D	Comp. Mode Split	0-1.2 percent	1.3-2.5 percent	2.6-3.7 percent	3.8-4.9 percent	5.0-6.2 percent	6.3-7.4 percent	7.5-100 percent
	Price / Employee	$10	$13	$20	$28	$35	$42	$44
E	Comp. Mode Split	0-1.4 percent	1.5-2.7 percent	2.8-4.1 percent	4.2-5.4 percent	5.5-6.8 percent	6.9-8.2 percent	8.3-100 percent
	Price / Employee	$10	$14	$22	$30	$38	$46	$49
F	Comp. Mode Split	0-1.4 percent	1.5-2.9 percent	3.0-4.3 percent	4.4-5.8 percent	5.9-7.2 percent	7.3-8.7 percent	8.8-100 percent
	Price / Employee	$10	$15	$24	$32	$41	$49	$52
G	Comp. Mode Split	0-1.7 percent	1.8-3.3 percent	3.4-5.0 percent	5.1-6.6 percent	6.7-8.3 percent	8.4-10.3 percent	10.4-100 percent
	Price / Employee	$10	$17	$27	$37	$46	$56	$59
H	Comp. Mode Split	0-2.1 percent	2.2-4.1 percent	4.2-6.2 percent	6.3-8.3 percent	8.4-10.3 percent	10.4-12.4 percent	12.5-100 percent
	Price / Employee	$10	$22	$34	$46	$58	$70	$74
I	Comp. Mode Split	0-2.3 percent	2.4-4.6 percent	4.7-6.8 percent	6.9-9.1 percent	9.2-11.4 percent	11.5-13.7 percent	13.8-100 percent
	Price / Employee	$10	$24	$37	$51	$64	$77	$81
J	Comp. Mode Split	0-2.5 percent	2.6-5.0 percent	5.1-7.5 percent	7.6-9.9 percent	10.0-12.4 percent	12.5-14.9 percent	15.0-100 percent
	Price / Employee	$11	$26	$41	$56	$70	$85	$89
LRT	Comp. Mode Split	0-3.1 percent	3.2-6.2 percent	6.3-9.3 percent	9.4-12.4 percent	12.5-15.5 percent	15.6-18.7 percent	18.8-100 percent
	Price / Employee	$14	$32	$51	$70	$87	$106	$111
Marquam Hill	Comp. Mode Split	0-6.7 percent	6.8-13.4 percent	13.5-20.1 percent	20.2-26.8 percent	26.9-33.5 percent	33.6-40.2 percent	40.3-100 percent
	Price / Employee	$30	$69	$109	$149	$188	$228	$238
Lloyd District	Comp. Mode Split	0-7.2 percent	7.3-14.3 percent	14.4-21.5 percent	21.6-28.6 percent	28.7-35.8 percent	35.9-42.9 percent	43.0-100 percent
	Price / Employee	$32	$74	$116	$160	$201	$243	$254
CBD	Comp. Mode Split	0-10.2 percent	10.3-20.4 percent	20.5-30.6 percent	30.7-40.8 percent	40.9-51.0 percent	51.1-61.2 percent	61.3-100 percent
	Price / Employee	$45	$106	$166	$228	$286	$346	$362

* Comp. – Comprehensive.

shopping. The intent was to make travel simpler for the rider, with only one transaction to pay fares and no need for the rider to carry change (hence the "round figure" of $3). Tri-Met has been marketing the QuikTik quite heavily, focusing on riders traveling to social or recreational destinations, primarily during the off-peak. Tri-Met's goal is to increase ridership among these infrequent riders, with a longer-term impact of increasing revenue.

RESULTS AND IMPACTS OF FARE INITIATIVES

PASSport Program

Ridership and Revenue Impacts and Customer Impacts and Benefits

Currently (2002) there are 210 business participating in the PASSport program, providing coverage for 58,929 employees. PASSport passes account for 7.6 percent of all trips taken on Tri-Met. Transit commuting at each participating company is estimated in its ECO rule survey; these have shown an increase in transit ridership at participating companies. An analysis of the program in 1999 indicated that there was a 57 percent increase in transit commute trips at participating companies after the first year of the program; the increase since then has not yet been calculated.

Since revenue under the general PASSport program is based on actual transit commute ridership at participating companies and this has increased, the PASSport program has resulted in increased revenue. However, no analysis has been conducted to estimate this increased revenue as of yet. Tri-Met staff consider the Lloyd District pass to be underpriced, relative to the general PASSport program, and therefore feel that it likely has a slight negative revenue impact on Tri-Met. As part of implementing the PASSport program, the Lloyd District implemented significant measures—including the elimination of free, on-street parking—that encourage the use of transit for travel to the District, even by those who do not have a PASSport. The overall revenue impact to Tri-Met of the Lloyd District PASSport in particular is therefore unclear.

Riders who receive a PASSport pass experience a significant reduction in the cost of travel by transit, even if the employer requires some type of payment by the employee. As indicated earlier, the per employee price for an annual all-zone pass reaches a maximum of $362, as compared to the regular Tri-Met annual all-zone pass price of $615. These riders also get the convenience of an annual pass.

Employers participating in the PASSport program automatically comply with the DEQ ECO Rule. Companies also have found these passes to be effective tools for employee recruitment and retention. Finally, employers subsidizing the pass may be eligible for the Oregon Business Energy Tax Credit for up to 35 percent of its subsidy expense.

Administrative Impacts and Issues

Administration of the PASSport program is handled primarily by four Tri-Met sales representatives and an administrative assistant. Part of one manager's time is devoted to directly overseeing the program, and a small portion of the time of several other staff members is devoted to supporting or overseeing the program.

PASSport has had little impact on the day-to-day use of cash on Tri-Met, as most of the riders either previously used passes or are new to Tri-Met. Staff does believe that PASSport has led to a reduction in the use of cash and tickets on trips to and from major events, facilitating faster boardings and better on-time performance at these times.

Tri-Met does not feel that there is significant fraud associated with PASSport passes, although there is some abuse: on the order of five or six individuals are caught each year misusing a PASSport pass or with a forgery.

QuikTik

Ridership and Revenue Impacts and Customer Benefits

QuikTik boardings are not recorded as a distinct fare category. Therefore, the only data on usage comes from a single onboard survey on fare use. This survey showed that QuikTik accounts for approximately 0.4 percent of all trips taken on Tri-Met. There has been little change in Day Ticket sales since the introduction of QuikTik, while all-zone cash and ticket fares have fallen from 10 percent to 9.6 percent of all trips taken on Tri-Met. There is therefore no evidence to date that QuikTik has increased ridership. The QuikTik is priced 3.2 percent less than the round trip cost using all-zone cash prices ($3.00 compared with $3.10) and the same amount greater than the round trip cost using all-zone discounted advance purchase tickets ($3.00 compared with $2.90). Considering the small use currently made of QuikTik, it appears to have resulted in no significant change in Tri-Met's revenue.

Riders previously paying the all-zone cash fare (including tickets purchased at TVMs) are saving a small amount using the QuikTik. In addition, there is an increase in convenience in that they only need to make one fare transaction. This can be a substantial benefit for trips to events where there can be a large number of individuals attempting to use TVMs immediately after the event ends.

Administrative Impacts and Issues

Since QuikTiks are represented by Tri-Met's standard paper transfers, they have not added any administration cost.

Drivers dislike QuikTiks, though, since the driver selling the QuikTik has to reposition the cutting bar on the transfers to issue the single QuikTik and then reposition it again to issue additional transfers. Drivers complain that this can slow down the boarding process.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

PASSport appears to have significantly benefited Tri-Met's riders at the participating sites as follows:

- Provides more convenient fare payment, utilizing employee IDs and stickers that are valid for a full year.
- Reduces the cost of travel for participating riders.

QuikTik offers convenience for riders making multiple trips during a period less than a full day, and has generally been well received.

Agency Impacts and Benefits

The PASSport has had a generally positive impact on Tri-Met, including the following:

- Increases in both ridership and revenue.
- Reduced use of cash on trips to and from special events.
- Improved service reliability on trips to and from special events.

QuikTik has had little impact on Tri-Met to-date. There is no evidence that is has significantly impacted ridership or revenue, as it represents a very small portion of Tri-Met's ridership. The program has resulted in some dissatisfaction among operators, as it requires additional effort to issue.

Impacts and Benefits for Partner Entities

The PASSport program impacts and benefits for employers were as follows:

- Helps them address Oregon DEQ's ECO Rule requirements.
- Facilitates distribution of commute benefits to employees at a lower administrative cost than in a regular monthly pass program—because it is an annual program.
- Encourages employees to use commute alternatives as opposed to driving alone, and therefore may allow employers to reduce the amount of parking required.

Liability to Agency

Employers are required to make quarterly payments to Tri-Met under the PASSport program, and Tri-Met has had some difficulty collecting timely payments from some employers. The quarterly payments raise Tri-Met's risk compared with traditional monthly pass programs, since the amount of money in each payment is increased and Tri-Met's leverage is decreased; with monthly passes, Tri-Met can refuse to provide the next month's passes until the employer has paid for the previous month's passes.

Fraud with the PASSport passes was originally a concern, but use of employee photo IDs appears to have addressed that concern. No significant fraud has been detected regarding the PASSport program.

Finally, according to Tri-Met, a significant issue in establishing the pricing scheme has been social equity; there has been concern that commuters not pay less for transit passes than other transit riders (such as low-income riders). This has been an issue in the agency's definition of revenue neutrality and one of the reasons the pricing has been set up so as to ensure that companies are paying full price for transit riders.

The QuikTik does not present any special liability risks to Tri-Met.

Constraints and Barriers

The establishment of the PASSport program has involved development of agreements between Tri-Met and employers. These agreements are standardized and utilize pricing based on a survey required by the Oregon DEQ. Moreover, the PASSport program grew out of the Oregon DEQ's ECO Rule. This allowed Tri-Met to move from being seen as almost an opponent by employers (since it is funded by a payroll tax) to being a partner in meeting the obligations imposed by the Eco Rule.

Required Equipment and Technology

No special equipment or technology has been required for either program. Tri-Met's TVMs did need to be reprogrammed to issue the QuikTik. These TVMs are only able to issue a limited number of different fare media, and were only able to be reprogrammed because Tri-Met had eliminated one of its original fare media several years ago.

Lessons Learned

Finally, key lessons learned from the case study include the following:

- When a transit agency can assist employers in meeting commute reduction rules imposed by other government agencies, it can dramatically change the relationship between the employers and the agency. Providing assistance to employers in complying with the ECO Rule opened the employers' doors to PASSport and Tri-Met's other transit offerings. A key factor has been that Tri-Met has minimized the employer's administrative requirements to implement these programs, making them as simple as possible for the employer.
- Including actual transit mode share as a key element in the pricing of an annual pass can allow an agency to increase revenue from the employers while also increasing ridership among the pass recipients.
- QuikTik has shown that there is a niche for multihour (but less than full-day) passes. It appears that these may provide a particular benefit to the agency when they are marketed for trips to special events, simplifying the sale of fare media and the loading of buses following the event.

CASE STUDY CONTACTS AND SOURCES

The following individuals were interviewed at Tri-Met headquarters (Portland) as part of this case study:

Kathryn Coffel
Director of Marketing Information
Tri-County Metropolitan Transportation District of Oregon
4012 S.E. 17th Avenue
Portland, OR 97202
503-238-7433
COFFELK@tri-met.org

Tom Strader, Senior Research Analyst
Tri-County Metropolitan Transportation District of Oregon
4012 S.E. 17th Avenue
Portland, OR 97202
503-238-7433
STRADERT@tri-met.org

Rhonda Danielson, Advertising and Marketing Manager
Tri-County Metropolitan Transportation District of Oregon
4012 S.E. 17th Avenue
Portland, OR 97202
503-238-7433

The following document (in addition to ridership and revenue summaries and other sales and operational data, contracts and pricing guidelines) was used in preparing the case study:

Tri-Met, Tri-Met Programs for Employers no date.

CASE STUDY **12**

VENTURA COUNTY TRANSPORTATION COMMISSION

Fare Program/Initiatives

Implementation of integrated regional farecard system

Development of joint university/transit card program

Development of joint access-to-jobs/transit card program

INTRODUCTION

The Ventura County Transportation Commission (VCTC) is responsible for the allocation of transportation resources in Ventura County, California, and also operates two transit systems: Ventura Intercity Service Transit Authority (VISTA) and Fillmore Area Transportation Corporation (FATCO). Besides those two systems, the county is served by six independent transit operators: South Coast Area Transit (SCAT), Simi Valley Transit, Thousand Oaks Transit, Camarillo Area Transit (CAT), Moorpark Transit, and Ojai Trolley Service. These eight systems operate a total of 102 vehicles.

All these systems except Ojai Trolley Service—which has a single vehicle—are currently participating in an integrated regional smart card program called Go Ventura. This follows completion of an earlier regional smart card demonstration, the Smart Passport project. This case study reviews

- The development and impacts of the Smart Passport project.
- The development and implementation of the Go Ventura project.
- Related efforts to develop a joint university/transit card program and a joint access-to-jobs/transit card program.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

Smart Passport Regional Payment Integration Project

The Smart Passport project was initiated in 1994 through a partnership among the FTA, the California Department of Transportation (Caltrans), VCTC, and Echelon Industries (the system vendor and integrator). Echelon had developed the Fare Transaction and Vehicle Monitoring System (known as FARETRANS VMS) through the FTA's Small Business Innovation Research (SBIR) program, also supported by funding from Caltrans. The FARETRANS system included not only fare collection using contactless smart cards but also automatic passenger counters (APCs) and an automatic vehicle location (AVL) system. Echelon had actually begun developing the system in 1992, based on recommendations from an SBIR feasibility study the firm had conducted (*20*), and had field-tested much of the system on three commuter bus routes in Los Angeles County in 1993.

Caltrans sought the participation of VCTC and the County's transit operators in a demonstration project in 1994, and the FARETRANS system was subsequently implemented on most of the seven transit services' vehicles in January 1996; 76 vehicles were ultimately equipped with smart card readers—and many of these with APC and AVL equipment as well—and eight smart card sales outlets were established. The system went live in March 1996, and the first data reports were produced in November of that year. The contactless Smart Passport was available as either an unlimited-ride monthly pass or as a stored-value card. The pass version of the card could be used to ride on any of the participating services in the County. Regional payment integration had actually been introduced in 1994 via the original Passport, a countywide flash pass.

The goals in implementing the smart card system included the following:

- Create a seamless universal fare medium that could be used on all transit services in the County.
- Improve data collection and reporting processes, and in particular to "use the advanced payment system to

encourage, accommodate, manage and assess travel patterns of passengers between transit systems" (*21*).
- Assess the feasibility—and the nature of the functional requirements—of implementing a multiagency payment system.
- Determine the impact of the combination of the technologies (smart card, APC and AVL) on operational efficiency.

The official demonstration period ended in June 1997, but the following month VCTC elected to contract directly with Echelon to continue the project. The FARETRANS system remained in operation until October 1999. VCTC had negotiated with Echelon to continue the system. However, due to rapid changes in the technologies being employed in the system—and the fact that Echelon was using only off-the-shelf equipment for which replacement parts were not always available—the company was unable to address the County's requirements (e.g., performance criteria related to system reliability and data accuracy), and therefore withdrew from the project. VCTC therefore issued an RFP for a new system and ultimately selected the Motorola/ERG team to provide what is now the Go Ventura system.

Go Ventura Regional Payment Integration Project

The RFP for a new regional payment system was issued in February 2000, and the Motorola/ERG team was selected in May of that year. The contract was actually signed in September 2000. Subsequent to the award of the contract, Motorola made a corporate decision to get out of the smart card business. Therefore, ERG assumed sole responsibility for the contract, although the cards being used are those developed by Motorola. Installation of equipment began in July 2001. The sale of the new Go Ventura smart cards was initiated in December of that year, and the system went live in January 2002. Like the Smart Passport system, the new system includes contactless smart card readers, APCs, and an AVL system. However, the cards are "dual interface," operating in both a contactless and contact mode. At present, the contact interface is used only in loading value to cards via sales office point-of-sale terminals. However, the current plan is also to use the contact interface to purchase proof-of-payment tickets from MetroLink ticket vending machines to ride the commuter rail service. The dual interface will also provide future flexibility in allowing for the addition of nontransit functions at some future point.

The plan is for MetroLink TVMs to be equipped with Cubic smart card readers (the "Tri-Reader") as part of the Los Angeles MTA regional smart card program now being developed. However, at this point, it is the understanding of VCTC that the Tri-Reader cannot process the type of contactless interface on the Go Ventura card; therefore, the Ascom TVMs will be configured to read the contact portion of the Go Ventura card. Moreover, rather than provide the MetroLink fare inspectors with hand-held units capable of reading the Go Ventura cards, the e-purse on the cards will be used to buy a paper ticket that can be presented as proof-of-payment for Ventura County riders.

The same operators that took part in the Smart Passport project are participating in the Go Ventura program, although the total number of vehicles represented has grown from 76 to 101. As with the earlier program, the smart cards can be loaded with a monthly pass, a stored value e-purse, or both. However, unlike most other U.S. electronic payment systems, the passes are for fixed calendar months rather than rolling periods. Other key purchase and usage features and parameters include the following:

- Each agency's fare structure is incorporated into every card.
- A 10 percent discount is provided with use of the e-purse (e.g., $0.90 is deducted for a $1 fare). However, this can be configured differently by an operator (e.g., an operator could provide a 15 percent discount).
- Riders are warned (on the card reader display) when a card's balance falls below $5.
- A rider is allowed to have a $2 negative balance on a card (i.e., the ride is provided even if there is insufficient value remaining in the rider's e-purse; the payment for the trip is then deducted from the e-purse the next time the rider adds value).

- Value—or a pass—can be loaded at a sales outlet or onboard any bus except SCAT buses, SCAT having chosen not to permit onboard loading in either the Smart Passport or Go Ventura projects on the assumption that such transactions would significantly slow down boarding times. A rider can pay for onboard loads remotely, either by calling VCTC and providing a credit card number or by mailing in a check; this information is then downloaded to the onbus card readers (this downloading is done twice a day). The e-purse value or pass is automatically loaded on the card the next time it is presented to a reader. Internet access for making these purchases is planned for later in 2002. (Remote loading had been planned for the Smart Passport program but was never implemented.)
- There is no fee for acquiring a card, but there is a $5 card replacement charge (i.e., if lost or stolen). Cards can be registered, however, which guarantees replacement of the pass or e-purse balance if the card is lost or stolen.

- There is a 4-minute "lockout" period on the reuse of a card, preventing card "passbacks."

With regard to clearinghouse functions, VCTC has had initial responsibility for all card revenue reconciliation and allocation to the operators, as well as report preparation. Settlement occurs quarterly. The computer system supporting the program is designed to handle up to 10,000 transactions per day; once the volume approaches this level, transaction processing will be turned over to ERG. VCTC has also led marketing efforts, which have included direct mail, newsletter, print ads, and radio ads. The details of the program are also described on the Go Ventura website (www.goventura.org).

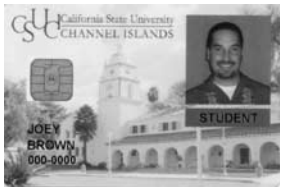
As of this writing (July 2002), the Go Ventura system had only been in operation for 6 months. Thus, it is too early to determine the level of success or to ascertain any real impacts on the operators. However, based on the lessons learned through the Smart Passport project, VCTC and its operating partners have managed to avoid most of the pitfalls encountered in implementing and operating that effort. The key steps followed in this case to ensure a more successful project included the following (*22*):

- VCTC served as the "champion" for the project.
- VCTC dedicated a staff project manager and data manager at the outset.
- VCTC staff has held regular meetings with the policymakers, operators, sales outlet staff and mechanics.
- VCTC required ERG to have a full-time local project manager.
- VCTC and the operators established a fare structure for the new cards that makes them competitive with other types of fare payment; this includes the e-purse discount.
- VCTC required that ERG develop training manuals for the drivers, sales outlet staff, and mechanics; a train-the-trainer program was also established for ongoing training.
- VCTC, in conjunction with the operators, established clear performance standards and data collection requirements (both were spelled out in the RFP).
- VCTC, in conjunction with the operators, defined the report schedule and formats that have been built into the project software.
- VCTC, in conjunction with the operators, adopted business rules, including clear clearinghouse/settlement responsibilities, and these were built into the project software.
- VCTC plans to include questions about the smart card program in its annual rider surveys.
- VCTC developed a comprehensive on-going marketing campaign.

Two specific components of the Go Ventura effort are reviewed below.

Joint University/Transit and Access-to-Jobs/Transit Card Programs

In implementing the Go Ventura program, VCTC has also pursued partnership arrangements with nontransit entities in the County. In particular, VCTC has been working with California State University-Channel Islands (CSUCI) on development of a joint university/transit card program. CSUCI is a new campus—the first graduating class started in Fall 2002—and enrollment is expected to eventually grow to 20,000. The administration wanted to develop a multi-application smart card and worked with VCTC and ERG on the concept. Consequently, a campus version of the Go Ventura card, featuring a photo and university logo on the front (see example shown here) and the county transit systems' logos on the back, was issued in Fall 2001. This card served as the campus ID card through the Spring 2002 semester, and could be loaded with a transit pass, at no cost to the student. The campus is primarily served by two routes, both of which are subsidized by the University. These routes are free. For other county routes, the card readers tracked student and faculty usage. The University maintained a transit account with VCTC, and the cost of student and faculty rides were debited from this account.



A new administration has now assumed responsibility for running the campus. It prefers magnetic stripe technology to smart cards for the primary campus card (i.e., for ID, use in the bookstore and other functions). Thus, the aforementioned cards will be replaced with magnetic stripe cards, although VCTC and the University are discussing the possibility of adding the University's magnetic stripe to the back of a Go Ventura card. Such a strategy would continue to facilitate transit usage by students and other members of the campus community. In this scenario, the smart card could also be used to supplement the applications included on the stripe (e.g., to maintain students' medical records, to pay for parking, and perhaps other uses). These applications would utilize either the contactless or contact interface of the smart card, depending on the particular requirements. VCTC hopes to be able to issue this joint card in Fall 2003.

The other nontransit partnership in place at present is with county social service agencies. Six access-to-jobs centers are equipped for the distribution and loading of Go Ventura cards with subsidized passes or e-purse value for eligible agency clients. As with the CSUCI rides, the card readers track usage of the access-to-jobs cards. This allows the subsidizing centers to pay for their clients' rides, and also to ensure that they are traveling to job sites as intended. VCTC provides the (empty) smart cards to these centers at no cost.

RESULTS AND IMPACTS OF FARE INITIATIVES

Customer Benefits

Because of persistent data processing problems and resulting inconsistency of reports, VCTC and the operators were unable to compile reliable information on usage of the Smart Passport. Roughly four thousand cards were distributed, although many of these were never used.

With regard to customer acceptance, only minimal market research was carried out. An informal onboard survey was undertaken by VCTC on all routes of one of the services, VISTA, and rider interviews were done on a second service, FATCO. The comments received through both of these efforts were generally quite positive. The VISTA survey focused on senior citizens, students and low-income riders, and the smart card was found to be attractive to these groups. According to the Volpe Center assessment, "Many of the users reported the card's stored value feature was used as an effective budgeting tool, enabling them to secure access to the transportation services they needed. Senior citizens also found the smart card's contactless feature provided them with a greater sense of comfort and safety because they could carry less cash" (*21*).

The limited nature of the survey effort, coupled with the lack of data on usage of the smart card, suggested the need for the following strategies in promoting and tracking customer acceptance/usage (*21*):

- Formal and systematic surveys and interviews with customers are needed to reliably assess customer satisfaction and to design strategies to improve satisfaction.
- Minimum requirements for data collection need to be established in the planning phase of the program.
- Reporting requirements that define report formats and the reporting schedule must be established.

Other key findings related to promoting customer acceptance included the following (*21*):

- Implementation of new technology requires a comprehensive marketing strategy using broadcast and print media.
- A program is needed that offers customers incentives and loyalties based on usage, such as free transfers, fare discounts, and automatic replenishment.

VCTC and its partners were able to use these lessons in developing and implementing the Go Ventura project. As indicated earlier, the Go Ventura project has been operational only since the beginning of 2002. As of June 2002, 2,200 cards had been distributed. VCTC had plans for a major advertising push during the summer of 2002. The agency also planned to include questions pertaining to smart card use on its forthcoming system survey.

Operational and Administrative Impacts and Issues

The Smart Passport project produced what must be considered mixed results operationally. According to the Volpe Center assessment of the project, "The fare collection system was plagued by numerous operational and data processing problems, resulting in inconsistent data and infrequent reports. While the system performed well for some of the smaller transit operators, the system was never fully operational for the largest transit operator in the County, South Coast Area Transit, due to system reliability problems" (*21*). On the other hand, the project was considered successful in terms of demonstrating the basic potential of using contactless smart card technology in transit and laying the groundwork for full regional integration. Despite the project's shortcomings, VCTC and the operators remained committed to pursuing the regional fare integration concept.

The specific operational and administrative problems and challenges encountered during the project include the following:

- **Lack of "buy-in" by drivers and mechanics.** It was felt that agency staff and operating personnel received insufficient training in use of the equipment and supporting systems: "Consequently, drivers often failed to enter the onboard information needed to provide accurate data, as well as inform management when system equipment was inoperative. Echelon reported that, in some cases, transit agency management limited their ability to properly train staff, such as restricting direct contact with staff and not allocating sufficient time for training" (*21*).
- **Equipment problems.** Equipment was not all delivered or installed in a timely manner, and there were excessive delays in replacing defective equipment. This led to several incidences of vandalism on the part of disgruntled drivers, i.e., when equipment did not work properly (*22*).
- **Persistent data processing problems.** This resulted in inconsistent reports. It was felt that one reason for this was that the underlying database was not robust enough for the system. Incidences of incorrect driver log-on (see above) also contributed to the reporting problem.

These and related problems resulted in the following lessons, subsequently used in the development of the Go Ventura program (*21*):

- All staff need extensive and ongoing training.
- The systems integrator needs to have a local presence.
- System performance requirements need to be established in conjunction with participating operators during the planning phase of the program and then applied regularly to monitor performance.
- Regular and open communication is needed among all stakeholders.
- Clearinghouse and settlement responsibilities need to be designated in the planning phase of the program.

As indicated above, the Go Ventura program has been operational only since January 2002. Thus far, the agencies have experienced far fewer problems than they did throughout the earlier program. There have been no significant hardware problems to date, and the agencies' operational and maintenance personnel have been much more accepting of the system than they had previously. There were some initial delays in the production of reports, however, due partly to considerable turnover in the system integrator's project team. The design of the regional clearinghouse system also underwent a couple of changes by the integrator, and still appears to be somewhat in a state of transition. VCTC currently manages the clearinghouse functions in-house, but these functions will eventually be turned over to ERG, which plans to handle them through the clearinghouse that has been established for the TransLink (San Francisco area) regional smart card program.

With regard to the cost of the Go Ventura system, the original amount of the contract with Motorola/ERG was $1.67 million; as of June 2002, several change orders had raised the total cost to approximately $1.8 million. The cards used in the project, Motorola dual interface "Type B" cards, were provided at an initial price (for the order of 10,000 cards) of $8.50 apiece.

Overall conclusions and lessons learned are summarized below.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

The introduction of smart cards discussed in this case study have had the following customer-related impacts and benefits:

- Improved ease of transit usage, creating the opportunity for seamless travel within the region.
- Improved customer convenience, through features such as onboard card loading (on all but one of the operators), allowance of a $2 negative balance (on the e-purse), warning when a rider's card balance drops below $5, and registration of cards (this guarantees replacement of the pass or e-purse balance if the card is lost or stolen).
- Reduced the cost of travel for some riders, through provision of a 10 percent discount with use of the e-purse.
- Generally positive reactions to the system on the part of smart card users, based on a limited survey effort undertaken during the pilot project.

Agency Impacts and Benefits

The agency-related impacts and benefits of these projects include the following:

- Smart Passport project costs (including design and implementation) were covered entirely by FTA and Caltrans. Go Ventura's costs are being covered by VCTC through capital grants from Caltrans and FTA.
- VCTC's management costs increased for both projects, as a consultant was hired for the initial portion of the Smart Passport project and a new data manager has been hired in conjunction with the Go Ventura project. The operating agencies' revenue collection and management costs have not been significantly affected by either project to date.
- Usage of the Smart Passport cards was felt to be relatively low, although actual ridership (and revenue) figures were not obtained due to equipment and data processing inconsistencies. However, the agencies did lose some revenue due to the equipment reliability problems: whenever a rider was unable to use his/her smart card due to equipment malfunction, no fare was charged for that ride. Go Ventura has been in operation only a short time, and the program has not yet been actively marketed; usage has thus been understandably quite low to date.
- The limited use of smart cards suggests that these projects have had minimal impact on the agencies' use of cash to date; however, as Go Ventura card penetration expands, the use of cash should decrease.
- The Smart Passport project had mixed success in terms of meeting its goals. It did "create a seamless universal fare medium," and also "demonstrated the feasibility of implementing a multiagency payment system." On the other hand, the project failed to "improve data collection and reporting processes," and was unable to "determine the impact of the combination of technologies (smart card, APC and AVL) in operational efficiency." (It is too early to determine whether Go Ventura has met its goals.)
- In both projects, the use of smart cards has provided greater flexibility to the operators in terms of the ability to offer additional fare options (e.g., e-purse).

- The limited level of usage suggests that neither project has had a significant impact on fare abuse and evasion, although the use of any type of electronic fare payment offers the potential to control abuse and evasion.
- In implementing the Smart Passport project, VCTC hired a consultant to provide assistance; however, the consultant was not kept on for the entire project. The project did not affect the operating agencies' personnel requirements. VCTC has assigned a project manager for implementation of the Go Ventura program; however, this individual was an existing VCTC employee, and he has retained his other duties during the implementation of the program. As mentioned above, the agency did hire a new data manager at the outset, though. The project has not resulted in any additional personnel for the operating agencies.
- These projects have had no measurable impact on service reliability; while the use of contactless smart cards can speed boardings, onboard loading tends to have the opposite effect; moreover, equipment reliability problems in the Smart Passport project also had a negative effect in some cases.

While the Smart Passport pilot project presented a number of operational challenges, it did demonstrate the general feasibility of developing an integrated regional payment system, while providing important lessons for designing, implementing and managing such a program. These lessons were carefully followed in the development of the Go Ventura program.

Impacts and Benefits for Partner Entities

The Smart Passport project produced significant benefit to Caltrans and FTA in testing the feasibility of using contactless smart cards as the basis for an integrated regional payment system. The project attracted interest from transit agencies throughout California and across the United States, and provided a series of important lessons in development and implementation of regional systems.

Within the Go Ventura program, VCTC has established partnerships with a local college (CSUCI) and county social service agencies. These partnerships should provide the following types of benefits to these entities:

- A joint transit-university card will facilitate transit usage by students, faculty, and staff; the card may also be used to provide certain applications (e.g., parking payments, storage of medical records) beyond those that would be provided on a university-only card.
- The use of the smart cards will allow distribution and loading of subsidized passes or value to social service agency clients, as well as tracking of their rides (to allow postpayment by agencies for access-to-jobs rides and to ensure proper usage of the cards).

Liability to Agency

The major area of liability to VCTC associated with the original Smart Passport program was the potential loss of interest in cooperating on future efforts on the part of the participating transit agencies. Given the various problems encountered with that program, such an outcome might well have been expected. However, the pilot project apparently demonstrated sufficient promise to the agencies that all agreed to participate in the subsequent Go Ventura effort.

Constraints and Barriers

A number of technical, institutional, and operational constraints and challenges were encountered in the implementation of the Smart Passport program. These included equipment reliability and data processing and reporting inconsistencies, which in turn contributed to lack of acceptance on the part of operational and maintenance personnel. One key problem was the lack of replacement parts for the largely off-the-shelf equipment used in the system. However, these challenges were successfully addressed in developing and implementing the follow-up Go Ventura program.

Required Equipment and Technology

The initiatives described here are based on use of contactless smart card technology. The initial program was essentially designed to test the applicability of this technology in a regional setting.

Lessons Learned

A number of key lessons were learned from the Smart Passport pilot project—and corroborated in the subsequent Go Ventura project—regarding the development and implementation of an integrated regional payment system (*21*):

- Regional farecard programs need a local champion.
- Staff resources and leadership capabilities need to be commensurate with the scope and complexity of the project and need to be in place at the beginning.
- Regular and open communication is needed among all the stakeholders.
- The systems integrator needs to have a local presence.
- The participants should establish a pricing structure for the new fare media that makes them competitive with other fare media.
- All staff need extensive and ongoing training.
- System performance requirements need to be established in conjunction with participating operators during the planning phase of the program and applied regularly to monitor performance.

- Minimum requirements for data collection need to be established in the planning phase of the program.
- Reporting requirements that define report formats and the reporting schedule must be established.
- Clearinghouse and settlement responsibilities need to be specifically designated in the planning phase of the program.
- Implementation of new technology requires a comprehensive and effective marketing strategy using broadcast and print media.
- A program is needed that offers customers incentives and loyalties based on usage, such as free transfers, fare discounts, and automatic replenishment.
- Formal, systematic surveys of and interviews with customers are needed to reliably assess—and to design strategies to improve—customer satisfaction.

CASE STUDY CONTACTS

The following individuals were interviewed as part of a site visit to VCTC (Ventura, CA):

Ginger Gherardi, Executive Director
VCTC
950 County Square Drive, Suite 207
Ventura, CA 93003
805-642-1591, x104
GGherardi@goventura.org

Steven DeGeorge, Project Manager
VCTC
950 County Square Drive, Suite 207
Ventura, CA 93003
805-642-1591
SDeGeorge@goventura.org

The following documents were used in preparing the case study:

Volpe National Transportation Systems Center. *Ventura County Fare Integration: A Case Study*, September 2001.
"Smart and Smarter," presentation by Ginger Gherardi, VCTC, 2002.
VCTC Go Ventura website: www.goventura.org

CASE STUDY **13**

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

Fare Program/Initiatives

SmarTrip®: evolution of smart card program

Metrochek and Smart Benefits: distribution of benefits using magnetic and smart card technology

Regional Smart Card Program: expansion of SmarTrip® technology throughout region

INTRODUCTION

The Washington Metropolitan Area Transit Authority (WMATA) operates the second largest rail system and the fifth largest bus network in the United States. Metrorail and Metrobus serve a population of 3.4 million within a 1,500 square mile area. The transit zone consists of the District of Columbia, two suburban Maryland counties, and three counties and three cities in Northern Virginia.

About 40 percent of the region's peak period trips to the urban core are on WMATA services. Average weekday trips exceed 600,000 on Metrorail and 500,000 on Metrobus. Over the past few years, Metrorail's share of total trips has grown from 8 to 15 percent, while Metrobus's share has increased from 5 to 8 percent (*23*).

WMATA's plans call for continued expansion of the Metrorail system. By the end of 2004, Metrorail will have added three miles of track, bringing the total system to more than 106 miles. In addition, WMATA will also be implementing improvements on Metrobus. Future Metrobus improvements include installing automatic vehicle location (AVL) equipment on all buses and expanding its fleet of vehicles fueled with compressed natural gas (CNG). In total, WMATA plans to purchase 414 CNG buses, of which 164 are either delivered or on order.

Among other improvements to its system, WMATA is conducting a number of fare initiatives on both Metrorail and Metrobus. All of these initiatives build from technology already in place at WMATA (i.e., smart cards). This case study focuses on three fare initiatives:

- *SmarTrip®*. The evolution of WMATA's smart card fare collection program. (SmarTrip is a registered trademark of the Washington Metropolitan Area Transit Authority.)

- *Metrochek and SmartBenefits*. Distribution of transit benefits using magnetic and smart card technology.
- *Regional Smart Card Program.* Fare integration though the implementation of the SmarTrip technology throughout the Washington-Baltimore-Northern Virginia region.

The implementation issues and impacts of these fare initiatives are further described below.

DEVELOPMENT AND IMPLEMENTATION OF FARE INITIATIVES

SmarTrip

In February 1995, WMATA introduced a demonstration program of a contactless smart card system to test the feasibility of implementing a smart card application in a multimodal transit system. The technology employed was a battery-powered cartridge, about the size of an audiocassette case, which had been developed by Cubic and was known as the GoCard® (GoCard® is a registered trademark of Cubic Transportation Systems, Inc.). The demonstration, funded by a Congressional earmark received through the FTA, involved 1,500 people, 19 Metrorail stations, three Metrobus lines, and five parking lots. It concluded in February 1996, having accomplished its objective. This set the stage for SmarTrip.

In May 1999, WMATA became the first major city in the United States to deploy a contactless smart card systemwide. WMATA's plan was to link both rail and parking operations with a single fare medium—the SmarTrip card. The SmarTrip card is an ISO-size plastic card that uses low-level radio frequencies to induce current in the electronics contained in the card. The card's thickness is approximately the same as a credit card.

Passengers desiring a SmarTrip card can purchase one for $5 at a customer service counter, by mail, or over the

Internet. The SmarTrip card can be used at Metrorail faregates and to pay parking fees at Metro-operated parking lots. Passengers load value onto their SmarTrip cards at Metrorail ticket vending machines (TVMs) in a manner similar to purchasing magnetic paper farecards. Value can be loaded using cash or credit/debit cards. However, unlike a paper farecard that has a limited useful life, the SmarTrip card can be used over and over again, possibly for several years. Another important feature of the SmarTrip card is that it can be registered to a specific user. The benefit of registering a SmarTrip card is that if it is ever lost or stolen, it can be replaced for a fee of $5. The patron then will be issued a new card with the value that was on the previous card at the time it was lost or stolen.

In addition to its use on WMATA's Metrorail system and at its parking lots, the SmarTrip card is beginning to demonstrate its usefulness in other applications as well. In order to test the concept of SmarTrip as a multipurpose medium, WMATA has recently partnered with two outside entities: First Union Bank and GSA.

First Union Pilot

WMATA has partnered with the First Union Bank to provide a multiapplication card for First Union customers. The pilot involves approximately one thousand customers who have been issued a combined First Union/SmarTrip card. This single card can be used as a debit card at any ATM in the country and also as a SmarTrip card on WMATA. The card is a hybrid card that uses both magnetic stripe technology (for the debit card application) and contactless smart card technology (i.e., SmarTrip). The future of this project has been cast in doubt with the 2002 acquisition of First Union Bank by Wachovia Bank. While the existing cards could continue to be used (i.e., in 2003), Wachovia had not indicated to WMATA any intention of issuing new cards carrying the SmarTrip application.

GSA Pilot

WMATA has partnered with GSA to implement a multiapplication card for GSA employees. The GSA/SmarTrip card is a contact/contactless dual interface card that includes the following elements and functionality:

- **Photo ID.** This permits employees to gain access to GSA and other government buildings. Photo IDs are visually inspected by building security.
- **Contact Chip.** The contact chip is used to store administrative information for GSA.
- **Bar Code.** The card includes a bar code with the employee's ID number for use by GSA.
- **Contactless Chip.** This chip is used by the SmarTrip application for holding Metrorail fare value.

The objective of this pilot program is to further test the flexibility and multifunctionality of the SmarTrip card.

Metrochek and SmartBenefits

In February 1993, WMATA introduced Metrochek to provide employers with a mechanism to extend the qualified transportation benefit to their employees. The qualified transportation benefit is a tax-free benefit that employers can extend to their employees to help pay for transportation to and from work on public transit or to fund the costs of their parking. For transit, the amount of the benefit is limited to $100 per month and must be provided in the form of vouchers or transit fare media. The parking benefit is limited to $175 per month. Generally, employers are not permitted to give their employees cash (i.e., in reimbursement for transportation costs).

In implementing the qualified transit benefit, many metropolitan areas charged their Metropolitan Planning Organizations (MPOs) with developing a system to implement the benefit program. As such, many MPOs instituted a system in which employers purchase vouchers that can be given directly to employees and redeemed for transit fare media. Many MPOs contracted with third parties to provide these vouchers. These third parties often charge a commission.

Rather than use a third party to provide special vouchers, WMATA decided to use its existing magnetic farecards as the medium for the region's transit benefit program. These cards are sold to employers at face value or paid for by employees as a pretax payroll deduction. The cards come in denominations of $1, $5, $10, $15, $20, $21 and $30. The value of the Metrochek is printed on the card and is also encoded in the card's magnetic stripe.

Metrocheks can be redeemed at over 200 transit providers in the Washington, DC, metropolitan area. Participating providers include bus, rail and vanpool operators. After accepting the Metrochek as payment for fare media, the participating provider simply remits to WMATA the used Metrocheks. WMATA then writes a check to the provider or arranges for electronic funds transfer through the automated clearinghouse in exchange for the total value of Metrocheks remitted.

Since they are magnetically encoded, Metrocheks can also be used directly in Metrorail faregates. When used on Metrorail, Metrocheks of $20 or more come with a 10 percent bonus. That is, a $20 Metrochek can be used for $22 worth of transit on Metrorail. However, once a Metrochek has been used

on Metrorail it is no longer valid for exchange for fare media at any other participating provider. Just as with the regular Metrorail farecards, the remaining value of the Metrochek is printed on the left-hand side of the card when it is used on Metrorail.

In September 2000, WMATA took a step in advancing the state of the art of the qualified transit benefit by combining the SmarTrip and Metrochek programs. The new program is called SmartBenefits. Under the SmartBenefits program, the employer no longer has to distribute Metrocheks to employees who use Metrorail. Instead, the employer authorizes the amount of an employee's benefit via the Internet using a special access account. To claim the benefit, each employee takes his or her registered SmarTrip card to a TVM at any Metrorail station and taps the card reader. The benefits must be claimed between the first and last day of the benefit month or the employees forfeits their benefit amount and the value is returned to the employer. The flow chart in Figure CS13-1 summarizes the SmartBenefits process.

In addition to using SmartBenefits on Metrorail, WMATA has begun a pilot program to extend SmartBenefits to vanpool customers. In conjunction with Vanpool Services International (VPSI), WMATA is testing the concept with three VPSI operators. From the employer's end, the program works much the same as the normal SmartBenefits program. However, employees are also given an Internet access account, which they use to designate the amount of their benefit that they want used for their vanpool transportation. In this way, employees can use all of their benefit to pay for their vanpool services or they can reserve a portion for use on Metrorail using their SmarTrip cards. Employees reserving a portion of their benefit for Metrorail would claim this amount at a Metrorail TVM.

Regional Smart Card Program

WMATA's Metrorail and Metrobus services make connections with numerous other operators in the Baltimore-Washington-Northern Virginia region. Table CS13-1 lists the various operators that have connections with Metrorail and Metrobus services.

TABLE CS13-1 WMATA inter-operator transit connections

Operator	Metrorail	Metrobus
MTA Commuter Bus	✓	✓
MTA Local Bus		✓
MTA Light Rail		✓
Connect-A-Ride	✓	✓
CUE	✓	✓
DASH	✓	✓
Fairfax Connector	✓	✓
The Bus (P.G. County)	✓	✓
Ride-On (Montgomery Co.)	✓	✓
PRTC-OmniRide	✓	✓
MARC	✓	✓
Virginia Railway Express	✓	✓

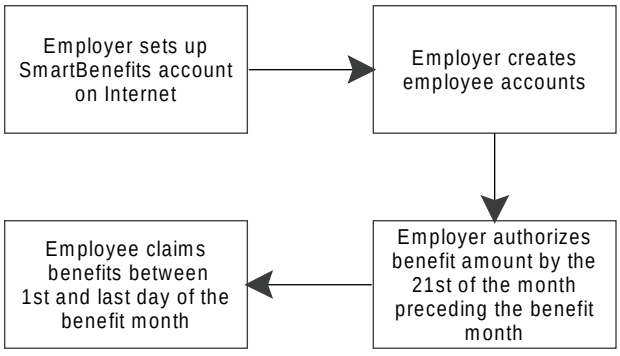


Figure CS13-1. SmartBenefits program.

Together with the Maryland MTA (primarily serving the Baltimore area), WMATA is launching one of the largest efforts at regional fare integration in the U.S. The driving force behind this effort is the successful implementation of WMATA's SmarTrip technology, and indeed SmarTrip represents the underlying technology platform for the regional program. Although a number of agencies are involved (e.g., Northern Virginia and Maryland local bus operators), WMATA and Maryland MTA are taking the lead roles in implementing two projects initiated by WMATA in the move toward making regional fare integration a reality: A Regional Bus Fare Collection System and a Regional Customer Service Center (RCSC):

- **Regional Bus Fare Collection System.** Under this joint procurement, the vendor, Cubic, is providing a common validating farebox with smart card capabilities, as well as all supporting garage and central computer systems and software. Once completed, all transit buses operating in the Washington region will have smart card capabilities. As such, passengers will eventually be able to seamlessly transfer from one system to the next without the need to purchase additional fare media.

  In-service testing of the new fareboxes began in November 2002. The fareboxes were installed on 80 Metrobuses that serve northern Virginia. Once testing is completed, WMATA and the other regional participants will begin installing the equipment on their entire fleets.
- **RCSC.** WMATA is spearheading the effort to establish the RCSC. Once fully implemented, the RCSC will provide the following services to the Baltimore-Washington-Northern Virginia region:
  – Responding to customer questions, complaints and disputes, as well as setting up account information

and processing smart card registrations and special transactions.
- Clearing, settlement, and financial management functions in order to process smart card transactions and move funds to the appropriate participants in the regional smart card program.
- Establishing a point-of-sale network to distribute smart cards and provide locations where patrons can load value.

An RFP to operate the RCSC was issued in October 2001 and an amendment to the RFP was issued early in 2002. In January 2003, WMATA selected the ERG Group to install and operate the RCSC. ERG plans to use its existing central computer system, installed in the San Francisco Bay Area to support the TransLink project, to perform the clearing, settlement, and financial management functions for the Washington-Baltimore region. Local smart card management, distribution, and customer service will be performed by ERG's subcontractor, Northrup-Grumman IT.

Once the bus farebox and the RCSC projects are complete, SmarTrip will become the de facto standard fare medium among all of the participating agencies in the region.

These projects are being carried out jointly with the agency's regional partners. Although a number of agencies are involved (e.g., Northern Virginia and Maryland local bus operators), WMATA and the Maryland MTA are taking the lead roles in implementing the projects.

RESULTS AND IMPACTS OF FARE INITIATIVES

SmarTrip

Customer Impacts and Benefits

Since its introduction, the SmarTrip program has experienced steady expansion; the growth in SmarTrip card sales is shown in Figure CS13-2. This steady rise in use and acceptance is particularly noteworthy considering that (1) WMATA has not promoted the card beyond its regular public fare information, and (2) the card costs the user $5 to acquire (i.e., before any value is added). As shown in the figure, SmarTrip monthly sales have ranged from approximately 4,000 to more than 10,000 new cards sold. During the period from May 1999 through May 2002, nearly 250,000 SmarTrip cards were sold.

Overall, SmarTrip customers are very satisfied with the benefits that they derive from using their cards. In user sur-

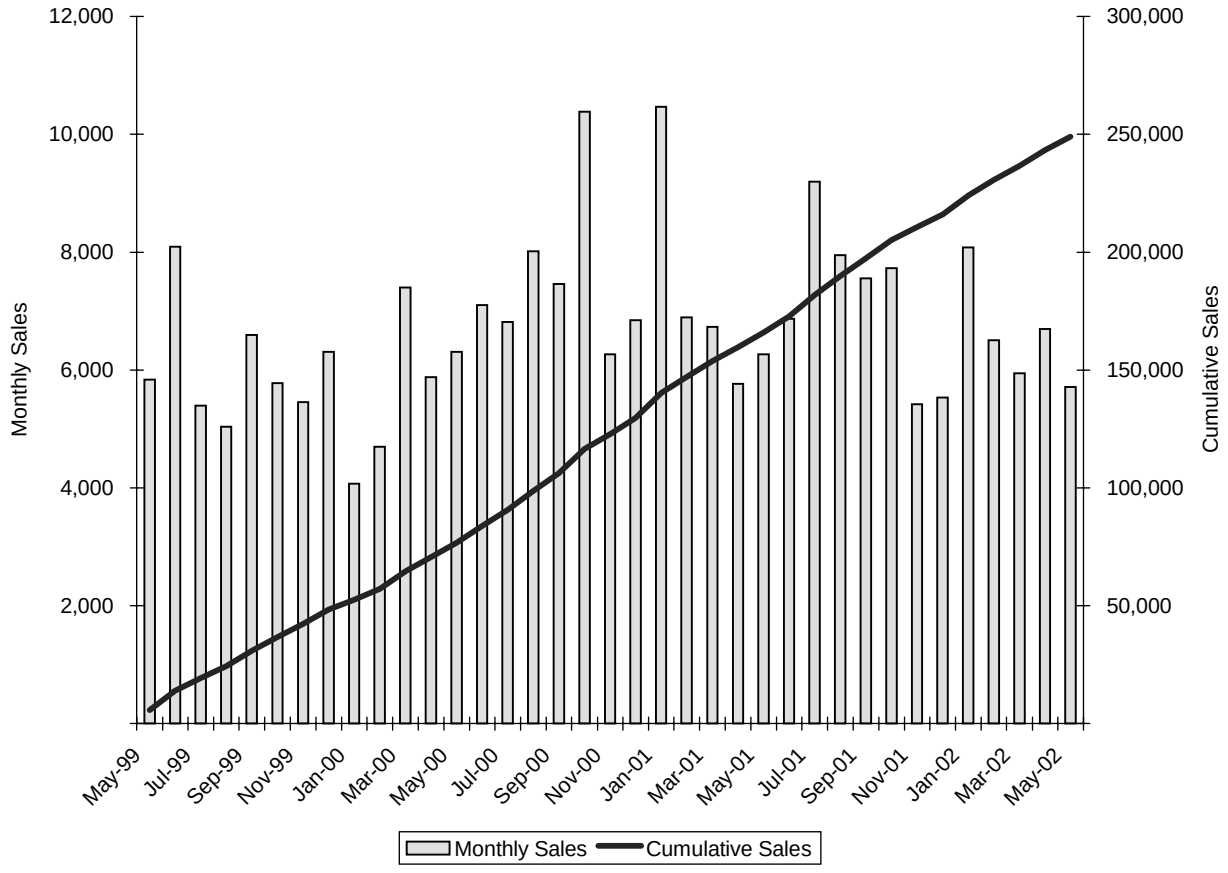


Figure CS13-2. SmarTrip sales, May 1999 to May 2002.

veys, customers rate convenience as the single highest factor for using the card. Table CS13-2 summarizes customers' ratings of a variety of reasons for using the SmarTrip card.

As suggested earlier, one of the major customer benefits of SmarTrip is the ability to restore the card's remaining value if the card is lost or stolen. Although customers need to register their cards in order to take advantage of this benefit, this has deterred very few card purchasers. Privacy concerns have apparently not been an issue with customers; WMATA has established a very strict privacy policy, promising its SmarTrip customers that their personal information will never be sold or released to a third party. As a result, more than 98 percent of all SmarTrip customers choose to register their cards.

In addition to the capability of replacing lost or stolen cards, SmarTrip provides other benefits to its customers. Among these are the following:

- **Ease of use.** The contactless technology allows for easier and faster access to the system at fare gates, particularly for many passengers with disabilities.
- **Multiple Payment Options.** The technology has the capability to accommodate multiple payment options (as well as multiple modes and operators, a feature that will become important as the Regional Smart Card Program is implemented).
- **Autoload Functionality.** This feature enables a smart card user to have value automatically loaded on to the card from virtually any fare collection system component (i.e., fareboxes, faregates, TVMs and point-of-sale devices). Although this feature is a mainstay of the SmartBenefits program (currently limited to Metrorail), it has yet to be demonstrated as a viable application on a bus farebox.

The smart card technology also offers the opportunity to introduce innovative fare structure and payment options. WMATA is considering the following strategy:

- **"Fair Fare" Strategy.** This option would enable a SmarTrip user to enjoy the benefits of an unlimited ride pass without buying a pass. A counter on the card keeps track of each card's use within a certain time period, and the fare system is programmed so that riders pay the lowest possible fare, based on their usage. For instance, once a cardholder has taken a certain minimum number of rides during a day, the card automatically becomes treated like an unlimited use day pass, and all subsequent rides that day become free. Even at this point, however, rides continue to be tracked; thus, if the cardholder uses the card a sufficient number of times in a 7-day period, the card becomes treated like a weekly pass (and subsequently a two-week pass) The flexibility of the software further permits the Fair Fare to be implemented on either a calendar or a rolling period basis. Moreover, future policies and interagency agreements could even extend the Fair Fare practices to include multiple operators. Fair Fare could attract new riders, as it essentially guarantees that a rider will pay the lowest possible fare for a particular trip.

TABLE CS13-2 Reasons for using SmarTrip card

Factor	Percent Rating Highest
Convenience	63
Durability	12
No need to carry cash	10
Fast transactions	10
Higher stored value than paper fare cards	6
Security feature	5

SOURCE: WMATA Department of Finance & Program Development.
NOTE: Total sums to more than 100% because respondents giving highest rating to more than one factor.

Data on usage of the First Union and GSA pilot programs are not available at this time. These programs are not necessarily intended to be expanded but are merely designed to demonstrate the feasibility of multiapplication cards. Future programs may or may not duplicate all of the features available in these two demonstrations.

Operational and Administrative Impacts and Benefits

One of the main benefits that WMATA has derived from implementing the SmarTrip program is the flexibility and opportunities that the technology has provided. Without the capabilities of the smart card, most of the other fare initiatives that WMATA is implementing (i.e., including those discussed in this case study: First Union Pilot, GSA Pilot, SmartBenefits, "Fair Fares" and the Regional Fare Integration effort) would not be possible.

Operationally, SmarTrip allows faster access through the faregates than the paper magnetic farecards. Reduced maintenance costs—due to the machines having fewer moving parts since transports and thermal printers are not needed—are generally considered another key benefit of contactless smart card technology. However, WMATA has not studied the operating and maintenance cost impacts of SmarTrip as yet. Indeed, WMATA has not pursued the program as a means of reducing costs, but rather as way to provide improved customer convenience, via a flexible state-of-the-art technology.

Because the current SmarTrip card is simply another payment option in the already automated Metrorail fare system, SmarTrip has otherwise had minimal impact on WMATA's operations to date. However, there may be negative revenue impacts to consider. For instance, in converting customers from magnetic farecards to smart cards, the agency stands to lose some of the expired-value revenue it now accrues from magnetic farecards with stored vale that has never been used. This is because many people use magnetic farecards once or twice and then dispose of them, even if they still have some

value. WMATA estimates that between $3 million and $5 million in unused value is written off annually. In contrast, the purchase fee and registration process ensures that most SmarTrip cards will be retained and reloaded time after time, effectively eliminating the possibility of expired value. As such, the SmarTrip program will result in reduction of this unofficial source of revenue.

The Fair Fare strategy under consideration could well also have a negative impact on fare revenue—though it should also result in some increase in ridership. The strategy essentially converts rides that would otherwise have been paid for (i.e., from stored value) to free rides, once the rider has exceeded the threshold usage level to turn the card into a pass. The extent of revenue loss, if any, will depend on the exact structure and pricing of the program (e.g., number of rides needed to reach certain pass levels, pass breakeven levels) and the number of riders using Fair Fare versus purchasing passes from the outset. WMATA has yet to conduct a complete analysis of the impacts.

Metrochek and SmartBenefits

Customer Impacts and Benefits

The Metrochek program actually has two different customers—the employee and the employer. The Metrochek program's immediate benefit to employees is the savings in travel costs. Additionally, there is a tax savings in that employee travel expenses are paid with pretax income, which provides the employee with a real value that can exceed the value of the transportation provided. Table CS13-3 shows an example of the real value to employees in both the private sector and the federal government in a case where an employer provides the maximum benefit of $100 per month.

As shown in this table, a $1,200 annual transit benefit is worth about $1,700 in income to a private-sector employee or federal employee under the Federal Employees Retirement System (FERS), and $1,625 to a federal employee under the Civil Service Retirement System (CSRS).

In terms of benefits to the employer, the Metrochek program allows the employer to provide its employees with a $1,200 benefit at a discount of up to 44 percent. The discount results from the employer' savings in payroll taxes. Table CS13-4 shows the savings to employers from the Metrochek program. Based on the ability to produce such savings, the program has grown to include over 2,500 private employers and 269 federal agencies in the Washington area.

SmartBenefits also provides significant benefits to program users. In addition to all of the benefits offered by the Metrochek program, employers taking part in the SmartBenefits program enjoy the convenience of using the Internet to manage the program, while employees enjoy the convenience of being able to automatically download their benefits through Metrorail TVMs.

TABLE CS13-3 Real value of Metrochek to employees

Value	Private-Sector/ Federal (FERS)	Federal Government (CSRS)
Benefit Amount	$1,200.00	$1,200.00
Federal Income Tax Savings	$336.00	$336.00
Employee FICA Savings (7.65 percent)	$91.80	$17.40
Estimated State Tax Savings (6 percent)	$72.00	$72.00
Total Value	$1,699.80	$1,625.40

SOURCE: WMATA Marketing Department.

TABLE CS13-4 Employer savings from Metrochek

Value	Private-Sector	Federal (FERS)	Federal (CSRS)
Benefit Amount	$1,200.00	$1,200.00	$1,200.00
Federal Income Tax Savings	($360.00)	$0.00	$0.00
Employer FICA Savings (7.65 percent)	($91.80)	($91.80)	($17.40)
Unemployment Tax Savings	($72.00)	($72.00)	($72.00)
Net Cost	$676.20	$1,036.20	$1,110.60
Percent Savings	43.7 percent	13.7 percent	7.5 percent

SOURCE: WMATA Marketing Department.

Operational and Administrative Impacts and Benefits

One of the main benefits to WMATA is that nearly 90 percent of all Metrochek value is used on Metrorail and Metrobus; Metrocheks used at other transit providers in the region represent only a fraction of those used on WMATA. However, the portion of Metrochek benefits used outside WMATA has been steadily rising. Between 2000 and 2002, the amount of Metrocheks redeemed at other transit providers increased from $4.5 million to $16.1 million. At the same time, WMATA's share of Metrochek revenues has decreased from 91 percent to 88 percent.

Another benefit to WMATA is the revenue derived from Metrochek sales. Between 1993 and 2002, Metrochek sales have grown more than 1,500 percent. Figure CS13-3 shows the increase in Metrochek sales since the program's inception from $8.3 million in 1993 to $133.8 million in 2002.

Where the SmartBenefits program is concerned, the benefits to WMATA are only just beginning to be realized. One benefit of the program is that it will almost certainly reduce the operating costs of the Metrochek program. By using the SmarTrip card, WMATA will be able to reduce the costs of printing and distributing Metrocheks to employers. Considering that nearly 90 percent of all Metrochek participants are users of WMATA's services, the potential costs savings are substantial. (Data on the cost savings is not currently available).

Regional Smart Card Program

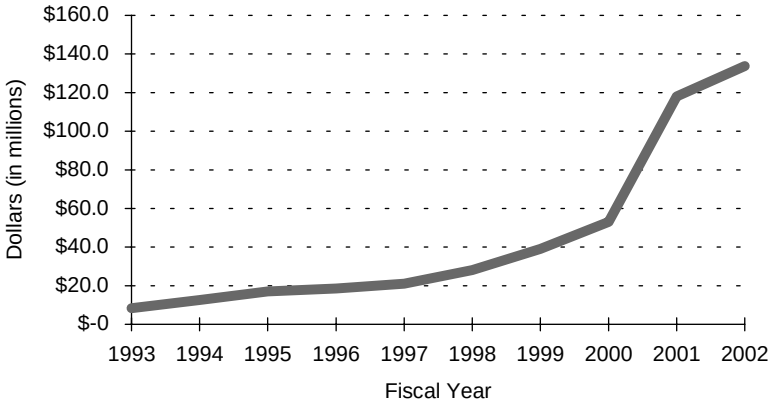
WMATA is in the early stages of its procurement of the bus farebox equipment. However, some potential impacts and benefits are identified below.

Customer Impacts and Benefits

Besides the aforementioned benefits of using the SmarTrip card, the key benefit to customers of the regional program will be the ability to travel throughout the region using a single card. Each card will be able to carry more than one type of fare product. For example, a patron with a smart card monthly pass for the Maryland commuter rail system, MARC, may wish to add a WMATA stored value application to the card. When the card is used on a particular system, that system's fare collection equipment will identify the appropriate fare product loaded on the card.

With regard to impacts on customers, a key issue relates to the plan to continue charging a purchase fee for the smart card. Although there has been no significant complaint among Metrorail users about the $5 price tag for the SmarTrip card, this could become more of an issue among bus riders. First of all, bus riders are often lower income than most rail riders, and thus may be generally more resistant to paying a surcharge for a farecard. In considering this issue, WMATA has found that the rate of SmarTrip card purchase has been strong even in the poorest neighborhoods. However, a key difference between the current situation and that planned for the bus system is that, on rail, the rider has a choice between paying for a smart card and using the magnetic farecard—which offers the same benefits of prepayment (including the 10 percent bonus on stored value) but without the initial fee. Although WMATA has decided to forego a magnetic option for the new bus fare equipment, flash passes will still be available in the short term. However, in order to take advantage of the stored value bonus, the convenience of seamless transfers to other systems, and other new fare options (e.g., Fair Fares), a bus rider will have to purchase a SmarTrip card; the alternative will be to pay for each ride in cash or to use a flash pass. This could well raise equity-related complaints from riders or from community organizations representing riders.

WMATA plans to provide cards at no (or minimal) charge to social service agencies, for free distribution to very low-income riders; whether this forestalls equity complaints remains to be seen. It will also be necessary to conduct an effective marketing campaign, educating riders as to the nature of the benefits of buying the card.



SOURCE: WMATA Marketing Department.

Figure CS13-3. Metrochek sales growth.

Operational and Administrative Impacts and Benefits

The implementation of the regional payment system will likely have a range of impacts on WMATA's operations and administration. The development of partnership agreements among the participants, particularly regarding establishing the Regional Customer Service Center, has been challenging. It has been necessary to resolve a range of issues in developing the structure of the proposed RCSC, including overall policy and business rules, technical requirements, and administrative and customer support functions. Moreover, even if the RCSC handles the bulk of the responsibilities for managing and supporting the regional program, WMATA and the other agencies in the program may have increased internal fare collection and data reporting responsibilities as well.

With regard to cost impacts, the most immediate impact on WMATA will be the capital cost associated with expanding SmarTrip acceptance to bus. The bus farebox project is estimated to cost $20 million for all of the equipment: fareboxes, computer systems, receiver vaults, smart card readers, spare parts, and warranty. Of course, since WMATA needed new fareboxes regardless of SmarTrip, the entire cost should not be attributed to the expansion of SmarTrip. Finally, there will also be costs associated with WMATA's use of the RCSC, as well as ongoing costs associated with maintaining the equipment and with any agency personnel needs in participating in the program (including adding staff where necessary and training operators and other support staff). At the present, information related to these costs is not available.

CONCLUSIONS AND LESSONS LEARNED

Customer Impacts and Benefits

SmarTrip has the following benefits and impacts for WMATA customers:

- Improved ease of use via contactless interface.
- Improved flexibility of fare payment through (1) accommodating multiple uses (i.e., transit, debit card, ID card and benefits card), and (2) potential for innovative fare structure and payment options (e.g., Fair Fare strategy, which is essentially a guaranteed lowest fare program).
- Improved convenience through (1) ability to register and restore value if card lost or stolen, (2) ability to accommodate multiple payment options, (3) autoload capability.
- Slightly higher cost to customers, given requirement to pay $5 to purchase the SmarTrip card.

There are essentially two different customer groups for the Metrochek program, employees and employers; benefits for each group include the following:

- Employees receive a transit expense bonus when using Metrochek, as a result of the tax savings. The amount of the bonus can vary from 35 to 40 percent, depending on the amount of the employee's benefit and whether the employee works in the government or private sector.
- Employers benefit from a savings in their payroll taxes. Employers can save anywhere from 7 to 44 percent on their payroll taxes by providing their employees with Metrocheks rather than a transportation allowance in their paychecks.

The SmartBenefits program has further benefits for employees and employers:

- Employees will have the convenience of claiming their benefits simply by tapping their cards at a Metrorail TVM. Once the new fareboxes are installed on Metrobuses, the reach of the SmartBenefits program will be further increased.
- Employers will be able to better manage their transit benefit programs via the Internet.

The Regional Smart Card Program is expected to have the following types of customer benefits and impacts:

- Ability to travel seamlessly using public transit throughout the Baltimore-Washington-Northern Virginia region regardless of mode or operator.
- Improved flexibility through ability to carry more than one agency's fare medium on the card.
- Higher cost, due to initial charge for card; passenger acceptance of this charge remains to be determined, although the charge has been readily accepted by Metrorail customers.

Agency Impacts and Benefits

The agency-related impacts and benefits experienced to date or anticipated for the SmarTrip program include the following:

- WMATA has not yet conducted an in-depth analysis of the costs versus benefits of the existing SmarTrip program or of its expansion throughout the region. However, WMATA has not viewed the program as a means of reducing costs; rather, the focus in implementing SmarTrip has been on improving the customer's convenience and providing customers with a flexible state-of-the-art fare payment medium.
- The SmarTrip program has proven very popular with Metrorail riders. Sales of the cards have increased steadily despite (1) the lack of any formal marketing of the program by WMATA, (2) the $5 initial purchase price, and (3) the limited sales locations.
- The SmarTrip program has improved WMATA's flexibility in terms of the ability to add new fare structure and payment options (e.g., Fair Fare strategy).

- The successful introduction of the Metrorail SmarTrip program has enabled WMATA to implement a number of other programs (e.g., First Union Pilot, GSA Pilot, SmartBenefits and Regional Fare Integration) that will further increase customer convenience and, thus, should increase ridership; these programs could ultimately lead to some improvements in the efficiency of WMATA's operation (e.g., through greater fare equipment reliability).
- The SmarTrip program may have a negative impact on system revenue, due to the loss of expired-value revenue associated with unused magnetic farecards (i.e., as increasing numbers of customers switch to SmarTrip cards, which are intended to be retained and reloaded for long periods of time). There may also be some revenue loss if the Fair Fare strategy is implemented; this strategy converts rides that would otherwise have been paid for from stored value to free rides once the rider has exceeded the threshold usage level to turn the card into a pass. The extent of revenue loss will depend on the pricing of the program and the number of riders using Fair Fare versus purchasing passes from the outset.

Agency benefits and impacts of the Metrochek and SmartBenefits initiatives include the following:

- Metrochek sales have increased exponentially since the program's inception in 1993. In 1993, Metrochek sales were $8.3 million. Today, Metrochek sales are $133.8 million. While Metrocheks can be used to buy fare media at more than 225 transportation providers throughout the Washington area, approximately 90 percent are used on WMATA's Metrorail and Metrobus.
- The SmartBenefits program has been successful so far. The true benefits to WMATA will not be fully achieved until the new smart card-capable fareboxes have been installed on Metrobus. At that time, WMATA should be able to convert most Metrochek users to SmartBenefits, which will eliminate the need for WMATA to print, process, and distribute large numbers of Metrocheks.

The expected agency benefits and impacts of the Regional Smart Card Program Fare include the following:

- Increased ridership and greater efficiency in fare collection.
- Increased fare collection and data reporting responsibilities for WMATA, despite the RCSC's overall responsibility for managing and supporting the regional program.
- Various costs, including (1) the capital cost associated with expanding SmarTrip acceptance to bus (an estimated $20 million for all of the new bus equipment); (2) fees associated with the agency's use of the RCSC; and (3) ongoing operating and maintenance costs, including training of personnel, hiring new personnel, and maintaining the equipment.

Clearly, the Regional Smart Card Program is a complex undertaking, entailing a range of institutional, operational and financial challenges. WMATA and the other agencies have addressed one of the major challenges in developing a common technology procurement strategy; in order for full regional integration to occur, it is now necessary to complete the process of establishing the clearinghouse.

Impacts and Benefits for Partner Entities

WMATA has entered into several types of partnerships in implementing these fare initiatives. While the First Union and GSA pilots have been quite limited in scope, they have demonstrated the feasibility of establishing multiapplication card arrangements; such arrangements offer the potential to significantly improve market penetration, for both transit riders and users of the partner applications.

The employer-based partnerships programs, Metrochek and SmartBenefits, benefit employers in several ways, as described above, under Customer Impacts and Benefits. These programs provide payroll tax benefits and also provide employers with a convenient means of distributing transit commuter benefits to employees. SmartBenefits in particular allows employers with a to manage their benefit programs easily by using the Internet.

Liability to Agency

The SmarTrip program carries some economic liability in terms of the potential loss of revenue: (1) the loss of expired value associated with reduced use of disposable farecards, and (2) the potential loss of fare revenue associated with the Fair Fare strategy. While neither source is expected to turn out to represent a substantial percentage of the overall system revenue, the impacts should be kept in consideration as the program expands.

Due in part to the tremendous growth of the Metrochek program, certain economic liabilities have resulted. Firstly, due to outstanding Metrocheks that have not yet been used, WMATA must carry a contingent liability of more than $10 million on its books (Note: the SmartBenefits program intends to solve this problem by allowing employers, through the Internet software, to remove employees' unclaimed benefits from the system). In addition, the fraud potential for Metrocheks is slightly higher than for other fare media. Since many employees receive Metrocheks in excess of their true transportation needs, an underground market of Metrochek sales has been created. For example, WMATA has discovered many Metrocheks being sold through on-line auction sites. No liabilities have yet been identified for the SmartBenefits program.

The Regional Smart Card Program carries the same types of economic liability as the existing SmarTrip program. In addition, there may be some political liability for the agency associated with the plan to continue charging an initial fee for obtaining the SmarTrip card. While this has not been an issue

for Metrorail riders, the situation could change when the program expands to buses where, unlike on rail, riders will not have the option to use magnetic farecards (at no initial cost) to obtain the discounts or bonuses attached to use of electronic fare media. This situation, coupled with the fact that the bus market tends to be lower income than the rail market, could conceivably generate equity-related complaints from riders or from community organizations representing riders. Hopefully, WMATA will be able to avoid such complaints by providing free or very low-cost cards to low-income riders and by educating these riders as to the benefits to be received by buying the card (e.g., registration and replacement of value).

Constraints and Barriers

A major technical constraint often facing agencies seeking to add smart card capability to an existing fare collection system is insuring compatibility with the existing system. In an effort to facilitate installation of the SmarTrip readers into the Metrorail faregates, WMATA opted to sole source the implementation to the existing rail fare collection vendor, Cubic Transportation Systems. While this expedited the implementation process, it also resulted in a constraint related to the price of the smart cards to be used in the system. Because Cubic at the time used only its own proprietary card technology (the GoCard), WMATA was limited to that single source of cards; this resulted in a relatively high per card price (around $10 apiece, initially). This price has subsequently dropped considerably (to roughly $5 apiece), and is expected to drop further; nevertheless, other types of smart cards produced by multiple vendors (e.g., ISO Type A or B cards) tend to be somewhat less expensive than proprietary cards. In the expanded regional system, Cubic will be providing its Tri-Reader technology, which is capable of being programmed to read Type A, Type B, or GoCard contactless cards. This provides an option to use a nonproprietary technology at some point, but since the Metrorail system currently can only read Cubic's proprietary cards, Type A and Type B cards could not be implemented until the Metrorail system has been retrofitted with Tri-Readers and the supporting software.

Initially, the Metrochek program met with some resistance from employees because the distribution cycle is quarterly. As such, employees needed to manage their transportation costs more carefully than if it were done monthly. Another constraint of the program is the result of WMATA's operating in the Washington area. Since three-quarters of the Metrocheks issued are distributed to federal employees, the Transportation Administrative Services Center (TASC) is involved in actively managing the program on behalf of most federal agencies. Due to the magnitude of the program, the lead time in the sales cycle for federal employers is much longer than for private-sector employers.

Currently, the only identifiable constraint of the SmartBenefits program is that it is limited to Metrorail users. However, the regional initiative will result in WMATA's extending the program to Metrobus and to other operators in the region.

Given the number of parties involved and the complexity of the necessary agreements, there are many potential constraints and barriers related to implementation and operation of the Regional Smart Card Program. In order for the program to reach fruition, the participating entities will need to develop and agree on a broad range of processes that will enable all participants to interface with each other in a seamless manner. The participants will need to make substantial changes in some of their current business practices in order to make the program work. Among the issues that need to be resolved are those related to governance (e.g., how will the regional program be controlled and managed), cost allocation details (e.g., the nature of the participant fee structure), revenue allocation and settlement procedures, operator reporting requirements, and operator customer service responsibilities.

Required Equipment and Technology

All of these fare initiatives are based on some form of advanced fare payment technology. SmarTrip uses smart card technology, Metrochek uses magnetic stripe technology, and SmartBenefits uses both smart card technology and web-based data management software.

The Regional Smart Card Program will rely on a regional standard for fare collection equipment and smart cards based on the SmarTrip format. The joint farebox procurement described above will ensure that all bus operators in the region will have a common farebox that is compatible with WMATA's rail equipment. Additionally, one of the requirements of the RCSC procurement is to ensure that the systems associated with the customer service, clearing and settlement functions, and point-of-sale network are fully compatible with the fare collection equipment deployed throughout the region.

Lessons Learned

A number of key lessons have been learned from the development of these fare initiatives; these include the following:

- Smart cards can prove quite popular with transit riders, even without extensive marketing by the agency, despite the existence of an initial purchase charge. Key selling points of the SmarTrip card have included (1) the ability to guarantee replacement of value if the card is lost, (2) automated loading methods; and (3) the contactless convenience of using the card.
- Using the SmarTrip technology as a platform, WMATA has been able to develop partnerships with the other tran-

sit operators in the region, and with nontransit entities (i.e., First Union Bank and the GSA). The completion of the regional program will likely create further opportunities to incorporate other applications (e.g., retail, hospitality and entertainment, university, security, and others) as well.

- Programs such as Metrochek and SmartBenefits programs can be quite beneficial—and thus attractive—to both employers and employees by streamlining the process of distribution of transit benefits.

CASE STUDY CONTACTS AND SOURCES

The following individuals assisted in providing information included as part of this case study:

Peter Benjamin
WMATA
600 Fifth Street, NW
Washington, DC 20001
202-962-1200
pbenjamin@wmata.com

Gregory Garback
WMATA
600 Fifth Street, NW
Washington, DC 20001
202-962-1358
ggarback@wmata.com

Craig Maxey
WMATA
600 Fifth Street, NW
Washington, DC 20001
202-962-1791
cmaxey@wmata.com

Lorraine Taylor
WMATA
600 Fifth Street, NW
Washington, DC 20001
202-962-2768
ltaylor@wmata.com

Donna Murray
WMATA
600 Fifth Street, NW
Washington, DC 20001
202-962-1188
dmurray@wmata.com

The following documents (in addition to ridership and revenue summaries and other data) were used in preparing the case study:

QS&A Research & Strategy. *2001 Public Perceptions of Transit Tracking Study.*

SmarTrip: Making the Move from 'Paper to Plastic', Washington Metropolitan Area Transit Authority, Office of Accounting Quarterly Meeting: Celebration of Change; May 30, 2002.

REFERENCES: PART II

1. Foote, P., and D. Stuart. *Impacts of Transit Fare Policy Initiatives Under an Automated Fare System.* Transportation Quarterly, Volume 54, Number 3, Summer 2000.
2. Foote, P., R. Patronsky, and D. Stuart. *Customer Impacts of CTA's Automated Fare Collection System*. Paper presented at TRB Annual Meeting, January 1999.
3. Foote, P., R. Patronsky, and D. Stuart. *Transit Customer Acceptance of Automated Fare Collection Systems*. Journal of Public Transportation, Volume 2, No. 3, 1999.
4. Stuart, D. *University and College Student Ridership Growth in Chicago U-PASS Program*. Paper presented at APTA Rapid Transit Conference, Boston, June 2001.
5. CTA Market Research Department. *2000–01 U-PASS Student Ridership*. Technical Report MR/DSD01-22, August 2001.
6. CTA Market Research Strategic Planning Department. *CTA Smart Card Pilot Program: Customer Satisfaction Survey*, Technical Report MR01-03, February 2001.
7. Foote, P., and D. Stuart. *Testing Customer Acceptance of Smart Cards at the Chicago Transit Authority.* Paper presented at TRB Annual Meeting, January 2002.
8. *CTA Smart Card Pilot Program.* A Presentation by Technology Management and Finance Division, CTA, February 2001.
9. Lee, D.A. *Introducing Fare Simplification and New Convenience Fares at Connecticut Transit*. Transportation Research Record 1669 (1999), pp. 109–112.
10. Ilium Associates. *CT TRANSIT Marketing Project: Recommendations*. Prepared for CT TRANSIT, June 1996.
11. Taylor, S., and D. Carter. *Maryland Mass Transit Administration Fare Simplification: Effects on Ridership and Revenue*, Transportation Research Record 1618 (1998), pp. 125–130.
12. *Getting On Board: The Maryland Comprehensive Transit Plan*, Volume I Executive Report, Maryland Mass Transit Administration, December 2000.
13. Benton International, *TransLink Program Plan* for the MTC, December 1995.
14. From presentation by Russell Driver, MTC, November 2000.
15. Charles River Associates, *Evaluation of the TransLink Demonstration (Final Report)*, for MTC, September 2002, p. xii.
16. "NJ TRANSIT's Call to Action: An Investment for the Future, Fiscal Years 2002 through 2006 and Beyond," *NJ TRANSIT*, September 2001.
17. Capadonna, L.V. *WorkPass Works for Everyone*. Act '99/ Hyperlink to Mobility (1999).
18. Multisystems, Lewis Polin & Associates, and Mundle & Associates. *OCTA Fare Structure Study—Final Report*, March 1994.
19. www.transitcenter.org/benefits/tc_ee/savings.htm
20. Echelon Industries. Advanced Fare Payment Media Study for USDOT/SBIR. 1992.
21. Volpe National Transportation Systems Center. *Ventura County Fare Integration: A Case Study*, September 2001.
22. Presentation on the project made by Ginger Gherardi, Executive Director of VCTC.
23. QS&A Research & Strategy. *2001 Public Perceptions of Transit Tracking Study*.

APPENDIX A
BIBLIOGRAPHY

Allen, George; Lipton, S. Gregory; and Brooke, Brian. "Unique Voucher Program Increases Alternative Commuting," submitted to TRB (July 1998).

Allen, John. "Fare Coordination Between Commuter Rail and Other Transit Services" (July 2001).

Ambrosino, G.; Boero, M.; Sassoli, P.; Iacometti, A.; and Biagiotti, S. "Integration of Public Transport Systems and Services in the City of Florence: Demand Responsive Bus Services in Low Demand Areas."

APTA. *2000 Transit Fare Summary* (2001).

Barr, Joseph. "Fare Integration Between Public and Private Operators: Existing Obstacles and the Potential for Smart Cards."

Blythe, P.T. "Implementing Smart Card Technology to Transform Transport Payment and Customer Information."

Booz-Allen & Hamilton, Inc. *Developing a Regional Approach to Fare Collection*, prepared for Greater Washington Region Transit Operators (February 2000).

Brown, Jeffrey; Hess, Daniel; and Shoup, Donald. "Unlimited Access," presented at the TRB 40th Annual Meeting, Washington, DC (November 1999).

Bullard, Robert. "Race and Public Transportation in Metro Atlanta: A Look at MARTA," *Transportation Equity* Volume 2, Number 1 (Summer 2000).

Chandrasekhar, B.N. "Demand Elasticities in Public Transport Case Study—Bombay."

Chang, Foun-Shea; Hou, Richard Chih-Jung; and Shen, Kirk. "A Pilot Study on Integrated Public Transportation Ticketing Using a Contactless Smart Card in Taipei Metropolitan Area."

Charles River Associates. *Evaluation of the TransLink Demonstration (Final Report)*, for Metropolitan Transportation Commission, September 2002.

Chira-Chavala, T. and Coifman, B. "Impacts of Smart Cards on Transit Operators," presented at TRB 75th Annual Meeting, Washington, DC (Jan. 1996).

Choi, Soon-Yong and Whinston, Andrew. *Smart Cards, Enabling Smart Commerce in the Digital Age*, Draft (May 1998).

Chung, Frances. "Experience of the Tripperpas in the Dutch Municipality of Groningen," submitted for TRB Annual Meeting (Jan. 2002).

Chung, Frances. "Technology and the Evolution of Fare and Service Integration in GO Transit," *UITP Congress Report, Toronto 1999*.

"Cleveland to Provide Pass Program for University Students," *Passenger Transport* (August 6, 2001).

Collura, John and Plotnikov, Valeri. "The Usefulness of an EPS Business Case in Public Transit," prepared for 10th ITS America Annual Mtg., Boston, MA (2000).

Community Transportation Association of America. "Missouri Bootheel Transportation Outreach Program."

Comps, Peter. "Integrating Proof-of-Payment Fare Systems with Modern Fare Systems," presented at 8th Joint Conference on Light Rail Transit, Dallas, TX (November 2000).

"Congress Considers Bills Boosting Transit Fringe Benefits," *Passenger Transport* (April 30, 2001).

Conklin, J.; Halvorsen, R.; Fleishman, D.; and Oram, R. "Employer-Based Annual Transit Pass Programs: A Survey of Current Practice in the Public Transit Industry." Presented at TRB Annual Meeting, Washington, DC (January 2002).

Crenshaw, Albert. "Commuting Accounts Gain Speed: IRS Proposes Rules to Help Firms Set Up Benefits Program," *Washington Post*, Sunday, February 6, Page H2.

"CTA, Riders Find a Win-Win Situation in Transit Benefits," *Passenger Transport* (June 18, 2001).

Eidel, Chantal. "A New Transit Fare Policy for Young People Powered by Direct Marketing," *UITP Workshop, Paris 2000*.

E-Squared Engineering. *Introduction to Electronic Payment Systems and Transportation*, prepared for ITS America Electronic Payment Systems Task Force (April 2001).

FHWA. *The Challenge of Job Access: Moving Toward a Solution* (1998).

Fleishman, D.; Shaw, N.; Joshi, A.; Freeze, R.; and Oram, R. *Fare Policies, Structures, and Technologies*, TCRP Report 10 (1996).

Fleishman, D.; Schweiger, C.; Lott, D.; and Pierlott, G. *Multipurpose Transit Payment Media*, TCRP Report 32 (1998).

Hillberry, Russell. "Some Fare Policy Implications of Smart Cards," prepared for the FTA Office of Research, Demonstration and Innovation (April 1998).

Integrated Transport Smartcard Organization (ITSO). *The ITSO Specification for Interoperable Public Transport Ticketing Using Contactless Smartcards*, Overview and Business Model (November 2000).

Intelligent Transportation Society of America. *ITS Electronic Payment Systems*, Workshop Proceedings, Reston, VA (February 1999).

Internal Revenue Service. *Qualified Transportation Fringe Benefits*, Federal Register, Vol. 66, No. 8 (January 11, 2001).

King, J. and Hensher, D.A. "Establishing Fare Elasticity Regimes for Urban Passenger Transport: Time-Based Fares for Concession and Non-Concession Markets Segmented by Trip Length," *Journal of Transportation and Statistics*, 1998—no. 1.

Kuester, Carol. "Implementing Smart Card Payment Systems for Transit with Multiple Partners: Examples from Germany and the United States," *European Transport Conference*—1999—no. P433.

Lee, David. "Introducing Fare Simplification and New Convenience Fares at CTTRANSIT." Submitted to TRB Annual Meeting.

Lobron Consultancy, Ltd. *Develop a Recommended Standard for Automated Fare Collection for Transit—Scoping Study Final Report*, TCRP J-6 Task 42, November 2002.

Louviau, Phillipe and Allouche, Jean-Francois. "First Field Test of the Contactless Ticketing System in Paris and Its Region."

Mudgal, V.S. "Comparative Analysis of Fare Structures in Metropolitan Cities in India," *Indian Journal of Transport Management*, 2000—no. 11.

Multisystems, Inc. *Analysis of the Fare Structure and Policies* (Final Report), prepared for the Capital Area Transportation Authority (June 2001).

Multisystems, Inc. "Coordinated Intermodal Transportation Pricing and Funding Strategies," *TCRP Research Results Digest 14*, October 1997.

Multisystems, Inc. *Fare Policy Study* (Final Report), prepared for Southeastern Pennsylvania Transportation Authority (January 2001).

Multisystems, Inc. *Fare Structure Pricing Research and Update of Ridership/Revenue Fares Model* (Final Report), prepared for Chicago Transit Authority (September 2000).

Multisystems, Inc., Mundle & Associates, and Parsons Transportation Group. *A Toolkit for Self-Service, Barrier-Free Fare Collection*, TCRP Report 80 (2002).

Multisystems, Inc. *Transit Fare Collection Decision Models for Fare Policy and Cost Analysis* (Final Project Summary Report), prepared for U.S.DOT/SBIR Program (November 1998).

Oorni, Seppo. "Smart Card Based Systems in Finland" (no date).

Pekkarinen, S. and Dargay, J. "Public Transport Pricing Policy: Empirical Evidence of Regional Bus Card Systems in Finland," *Transportation Research Record 1604* (1997).

Petitte, Ryan. "Fare Variable Construction and Rail Transit Ridership Elasticities: A Case Study of the Washington, DC Metro Rail System" (July 2000).

Ponnuswamy, S. and Nesamani, K.S. "Improving the Patronage of MRTS. Through Integration and Fare Structure Co-ordination," *Indian Journal of Transport Management*, 2000—no. 10.

Ratton Neto, H.X. "Transport Subscription: An Efficient Means to Better Performances in Urban Public Transport Networks," (no date).

San Luis Obispo County Council of Governments (SLOCOG). *Draft Welfare Reform Mobility Study* (no date).

Schelin, Eva and Gustafsson, Inger. "Integrated Payment and Information in Transport Test Site Gothenburg of ADEPT II," (no date).

Smart Card Forum Proceedings, Schaumburg, IL. *Cards on the Move* (June 2000).

Stern, R. *Bus Transit Fare Collection Practices*, TCRP Synthesis 26 (1997).

Stern, R. *Passenger Transfer System Review*, TCRP Synthesis 19 (1996).

Stitcher, Joseph. "Partners with UCLA on Farecard Demonstration," *Passenger Transport* (August 20, 2001).

Strategies for Increasing the Effectiveness of Commuter Choice Programs, TCRP Project H-25 (2003).

Stuart, Darwin and Foote, Peter. "Impacts of Transit Fare Policy Initiatives Under An Automated Fare System," *Transportation Quarterly*, Vol. 54, No. 3 (2000).

Stuart, Darwin; Foote, Peter; and Patronsky, Ross. "Transit Customer Acceptance of Automated Fare Collection Systems," *Journal of Public Transportation*, 1999—no. 3.

Thomas, Robert; Boyle, Daniel; and Harris, Annie. "Metropolitan Atlanta Rapid Transit Authority Fare Elasticity Model," *Transportation Research Record 1669* (1999).

Transportation Research Board. *Workshop on Transit Fare Policy and Management: Research Needs and Priorities*, Transportation Research Circular 421 (April 1994).

U.S.DOT/Volpe National Transportation Systems Center. *Advanced Public Transportation Systems: The State of the Art, Update '98* (January 1998).

Vargas, Jessica. *"Unlimited Access" for San Juan's University Population: A Market Study of Student Attitudes Toward Transit* (June 2001).

Vivier, Jean. "Urban Transport Pricing," *Public Transport International*—5/99.

Volpe National Transportation Systems Center and Battelle Labs. *National Transit Smart Card Guidelines, Transit-University Module* (Draft) (1999).

Volpe National Transportation Systems Center and Booz-Allen & Hamilton. *National Transit Smart Card Guidelines, Regional Fare Program Integration Module* (Draft) and *Transit-Financial Module* (Draft) (1999).

Volpe National Transportation Systems Center and IBI. *National Transit Smart Card Guidelines, Employer Programs Module* (Draft) (1999).

Volpe National Transportation Systems Center. *National Guidelines and Technical Specifications Initiative for Electronic Payment Systems, Transit Requirements Document* (Draft, Version 2), Cambridge, MA (November 1998).

Watry, Duncan and Straus, Peter. "MUNI Metro Goes POP: Implementing Proof of Payment Fare Collection on MUNI Metro," presented at the 8th Joint Conference on Light Rail Transit, Dallas, TX (November 2000).

Weinstein, A.; Lockhart, R.; and Rolandson, B. "Transit Prepayment Challenges—Factors Influencing Customers' Willingness to Purchase High Value Tickets."

White, Chris. *Effects of the go! Pass on Transit Ridership and Downtown Commuting* (First Report) (September 2000).

Williamson, Jennifer and Hurwitz, Elliot. "The Marketing and Fare Nexus Applied to San Diego," *Transportation Research Record 1669* (1999).

APPENDIX B
KEY STUDY RESOURCES

A number of key transit fare-related resources were identified in the course of this study. The major categories of past or ongoing research and sources of information on fare-related issues are as follows:

- Prior TCRP Research
- U.S.DOT-Sponsored Research
- Fare-Related Research and Development Efforts
- Conference Presentations and Magazine, Journal and Newspaper Articles

Full citations for all of the reports mentioned below are provided in the bibliography.

PRIOR TCRP RESEARCH

Several prior TCRP (and TRB-sponsored) studies have reviewed various aspects of fare-related issues considered in this study. These studies are as follows:

- TCRP Report 10, *Fare Structures, Policies, and Technologies*. This comprehensive study considered developments related to—and the interrelationships among—the major parameters of the transit fare decision-making process (i.e., policy, structure, and technology) and developed a set of guidelines for fare-related decisions.
- TCRP Report 32, *Multipurpose Transit Payment Media*. This study examined the potential for introducing multipurpose payment media (i.e., smart cards) that can be used to purchase transit services from multiple operators and, potentially, other goods and services (e.g., parking and retail products). The study examined smart card technology, legal and institutional issues associated with multipurpose programs, cost and revenue impacts, and customer attitudes.
- TCRP Report 80, *A Toolkit for Self Service, Barrier-Free Fare Collection*. This study produced a set of guidelines for use by transit agencies considering (1) introducing self-service fare collection, (2) switching from some other type of fare collection to self-service, or (3) improving an existing system.
- TCRP Research Results Digest 14, *Coordinated Intermodal Transportation Pricing and Funding Strategies*. This study examined the potential for intermodal regional pricing (i.e., involving transit and auto-related pricing such as parking and congestion pricing).
- TCRP Synthesis of Transit Practice 19, *Passenger Transfer System Review.* This report discusses transit agencies' transfer policies and practices.
- TCRP Synthesis of Transit Practice 26, *Bus Transit Fare Collection Practices.* This report summarizes bus fare collection equipment, approaches and issues.
- TRB Circular 421, *Workshop on Transit Fare Policy and Management) Woods Hole Workshop*. This report documents the proceedings and findings of a fare policy workshop held in Woods Hole, MA, in 1993; this workshop represented the first systematic effort to identify the key issues facing transit fare decision-makers since a similar workshop had been held in 1980.

U.S.DOT-SPONSORED RESEARCH

Several key research efforts have been conducted for the U.S.DOT/FTA; these include the following:

- FTA, *Fare ReVIEW* project. This project led to the development of a set of guidelines for transit agencies to assess their revenue management capabilities and requirements.
- SBIR, *Transit Fare Collection Decision Models for Fare Policy and Cost Analysis*. This study considered the need for, and feasibility of, developing computer-assisted decision models dealing with various aspects of fare system design.
- FTA/Volpe Center, *National Guidelines and Technical Specifications for Electronic Payment Systems.* This effort, now underway, involves the development of a series of documents to assist transit agencies in the design and implementation of multiple agency and multiapplication smart card programs.

FARE-RELATED RESEARCH AND DEVELOPMENT EFFORTS

Another source of information for the study was research and analysis conducted or sponsored by individual transit agencies and transportation industry organizations. Key examples include the following:

- APTA, *Transit Fare Summary*. An annually updated compendium of data on specific agencies' current fare structures and payment options.
- ITS America's Electronic Payment Systems Task Force, *Introduction to Electronic Payment Systems and Transportation*. This document identifies developments in

electronic payment in transit and the broader transportation environment.

- A number of transit and regional planning agencies have sponsored fare-related research and planning studies in recent years. These studies have generally sought to identify possible fare policy and structure—or technology—options for improving or updating the agencies' fare systems; just in the past few years, studies have been conducted in San Francisco, Philadelphia, Chicago, Los Angeles, Boston, Washington, DC, Atlanta, Denver, Dallas, Pittsburgh, St. Louis, San Diego, Miami, Baltimore, and San Juan, PR, as well as in smaller cities such as Lansing, MI, Norfolk, VA, Reno, NV, and Rochester, NY. In some cases, studies have focused on the feasibility of regional fare integration, using advanced technologies such as smart cards; examples include extensive research and development efforts in the metropolitan areas of San Francisco Bay, the Washington, DC, New York City/Northern New Jersey, Los Angeles, Seattle/Central Puget Sound, San Diego, Miami, and southwestern Connecticut.

CONFERENCE PRESENTATIONS AND MAGAZINE, JOURNAL, AND NEWSPAPER ARTICLES

In addition to full reports, various magazine, journal, and newspaper articles and unpublished conference presentations have addressed issues relevant to this study. Through Internet-based searches of key databases, we have identified relevant papers and presentations pertaining to fare-related issues. Key sources and databases included the following:

- *Transportation Research Board*, for published Research Record papers and other papers presented.
- *APTA/Passenger Transport*, for fare-related articles.
- *International Union of Public Transport* (UITP), for international papers and presentations.
- Other sources included local newspaper articles on fare issues (via the Internet) and conference presentations and papers (e.g., from the annual APTA Fare Collection Workshop, Transportation Research Board Annual Meeting, and other meetings).

APPENDIX C
ESTIMATION OF FARE SYSTEM COSTS

This appendix discusses the costs of procuring and implementing a new or upgraded fare system featuring some form of electronic payment based on magnetic stripe or smart card technology. The two introductory sections, on factors affecting capital and equipment costs, are largely taken from TCRP Report 10. The detailed discussions of costs for a small, bus only, transit system and a midsize, bus and LRT transit system were developed for this report.

FACTORS AFFECTING CAPITAL COSTS

Fare collection equipment tends to be a customized product. There is no typical cost; rather, a range of costs can be estimated, keeping in mind that many conditions and assumptions may be involved in the estimate. Unit costs are generally developed for each type of equipment based on 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. In addition, costs for engineering and support services depend on the purchasing experience of the agency, the local contracting environment, and the skills available within the agency's personnel—and also whether the agency is purchasing this type of equipment for the first time or it is a new generation replacing "old" equipment. It should also be kept in mind that much fare collection equipment is largely built in response to individual orders. Each agency's requirements invariably impose different performance features, even if major modules or subassemblies are the same among several orders. Final configurations of even very similar equipment for different agencies are rarely alike.

The price for any type of equipment is therefore sensitive to such factors as the following:

- The equipment specifications for the individual agency, including performance requirements and features; this affects the amount of customization required for a product, and this customization can represent a substantial portion of the overall price.
- The quantities of the particular equipment being ordered.
- The extent to which the new equipment will have to interface with existing equipment (i.e., that is not being replaced).
- The nature of the vendor selection and negotiation process (e.g., type of contract: low bid, two step or negotiated).
- The timing of the procurement (relative to the procurement of similar equipment by other agencies—and therefore the extent of refinement of the technology).
- Growth potential (e.g., opportunities for new/extended lines).
- Warranty terms: warranties are generally for 1 year, but this period can be extended based on other clauses associated with equipment performance.
- Documentation requirements (i.e., striking a balance between what is offered as manufacturer's "standard" and degree of customization for the agency).
- Software requirements: some software customization is expected, but requests for additional functions, features and reports will be considered extra and will increase the cost.
- Vehicle/station/facility modifications: the cost of modifications to vehicles, stations, bus garages, or other facilities also needs to be considered.
- Americans with Disabilities Act (ADA) requirements: fare collection equipment must address ADA requirements; these include accommodation of wheelchairs in turnstiles, provision of sufficient room on buses to pass the farebox in a wheelchair, compliance with height requirements for buttons on automated vending machines, and accommodation of needs of blind riders in purchasing and using fare media.

Thus, there are many factors that must be considered in developing the capital costs for a new fare collection system. Obviously, the more extensive and complex the procurement, the greater the number of factors. Cost information for different types of equipment and fare media is presented below.

EQUIPMENT COST INFORMATION

Cost issues are critical in selecting a fare collection technology. The choice of specific media and equipment options has major cost implications, both in terms of initial capital expenditures and on-going operating and maintenance expenses. Within both cost categories, the actual cost levels are highly dependent on the specific requirements and specifications of the individual transit agencies—as well as a variety of other factors as discussed above. With these factors in mind, it is still useful to develop order-of-magnitude cost estimates for various types of equipment and media. This enables a transit agency to conduct a preliminary evaluation of the relative costs of the different technologies or equipment options.

Table C-1 presents a range of estimated bus- and rail-related costs such as might be incurred by a system introducing magnetic farecard or smart card capabilities; variable system and

TABLE C-1 Unit cost estimates—electronic payment systems

Cost Element	Cost (dollars)*		Nature of Cost	
	Low	High	One-Time	Ongoing
Bus-Related Costs per Unit				
Mechanical farebox	2,000	3,000	X	
Electronic registering farebox	4,000	5,000	X	
Electronic registering farebox (with smart card reader)	5,000	8,000	X	
Validating farebox (with magnetic card processing unit)	10,000	12,000	X	
Validating farebox (with smart card reader)	12,000	14,000	X	
Validating farebox (with magnetic & smart card reader)	13,000	17,500	X	
Stand-alone smart card processing unit	1,000	7,000	X	
Magnetic farecard processing unit (upgrade)	4,000	6,000	X	
Onboard probe equipment**	500	1,500	X	
Garage probe equipment**	2,500	3,500	X	
Application software (smart card units)	0	100,000	X	
Garage hardware/software	10,000	20,000	X	
Central hardware/software	25,000	75,000	X	
Rail-Related Costs per Unit				
Ticket vending machine (TVM)	30,000	60,000	X	
TVM upgrade—smart card processing	3,000	7,000	X	
TVM upgrade—magnetic farecard processing	3,000	5,000	X	
Add-Fare machine (cash only)	5,000	25,000	X	
Fare Gate (magnetic/contactless card)	20,000	35,000	X	
Stand-Alone smart card validator	5,000	8,000	X	
Stand-Alone magnetic farecard validator	8,000	11,000	X	
Portable (hand-held) smart card validator	2,000	4,000	X	
Attended smart card revaluing device	2,500	6,000	X	
Attended magnetic farecard issuing device	5,000	10,000	X	
Station hardware/software (heavy rail)	50,000	100,000	X	
Station hardware/software (light rail)	7,000	10,000	X	
Central hardware/software	100,000	200,000	X	
Variable System Costs				
Spare Parts (% of equipment cost)	10	15	X	
Support services include training, documentation, revenue testing, and warranties (% of equipment cost)	10	15	X	
Installation (% of equipment cost)	3	10	X	
Nonrecurring engineering & software costs (% of equipment cost)	0	30	X	
Contingency (% of equipment/operating cost)	10	15	X	X
Equipment maintenance costs (% of equipment cost)	5	7		X
Software licenses/system support (% of systems/software cost)	15	20		X
Revenue handling costs (% of annual cash revenue)	5	10		X
Clearinghouse (e.g., card distribution, revenue allocation) ++ (%of annual Automatic Fare Collection revenue) (% of annual AFC revenue)	3	6		X
Fare Media Costs per Unit				
Magnetic or capacitive cards	0.01	0.30		X
Contactless cards (plastic)	2.00	5.00		X
Contactless cards (paper)	0.30	1.00		X
Contact cards	1.50	4.00		X
Dual interface cards	5.00	10.00		X

* 2002 $; the actual cost depends on functionality/specifications, quantity purchased and specific manufacturer.
** In an integrated regional system, there is no additional cost for probe equipment.
++ This depends on the nature of the regional program, if any.

fare media costs are also included in the table. Ultimately, the overall cost for an agency's fare collection system depends largely on the size—and modal composition—of the agency. In other words, a heavy rail agency will have very different equipment needs from a small bus agency. The nature of the technology and equipment capabilities selected will also greatly influence the ultimate cost. Moreover, if the agency is procuring a new fare system (or upgrading an existing system) as part of an integrated regional payment system, the exact types and quantities of equipment needed—and the cost to the agency—will depend to a large extent on the nature of the program and institutional arrangement being established.

Equipment cost estimates are presented below for procuring and implementing some form of electronic payment at two hypothetical transit agencies of different sizes and modes. For each agency, two scenarios have been developed: one focusing on the use of magnetic stripe farecards, the other on contactless smart cards. Unit cost estimates presented here

TABLE C-2 Smart card system for small bus agency in regional fare program*

Cost Element	Unit Cost		Number of Units	Total Cost	
	Low	High		Low	High
One-Time Costs					
electronic farebox with smart card reader	$5,000	$8,000	100	$500,000	$800,000
smart card application software**	$10,000	$25,000	1	$10,000	$25,000
revenue equipment (vaults, bins, etc.)	$40,000	$65,000	1	$40,000	$65,000
garage hardware/software	$15,000	$35,000	2	$30,000	$70,000
attended smart card revaluing device***	$2,500	$6,000	5	$12,500	$30,000
spare parts	10% of equipment cost	15% of equipment cost		$59,250	$148,500
support services	10% of equipment cost	15% of equipment cost		$59,250	$148,500
installation/nonrecurring engineering	3% of equipment cost	10% of equipment cost		$17,775	$99,000
fare media costs (contactless cards) +	$2.00	$5.00	10,000	$20,000	$50,000
contingency costs	10% of one-time cost	15% of one-time cost		$74,878	$215,400
Total One-Time Costs				*$823,653*	*$1,651,400*
Ongoing Costs					
equipment maintenance costs	5% of equipment cost	6% of equipment cost		$29,625	$59,400
software licenses/system support	15% systems/software	20% systems/software		$3, 750	$15,000
revenue handling costs (cash)	5% of cash revenue	10% of cash revenue		$120,000	$240,000
clearinghouse costs++	3% of smart card revenue	6% of smart card revenue		$72,000	$144,000
contingency costs	10% of ongoing cost	15% of ongoing cost		$22,538	$68,760
Total Ongoing Costs				*$247,913*	*$527,160*
Total First Year Cost				***$1,071,565***	***$2,178,560***

* This is a bus system with 100 vehicles and 2 garages; average weekday ridership = 20,000. The transit agency is installing electronic registering fareboxes with smart card processing units.

** This agency will also be responsible for a portion of the cost of application software for the smart card readers; this is estimated at $100,000 for the overall system.

*** It is assumed that smart cards are sold through the normal pass sales outlets and by employers. However, there are card valuing machines available to reload the cards once they have been acquired. Cards can also be reloaded on the buses.

\+ The estimated number of smart cards assumes that 50% of rides are made using the cards (i.e., as monthly passes or stored value cards), that each card is used an average of twice a day, and that each card is retained an average of 9 months (i.e., a cardholder uses an average of 1.33 cards per year.) A 50% card reserve is also assumed.

++ It is assumed that this agency is participating in a regional integrated card program, and is responsible for a portion of the clearinghouse funding; clearinghouse costs include revenue settlement, distribution of cards, and other support functions.

are based on discussions with agencies, consultants and vendors over the past few years regarding the range of costs for comparable equipment available in the U.S. marketplace as of late 2002.

Small Transit System (Bus Only)

Two sets of cost estimates were developed for a small transit system that operates buses only:

(1) Costs for such a hypothetical small bus agency that is integrated into a regional program to add smart card (Table C-2).

(2) Costs for a stand-alone small bus agency to add a magnetic system (Table C-3).

The smart card alternative is estimated to have somewhat lower costs at both the low and high end of the cost range. The major source of the cost differential is the higher cost of an electronic registering farebox equipped to process magnetic (read-write) farecards. The cost of fare media is greater for the smart card scenario, but the relatively low number of cards needed results in a relatively low cost differential. Note that there is also expected to be a somewhat lower maintenance cost for the contactless smart card processing units than for the magnetic units—due to the fact that the smart card equipment has no moving parts and is fully enclosed, that is, it has no slots into which foreign objects can be inserted.

TABLE C-3 Magnetic farecard system for small bus agency*

Cost Element	Unit Cost		Number of Units	Total Cost	
	Low	High		Low	High
One-Time Costs					
elect. farebox with card processing unit	$8,000	$10,000	100	$800,000	$1,000,000
revenue equipment (vaults, bins, etc.)	$40,000	$65,000	1	$40,000	$65,000
garage hardware/software	$15,000	$35,000	2	$30,000	$70,000
attended farecard issuing device**	$5,000	$10,000	5	$25,000	$50,000
spare parts	10% of equipment cost	15% of equipment cost		$89,500	$177,750
support services	10% of equipment cost	15% of equipment cost		$89,500	$177,750
installation/nonrecurring engineering	3% of equipment cost	10% of equipment cost		$26,850	$118,500
fare media costs (magnetic cards) +	$0.15	$0.30	30,000	$4,500	$9,000
contingency costs	10% of one-time cost	15% of one-time cost		$110,535	$250,200
Total One-Time Costs				*$1,215,885*	*$1,918,200*
Ongoing Costs					
equipment maintenance costs	6% of equipment cost	7% of equipment cost		$53,700	$82,950
software licenses/system support	15% systems/software	20% systems/software		$3,750	$15,000
revenue handling costs (cash)	6% of cash revenue	10% of cash revenue		$144,000	$240,000
revenue handling costs (farecards)	3% of farecard revenue	6% of farecard revenue		$72,000	$144,000
contingency costs	10% of ongoing cost	15% of ongoing cost		$20,145	$50,693
Total Ongoing Costs				*$293,595*	*$532,643*
Total First Year Cost				***$1,509,480***	***$2,450,843***

* This is a bus system with 100 vehicles and 2 garages; average weekday ridership = 20,000. The transit agency is installing electronic registering fareboxes with magnetic farecard processing units.

** It is assumed that farecards are sold—and can be revalued—at attended point of sale devices. Cards can also be reloaded on the buses.

\+ The estimated number of smart cards assumes that 50% of rides are made using the cards (i.e., as monthly passes or stored value cards), that each card is used an average of twice a day, and that each card is retained an average of 3 months (i.e., each cardholder uses an average of 4 cards per year). A 50% card reserve is also assumed.

TABLE C-4 Smart card system for bus and LRT agency in regional program*

Cost Element	Unit Cost		Number of Units	Total Cost	
	Low	High		Low	High
One-Time Costs					
validating farebox with smart card reader	$12,000	$14,000	800	$9,600,000	$11,200,000
smart card application software	$10,000	$25,000	1	$10,000	$25,000
revenue equipment (vaults, bins, etc.)	$40,000	$65,000	1	$40,000	$65,000
garage hardware/software	$15,000	$35,000	4	$60,000	$140,000
card TVM interface upgrade**	$3,000	$7,000	40	$120,000	$280,000
platform validator	$5,000	$8,000	40	$200,000	$320,000
portable validator	$2,000	$4,000	30	$60,000	$120,000
station hardware/software	$7,000	$10,000	20	$140,000	$200,000
spare parts	10% of equipment cost	15% of equipment cost		$1,023,000	$1,852,500
support services	10% of equipment cost	15% of equipment cost		$1,023,000	$1,852,500
installation/nonrecurring engineering	3% of equipment cost	10% of equipment cost		$306,900	$1,235,000
fare media costs (contactless cards)+	$2.00	$5.00	100,000	$200,000	$500,000
contingency costs	10% of one-time cost	15% of one-time cost		$1,278,290	$2,668,500
Total One-Time Costs				*$14,061,190*	*$20,458,500*
Ongoing Costs					
equipment maintenance costs	5% of equipment cost	6% of equipment cost		$511,500	$741,000
software licenses/system support	15% systems/software	20% systems/software		$52,500	$141,250
revenue handling costs (cash)	5% of cash revenue	10% of cash revenue		$1,500,000	$3,000,000
clearinghouse costs++	3% of smart card revenue	6% of smart card revenue		$900,000	$1,800,000
contingency costs	10% of ongoing cost	15% of ongoing cost		$296,400	$852,338
Total Ongoing Costs				*$3,260,400*	*$6,534,588*
Total First Year Cost				***$17,321,590***	***$26,993,088***

* This system has 800 buses (4 garages) and 20 LRT stations. Average weekday ridership = 200,000; annual ridership = 60 million. The transit agency is installing new validating fareboxes that accept smart cards but not magnetic cards, and is adding smart card-accepting devices to the existing TVM's.

** A stored-value smart card must be touched to a TVM or a stand-alone validator (i.e. to deduct the value of the ride). A smart card containing a pass need only be validated the first time it is used. Inspectors carry portable units that check smart cards for proof-of-payment. A rider may also buy a paper proof-of-payment ticket from a TVM. Value can be added to a smart card at TVMs.

\+ The estimated number of smart cards assumes that 30% of rides are made using the cards (i.e., as monthly passes or stored value cards), that each card is used an average of twice a day, and that each card is retained an average of 9 months (i.e., a cardholder uses an average of 1.33 cards per year). A 50% card reserve is also assumed.

++ Clearinghouse costs include collection of merchant revenue, settlement, distribution of media, and other related functions.

Mid-Size Transit System (Bus and Light Rail)

Tables C-4 and C-5 present cost estimates for a larger hypothetical transit system adding smart card or magnetic capabilities, respectively. This agency is assumed to operate both bus and light rail service. In contrast to the small bus example, the smart card scenario is expected to be somewhat more costly than the magnetic scenario, primarily because the validating fareboxes assumed here have a higher upper-range cost when equipped to process smart cards than they do to process magnetic cards. Note, however, that the overall ongoing costs for the smart card scenario are slightly lower than those for the magnetic scenario due to the lower maintenance requirements for the smart card equipment, as explained above.

In addition to the fareboxes, there are several other key cost differences in these two scenarios. In the magnetic alternative, replacement of half of the TVMs is assumed. This is necessary to provide for in-station farecard vending capabilities; the other half of the TVMs are merely being upgraded to allow a farecard to be used to buy a paper proof-of-payment ticket. In the smart card scenario, in contrast, all

TABLE C-5 Magnetic farecard system for bus and LRT agency*

Cost Element	Unit Cost		Number of Units	Total Cost	
	Low	High		Low	High
One-Time Costs					
validating farebox with card processing unit	$10,000	$12,000	800	$8,000,000	$9,600,000
revenue equipment (vaults, bins, etc.)	$40,000	$65,000	1	$40,000	$65,000
garage hardware/software	$15,000	$35,000	4	$60,000	$140,000
farecard vending machine **	$35,000	$60,000	40	$1,400,000	$2,400,000
card TVM interface upgrade	$3,000	$5,000	40	$120,000	$200,000
station hardware/software	$7,000	$10,000	20	$140,000	$200,000
spare parts	10% of equipment cost	15% of equipment cost		$976,000	$1,260,500
support services	10% of equipment cost	15% of equipment cost		$976,000	$1,260,500
installation/nonrecurring engineering	3% of equipment cost	10% of equipment cost		$292,800	$378,150
fare media costs (magnetic farecards) +	$0.05	$0.25	180,000	$9,000	$45,000
contingency costs	10% of one-time cost	15% of one-time cost		$1,201,380	$2,332,373
Total One-Time Costs				*$13,215,180*	*$17,881,523*
Ongoing Costs					
equipment maintenance costs	6% of equipment cost	7% of equipment cost		$585,600	$882,350
software licenses/system support	15% systems/software	20% systems/software		$51,000	$135,000
revenue handling costs (cash)	5% of cash revenue	10% of cash revenue		$1,500,000	$3,000,000
revenue handling costs (farecards)	3% of farecard revenue	6% of farecard revenue		$900,000	$1,800,000
contingency costs	10% of ongoing cost	15% of ongoing cost		$303,660	$872,603
Total Ongoing Costs				*$3,340,260*	*$6,689,953*
Total First Year Cost				***$16,555,440***	***$24,571,475***

* This system has 800 buses (4 garages) and 20 LRT stations. Average weekday ridership = 200,000; annual ridership = 60 million. The transit agency is installing new validating fareboxes and is adding magnetic farecard accepting devices to the existing TVM's.

** It is assumed that one TVM per station can vend (and reload) farecards; the other TVM's in the stations continue to vend/validate paper tickets. However, farecards can be used to buy proof of payment paper tickets.

\+ The estimated number of farecards assumes that 30% of rides are made using the cards (for monthly passes or stored value cards), that each card is used an average of twice a day, and that each card is retained an average of 3 months (i.e., a cardholder uses an average of 4 cards per year). A 50% card reserve is also assumed.

of the existing TVMs are being upgraded to allow validation of the cards (i.e., to deduct the value of a trip from the card's stored value) and also to allow adding value to a card; no new TVMs are required, however, as smart cards must be acquired elsewhere and registered with the agency. Fare inspectors in the smart card scenario will have to carry portable card readers to ensure that each card has either been validated or contains an unlimited-ride pass. In the magnetic scenario, inspectors will simply check each rider for a paper proof-of-payment ticket. As can be seen in comparing the two alternatives, the greater number of cards needed for this system also greatly increases the fare media cost differential between the two.

In conclusion, it is difficult to generalize about the costs associated with procuring and implementing a new fare system. Hence, the estimates presented here should be considered order-of-magnitude guidelines only; an agency will have to solicit bids from vendors to determine the true cost of implementing a fare system with the types of capabilities described here.

APPENDIX D
STUDY FRAMEWORK AND METHODOLOGY

INTRODUCTION

In considering the various types of fare policy, structure, and technology programs and initiatives identified in the study, it is useful to understand the nature of the impacts each approach can be expected to have on a transit agency's customers and operations. In order to facilitate the analysis and evaluation of these programs and initiatives, the study team developed an evaluation framework and methodology. This framework and methodology, as well as a summary assessment of each of the programs and initiatives, is presented in this appendix. The basic framework and methodology were also used in the more detailed case study evaluation of specific applications of the various fare-related strategies; the case study reports are presented in Part II.

Types of Programs and Initiatives

The types of fare-related initiatives and programs to be evaluated were identified through the research conducted in this study and represent the key fare policy, structure, and technology developments identified in the body of this report. The initiatives and programs were grouped into the following categories:

1. Fare policy and strategy initiatives
2. New payment options with electronic fare media
3. New fare collection and payment strategies
4. University programs
5. Employer benefits programs
6. Access-to-jobs programs
7. Multiapplication programs

Within each category, three different types of programs implemented or planned by one to four different transit agencies were studied, for a total of 21 types of programs. The full list of initiatives and programs, along with examples of each, is presented in Table D-1. The evaluation methodology and results are discussed below.

EVALUATION FRAMEWORK AND METHODOLOGY

Evaluation Criteria and Measures

The initial step in developing an evaluation framework and methodology was to define the evaluation criteria, i.e., the key parameters and attributes of the fare programs and initiatives. The attributes included in this framework are as follows:

- **Goals and objectives of the program.** The goals and objectives of the specific type of program (e.g., increase ridership, increase revenue, promote seamless travel, increase market penetration of key groups, reduce operational costs, address equity concerns, facilitate governmental mandate, or others).
- **Customer impacts and benefits.** The customer impacts and benefits the program is likely to have. This includes, for example, the extent of use of—and customer satisfaction with—the program in question, the effect (or likely effect) on customer attitudes toward the agency, the impact on ease of travel and convenience of fare payment, and the impact on the cost of travel.
- **Agency impacts and benefits.** The types of operational and administrative impacts associated with the program. Depending on the nature of the program being evaluated, these may include such items as the impact on personnel requirements, maintenance requirements, service reliability, fare abuse and evasion, and flexibility of fare policy/options. Also included here are the impact on costs and revenues: The agency's costs for each element of implementing and administering the program—e.g., design and development of program, purchase and installation of necessary equipment, collection of fares and payments from customers, providing fare instruments to partner entities for distribution to customers, processing fares collected, collection of payments from and reconciliation of revenues with partners and other funding entities, and the expected revenue impacts.
- **Impact on, and benefits to, partner entities.** In a fare payment-related partnership (e.g., with an employer, university, social service agency, or other entity), the likely impacts on, or benefits to, the partner entity, such as improved market penetration of payment option; improved ability to distribute and track benefits to employees, students, or clients; or reduced parking requirements.
- **Potential liability to the transit agency.** The potential negative economic, legal, or political implications of the program. In other words, the types of risks the agency faces in implementing the program in terms of potential revenue loss, legal challenges, political opposition, loss of public support, or loss of ridership (e.g., from key market segments other than those targeted by the program in question).

- **Constraints and barriers to implementation**. The types of constraints or implementation barriers the agency faces in developing and introducing the program. These may be related to technical issues (e.g., requirements for a particular type of technology), institutional factors (e.g., the need to establish workable agreements with would-be partners), or funding issues (e.g., the existence of earmarked funding associated with the program, and the issues associated with the funding).
- **Key external influences**. Specific external factors (e.g., political pressure, environmental justice claims) influencing the program.
- **Technology and equipment requirements**. The specific technology and equipment requirements of the program, for instance, the introduction of AFC or smart card equipment.

The study team identified a set of criteria associated with the above categories. For example, "ease of travel" is a criterion under Customer Impacts and Benefits. These criteria are presented in Table D-2. As indicated in the table, most of the criteria can be used to evaluate the type of program (e.g., introduction of "rolling" passes, or an annual employer pass program); however, a few criteria (e.g., "satisfaction with/use of program") can be applied only to a specific agency's actual use of a program or initiative. The latter criteria were used for the case studies but were excluded from the general evaluation presented in this appendix.

While a number of these criteria, notably those related to costs and revenues, may be quantifiable in specific cases, this general evaluation was restricted to a qualitative assessment consisting of a relative rating of the type/level of impact for each criterion—indicating, for example, if the program had a positive or negative effect on a specific criterion. (The case studies include quantitative impacts wherever available for appropriate criteria.) The rating measures that were applied to the types of fare programs are shown in Table D-3.

Evaluation Matrices

Using the criteria and measures described above, the project team developed a set of matrices, each matrix addressing one of the specific initiatives or programs listed in Table D-1. For each matrix, the type of program was assessed in terms of all of the aforementioned criteria.

Tables D-4.1 to D-4.7 summarize the evaluation for each criterion and each of the three types of programs within the seven categories of programs or initiatives: fare policy and strategy initiatives (Table D-4.1), new payment options with electronic fare media (Table D-4.2), new fare collection and payment strategies (Table D-4.3), access-to-jobs programs (Table D-4.4), multiapplication programs (Table D-4.5), university programs (Table D-4.6), and employer programs (Table D-4.7). Following each summary table are three tables, one for each of the three types of programs studied with regard to that particular category of program or initiative. These are numbered with additional digits based on the summary table. For example, Table D-4.1, concerning fare policy, is followed by Table D-4.1.1 on the elimination of transfers, Table D-4.1.2 on fare simplification, and so forth. These detailed tables give not only the rating but also a brief rationale for the rating for each criterion in relation to that program or initiative.

In conducting this evaluation, the study team utilized the findings of this research, coupled with team members' prior experience in the design and assessment of fare programs for a range of types/sizes of agencies. A brief explanation is provided for each rating measure. Clearly, a considerable amount of professional judgement had to be applied, for several reasons:

- In some cases, different agencies may have experienced somewhat different types of impacts with comparable types of programs. This assessment of the *type* of program has therefore focussed on the general nature of the impacts an agency might reasonably expect in pursuing such a strategy. Specific agencies' experiences were evaluated through the case studies.
- Some of the initiatives (e.g., guaranteed last ride, automated benefits distribution) have been tried by only one or two agencies to-date, and are still in the early stages of implementation.
- Some of the initiatives (e.g., frequency-based discount/guaranteed lowest fare, and certain types of multiapplication programs) are conceptual at this point, and have not actually been tested in any operational settings.

Thus, the general nature of these assessments should be kept in mind. Specific agencies' applications of most of these initiatives and programs were evaluated through the case studies. However, as can be seen in the case studies—and discussed in the body of the report—individual agency experiences do vary somewhat for comparable types of programs. Thus, it is felt that these overall evaluation findings—in conjunction with the case study findings—provide useful general guidance for agencies considering the various strategies.

TABLE D-1 Types and examples of fare initiatives and programs

Type of Fare Initiative and Program	United States Examples	Evaluation Matrix for Initiative and Program
Fare policy and strategy initiatives		Table D-4.1
Elimination of transfers/onboard sale of day pass	Baltimore, Orange Co. (CA), San Jose, Delaware	Table D-4.1.1
Fare simplification (e.g., reduction/elimination of zones)	Baltimore, Norfolk, Delaware, Connecticut	Table D-4.1.2
Introduction of partial day pass (e.g., 4 hrs, or after 9:30am)	Portland (OR), Washington (DC)	Table D-4.1.3
New payment options with electronic fare media		Table D-4.2
Rolling (activate on first-use) passes	NY, Chicago, Houston, Conn., Rochester (NY)	Table D-4.2.1
Frequency-based discount/guaranteed lowest fare	Washington*	Table D-4.2.2
Guaranteed last ride (i.e., negative balance)	Chicago	Table D-4.2.3
New fare collection and payment strategies		Table D-4.3
Regional payment integration	SF,* LA,* Ventura Co. (CA), SD,* Washington*	Table D-4.3.1
Postpayment/billing for number of rides taken	Phoenix	Table D-4.3.2
Conversion to POP from pay-on-entry or use of conductors	Newark, Northern California (Caltrain)*	Table D-4.3.3
University programs		Table D-4.4
Pass/unlimited-access programs	Chicago, Seattle, Boulder (CO), Connecticut	Table D-4.4.1
Reduced-fare programs	Lansing (MI), Akron (OH), Chapel Hill (NC)	Table D-4.4.2
Joint transit-university card programs	Santa Monica (CA), Ventura Co.*	Table D-4.4.3
Employer benefits programs		Table D-4.5
Annual pass programs	Denver, Minn./St. Paul, Salt Lake City, Seattle	Table D-4.5.1
Voucher programs	NY, Washington, SF, Boston	Table D-4.5.2
Automated benefits distribution	Washington, SF, NY	Table D-4.5.3
Access-to-jobs programs		Table D-4.6
Special payment arrangements	New Jersey, Delaware, Akron (OH), Albany (NY)	Table D-4.6.1
Use of electronic payment media	Rochester (NY), Lubbock (TX)	Table D-4.6.2
Link transit benefits with electronic benefits transfer (EBT)	Albuquerque,* Cincinnati,*	Table D-4.6.3
Multiapplication programs		Table D-4.7
Electronic toll/parking	Washington, Orlando*	Table D-4.7.1
Financial services/other payment and loyalty programs	Washington, Honolulu,* Atlanta**	Table D-4.7.2
Identification/access/security	Washington	Table D-4.7.3

* initiative is planned or under consideration.
** no longer in place.

TABLE D-2 Evaluation criteria

Evaluation Criteria	Applies to type of program	Applies only to specific case*	Definition
Goals and Objectives of Program	✓		Increase ridership, increase revenue, promote seamless travel, reduce costs, etc.
Customer Impacts and Benefits			
Ease of travel	✓		Improves ease of use of transit system (e.g., facilitates "seamless" travel in region)?
Flexibility of fare payment	✓		Increases number of payment options?
Convenience of fare payment	✓		Increases ease of payment or purchase of fare media?
Cost of travel	✓		Reduces fare to participants?
Satisfaction with/use of program		✓	Are people using—and satisfied with—the program?
Overall attitude toward agency	✓		Improves the public's opinion of the transit agency?
Agency Impacts and Benefits			
Design/implementation costs	✓		Are there design and/or implementation costs related to program?
Equipment maintenance costs	✓		Impact on equipment maintenance costs?
Revenue collection/management costs	✓		Increases revenue management (e.g., media distribution and reconciliation) costs?
Capital costs	✓		Are there fare equipment procurement costs?
Use of cash	✓		Reduces use of cash for fare payment?
Ridership	✓		Increases ridership?
Revenue	✓		Increases fare revenue?
Success at achieving goals/objectives		✓	Have goals/objectives been achieved?
Fare abuse/evasion	✓		Impact on fare abuse or evasion (e.g., underpaying fare or using someone else's ID to get lower fare)?
Fare structure flexibility	✓		Increases ability to add fare strategies?
Personnel requirements	✓		Impact on number of staff needed for revenue management?
Service reliability	✓		Improves ability to keep to schedules (e.g., faster boarding)
Impact on/Benefits to Partner Entity			
Market penetration	✓		Increases number of people using partner's card or services?
Ease of distribution of benefits	✓		Improves ability to distribute benefits to employee/student/client?
Other (e.g., need for parking)	✓		Reduces parking spaces needed (or other benefit)?
Liability to agency			
Economic liability	✓		Does agency risk losing revenue though the program?
Political/legal liability	✓		Is there potential for legal/political challenges (e.g., regarding equity)?
Constraints and Barriers			
Technical	✓		Are there technology issues (e.g., need for new technology or compatibility with existing equipment)?
Institutional	✓		Are there issues related to agreements with partner entities?
Funding Issues and Sources	✓		Is there a funding source for the program or initiative?
Required Equipment and Technology	✓		Type of equipment needed for program
Key External Influences		✓	External factors that have affected the program

*Items that apply only to specific cases were not included in the subsequent program evaluation matrices; they are addressed in the case study assessments.

TABLE D-3 Evaluation measures

Evaluation Criteria	Rating Measures
Goals and Objectives of Program	**NA**
Customer Impacts and Benefits	
Ease of travel	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Flexibility of fare payment	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Convenience of fare payment	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Cost of travel	"**1**" = decrease, "**0**" = no real impact, "**-1**" = increase
Overall attitude toward agency	"**1**" = positive impact, "**0**" = no real impact, "**-1**" = negative impact
Agency Impacts and Benefits	
Design/implementation costs	"**1**" = reduced cost, "**0**" = no real impact, "**-1**" = new/additional cost
Equipment maintenance costs	"**1**" = reduced cost, "**0**" = no real impact, "**-1**" = new/increased cost
Revenue collection/management costs	"**1**" = reduced cost, "**0**" = no real impact, "**-1**" = new/increased cost
Capital costs	"**1**" = reduced cost, "**0**" = no real impact, "**-1**" = new/increased cost
Use of cash	"**1**" = decrease, "**0**" = no real impact, "**-1**" = increase
Ridership	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Revenue	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Fare abuse/evasion	"**1**" = decrease, "**0**" = no real impact, "**-1**" = increase
Fare structure flexibility	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Personnel requirements	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Service reliability	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Impact on/Benefits to Partner Entity	
Market penetration	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Ease of distribution of benefits	"**1**" = increase, "**0**" = no real impact, "**-1**" = decrease
Other (e.g., need for parking)	"**1**" = positive impact, "**0**" = no real impact, "**-1**" = negative impact
Liability to agency	
Economic liability	"**1**" = minimal risk, "**0**" = some risk, "**-1**" = significant risk
Political/legal liability	"**1**" = minimal risk, "**0**" = some risk, "**-1**" = significant risk
Constraints and Barriers	
Technical	"**1**" = none, "**0**" = minor barriers/issues, "**-1**" = significant barriers/issues
Institutional	"**1**" = none, "**0**" = minor barriers/issues, "**-1**" = significant barriers/issues
Funding Issues and Sources	"**1**" = dedicated funding, "**0**" = not a major issue, "**-1**" = significant barrier
Required Equipment and Technology	**NA**

* NA = Not applicable.

TABLE D-4.1 Summary evaluation matrix: fare policy/strategy initiatives

Type of Program/Initiative	Elimination of Transfers/On-Board Sale of Day Pass	Fare Simplification	Introduction of Partial Day Pass
Examples	*Baltimore* – MTA *Orange Co. (CA)* – OCTA *San Jose* – SCVTA *Delaware* – First State Transit	*Baltimore* – MTA *Norfolk (VA)* – HRT *Connecticut* – CT TRANSIT *Delaware* – First State Transit	*Portland (OR)* – Tri-Met *Washington*, DC – WMATA
Description of Approach	Free/low-cost transfers eliminated (i.e., full fare per boarding); day passes sold on-board	Zones reduced or removed, or peak/off-peak differential removed	Passes offered for periods of less than a full day (e.g., 4-hrs or valid after certain time)
Goals/Objectives of Program	To reduce conflicts between riders and drivers and reduce abuse of transfers	To improve ease of use of transit system, especially by new or occasional riders	To provide convenient fare option for tourists/out-of-town visitors
Criterion	**Rating**	**Rating**	**Rating**
Customer Impacts/Benefits			
Ease of travel (e.g., seamless)	0	1	1
Flexibility of fare payment	0	-1	1
Convenience of fare payment	0	1	1
Cost of travel	0	0	1
Overall attitude toward agency	0	0	1
Agency Impacts/Benefits			
Design/implementation costs	0	-1	0
Equipment maintenance costs	-1	0	-1
Revenue collection/management costs	0	1	0
Capital costs	-1	0	-1
Use of cash	1	0	1
Ridership	0	1	1
Revenue	1	-1	1
Fare abuse/evasion	1	1	0
Fare structure flexibility	0	-1	1
Personnel requirements	0	0	0
Service reliability	0	1	1
Impact on/Benefits to Partner Entities			
Market penetration	NA	NA	1
Ease of distribution of benefits	NA	NA	NA
Other (e.g., need for parking)	NA	NA	NA
Liability to agency			
Economic liability	1	-1	1
Political/legal liability	-1	-1	1
Constraints/Barriers			
Technical	-1	0	-1
Institutional	0	0	0
Funding Issues and Sources	0	0	0
Required Equipment/Technology			
	Day pass machine	None	Day pass machine

TABLE D-4.1.1 Evaluation matrix: fare policy/strategy initiatives
Elimination of transfers/onboard sale of day pass

Type of Program/Initiative	**Elimination of transfers/onboard sale of day pass**
Examples	*Baltimore* – MTA *Orange Co. (CA)* – OCTA *San Jose* – SCVTA *Delaware* – First State Transit
Description of Approach	Free/low-cost transfers eliminated in favor of a full fare per boarding; however, day passes are sold on-board buses and at other locations
Goals/Objectives of Program	To reduce conflicts between riders and drivers and reduce abuse of transfers

Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	0 less seamless without transfers, but day pass improves situation
Flexibility of fare payment	0 less flexible without transfers, but day pass improves situation
Convenience of fare payment	0 less convenient without transfers, but day pass improves situation
Cost of travel	0 depends on rider's trip pattern
Overall attitude toward agency	0 depends on rider's trip pattern (i.e., whether cost rises)
Agency Impacts/Benefits	
Design/implementation costs	0 should not significantly affect these costs
Equipment maintenance costs	-1 maintenance for day pass issuing unit
Revenue collection/management costs	0 should not significantly affect these costs
Capital costs	-1 requires day pass issuing unit
Use of cash	1 day pass should reduce cash
Ridership	0 elimination of transfers will reduce, but day pass should increase
Revenue	1 should increase revenue
Fare abuse/evasion	1 should reduce abuse
Fare structure flexibility	0 less flexible without transfers, but day pass improves situation
Personnel requirements	0 should not affect this
Service reliability	0 should not affect this
Impact on/Benefits to Partner Entity	
Market penetration	NA (no partnership involved)
Ease of distribution of benefits	NA (no partnership involved)
Other (e.g., need for parking)	NA (no partnership involved)
Liability to agency	
Economic liability	1 should generate additional revenue
Political/legal liability	-1 could generate considerable opposition from those who transfer
Constraints/Barriers	
Technical	-1 requires day pass issuing unit
Institutional	0 not a major issue
Funding Issues and Sources	0 not a major issue
Required Equipment and Technology	
	In-bus (and possibly in-station) day pass issuing machine

TABLE D-4.1.2 Evaluation matrix: fare policy/strategy initiatives
Fare simplification

Type of Program/Initiative	**Fare Simplification**
Examples	*Baltimore* – MTA eliminated zones on its bus system *Norfolk (VA)* – HRT eliminated zones on its bus system *Connecticut* – CT TRANSIT eliminated zones on its bus systems *Delaware* – First State Transit reduced zones on statewide system
Description of Approach	The number of fare zones is reduced or zones are removed altogether, or a peak/off-peak differential removed
Goals/Objectives of Program	To improve ease of use of transit system, especially by new or occasional riders
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 easier to use system, especially for new/occasional riders
Flexibility of fare payment	-1 somewhat reduces flexibility
Convenience of fare payment	1 easier to understand fares and buy fare media
Cost of travel	0 depends on rider's trip pattern
Overall attitude toward agency	0 depends on rider's new fare
Agency Impacts/Benefits	
Design/implementation costs	-1 requires modification of fare structure
Equipment maintenance costs	0 should not affect these costs
Revenue collection/management costs	1 could somewhat reduce these costs
Capital costs	0 should not affect these costs
Use of cash	0 should not affect this
Ridership	1 depends on revised pricing, but could increase ridership
Revenue	-1 depends on revised pricing, but could lose revenue
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	-1 somewhat reduces flexibility
Personnel requirements	0 should not affect this
Service reliability	1 should reduce dwell time
Impact on/Benefits to Partner Entity	
Market penetration	NA (no partnership involved)
Ease of distribution of benefits	NA (no partnership involved)
Other (e.g., need for parking)	NA (no partnership involved)
Liability to agency	
Economic liability	-1 could lose revenue
Political/legal liability	-1 could generate opposition from those whose fares increase
Constraints/Barriers	
Technical	0 not a major issue
Institutional	0 not a major issue
Funding Issues and Sources	0 not a major issue
Required Equipment and Technology	
	None

TABLE D-4.1.3 Evaluation matrix: fare policy/strategy initiatives
Introduction of partial day passes

Type of Program/Initiative	**Introduction of Partial Day Passes**
Examples	*Portland (OR)* – Tri-Met "Quik Tik" good for 6-hours ($3); full day pass is $4 *Washington, DC* – WMATA's day pass is valid beginning at 9:30AM
Description of Approach	Passes offered for periods of less than a full day (e.g., 4-hrs or valid after certain time)
Goals/Objectives of Program	To provide convenient fare option for tourists/out-of-town visitors
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 easier to use system, especially for new/occasional riders
Flexibility of fare payment	1 new fare option
Convenience of fare payment	1 more convenient, especially for new/occasional riders
Cost of travel	1 reduces cost if several trips made during valid period
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	0 should not significantly affect these costs
Equipment maintenance costs	-1 maintenance for day pass issuing unit
Revenue collection/management costs	0 should not significantly affect these costs
Capital costs	-1 may require day pass issuing unit
Use of cash	1 will reduce cash somewhat
Ridership	1 should increase ridership somewhat
Revenue	1 could increase revenue somewhat – if attracts new riders
Fare abuse/evasion	0 should not affect this
Fare structure flexibility	1 new fare option
Personnel requirements	0 should not affect this
Service reliability	1 should reduce dwell time
Impact on/Benefits to Partner Entity	
Market penetration	1 should be popular with tourists/out of town visitors
Ease of distribution of benefits	NA (no partnership involved)
Other (e.g., need for parking)	NA (no partnership involved)
Liability to agency	
Economic liability	1 could generate additional revenue
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 may require day pass issuing unit
Institutional	0 not a major issue
Funding Issues and Sources	0 not a major issue
Required Equipment and Technology	
	May require in-bus (and possibly in-station) day pass issuing machine

TABLE D-4.2 Summary evaluation matrix: electronic payment options

Type of Program/Initiative	Rolling (Activate on First Use) Passes	Frequency-Based Discount/Guaranteed Lowest Fare	Guaranteed Last Ride (i.e., Negative Balance)
Examples	*New York City* – NYMTA *Chicago* – CTA *Houston* – Metro *Connecticut* – CT TRANSIT	*Washington, DC* – WMATA is considering a guaranteed lowest fare strategy	*Chicago* – CTA testing with smart card pilot
Description of Approach	Passes good for specified number of days (e.g., 1-, 7-, 14-, or 30-Days); pass is activated on its first use	Reduced fare for each ride above certain minimum number; variation is to guarantee lowest fare	Ride is guaranteed, regardless of amount remaining on card; "neg. balance" deducted next time rider adds value to card
Goals/Objectives of Program	Encourage use of passes and reduce admin. requirements assoc. with selling passes	Provide incentive to buy and use farecard – and to retain same card for long time	To provide an incentive to purchase and use a farecard
Criterion	**Rating**	**Rating**	**Rating**
Customer Impacts/Benefits			
Ease of travel (e.g., seamless)	1	1	1
Flexibility of fare payment	1	1	1
Convenience of fare payment	1	1	1
Cost of travel	0	1	0
Overall attitude toward agency	1	1	1
Agency Impacts/Benefits			
Design/implementation costs	0	-1	-1
Equipment maintenance costs	0	0	1
Revenue collection/management costs	1	0	0
Capital costs	-1	-1	-1
Use of cash	1	1	1
Ridership	1	1	1
Revenue	-1	-1	0
Fare abuse/evasion	1	1	0
Fare structure flexibility	1	1	0
Personnel requirements	1	0	0
Service reliability	1	1	1
Impact on/Benefits to Partner Entities			
Market penetration	NA	NA	NA
Ease of distribution of benefits	NA	NA	NA
Other (e.g., need for parking)	NA	NA	NA
Liability to agency			
Economic liability	0	-1	0
Political/legal liability	1	1	1
Constraints/Barriers			
Technical	-1	-1	-1
Institutional	0	0	0
Funding Issues and Sources	-1	-1	-1
Required Equipment/Technology			
	Electronic payment system (magnetic or smart card)	Electronic payment system; smart card for guaranteed lowest fare	Smart card system

TABLE D-4.2.1 Evaluation matrix: electronic payment options
Rolling (activate on first use) passes

Type of Program/Initiative	**Rolling (Activate on First Use) Passes**
Examples	*New York City* – NYMTA *Chicago* – CTA *Houston* – Metro *Connecticut* – CT TRANSIT
Description of Approach	Passes good for specified number of days (e.g., 1-, 7-, 14-, or 30-Days); pass is activated the first time it is swiped through or inserted into reader.
Goals/Objectives of Program	To encourage use of passes and to reduce the administrative requirements associated with selling passes (i.e., since pass sales are spread out throughout the month)
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 makes system easier to use
Flexibility of fare payment	1 more flexible than fixed calendar period passes
Convenience of fare payment	1 more convenient, since can buy pass at any time; can buy 7-day passes in advance
Cost of travel	0 same cost as flash passes
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	0 should not significantly affect these costs
Equipment maintenance costs	0 maintenance for new fare equipment – will decrease if contactless smart card
Revenue collection/management costs	1 should reduce these costs
Capital costs	-1 requires electronic fare system
Use of cash	1 should reduce cash
Ridership	1 should increase ridership somewhat
Revenue	-1 could reduce revenue – if riders not now using passes switch to passes
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	1 offers considerable flexibility
Personnel requirements	1 could reduce need for pass sales/administration staff
Service reliability	1 should reduce dwell time
Impact on/Benefits to Partner Entity	
Market penetration	NA (no partnership involved)
Ease of distribution of benefits	NA (no partnership involved)
Other (e.g., need for parking)	NA (no partnership involved)
Liability to agency	
Economic liability	0 could result in some loss of revenue – if it attracts significant no. of new pass users
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 requires some type of electronic payment system
Institutional	0 not a major issue
Funding Issues and Sources	-1 requires funding to procure new system
Required Equipment and Technology	
	Requires an electronic payment system (magnetic or smart card)

TABLE D-4.2.2 Evaluation matrix: electronic payment options
Frequency-based discount/guaranteed lowest fare

Type of Program/Initiative	**Frequency-Based Discount/Guaranteed Lowest Fare**
Examples	*Washington, DC* – WMATA is considering a guaranteed lowest fare strategy
Description of Approach	A reduced fare is charged for each ride above a certain minimum number of rides taken with a particular farecard; a variation is to guarantee riders the lowest fare for which they are eligible (based on the extent of usage of their farecards)
Goals/Objectives of Program	To provide an incentive to purchase and use a farecard – and also to retain the same card for a long period of time
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 makes system easier to use
Flexibility of fare payment	1 increases flexibility
Convenience of fare payment	1 convenient, since rider does not have to worry about best option
Cost of travel	1 will reduce cost if used enough
Overall attitude toward agency	1 should improve general opinion of agency; excellent marketing angle
Agency Impacts/Benefits	
Design/implementation costs	-1 has significant system design costs, especially guaranteed lowest fare
Equipment maintenance costs	0 maintenance for new fare equipment – will decrease if contactless smart card
Revenue collection/management costs	0 should not affect these costs
Capital costs	-1 requires electronic fare system
Use of cash	1 should reduce cash
Ridership	1 should increase ridership somewhat
Revenue	-1 will reduce revenue; guaranteed lowest fare could lose significant revenue
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	1 offers considerable flexibility
Personnel requirements	0 should not affect this
Service reliability	1 should reduce dwell time, especially if contactless card used
Impact on/Benefits to Partner Entity	
Market penetration	NA (no partnership involved)
Ease of distribution of benefits	NA (no partnership involved)
Other (e.g., need for parking)	NA (no partnership involved)
Liability to agency	
Economic liability	-1 guaranteed lowest fare has potential for significant revenue loss
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 requires some type of electronic payment system
Institutional	0 not a major issue
Funding Issues and Sources	-1 requires funding to procure new system
Required Equipment and Technology	
	Requires an electronic payment system; smart card needed for guaranteed lowest fare

TABLE D-4.2.3 Evaluation matrix: electronic payment options
Guaranteed last ride

Type of Program/Initiative	**Guaranteed Last Ride (i.e., Negative Balance)**
Examples	*Chicago* – CTA is testing with its smart card pilot
Description of Approach	A ride is guaranteed, regardless of amount remaining on farecard; the "negative balance" is then deducted the next time the rider adds value to card
Goals/Objectives of Program	To provide an incentive to purchase and use a farecard
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 makes system easier to use
Flexibility of fare payment	1 increases flexibility
Convenience of fare payment	1 convenient, since rider does not have to worry about running out of value
Cost of travel	0 depends on pricing
Overall attitude toward agency	1 should improve general opinion of agency; excellent marketing angle
Agency Impacts/Benefits	
Design/implementation costs	-1 could have significant system design costs
Equipment maintenance costs	1 maintenance will decrease if contactless smart card used
Revenue collection/management costs	0 should not affect these costs
Capital costs	-1 requires smart card system
Use of cash	1 should reduce cash
Ridership	1 should increase ridership somewhat
Revenue	0 will not affect revenue if strong incentive to reload same card
Fare abuse/evasion	0 requires strong incentive to reload same card
Fare structure flexibility	0 does not really affect this
Personnel requirements	0 should not affect this
Service reliability	1 should reduce dwell time, especially if contactless card used
Impact on/Benefits to Partner Entity	
Market penetration	NA (no partnership involved)
Ease of distribution of benefits	NA (no partnership involved)
Other (e.g., need for parking)	NA (no partnership involved)
Liability to agency	
Economic liability	0 has potential for significant revenue loss if no strong incentive to reload cards
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 requires smart card system
Institutional	0 not a major issue
Funding Issues and Sources	-1 requires funding to procure new system
Required Equipment and Technology	
	Requires smart card system

TABLE D-4.3 Summary evaluation matrix: fare collection/payment strategies

Type of Program/Initiative	**Regional Payment Integration**	**Post Payment/Billing for Number of Rides Taken**	**Conversion to POP from Another Strategy**
Examples	*Ventura Co. (CA)* – VCTC *San Francisco* – TransLink *Washington/Baltimore* – SmarTrip to be expanded *Los Angeles* – LACMTA	*Phoenix* – Valley Metro BusCard Plus program; also accept credit cards	*Newark, NJ* – NJT converted Newark City Subway to POP *Northern California* – Caltrain planning to convert to POP
Description of Approach	Common farecard provided for use on all of region's services	Rider (or employer or funding agency) billed for no. rides taken; system tracks usage of each farecard	Some agencies converting from pay-on-entry or use of conductors to POP
Goals/Objectives of Program	To facilitate seamless travel throughout region	Provide convenience of passes, but without allowing unlimited rides; also to document actual transit usage	To reduce fare collection costs and/or to reduce dwell times – and thus improve service reliability
Criterion	**Rating**	**Rating**	**Rating**
Customer Impacts/Benefits			
Ease of travel (e.g., seamless)	1	0	0
Flexibility of fare payment	1	1	-1
Convenience of fare payment	1	1	-1
Cost of travel	0	0	0
Overall attitude toward agency	1	1	0
Agency Impacts/Benefits			
Design/implementation costs	-1	-1	-1
Equipment maintenance costs	1	0	-1
Revenue collection/management costs	-1	-1	0
Capital costs	-1	-1	-1
Use of cash	1	1	0
Ridership	1	0	0
Revenue	0	-1	-1
Fare abuse/evasion	1	0	-1
Fare structure flexibility	1	1	-1
Personnel requirements	-1	0	0
Service reliability	1	1	1
Impact on/Benefits to Partner Entities			
Market penetration	1	1	NA
Ease of distribution of benefits	NA	1	NA
Other (e.g., need for parking)	NA	1	NA
Liability to agency			
Economic liability	-1	-1	-1
Political/legal liability	1	1	1
Constraints/Barriers			
Technical	-1	0	-1
Institutional	-1	-1	NA
Funding Issues and Sources	-1	0	0
Required Equipment/Technology			
	Smart card system & regional clearinghouse	Requires that equipment include transactional database	TVM's, validators, possibly hand-held readers and ticket office machines

TABLE D-4.3.1 Evaluation matrix: fare collection/payment strategies
Regional payment integration

Type of Program/Initiative	**Regional Payment Integration**
Examples	*Ventura Co. (CA)* – VCTC implementing regional smart card *San Francisco* – TransLink smart card pilot underway; full system will cover 26 agencies *Washington/Baltimore* – SmarTrip to be expanded to buses in region and to Baltimore *Los Angeles* – LACMTA developing UFS (regional smart card program)
Description of Approach	Common farecard provided for use on all of region's services
Goals/Objectives of Program	To facilitate seamless travel throughout region

Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 facilitates seamless travel
Flexibility of fare payment	1 electronic payment creates greater flexibility
Convenience of fare payment	1 contactless smart card convenient
Cost of travel	0 does not affect this – depends on transfer cost and/or discount/bonus offered
Overall attitude toward agency	1 should improve general opinion of agencies involved
Agency Impacts/Benefits	
Design/implementation costs	-1 will likely have significant system design costs
Equipment maintenance costs	1 maintenance will decrease if contactless smart card
Revenue collection/management costs	-1 requires clearinghouse to allocate revenues and support system
Capital costs	-1 requires smart card system
Use of cash	1 should reduce cash
Ridership	1 should increase ridership somewhat
Revenue	0 will not directly affect revenue; revenue will increase if new riders attracted
Fare abuse/evasion	1 electronic payment will reduce abuse/evasion
Fare structure flexibility	1 electronic payment creates greater flexibility
Personnel requirements	-1 will require staff participation in developing regional system
Service reliability	1 should reduce dwell time, especially if contactless card used
Impact on/Benefits to Partner Entity	
Market penetration	1 should increase usage of farecards
Ease of distribution of benefits	NA
Other (e.g., need for parking)	NA
Liability to agency	
Economic liability	-1 could be significant costs to agencies, depending on usage and clearinghouse fee structure
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 requires common smart card technology for all participants
Institutional	-1 significant requirements: financing/procurement agreements, governance framework
Funding Issues and Sources	-1 requires substantial funding (for each agency) to implement new system & clearinghouse
Required Equipment and Technology	
	Requires that all participants have common smart card system, and requires regional clearinghouse system

TABLE D-4.3.2 Evaluation matrix: fare collection/payment strategies
Post payment

Type of Program/Initiative	**Post Payment/Billing for Number of Rides Taken**
Examples	*Phoenix* – Valley Metro BusCard Plus program: employers invoiced for employees' rides; system also accepts credit cards for fare payment
Description of Approach	Rider (or employer or funding agency) is billed for number of rides a cardholder actually takes; system tracks usage of each farecard
Goals/Objectives of Program	To provide convenience of monthly passes, but without allowing unlimited rides; also possibly to track/document actual transit usage
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	0 depends on nature of regional payment integration, if any
Flexibility of fare payment	1 new payment option
Convenience of fare payment	1 does not require prepayment
Cost of travel	0 does not affect this – depends on pricing
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 will have some design/implementation costs
Equipment maintenance costs	0 maintenance could increase if magnetic, decrease if contactless smart card
Revenue collection/management costs	-1 will increase costs somewhat
Capital costs	-1 requires fare equipment with transactional database
Use of cash	1 should reduce cash usage
Ridership	0 may increase ridership somewhat if attracts new riders
Revenue	-1 will not directly affect fare revenue, but agency loses float from prepayment
Fare abuse/evasion	0 electronic farecard should reduce abuse; accepting credit cards could allow abuse
Fare structure flexibility	1 new payment option
Personnel requirements	0 will require some staff time, but probably not additional people
Service reliability	1 should reduce dwell time, since driver does not have to check validity of pass/farecard
Impact on/Benefits to Partner Entity	
Market penetration	1 could be popular option
Ease of distribution of benefits	1 could be used in distribution of employment or social service benefits
Other (e.g., need for parking)	1 allows employers/social service agencies to track actual transit usage of employees/clients
Liability to agency	
Economic liability	-1 results in loss of float; accepting credit cards (without verification) allows possible fraud
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	0 requires that equipment include transactional database (most new equipment does)
Institutional	-1 requires agreements with employers, social service agencies, possibly with banks
Funding Issues and Sources	0 should not be a significant issue
Required Equipment and Technology	
	Requires that equipment include transactional database

TABLE D-4.3.3 Evaluation matrix: fare collection/payment strategies
Conversion to POP

Type of Program/Initiative	**Conversion to POP from Another Fare Collection Strategy**
Examples	*Newark, NJ* – NJT converted Newark City Subway to POP *Northern California* – Caltrain is planning to convert to POP
Description of Approach	Some agencies have considered converting (or actually converted) from pay-on-entry or use of conductors to proof-of-payment fare collection
Goals/Objectives of Program	To reduce fare collection costs and/or to reduce dwell times – and thus improve service reliability
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	0 depends on nature of regional payment integration, if any
Flexibility of fare payment	-1 there may be fewer payment options with POP
Convenience of fare payment	-1 may require extra step (validation), especially with electronic payment
Cost of travel	0 does not affect this – depends on pricing
Overall attitude toward agency	0 should not affect this
Agency Impacts/Benefits	
Design/implementation costs	-1 will have some design/implementation costs
Equipment maintenance costs	-1 new equipment (e.g., TVMs) means more maintenance
Revenue collection/management costs	0 costs increase if need to add inspectors, decrease if switch from conductors
Capital costs	-1 requires new equipment (TVMs, etc.)
Use of cash	0 depends on options for buying POP tickets
Ridership	0 should not affect ridership
Revenue	-1 could lose revenue through fare evasion
Fare abuse/evasion	-1 will likely rise, since POP involves only random inspections
Fare structure flexibility	-1 there may be fewer payment options with POP
Personnel requirements	0 requires inspectors, but impact depends on existing type of fare collection
Service reliability	1 should reduce dwell time, since no delay for on-board payment
Impact on/Benefits to Partner Entity	
Market penetration	NA (no partnership involved)
Ease of distribution of benefits	NA (no partnership involved)
Other (e.g., need for parking)	NA (no partnership involved)
Liability to agency	
Economic liability	-1 results in loss of revenue, due to increased evasion
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 requires new equipment; electronic payment presents particular challenges
Institutional	NA
Funding Issues and Sources	0 should not be a significant issue
Required Equipment and Technology	
	Requires ticket vending machines (TVM's), validators, and (if electronic payment being used) possibly hand-held readers; ticket office machines also may be needed

TABLE D-4.4 Summary evaluation matrix: access-to-jobs programs

Type of Program/Initiative	Special Payment Arrangements	Use of Electronic Payment Media	Link Transit Benefits to EBT
Examples	*New Jersey* – WorkPass provides NJT monthly passes *Delaware* – free rides for interviews, free passes once hired *Akron* – free rides on transit *Albany* – transit passes	*Lubbock* – farecards used to track transit use *Rochester* – farecards used to track transit use	*Albuquerque* – plan to use EBT card on transit *Cincinnati* – considering link to EBT smart card *New Jersey* – pilot to include transit on EBT/ID card
Description of Approach	Free/reduced fares to find job, possibly to get to job	Use farecards to track transit use	Provide access-to-jobs benefits on EBT card
Goals/Objectives of Program	Assist welfare recipients in obtaining work	Assist welfare recipients in obtaining work, and monitor use of funds	Increase efficiency of providing transit benefits to welfare recipients
Criterion	**Rating**	**Rating**	**Rating**
Customer Impacts/Benefits			
Ease of travel (e.g., seamless)	0	1	1
Flexibility of fare payment	0	1	1
Convenience of fare payment	1	1	1
Cost of travel	1	1	1
Overall attitude toward agency	1	1	1
Agency Impacts/Benefits			
Design/implementation costs	0	-1	-1
Equipment maintenance costs	0	1	1
Revenue collection/management costs	0	-1	-1
Capital costs	0	-1	-1
Use of cash	0	0	0
Ridership	1	1	1
Revenue	0	0	0
Fare abuse/evasion	-1	1	1
Fare structure flexibility	0	0	0
Personnel requirements	0	-1	-1
Service reliability	0	1	1
Impact on/Benefits to Partner Entities			
Market penetration	0	0	1
Ease of distribution of benefits	1	1	1
Other (e.g., need for parking)	0	0	0
Liability to agency			
Economic liability	1	1	1
Political/legal liability	1	1	1
Constraints/Barriers			
Technical	1	-1	-1
Institutional	0	-1	-1
Funding Issues and Sources	1	-1	-1
Required Equipment/Technology			
	None	Electronic payment system	Electronic payment system

EBT = electronic benefits transfer.

TABLE D-4.4.1 Evaluation matrix: access-to-jobs programs
Special payment arrangements

Type of Program/Initiative	**Special Payment Arrangements**
Examples	*New Jersey* – WorkPass provides NJT monthly passes *Delaware* – free rides for interviews, free passes (up to 3 weeks) once hired *Akron*, *OH* – TANF clients ride fixed-route transit for free *Albany, NY* – CDTA provides transit passes
Description of Approach	Free or reduced fares for welfare recipients to find job, possibly to get to job
Goals/Objectives of Program	Assist welfare recipients in obtaining work
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	0 depends on nature of regional payment integration, if any
Flexibility of fare payment	0 does not affect flexibility
Convenience of fare payment	1 convenient, since person receives pass (or can otherwise ride for free)
Cost of travel	1 can make transit free or very inexpensive
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	0 should not significantly affect these costs
Equipment maintenance costs	0 should not affect these costs
Revenue collection/management costs	0 should not significantly affect these costs
Capital costs	0 should not require new fare collection equipment
Use of cash	0 should not significantly affect the use of cash
Ridership	1 should increase somewhat
Revenue	0 should not result in loss of revenue, since programs are subsidized
Fare abuse/evasion	-1 opportunity for abuse (e.g., sharing pass with non-client)
Fare structure flexibility	0 does not really affect this
Personnel requirements	0 should not really affect this
Service reliability	0 should not really affect this
Impact on/Benefits to Partner Entity	
Market penetration	0 not really an issue
Ease of distribution of benefits	1 easy way for social service agencies to distribute benefits to clients
Other (e.g., need for parking)	0 not really an issue
Liability to agency	
Economic liability	1 no particular liability
Political/legal liability	1 no particular liability
Constraints/Barriers	
Technical	1 should not have any technical barriers
Institutional	0 should not be a significant issue
Funding Issues and Sources	1 social service funding exists
Required Equipment and Technology	
	No particular equipment or technology required

TABLE D-4.4.2 Evaluation matrix: access-to-jobs programs
Use of electronic payment media

Type of Program/Initiative	**Use of Electronic Payment Media**
Examples	*Lubbock, TX* – magnetic farecards used to track transit use *Rochester, NY* – magnetic farecards used to track transit use
Description of Approach	Use farecards to track actual transit use by program participants
Goals/Objectives of Program	Assist welfare recipients in obtaining work, and monitor use of funds
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel (e.g., seamless)	1 promotes seamless travel if part of regional payment integration
Flexibility of fare payment	1 may offer new payment option(s)
Convenience of fare payment	1 convenient, since person can directly use farecard
Cost of travel	1 assumes that travel is subsidized
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 costs could be significant for technical development and implementation
Equipment maintenance costs	1 would reduce somewhat if contactless cards used
Revenue collection/management costs	-1 would carry some administrative costs
Capital costs	-1 would likely require new fare collection equipment
Use of cash	0 should not significantly affect the use of cash
Ridership	1 should increase somewhat
Revenue	0 should not result in loss of revenue, since programs are subsidized
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	0 does not really affect this
Personnel requirements	-1 would require some staff time
Service reliability	1 should reduce dwell time, and thus improve reliability
Impact on/Benefits to Partner Entity	
Market penetration	0 not really an issue
Ease of distribution of benefits	1 easy way for social service agencies to distribute benefits to clients
Other (e.g., need for parking)	0 not really an issue
Liability to agency	
Economic liability	1 no particular liability
Political/legal liability	1 no particular liability
Constraints/Barriers	
Technical	-1 requires development of tracking program
Institutional	-1 agreements with social service agencies could be complicated
Funding Issues and Sources	-1 funding for agency to purchase new equipment an issue
Required Equipment and Technology	
	Requires electronic payment system (smart card or magnetic)

TABLE D-4.4.3 Evaluation matrix: access-to-jobs programs
Link transit benefits to EBT

Type of Program/Initiative	**Link Transit Benefits to EBT**
Examples	*Albuquerque, NM* – developing system to use EBT card on transit *Cincinnati* – considering linking to Ohio EBT smart card *New Jersey* – has proposed pilot to include transit on state EBT/ID card
Description of Approach	Provide access-to-jobs benefits on electronic benefits transfer card
Goals/Objectives of Program	Increase efficiency of providing transit benefits to welfare recipients
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel (e.g., seamless)	1 promotes seamless travel if part of regional payment integration
Flexibility of fare payment	1 may offer new payment option(s)
Convenience of fare payment	1 convenient, since person can directly use farecard
Cost of travel	1 assumes that travel is subsidized
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 costs could be significant for technical development and implementation
Equipment maintenance costs	1 would reduce somewhat if contactless cards used
Revenue collection/management costs	-1 would carry some administrative costs
Capital costs	-1 would likely require new fare collection equipment
Use of cash	0 should not significantly affect the use of cash
Ridership	1 should increase somewhat
Revenue	0 should not result in loss of revenue, since programs are subsidized
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	0 does not really affect this
Personnel requirements	-1 would require some staff time
Service reliability	1 should reduce dwell time, and thus improve reliability
Impact on/Benefits to Partner Entity	
Market penetration	1 would increase number of people with direct access to transit payment
Ease of distribution of benefits	1 easy way for social service agencies to distribute benefits to clients
Other (e.g., need for parking)	0 not really an issue
Liability to agency	
Economic liability	1 no particular liability
Political/legal liability	1 no particular liability
Constraints/Barriers	
Technical	-1 requires transit and social service agencies to agree on specific card technology
Institutional	-1 agreements with social service agencies could be complicated
Funding Issues and Sources	-1 funding for agency to purchase new equipment an issue
Required Equipment and Technology	
	Requires electronic payment system (smart card or magnetic)

EBT = electronic benefits transfer.

TABLE D-4.5 Summary evaluation matrix: multiple application programs

Type of Program/Initiative	Electronic Toll/Parking	Financial Services, Other Payment or Loyalty Programs	Identification, Access, Security
Examples	*Washington, DC* – WMATA's SmarTrip card can be used in WMATA rail stations *Orlando* – test of multi-modal payment system (transit, toll, parking)	*Washington, DC* – pilot linking SmarTrip with bank ATM card *Honolulu* – plan for system to combine transit and local attractions *Atlanta* – pilot (completed) to accept bank stored-value cards for transit payment	*Washington, DC* – plan to use SmarTrip for ID/access in car-sharing program; also, SmarTrip application included in GSA ID cards, and bldg. access included in SmarTrip cards
Description of Approach	Integrate transit and other modes	Integrate transit and other payment programs	Integrate transit and ID, access, security
Goals/Objectives of Program	Improve convenience of multi-modal travel payments	Increase market penetration of potential transit users	Increase market penetration of potential transit users
Criterion	**Rating**	**Rating**	**Rating**
Customer Impacts/Benefits			
Ease of travel (e.g., seamless)	1	1	1
Flexibility of fare payment	1	1	1
Convenience of fare payment	1	1	1
Cost of travel	0	0	0
Overall attitude toward agency	1	1	1
Agency Impacts/Benefits			
Design/implementation costs	-1	-1	-1
Equipment maintenance costs	1	1	1
Revenue collection/management costs	-1	-1	-1
Capital costs	-1	-1	-1
Use of cash	1	1	1
Ridership	1	1	1
Revenue	0	0	0
Fare abuse/evasion	1	1	1
Fare structure flexibility	1	1	1
Personnel requirements	0	0	0
Service reliability	1	1	1
Impact on/Benefits to Partner Entities			
Market penetration	1	1	1
Ease of distribution of benefits	0	0	0
Other (e.g., need for parking)	0	0	0
Liability to agency			
Economic liability	1	1	1
Political/legal liability	1	1	1
Constraints/Barriers			
Technical	-1	-1	-1
Institutional	-1	-1	-1
Funding Issues and Sources	-1	-1	-1
Required Equipment/Technology			
	Smart card system	Smart card system	Smart card system

TABLE D-4.5.1 Evaluation matrix: multiple application programs
Electronic toll/parking

Type of Program/Initiative	**Electronic Toll/Parking**
Examples	*Washington, DC* – WMATA's SmarTrip card can be used in WMATA rail stations *Orlando* – test of multi-modal payment system (transit, toll, parking)
Description of Approach	Integrate transit payments with those for other modes
Goals/Objectives of Program	Improve convenience of multi-modal travel payments
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 promotes seamless travel if part of regional payment integration
Flexibility of fare payment	1 may involve new payment option(s)
Convenience of fare payment	1 convenience of multiple uses for card
Cost of travel	0 does not necessarily reduce fare – only if discount/bonus included
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 costs could be significant for developing system and partnership agreements
Equipment maintenance costs	1 would reduce somewhat if contactless cards used
Revenue collection/management costs	-1 would require some type of clearing/settlement function
Capital costs	-1 would likely require new fare collection equipment
Use of cash	1 should reduce somewhat
Ridership	1 should increase somewhat
Revenue	0 should not affect revenue, unless significant discount included
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	1 provides opportunity for considerable flexibility
Personnel requirements	0 should not really affect this
Service reliability	1 should reduce dwell time, and thus improve reliability
Impact on/Benefits to Partner Entity	
Market penetration	1 would increase number of people with direct access to transit payment
Ease of distribution of benefits	0 not directly relevant
Other (e.g., need for parking)	0 not directly relevant
Liability to agency	
Economic liability	1 should not result in appreciable revenue loss
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 requires different modal operators to agree on specific card technology
Institutional	-1 development of agreements could be complicated
Funding Issues and Sources	-1 funding for agency to purchase new equipment an issue
Required Equipment and Technology	
	Requires smart cards (contactless or dual interface), readers, vending equipment

TABLE D-4.5.2 Evaluation matrix: multiple application programs
Financial services, other payment or loyalty programs

Type of Program/Initiative	**Financial Services, Other Payment or Loyalty Programs**
Examples	*Washington, DC* – pilot linking SmarTrip fare payment with bank ATM card *Honolulu* – plan for system to combine transit and local attractions (e.g., zoo) *Atlanta* – pilot (completed) to accept bank stored-value cards for transit payment
Description of Approach	Integrate transit and other payments/loyalty programs on same card (e.g., accept bank or other e-purse for transit use)
Goals/Objectives of Program	Increase market penetration of potential transit users
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 promotes seamless travel if part of regional payment integration
Flexibility of fare payment	1 may involve new payment option(s)
Convenience of fare payment	1 convenience of multiple uses for card
Cost of travel	0 does not necessarily reduce fare – only if discount/bonus included
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 costs could be significant for developing system and partnership agreements
Equipment maintenance costs	1 would reduce somewhat if contactless cards used
Revenue collection/management costs	-1 would require some type of clearing/settlement function
Capital costs	-1 would likely require new fare collection equipment
Use of cash	1 should reduce somewhat
Ridership	1 should increase somewhat
Revenue	0 should not affect revenue, unless significant discount included
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	1 provides opportunity for considerable flexibility
Personnel requirements	0 should not really affect this
Service reliability	1 should reduce dwell time, and thus improve reliability
Impact on/Benefits to Partner Entity	
Market penetration	1 would increase number of people with direct access to transit payment
Ease of distribution of benefits	0 not directly relevant
Other (e.g., need for parking)	0 not directly relevant
Liability to agency	
Economic liability	1 should not result in appreciable revenue loss
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 requires different entities to agree on specific card technology
Institutional	-1 development of agreements could be complicated
Funding Issues and Sources	-1 funding for agency to purchase new equipment an issue
Required Equipment and Technology	
	Requires smart cards (contactless or dual interface), readers, vending equipment

TABLE D-4.5.3 Evaluation matrix: multiple application programs
Identification, access, security

Type of Program/Initiative	**Identification, Access, Security**
Examples	*Washington, DC* – plan to allow SmarTrip card to be used for ID/access in car-sharing program; also, SmarTrip application included in GSA ID cards, and building access included in SmarTrip cards (pilot for some employees)
Description of Approach	Integrate transit and ID/access/security applications on same card
Goals/Objectives of Program	Increase market penetration of potential transit users
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 promotes seamless travel if part of regional payment integration
Flexibility of fare payment	1 may involve new payment option(s)
Convenience of fare payment	1 convenience of multiple uses for card
Cost of travel	0 does not necessarily reduce fare – only if discount/bonus included
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 costs could be significant for developing system and partnership agreements
Equipment maintenance costs	1 would reduce somewhat if contactless cards used
Revenue collection/management costs	-1 would require some type of clearing/settlement function
Capital costs	-1 would likely require new fare collection equipment
Use of cash	1 should reduce somewhat
Ridership	1 should increase somewhat
Revenue	0 should not affect revenue, unless significant discount included
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	1 provides opportunity for considerable flexibility
Personnel requirements	0 should not really affect this
Service reliability	1 should reduce dwell time, and thus improve reliability
Impact on/Benefits to Partner Entity	
Market penetration	1 would increase number of people with direct access to transit payment
Ease of distribution of benefits	0 not directly relevant
Other (e.g., need for parking)	0 not directly relevant
Liability to agency	
Economic liability	1 should not result in appreciable revenue loss
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 requires different entities to agree on specific card technology
Institutional	-1 development of agreements could be complicated
Funding Issues and Sources	-1 funding for agency to purchase new equipment an issue
Required Equipment and Technology	
	Requires smart cards (contactless or dual interface), readers, vending equipment

TABLE D-4.6 Summary evaluation matrix: university programs

Type of Program/Initiative	Pass/Unlimited Access Programs	Special Reduced Fare Programs	Joint Transit-Univ. Card Programs
Examples	*Chicago* – U-Pass *Seattle* – U-Pass *Hartford (CT)* – Upass *Boulder (CO)*	*Lansing* – 25% of full fare *Akron, OH* – free fare *Chapel Hill, NC* – free fare	*Ventura Co./U. Cal. Santa Monica/UCLA*
Description of Approach	Special pass pricing for students; may require purchase for all students	Low single ride fares for students; may also involve low pass prices	Partnership to allow use of university cards directly on transit services
Goals/Objectives of Program	Increase transit ridership, improve access to campus	Increase transit ridership, improve access to campus	Increase transit ridership, improve access to campus
Criterion	**Rating**	**Rating**	**Rating**
Customer Impacts/Benefits			
Ease of travel (e.g., seamless)	0	0	1
Flexibility of fare payment	1	1	1
Convenience of fare payment	1	1	1
Cost of travel	1	1	0
Overall attitude toward agency	1	1	1
Agency Impacts/Benefits			
Design/implementation costs	-1	0	-1
Equipment maintenance costs	0	1	1
Revenue collection/management costs	-1	1	-1
Capital costs	0	0	-1
Use of cash	1	1	1
Ridership	1	1	1
Revenue	-1	-1	0
Fare abuse/evasion	-1	-1	1
Fare structure flexibility	0	0	1
Personnel requirements	0	0	0
Service reliability	0	0	1
Impact on/Benefits to Partner Entities			
Market penetration	1	1	1
Ease of distribution of benefits	1	1	1
Other (e.g., need for parking)	1	1	1
Liability to agency			
Economic liability	-1	-1	1
Political/legal liability	0	-1	1
Constraints/Barriers			
Technical	1	1	-1
Institutional	-1	-1	-1
Funding Issues and Sources	0	0	-1
Required Equipment/Technology			
	None	None	Smart card (contactless or dual interface) system

TABLE D-4.6.1 Evaluation matrix: university programs
Special pass/unlimited access programs

Type of Program/Initiative	**Special Pass/Unlimited Access Programs**
Examples	*Seattle* – KC Metro/U. Washington (U-Pass) *Chicago* – CTA/any interested university (U-Pass) *Hartford (CT)* – CT TRANSIT/Trinity College, Capital Community College *Boulder (CO)* – RTD/U. Colorado
Description of Approach	Special pass pricing for students; may require purchase for all students
Goals/Objectives of Program	Agency's goal is to increase ridership, university's goals are to improve access to and around campus – and possibly to reduce parking demand
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	0 depends on nature of regional payment integration, if any
Flexibility of fare payment	1 new payment option for students
Convenience of fare payment	1 convenient, since students use ID or get semester/annual pass
Cost of travel	1 can make transit free or very inexpensive
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 development of agreements could be time-consuming
Equipment maintenance costs	0 should not affect fare collection equipment
Revenue collection/management costs	-1 dealing with university will incur some costs
Capital costs	0 should not require new fare collection equipment
Use of cash	1 should reduce considerably
Ridership	1 should increase significantly
Revenue	-1 may result in some loss of revenue (depends on program pricing)
Fare abuse/evasion	-1 opportunity for abuse (e.g., sharing pass with non-student)
Fare structure flexibility	0 does not really affect this
Personnel requirements	0 does not really affect this
Service reliability	0 drivers have to visually inspect ID or pass
Impact on/Benefits to Partner Entity	
Market penetration	1 should be popular with students
Ease of distribution of benefits	1 easy way for university to distribute benefits to students
Other (e.g., need for parking)	1 could reduce demand for parking on/near campus
Liability to agency	
Economic liability	-1 potential for revenue loss
Political/legal liability	0 could be opposed by non-student riders
Constraints/Barriers	
Technical	1 should not have any technical barriers
Institutional	-1 development of agreement with university could be complicated
Funding Issues and Sources	0 university would pay for program
Required Equipment and Technology	
	No particular equipment or technology required

TABLE D-4.6.2 Evaluation matrix: university programs
Reduced fare programs for students

Type of Program/Initiative	**Reduced Fare Programs for Students**
Examples	*Lansing, MI* – CATA/Michigan State, others: 25% of full fare for students *Akron, OH* – Metro RTA: free for students *Chapel Hill, NC* – Chapel Hill Transit: eliminated the fare
Description of Approach	Low single ride fares for students; may also involve low pass prices
Goals/Objectives of Program	Agency's goal is to increase ridership, university's goals are to improve access to and around campus – and possibly to reduce parking demand
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	0 depends on nature of regional payment integration, if any
Flexibility of fare payment	1 may involve new payment option(s) for students
Convenience of fare payment	1 convenient if free fare, no more convenient if have to pay cash
Cost of travel	1 can make transit free or very inexpensive
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	0 should not significantly affect these costs
Equipment maintenance costs	1 would reduce somewhat if free fare; otherwise, should not affect
Revenue collection/management costs	1 would reduce somewhat if free fare; otherwise, should not affect
Capital costs	0 should not require new fare collection equipment
Use of cash	1 would reduce considerably if free fare; otherwise, could increase
Ridership	1 should increase significantly
Revenue	-1 would result in loss of revenue compared to charging full fare
Fare abuse/evasion	-1 opportunity for abuse (e.g., non-students using student IDs)
Fare structure flexibility	0 does not really affect this
Personnel requirements	0 does not really affect this
Service reliability	0 drivers have to visually inspect ID
Impact on/Benefits to Partner Entity	
Market penetration	1 should be popular with students
Ease of distribution of benefits	1 easy way for university to distribute benefits to students
Other (e.g., need for parking)	1 could reduce demand for parking on/near campus
Liability to agency	
Economic liability	-1 potential for significant revenue loss
Political/legal liability	-1 could be strongly opposed by non-student riders
Constraints/Barriers	
Technical	1 should not have any technical barriers
Institutional	-1 development of agreement with university could be complicated
Funding Issues and Sources	0 university would pay for program
Required Equipment and Technology	
	No particular equipment or technology required

TABLE D-4.6.3 Evaluation matrix: university programs
Joint transit-university card programs

Type of Program/Initiative	**Joint Transit-University Card Programs**
Examples	*Ventura Co. (CA)* – VCTC/U. Cal. Channel Islands: joint smart card *Los Angeles* – Santa Monica Blue Bus/UCLA (BruinGO): UCLA billed for no. rides
Description of Approach	Partnership to allow use of university cards directly on transit services (or vice versa)
Goals/Objectives of Program	Agency's goal is to increase ridership, university's goals are to improve access to and around campus – and possibly to reduce parking demand
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	1 promotes seamless travel if part of regional payment integration
Flexibility of fare payment	1 new payment option(s) for students
Convenience of fare payment	1 convenient, since student can directly use campus card on transit
Cost of travel	0 does not necessarily reduce fare – only if discount/bonus included
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 costs could be significant for developing partnership agreements
Equipment maintenance costs	1 would reduce somewhat if contactless cards used; could increase if contact cards
Revenue collection/management costs	-1 would require some type of clearing/settlement function
Capital costs	-1 would likely require new fare collection equipment
Use of cash	1 should reduce somewhat
Ridership	1 should increase somewhat
Revenue	0 should not affect revenue, unless significant discount included
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	1 provides opportunity for considerable flexibility
Personnel requirements	0 should not really affect this
Service reliability	1 should reduce dwell time, and thus improve reliability
Impact on/Benefits to Partner Entity	
Market penetration	1 should be popular with students
Ease of distribution of benefits	1 easy way for university to distribute benefits to students
Other (e.g., need for parking)	1 could reduce demand for parking on/near campus
Liability to agency	
Economic liability	1 should not result in appreciable revenue loss
Political/legal liability	1 should not be opposed by non-student riders
Constraints/Barriers	
Technical	-1 requires agency and university to agree on specific card technology
Institutional	-1 development of agreement with university could be complicated
Funding Issues and Sources	-1 funding for agency to purchase new equipment an issue
Required Equipment and Technology	
	Requires smart cards (contactless or dual interface), readers, vending equipment

TABLE D-4.7 Summary evaluation matrix: employer programs

Type of Program/Initiative	Annual Employer Pass Programs	Transit Voucher Programs	Automated Benefits Distribution Programs
Examples	*Minn./St. Paul* – Metropass: price based on mode share *Portland* – Passport: price based on mode share *San Jose* – Eco Pass: price based on formula *Seattle* – FlexPass: price based on formula, no minimum	*New York* – TransitCheck: can be MetroCard *Washington, DC* – Metrochek: farecard, use for payment or redeem for other *San Francisco* – CommuterCheck: redeem for any operator *Boston* – CommuterCheck: redeem for MBTA	*Washington, DC* – SmartBenefits *New York City* – Premium TransitCheck
Description of Approach	Employers buy annual passes for all employees; price much lower than normal pass	Employers distribute vouchers to employees, who use the vouchers to buy fare media (or use directly, if farecard)	Employer automatically provides benefits via electronic fare media
Goals/Objectives of Program	Increase transit ridership, improve access to work	Increase transit ridership, improve access to work	Increase ridership, reduce administrative requirements of benefits program
Criterion	**Rating**	**Rating**	**Rating**
Customer Impacts/Benefits			
Ease of travel (e.g., seamless)	0	0	1
Flexibility of fare payment	0	1	1
Convenience of fare payment	1	-1	1
Cost of travel	1	1	1
Overall attitude toward agency	1	1	1
Agency Impacts/Benefits			
Design/implementation costs	-1	0	-1
Equipment maintenance costs	0	0	1
Revenue collection/management costs	-1	-1	1
Capital costs	0	0	-1
Use of cash	1	1	1
Ridership	1	1	1
Revenue	-1	0	0
Fare abuse/evasion	0	-1	1
Fare structure flexibility	0	0	1
Personnel requirements	-1	0	-1
Service reliability	0	0	1
Impact on/Benefits to Partner Entities			
Market penetration	1	1	1
Ease of distribution of benefits	1	1	1
Other (e.g., need for parking)	1	1	1
Liability to agency			
Economic liability	-1	1	1
Political/legal liability	-1	1	1
Constraints/Barriers			
Technical	1	1	-1
Institutional	-1	0	-1
Funding Issues and Sources	0	0	-1
Required Equipment/Technology			
	None	None	Smart card system, Internet access

TABLE D-4.7.1 Evaluation matrix: employer benefits programs
Annual employer pass programs

Type of Program/Initiative	**Annual Employer Pass Programs**
Examples	*Minn./St. Paul* – Metropass: price based on company's transit mode share, no minimum *Portland* – Passport: price based on company's transit mode share, min. differs by zone *San Jose* – Eco Pass: price based on formula, no min.; also has "neighborhood" pass *Seattle* – FlexPass: price based on formula, no minimum
Description of Approach	Employers buy annual passes for all employees; price much lower than normal pass; price based on formula (e.g., co. size, location, level of transit service)
Goals/Objectives of Program	Agency's goal is to increase ridership, employer's goals are to improve access to work – and possibly to reduce parking demand
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	0 depends on nature of regional payment integration, if any
Flexibility of fare payment	0 does not really affect flexibility
Convenience of fare payment	1 annual pass very convenient
Cost of travel	1 can make transit free or very inexpensive
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 development of formula and agreements with employers can be time-consuming
Equipment maintenance costs	0 should not affect fare collection equipment
Revenue collection/management costs	-1 can be significant administrative expense (e.g., surveys of employees)
Capital costs	0 should not require new fare collection equipment
Use of cash	1 should reduce considerably
Ridership	1 should increase significantly
Revenue	-1 may result in some loss of revenue (depends on pass pricing)
Fare abuse/evasion	0 minimal opportunity for abuse, since all employees receive pass
Fare structure flexibility	0 does not really affect this
Personnel requirements	-1 may require staff to administer program
Service reliability	0 should not affect reliability
Impact on/Benefits to Partner Entity	
Market penetration	1 should be popular with employees
Ease of distribution of benefits	1 easy way for employer to distribute transit benefits to employees
Other (e.g., need for parking)	1 could reduce demand for parking at employment site
Liability to agency	
Economic liability	-1 potential for revenue loss if formula not carefully designed – and updated
Political/legal liability	-1 could be opposed by riders who do not have opportunity to partcipate
Constraints/Barriers	
Technical	1 should not have any technical barriers
Institutional	-1 development of agreements with employers could be complicated
Funding Issues and Sources	0 should not be a significant issue
Required Equipment and Technology	
	No particular equipment or technology required

TABLE D-4.7.2 Evaluation matrix: employer benefits programs
Transit voucher programs

Type of Program/Initiative	**Transit Voucher Programs**
Examples	*New York* – TransitCheck: can be MetroCard, used directly for payment (NYCTA) *Washington, DC* – Metrochek: farecard, use for payment (Metrorail) or redeem for other *San Francisco* – CommuterCheck: redeem for any operator in region *Boston* – CommuterCheck: redeem for MBTA
Description of Approach	Employers buy vouchers, distribute to employees, who use the vouchers to buy fare media – or in some cases, can be used directly for fare payment
Goals/Objectives of Program	Agency's goal is to increase ridership, employer's goals are to improve access to work – and possibly to reduce parking demand
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel	0 depends on nature of regional payment integration, if any
Flexibility of fare payment	1 gives employee flexibility to purchase any type of payment
Convenience of fare payment	-1 requires employee to obtain fare medium, unless voucher is also farecard
Cost of travel	1 can make transit free or very inexpensive
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	0 should not significantly affect these costs
Equipment maintenance costs	0 should not affect fare collection equipment
Revenue collection/management costs	-1 some cost for provision of vouchers (e.g., third party provider)
Capital costs	0 should not require new fare collection equipment
Use of cash	1 should reduce considerably
Ridership	1 should increase significantly
Revenue	0 should not significantly affect revenue
Fare abuse/evasion	-1 some opportunity for abuse, since employee can give voucher to non-employee
Fare structure flexibility	0 does not really affect this
Personnel requirements	0 should not require staff to administer program
Service reliability	0 should not affect reliability
Impact on/Benefits to Partner Entity	
Market penetration	1 should be popular with employees
Ease of distribution of benefits	1 easy way for employer to distribute transit benefits to employees
Other (e.g., need for parking)	1 could reduce demand for parking at employment site
Liability to agency	
Economic liability	1 no significant liability
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	1 should not have any technical barriers
Institutional	0 should not be a significant issue
Funding Issues and Sources	0 should not be a significant issue
Required Equipment and Technology	
	No particular equipment or technology required

TABLE D-4.7.3 Evaluation matrix: employer benefits programs
Automated transit benefits distribution programs

Type of Program/Initiative	**Automated Transit Benefits Distribution Programs**
Examples	*Washington, DC* – SmartBenefits *New York City* – Premium TransitCheck
Description of Approach	Employer automatically provides benefits via electronic fare media
Goals/Objectives of Program	Agency's goal is to increase ridership, employer's goal is to reduce administrative requirements of transit benefits program.
Criterion	**Rating and Explanation**
Customer Impacts/Benefits	
Ease of travel (e.g., seamless)	1 promotes seamless travel if part of regional payment integration
Flexibility of fare payment	1 may offer new payment option(s)
Convenience of fare payment	1 convenient, since employee automatically receives benefit
Cost of travel	1 assumes that employer subsidizes pass
Overall attitude toward agency	1 should improve general opinion of agency
Agency Impacts/Benefits	
Design/implementation costs	-1 costs could be significant for technical development and implementation
Equipment maintenance costs	1 would reduce somewhat if contactless cards used
Revenue collection/management costs	1 should ultimately reduce administrative costs
Capital costs	-1 would likely require new fare collection equipment
Use of cash	1 should reduce somewhat
Ridership	1 should increase somewhat
Revenue	0 should not affect revenue, unless significant discount included
Fare abuse/evasion	1 should reduce abuse/evasion
Fare structure flexibility	1 provides opportunity for considerable flexibility
Personnel requirements	-1 would require some staff time
Service reliability	1 should reduce dwell time, and thus improve reliability
Impact on/Benefits to Partner Entity	
Market penetration	1 should be popular with employees
Ease of distribution of benefits	1 easy way for employer to distribute benefits to employees
Other (e.g., need for parking)	1 could reduce demand for parking at employment site
Liability to agency	
Economic liability	1 no significant liability
Political/legal liability	1 opposition unlikely
Constraints/Barriers	
Technical	-1 requires development & use of website by agency and employers
Institutional	-1 development of agreement with employers could be complicated
Funding Issues and Sources	-1 funding for agency to purchase new equipment an issue
Required Equipment and Technology	
	Requires smart cards, vending/reload equipment, Internet access

Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation