TRANSIT COOPERATIVE RESEARCH PROGRAM

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TCRP Report 10

Fare Policies, Structures, and Technologies

Transportation Research Board
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Fare Policies, Structures, and Technologies

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Subject Area

Public Transit

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

TRANSPORTATION RESEARCH BOARD
NATIONAL RESEARCH COUNCIL

NATIONAL ACADEMY PRESS
Washington, D.C. 1996

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 Transit 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 Academy of Sciences, 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 endusers 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 10

Project A-1 FY '92
ISSN 1073-4872
ISBN 0-309-05713-2
Library of Congress Catalog Card No. 96-60005

Price $45.00

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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 Transit Development Corporation, the National Research Council, 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.

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Published reports of the

TRANSIT COOPERATIVE RESEARCH PROGRAM

are available from:

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Printed in the United States of America

FOREWORD

By Staff
Transportation Research Board

This report will be of interest to policy makers and managers at transit agencies developing and implementing fare policies to meet their social, financial, and service needs. The report includes the results of a comprehensive study of the major parameters of the transit fare decision-making process, and it provides guidance for making decisions related to fare policy, structure, and technology.

Every transit agency must eventually address fare policy, structure, and technology, and, while each of these areas has typically been evaluated separately, it is important to understand the interrelationship among them. Policy generally guides the direction for structure, but technology decisions can also affect decisions regarding structure—as well as policy. Electronic fare payment, for instance, offers the agency the ability to provide a broad range of fare options, while improving its own revenue control and operations planning capabilities. Emerging technological developments can also facilitate the expansion of the existing use of fare instruments to a broader base, possibly including other transit operators and non-transit functions. Thus, as transit agencies face pressures to maximize their operating efficiencies, increase revenues, and expand their ridership, the need to be aware of capabilities of the emerging technologies becomes more important than ever.

Under TCRP Project A-1, *Fare Policies, Structures, and Technologies*, research was undertaken by a team headed by Multisystems, Inc. to evaluate alternative fare structures; to review current and emerging fare collection and media distribution technologies; and to develop techniques and guidelines to enable transit agencies to evaluate and identify appropriate policies, structures, and technologies. This report highlights the issues to be considered in making fare-related decisions, the experiences of transit agencies in selecting and using the various approaches, and the advantages and disadvantages—and future promise—of emerging developments. A companion document, *Transit Fare Decision-Making Guidelines*, has been designed to quickly assist policy makers and managers in making fare-related decisions. These *Guidelines* are reproduced herein in Appendix D. The case studies discussed in this report are presented in a separate document, *Fare Policies, Structures, and Technologies: Case Studies.* This document is available for loan by request to the TCRP, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

CONTENTS

ACKNOWLEDGMENTS

The research described in this report was performed under TCRP Project A-1 by Multisystems, Inc.; J.W. Leas & Associates, Inc.; Oram Associates; and Applied Systems Institute, Inc. Multisystems served as the primary contractor for the study.

Daniel Fleishman of Multisystems, the Principal Investigator for the study, was responsible for overall supervision of the research and is the primary author of this Final Report. Ashok Joshi led the research effort at J.W. Leas & Associates; Richard Oram conducted the research for Oram Associates; and Joanne Lehtihet led the research effort at Applied Systems Institute. Additional participants in the research effort included Nicola Shaw, Rick Halvorsen, and Peter Furth of Multisystems; Richard Freeze and Wes Leas of J.W. Leas & Associates; and Peter Ognibene, formerly of Applied Systems Institute. Case studies were prepared by Daniel Fleishman, Richard Oram, Nicola Shaw, Rick Halvorsen, Ashok Joshi, and Richard Freeze.

Guidance was provided throughout the project by Stephanie Nellons Robinson, the TCRP Senior Program Officer for the project.

FARE POLICIES, STRUCTURES, AND TECHNOLOGIES

SUMMARY

The overall goal of Transit Cooperative Research Program Project A-1 was to provide transit agencies with guidance in making decisions related to fare policies, structures, and technologies. In addressing this goal, the research involved a comprehensive study of the nature of and interaction among these three areas. The study consisted of the following major elements:

- Initial Review—The researchers reviewed the current fare policies and structures and types of fare payment and collection technologies at transit agencies of various sizes in the United States and, for selected cases, in other countries.
- Case Study Analysis—The researchers analyzed case studies of the decision-making process and results of the development of fare policies, modification of existing fare structures, and selection of new technologies and equipment at 12 U.S. transit agencies (of varying size and modal orientation).
- Review of Technology Trends and Developments—The researchers reviewed and assessed emerging trends and developments related to fare payment and collection technology; this effort included a review of electronic fare payment applications (i.e., using magnetic stripe and smart card technologies) around the world, as well as emerging developments such as regional fare integration, multiple use of farecards, post payment, and electronic funds transfer.

The key findings of the study are summarized as follows.

FARE POLICY AND STRUCTURE ISSUES

Development of Fare Policy Goals

- Although some agencies develop formal fare policy statements to guide future fare restructuring and technology development, many agencies simply identify policy goals in reaction to financial crises or other outside influences. Very few agencies (3 percent) perform regularly scheduled (annual or other) fare changes—most change fares "as needed."
- Fare-related decisions are based on such factors as the agency's size and modal composition, as well as on the nature of the change being considered. In general, however, there appear to be three basic decision-making scenarios: policy-driven (changes are based on pre-established goals), technology-driven (changes are based on the type of technology selected), and service-driven (changes are based on the need to integrate a new mode or service into system).

- The major fare policy goals can be categorized as customer-related, financial, management-related, or political. Certain goals inherently are in competition; therefore, it is necessary to rank the major goals. Because of the widespread decline in ridership in recent years, the general emphasis in the industry has shifted somewhat over the past decade or so from a primary concern with generating additional revenue to an often equal emphasis on increasing ridership. This change generally has been marked by a greater focus on the "customer"—through simplification of fare structures (e.g., eliminating or reducing the number of fare zones), improving convenience through the addition of prepaid options, or introducing discounted fare media.

Development of Fare Structures

- The transit industry has debated the advantages and disadvantages of flat versus differentiated fare strategies for years. It is argued that differentiation is beneficial—because it can enable generation of higher revenues—and warranted—because of the higher operating cost associated with serving long trips, operating during peak hours, and providing premium service. Although differentiated fare strategies are used by some agencies, the industry has leaned toward flat-fare schemes—with market-based elements. As of 1994, 37 percent of North American bus agencies reported distance-based (actually zonal) pricing, 27 percent had some type of service-based differentiation, and 6 percent offered a time-of-day differential.
- The transit industry has increasingly embraced market-based pricing, recognizing the benefits of targeting different rider markets. This approach involves offering various types of prepaid options—passes and multi-ride instruments—and centers on providing a choice of payment options to riders. Over three-quarters of North American transit agencies offer some type of discounted prepaid option (one or more type of unlimited-ride pass, some form of volume or multi-ride discount, or combinations thereof).
- The transit agency benefits from any form of prepayment through reduced cash handling, improved cash flow, and perhaps decreased boarding times (depending on the fare collection technology in place). On the other hand, passes also present a major disadvantage through "lost revenue" from high frequency use. Additional revenue loss occurs through illegal sharing of passes and through counterfeiting. The negative revenue impact of period passes remains a major concern among transit agencies, and they seek to minimize the impact by setting the pass price and breakeven level carefully, as well as seeking to develop ever more secure media. Some agencies have gone so far as to eliminate period passes.

Identification of Ridership and Revenue Impacts of Fare Changes Versus Other Factors

- Although fare levels and strategies affect transit use, variables can have at least as strong an influence. On the basis of the case study analyses conducted in this study, it was determined that important non-fare factors affecting transit demand include the state of the local economy (including employment levels and fuel prices), residential and employment shifts (e.g., suburbanization), and the level of transit service provided.
- Determining the relative effects of the various factors (i.e., through time series regression techniques) is always a challenge and can be complicated considerably by gaps or inconsistencies in the data available for key variables. Such problems can make it difficult to isolate the effects of these different factors and to use the

results to predict the effects of a prospective fare change accurately. The constraints associated with such analyses have led transit agencies to consider and use various methods to estimate the effects of future fare change. Regardless of the technique chosen, however, professional judgment must play a significant role, and the dynamic nature of the external environment must be considered in all analyses.

FARE PAYMENT AND COLLECTION TECHNOLOGY ISSUES

Benefits and Costs Associated with Electronic Fare Payment Technologies

- The advent of electronic fare payment has facilitated the use of stored value as a prepaid option. Stored value offers the convenience associated with any type of prepayment and allows the rider to decide how much to prepay at a given time. This option can also "mask" the complexity of a fare structure to the rider because he or she does not have to know the exact fare for a particular trip.
- Stored value—and electronic fare payment in general—enables agencies to offer various fare options and to modify the fare structure easily. For instance, electronic stored value media permit differentiation of fares by payment option (i.e., time-based, trip-based, value-based, or combinations thereof), time of day, mode, nature of minimum purchase price, and discount or bonus offered. Because electronic payment can enable agencies to offer a range of fare options and structures with a single fare medium, electronic fare payment also can facilitate integration of multiple operators in a region.
- The use of electronic fare payment can considerably reduce bus operators' fare collection responsibilities, thereby minimizing potential operator and rider conflicts (i.e., regarding pass or transfer validity). The reduction in the need for operators to handle and inspect transfers or flash passes can result in reduced dwell time, thereby improving service reliability.
- Electronic fare payment allows the collection of more accurate and comprehensive ridership data (by fare category); this can permit better analysis and forecasting of fare changes, as well as improved understanding of ridership patterns by route and time period—and thus better service planning.
- The use of electronic media facilitates the generation of increased revenues through reduced fare evasion and abuse and through better revenue control.
- Agencies can receive revenue from unused value on stored value cards—the agency benefits from the "float" associated with prepayment in general, as well as the remaining value on cards never actually used for purchasing trips.
- Electronic payment also offers opportunities related to expanding the existing capabilities of the fare media themselves (e.g., through regional fare integration, multiple use cards, and post payment and employer billing applications).
- The maintenance and repair costs for electronic payment—and distribution—equipment can be expected to rise (at least initially), because of the need for more highly trained personnel. Use of these technologies, however, may result in net fare collection cost savings because of reductions in the numbers of overall fare collection staff (particularly ticket agents, clerks, and revenue processing personnel) needed.
- The cost of purchasing and implementing electronic fare collection equipment can be high, depending on the specific types of equipment involved. The unit cost of the fare media can also be high (i.e., for smart cards).

Developments Related to Selection of Electronic Fare Technologies

- The use of electronic fare collection equipment in general has grown significantly over the past several years and should expand at an even greater rate in the next few

years (as budgets allow). For bus operators, the desire for improved data collection and revenue security has led many agencies to install electronic registering fareboxes, and a growing number of agencies have acquired swipe readers to read passes. Both rail and bus operators are beginning to purchase ticket processing units, in order to automate transfer issuance and acceptance and to accept stored-value cards.

- Several regional fare integration efforts have been initiated, facilitated by the capabilities of electronic media to allow a "universal ticket" to be used for multiple operators.
- Agencies have begun to take advantage of new transactional database capabilities and implement billing and post payment programs (e.g., in order to allow employers to document trip reduction efforts, to permit acceptance of commercial credit cards for fare payment, or both).
- Transit fare payment developments increasingly are intersecting with developments in the banking industry, through the use of 1) electronic funds transfer methods for purchase of fare media (e.g., credit or debit card payments in automated vending machines, as well as sale of fare media through automated teller machines), and 2) use of credit cards for direct payment of fares.
- In the coming years, developments in the banking industry—and other sectors, such as communications and retail—also will influence the selection of particular fare payment technologies by transit agencies. As these industries begin to adopt the prepaid stored-value (or "electronic purse") concept as a replacement for use of cash in small purchases, there will be an increase in opportunities for transit agencies to participate in multiple use arrangements. Such arrangements can take various institutional forms, one of which is for the transit agency to accept the multiple use card issued by the bank (or other private entity) as a fare medium. The medium in most such programs, at least within the foreseeable future, probably will be the contact smart card, for which the commercial banking industry is developing international specifications and standards.
- The alternative multiple use arrangement is for the transit agency to initiate and administer the program (most probably in partnership with a private company as part of a public-private joint venture) and enlist other entities (e.g., retail outlets, vending machine operators, and parking lots) to accept the fare card for payment. This could reduce the transit agency's fare collection costs, as system vendors are, in several current programs, helping to finance the fare equipment and media in return for collecting transaction fees (on fares and other payments using the card). Because such programs are not directly tied to the banking system, the medium could be any technology, although indications are that it will be some type of smart card.
- Regarding the use of specific fare media technologies, magnetic stripe cards and tickets are seeing increasing use, both as passes used in a read-only mode and as stored-value media. The two largest rail systems in the United States are installing magnetic automated fare collection systems, and a growing number of bus operators are installing magnetic readers and processing units.
- Smart cards are receiving increasing consideration by the transit industry in general. Cards are now being tested by agencies throughout the world, including several in the United States. At this point, the transit industry is more interested in contactless smart cards than in contact cards. This has produced dual paths for transit smart card use: contactless cards are more often the medium of choice in programs initiated by the transit agency (and perhaps restricted to transportation applications), while contact cards are typically employed in multiple use arrangements that include banking networks. Until one technology is demonstrated to be superior for use in transit—

technically, economically, or both—this trend probably will continue; eventually, a combination card, capable of use in either form, may well see widespread use.

- The data and logic capabilities of smart cards have made them the general technology of choice in both multiple use programs and regional fare integration efforts.
- Regardless of the specific smart card technology adopted, the economics of providing the cards will be a key concern to transit agencies until the price of the cards drops considerably, the cards are demonstrated (through large-scale testing and independent evaluation) to represent a cost-effective alternative to the currently lower-priced magnetic stripe cards, or both. Smart card prices will come down as use spreads and the cards are produced in greater volumes. Moreover, several feasibility studies have concluded that smart cards are already more cost-effective than other options because of their durability, reliability, security, and data capacity advantages. Nevertheless, at least in the near term, smart card use by most transit agencies probably will follow one (or a combination) of the following scenarios: 1) the cards are provided at no charge or at a substantial discount by an outside party (i.e., a bank or a card supplier, as part of a multiple use program, or the Federal government, perhaps as part of a demonstration); 2) cards are provided only for a specialized uses (e.g., the elderly and disabled or, perhaps, agency maintenance personnel); or 3) cards are issued only to high frequency users (i.e., who will keep a single card for a long time) or are sold with high minimum purchase prices. Even in the first scenario, it is unlikely that smart cards would be the sole fare medium; thus, at least for the foreseeable future, smart cards probably are to be offered along with less expensive media (e.g., magnetic stripe cards, tokens, or paper tickets) that remain available for occasional riders or riders unable to afford the smart card purchase price.

In summary, although the changes in the fare policy and structure area have been relatively subtle in recent years, the technology area has seen major changes. The past several years have seen considerable advancement in the design and capabilities of fare payment media and equipment, and advancements are continuing rapidly. Given the pace of technological change and the questions concerning future public funding, it is difficult to predict with any certainty what will happen in the coming years in this area. What is clear is that the escalating budgetary constraints are increasing the importance of all of transit agencies' fare-related decisions. Pressures to generate greater revenues from fares—while striving to minimize the loss of riders—will increase the need for 1) careful fare structure development, including the targeting of individual rider markets, and 2) improvements in revenue control, including minimizing the loss of revenues through fare abuse and evasion. Although the technological fare collection advances have served to improve agencies' abilities to address both of these areas, the rate of change in the development of these technologies—coupled with a general lack of widespread operational testing—has significantly complicated the selection of the most appropriate new technology. Some transit agencies are evaluating the available options—in some cases re-evaluating previous decisions; other agencies are taking a wait-and-see attitude—until the emerging technologies have been tested thoroughly and their benefits documented. Although it does not provide all of the answers, this report has been developed to assist transit agencies in making these decisions—by discussing the options available, the experiences with these options to date, and the issues to be considered.

CHAPTER 1

INTRODUCTION AND RESEARCH APPROACH

BACKGROUND

If transit agencies are to maintain, if not improve, their services in the face of tight fiscal constraints—and, in many cases, declining ridership—they must establish effective pricing structures. Transit markets are changing—because of such trends as increasing suburbanization and the growing numbers of elderly and persons with disabilities)—and the transit industry has realized that transit ridership consists of submarkets. Research has shown that these submarkets can be reached through differential pricing (i.e., market-based or consumer-based pricing), allowing riders to choose fare media (and perhaps levels) on the basis of their own travel needs and sensitivity to price.

Because of fiscal constraints, agencies are seeking better means to reduce loss of revenue resulting from fare evasion and abuse and to improve revenue control in general. Moreover, the national emphasis on creating seamless transportation throughout a region is prompting increasing consideration of new ways to integrate regional arrangements.

Fortunately, pursuit of these goals has been paralleled by new developments in fare collection and distribution approaches and technologies. These technological advances, including electronic (or automated) fare collection and distribution systems, have served to facilitate the provision of a broader range of fare structures and instruments and a wider distribution network and to improve related functions, such as revenue control, data collection, operations planning, and fare integration (i.e., among different modes in a single system or among adjoining systems in a region). The fundamental changes in pricing structure—made possible by electronic technologies—have had considerable influence on fare policy decisions. Older fare collection equipment has typically limited the range and structural complexity of fare options that a transit agency could consider; however, electronic systems offer numerous options and can provide different options within a single system.

The primary advantage lies in the opportunity to tailor the fare structure to address specific goals and objectives and to expand the role of fare policy. For instance, the flexibility offered by electronic fare collection may enable the agency to better match demand to available capacity (e.g., by effecting shifts of demand from peak to off-peak periods or from high use to lower use modes through differential time-of-day or modal pricing). New technologies and approaches also offer possibilities to expand the revenue-generating potential of the transit agency (e.g., through usage charges associated with selling transit passes or farecards through automated teller machines [ATMs]). Meanwhile, electronic fare collection can further more traditional fare policy goals such as revenue and ridership maximization, improved convenience, and improved equity.

Such flexibility has drawbacks. First, the new technologies can be expensive. In times of serious financial constraints, a transit agency must assess its ability to expend large portions of its capital budget on new fare collection and distribution equipment; therefore, an agency must understand the costs and benefits associated with a new system. In addition, the flexibility and dizzying array of options afforded by the new equipment complicates the development of a rational, cohesive fare structure. Any agency implementing any advanced technology—and seeking to take advantage of its full capabilities—must perform a detailed analysis. Guidelines for evaluating fare structures and technologies would provide a useful starting point for such an effort.

FARE DECISION PARAMETERS

Essentially, five fundamental parameters are related to fare decisions: fare policy, fare strategy, fare structure, fare payment technology, and fare collection system. Fare policy has several definitions; in the broadest sense, fare policy applies to all aspects of fare structure development, pricing, and selection of fare collection and payment methods. For this study, fare policy is defined as the principles, goals, and constraints that influence the management of a transit agency in setting and collecting fares. Fare strategy, as used in this study, refers to a general fare collection and payment structure approach; possible approaches include flat fare, differential pricing (by distance traveled, time of day or type of service), market-based or discounted payment options, and transfer pricing. The fare structure is the combination of one or more fare strategies with specific fare levels. Technology refers to the type of fare payment media (i.e., cash, token, paper ticket, or advanced payment media) and equipment used for fare collection and sale and distribution of media. Finally, the fare system is the basic fare collection and distribution approach, as well as the specific equipment and payment media; the basic types of fare collection approaches are barrier, payment on entry, and proof of payment (POP).

A transit agency must make decisions about each of these parameters. Although each parameter is typically evaluated separately, they are interrelated, and each decision ultimately affects decisions in the other parameters. Policy generally sets the direction for the strategy and specific structure, but technology choices also can affect the structure selected. Thus, it is useful to understand the options available for each parameter (those in use as well as emerging developments), agency experiences in selecting and implementing different options, and issues to consider in making fare-related choices.

TCRP PROJECT A-1 AND OVERVIEW OF THE FINAL REPORT

A comprehensive study of fare policies, fare strategies and structures, fare collection, and distribution technologies and systems and their interrelationships seemed warranted at this time. Transit agencies can benefit from the results of systematic research into these fundamental parameters and the provision of guidelines for making the complex decisions associated with each of these issues. Transportation Cooperative Research Program (TCRP) Project A-1 — Fare Policies, Structures, and Technologies—was conducted to provide these benefits.

TCRP Project A-1 examined the state of the art and emerging developments related to each of the stated parameters. The bulk of the study was performed between April 1993 and June 1995; wherever possible, however, the information presented has been updated as of the end of 1995. This report presents the research methodology and results of the study. A companion document, *Transit Fare Decision-Making Guidelines*, has been designed to assist transit managers and staff in quickly making decisions related to the basic parameters; the details associated with each step identified in the *Guidelines* are provided in this overall Final Report.

The chapters of the Final Report are as follows:

- CHAPTER 2: Fare Policy Development and Decision-Making Process—This chapter describes fare policy development and introduces the decision-making process for the fare-related parameters.
- CHAPTER 3: Fare Strategies and Payment Options—This chapter discusses the different fare strategies and fare payment options, including their relative advantages and disadvantages; the chapter also describes the current application of strategies and specific fare structures at various transit agencies.
- CHAPTER 4: Fare Structure Development and Evaluation Process and Effects—This chapter discusses the case study analysis and summarizes the case study agencies' fare structure development and evaluation processes—as well as the effects of past fare changes on ridership and revenue.
- CHAPTER 5: Fare Payment and Collection Technology Options—This chapter reviews the fare collection and media distribution approaches and technologies in use in the transit industry.
- CHAPTER 6: Electronic Fare Payment Options—This chapter discusses emerging trends and developments in fare payment technology, with the focus on electronic fare payment methods.
- CHAPTER 7: Emerging Fare Payment and Media Purchase Developments—This chapter discusses emerging applications of electronic fare payment (i.e., beyond the simple payment of fares for a single agency), as well as emerging developments related to fare media purchasing and processing methods.
- CHAPTER 8: Selection and Procurement of New Technology—This chapter discusses issues related to the selection and procurement of new fare technologies and equipment; the chapter includes a discussion of the costs and benefits associated with the different technologies.
- CHAPTER 9: Summary of Findings—This chapter summarizes the key findings of the research.

The appendixes provide further information about the various applications identified in these chapters. The case studies discussed in this report are presented in a separate document, *Fare Policies, Structures, and Technologies: Case Studies.*

CHAPTER 2

FARE POLICY DEVELOPMENT AND DECISION-MAKING PROCESS

INTRODUCTION

Transit agencies use various approaches in developing or making decisions about fare structures and systems. The approach followed depends on such factors as the type of change being made (e.g., looking at new strategies, modifying fare levels, upgrading the overall technology, or adding additional equipment), the nature of the agency (e.g., size, modal composition, organizational structure, and institutional setting), and the status of the existing fare structure and fare system. Regardless of the types of changes being pursued, the initiatives and guidelines for making these decisions should, ideally, derive from the agency's fare policy.

Where policy principles or goals have been defined, they generally dictate how an agency develops strategies or selects technology; however, the availability of increasingly sophisticated fare collection and distribution equipment, coupled with the broad range of strategies that they facilitate, can, in turn, affect policy decisions. Agencies arrive at fare policies in different ways, and they place differing degrees of importance on the various issues comprising their policies. In this chapter, we review the issues considered important in formulating fare policies and the general fare decision-making process; this overall process establishes the framework for consideration of the other major fare parameters, which are discussed in the remainder of the report.

ROLE OF FARE POLICY IN DECISION MAKING

A transit agency's fare policy establishes the principles and goals underlying and guiding the agency's pricing-related decisions. This policy may be spelled out in a fare policy statement or may be implied in the agency's other formal policies and actions. If a formal fare policy statement has been established, it may present the long-term goals related to, and ideally addressed by, the fare structure (e.g., to maximize ridership, to maximize social equity, or to maximize revenue). The statement may also identify more specific short-term objectives (e.g., achieve a certain fare recovery ratio or meet a certain ridership or revenue target). Finally, a comprehensive policy statement may specify guidelines or procedures for determining and implementing changes to the fare structure or fare system.

In the late 1980s, for example, the Chicago Transit Authority (CTA) developed its fare policy around two major elements: 1) near-term fare restructuring guidelines and 2) long-range fare collection and technology improvements (*1*). This policy, a key component of the Authority's *Strategic Management Plan*, was intended to provide direction regarding future fare decisions and not simply to address a specific fare change or equipment procurement. A more recent example of a comprehensive fare policy statement is that developed by the Massachusetts Bay Transportation Authority (MBTA) in Boston. This statement, adopted by the MBTA Board of Directors in early 1993, includes a set of basic underlying principles, the regional context for the development of the policy statement, long-term policy goals, a short-term plan, and a procedure for identifying, determining, and implementing fare changes.

Although some agencies maintain ongoing fare policies that guide fare-related changes, most agencies make fare decisions on an ad hoc basis. These agencies' fare policy decisions are made as a result of a specific problem (e.g., a greater than expected downturn in ridership or revenue or a fare theft scandal) or in response to political pressures (e.g., protests from consumer groups over certain fare proposals). Thus, whereas fare policy can—and should—be used to help a transit agency achieve certain planned financial, social, and environmental goals, it is more frequently used to address short-term problems. This is confirmed by the 1994 American Public Transit Association (APTA) Fare Summary (*2*), which revealed that, of the more than 300 transit systems that responded, 97 percent made fare changes "as necessary." Thus, only 3 percent report making changes on a scheduled (annual or multi-year) basis or in response to the cost of living or another indicator. (These figures are shown, broken out by mode, in Table 1.)

In contrast, in a 1983-1984 survey of transit professionals involved in setting fares at 63 U.S. transit agencies, Markowitz (*3*) found that 34 percent of the responding agencies (which included the 44 largest U.S. transit agencies) reported making their most recent fare changes as a result of the normal annual budget review process and 11 percent as a result of some other specific fare modification schedule. In a third of the cases, the motivation for the most recent change was a "financial crisis," and in an additional 8 percent of the cases, fare changes were prompted by "the actions of outside government agencies." Thus, although the APTA survey is of a much larger sample—and thus includes many small agencies—it would seem that the fare decision-making process has become increasingly reactive. The types of issues that have spurred fare policy reviews or fare changes at specific agencies are discussed in Chapter 4, which presents the findings from the case study analysis of 12 U.S. agencies.

Regarding fare recovery ratio requirements for the industry as a whole, Table 2 indicates that 61 percent of the agencies responding to the 1994 APTA Fare Summary have neither a

TABLE 1 Fare change polices among transit systems

Type of System*	No. of Systems	As Needed	Trigger Points	Annual Changes	Multi-Year Changes
bus	293	284	2	1	6
heavy rail	15	14	1	0	0
light rail	19	16	1	0	2
comm. rail	17	15	1	1	0

Source: APTA Fare Summary, 1994

TABLE 2 Fare recovery ratio goals and requirements

Type of System*	No. of Systems	Ratio Required	Ratio Goal	No Require. or Goal	Median Ratio
bus	293	69	45	179	30%
heavy rail	15	5	3	7	44%
light rail	19	6	6	7	37%
comm. rail	17	6	3	8	50%

Source: APTA Fare Summary, 1994

* These categories are not mutually exclusive.

required recovery ratio nor a specific goal; only 24 percent have a required ratio and a mere 15 percent of the agencies reported having a fare recovery goal. Finally, Table 3 summarizes changes in base fare levels between 1991 and 1994. As shown, fares have increased somewhat, although not dramatically. Whereas $0.75 remains the most common fare (20 percent in 1994, down from 28 percent), the number of agencies with $1.00 fares nearly equals the number at $0.75, as the percentage has grown from 14 percent to 19 percent; the percentage over $1.00 has doubled, from 8 percent to 16 percent. It should be noted that many of the fares reported in the 1994 summary are unchanged from 1991—many agencies have not changed fares since then.

DECISION-MAKING SCENARIOS

Beyond the issue of planned versus ad hoc policy making, a range of approaches is employed in making specific fare-related decisions. Some agencies take a "top-down" approach, beginning with the establishment (or reconsideration) of policy goals and identifying and evaluating potential structural and technological options that address these goals. Other agencies decide on changes to technology and equipment and then consider fare structure options that can be accommodated by the new equipment. In other cases, an agency's decisions on strategy and structure and technology may be driven by a change to the system (e.g., the introduction of a new mode or the significant expansion of existing service).

A review of recent fare-related changes and planning efforts (at the case study agencies and elsewhere) indicates that decisions at transit agencies reflect the following three factors:

- **Policy.** The agency has established a set of goals and objectives and seeks a new fare structure, new fare technology, or both to address specific goals. These goals can be short term, such as surviving an immediate budgetary crisis, or long term, such as improving public mobility. The goals and the resulting strategies are usually agency-specific, but a growing number of regions (e.g., the San

TABLE 3 Changes in fare levels, 1991-1994

Type of System*	No of Systems		<$0.50		$0 50		$0 55-0 70		$0 75		$0.80-0 95		$1 00		$1 05-1 20		$1 25-1 45		$1 50		>$1 50	
	91	94	91	94	91	94	91	94	91	94	91	94	91	94	91	94	91	94	91	94	91	94
bus	269	293	18	13	39	40	44	35	74	60	35	40	37	57	8	15	7	20	5	7	2	6
heavy rail	12	15	-	1	-	-	-	-	1	1	2	2	3	2	2	-	3	4	1	3	-	2
light rail	14	17	-	-	1	1	-	-	1	-	4	3	3	6	2	2	2	3	1	3	-	-
comm rail	15	17	-	-	-	-	-	-	-	-	2	2	2	1	2	1	-	1	-	-	9	13

Source: APTA Fare Summaries, 1991 and 1994

* These categories are not mutually exclusive.

Francisco and Seattle areas) are developing new technological and revenue-sharing approaches to facilitate regional coordination.

- **Technology.** The agency has selected a new technology and develops a new fare structure to take advantage of the capabilities of this technology; a current example is the New York Metropolitan Transportation Authority (NYMTA).
- **Service.** The agency is introducing a new mode of service (e.g., light rail) and needs new technology, a new fare structure, or both for the new mode, and possibly for the overall system; recent examples include the Bi-State Development Agency (BSDA) in St. Louis and Dallas Area Rapid Transit (DART). This scenario also applies to a new transit system, such as Southern California's Metrolink commuter rail service.

Decision making and the issues involved can differ considerably depending on these factors. For instance, if policy is the deciding factor, then the process is iterative and requires the analysis of trade-offs and interrelationships between technology and strategy options. Evaluation criteria that reflect the existing goals must be established for both types of options. In contrast, if technology is the deciding factor, the fare structure is typically not considered until after the new technology has been selected and the capabilities and limitations of the new equipment are understood. In such a case, policy goals have to be established—or at least revisited—in developing a new structure. Finally, if service is the deciding factor, then the scenario is similar to that for policy in that technology and strategy both have to be considered; however, this scenario also requires the establishment or reconsideration of policy goals for the new service. Issues that may arise in each scenario are summarized in Table 4.

These three scenarios are general in nature. Decision making may differ considerably from one agency to the next, even among agencies sharing a general scenario. The specific process is affected by the size and complexity of the system (e.g., the number of different modes), the existing fare structure and fare system, the institutional setting (e.g., the number and nature of funding agencies and sources and legislative requirements), the organizational environment (including size and type of policy board, as well as management and staffing organization), and the nature of "external influences" (e.g., local interest groups, the business community, and the news media). The issues considered most important in making fare-related decisions will also vary. These issues are discussed in the remainder of this chapter and in Chapter 4 for the case study agencies in particular.

OVERALL FARE SYSTEM AND STRUCTURE DEVELOPMENT PROCESS

This section outlines the overall fare system and structure development process. The process described here and shown in Figure 1 is an "idealized" decision-making process. Not every fare-related decision follows this process—or at least not every step. The steps included here generally follow the policy-driven planning approach, although the service-based scenario essentially requires the same approach. In a technology-driven scenario, the transit agency has already completed the steps between "evaluate fare system options" and "select fare system." This agency should still carry out the other steps shown, including "define and prioritize fare policy goals" and "develop evaluation criteria." Of course, in this case, the goals and criteria would apply only to the fare strategy and structure issues.

Depending on the scenario and the decision to be made, an agency may pursue only a few of these steps—not necessarily

TABLE 4 Fare policy and structure and technology decision-making scenarios

SCENARIO 1: POLICY-DRIVEN DECISION-MAKING

Transit agency seeks new technology (e g , MBTA - 1993) and/or new fare structure (e g , CTA - 1989/90) to meet specific local policy goals

Technology decision areas

- fare collection/control strategy (e g , proof-of-payment vs barrier)
- level of automation (e g , magnetic cards vs smart cards); type of equipment/technology
- same technology on all modes, or change only on rail (or only on bus)
- type of media distribution strategy/equipment (e g , TVM's vs TOM'S, use of ATM'S, credit cards)
- phase in new technology or implement all at once

Fare structure decision areas:

- retain existing basic structure, introduce additional fare options (e g , peak/off-peak differential, deep discounting), or totally revamp existing structure (e g , introduce -- or, conversely, eliminate -- distance-based pricing)
- change pricing (e g , base fare, passes), or leave as is
- introduce fare structure revisions before technology modifications, or at same time

SCENARIO 2: TECHNOLOGY-DRIVEN DECISION-MAKING

Transit agency has selected new technology, and develops new fare structure to take advantage of capabilities of new technology (e g , NYMTA - 1992/3)

Policy decision areas

- relative importance of major policy goals (e g , which is more important, maximize ridership or maximize revenue -- or balance both)

Fare structure decision areas

- introduce additional fare options, or totally revamp existing structure
- change pricing (e g , base fare, passes), or leave as is
- introduce fare structure revisions before technology modifications, or at same time

SCENARIO 3: SERVICE-DRIVEN DECISION-MAKING

A) Existing transit agency is introducing new mode (e g , rail service), and needs technology and/or new structure (e g , Bi-State in St Louis - 1992/3)

B) Agency is new, and needs to develop fare policy and structure, as well as to select technology (e g , SCRRA/Metrolink - 1992/3)

Policy decision areas

- develop policy goals for new mode and for overall system (e g , maximize ease of use of new mode, maximize integration of modes)

Technology decision areas

- fare collection/control strategy
- level of automation; type of equipment/technology
- same technology as on existing mode(s), or new technology; alternatively, new technology on whole system
- type of media distribution strategy/equipment

Fare structure decision areas

- extend existing fare structure (if applicable) to new mode, introduce new structure for new mode, or introduce new structure for entire system
- extend existing pricing to new mode, change pricing for new mode only, or change pricing for system

in the order suggested in Figure 1. Nevertheless, this process includes all of the types of steps an agency is likely to follow and fare-related decisions likely to be faced. Thus, the procedures and requirements of the individual steps—and their interrelationships—is of greater importance in understanding the decision-making process than the particular order in which they are undertaken.

The types of input and considerations typically necessary in each step, as well as the types of decisions that generally must be addressed in each step are listed below.

STEP 1. Define and Prioritize Fare Policy Goals. Inputs and considerations are as follows:

- Existing fare policy, structure, and technology;
- Ridership trends;
- Revenue needs and funding situation;
- Legal requirements (e.g., for fare recovery ratio);
- Need or pressure to integrate with other operators;
- Mode(s) of service;
- System size; and
- Other constraints.

Decision points are as follows:

- Relative priorities for goals.

STEP 2. Develop Evaluation Criteria. Inputs and considerations are as follows:

- Goals and priorities and
- Specific objectives and concerns for fare system.

Decision points are as follows:

- Weights for different criteria and
- Specific criteria for evaluating fare media and technology versus fare strategies.

STEP 3. Evaluate Fare System Options. Inputs and considerations are as follows:

- Goals and priorities,
- Evaluation criteria and weighting scheme,
- Existing technology and equipment,
- Existing fare structure,
- Budgetary constraints, and
- Assessment of new equipment requirements.

Decision points are as follows:

- List of options to be considered.

STEP 4. Evaluate Fare Strategy Options. Inputs and considerations are as follows:

- Goals and priorities,
- Evaluation criteria and weighting scheme,
- Existing fare structure,
- Technology options being considered,
- Mode(s) of service,
- Size of system,
- Nature of trip-making and market segments (e.g., predominantly long radial commute trips and short intra-central business district [CBD] off-peak trips), and
- Evaluation of alternative fare structures (if necessary).

Decision points are as follows:

- List of options to be considered and

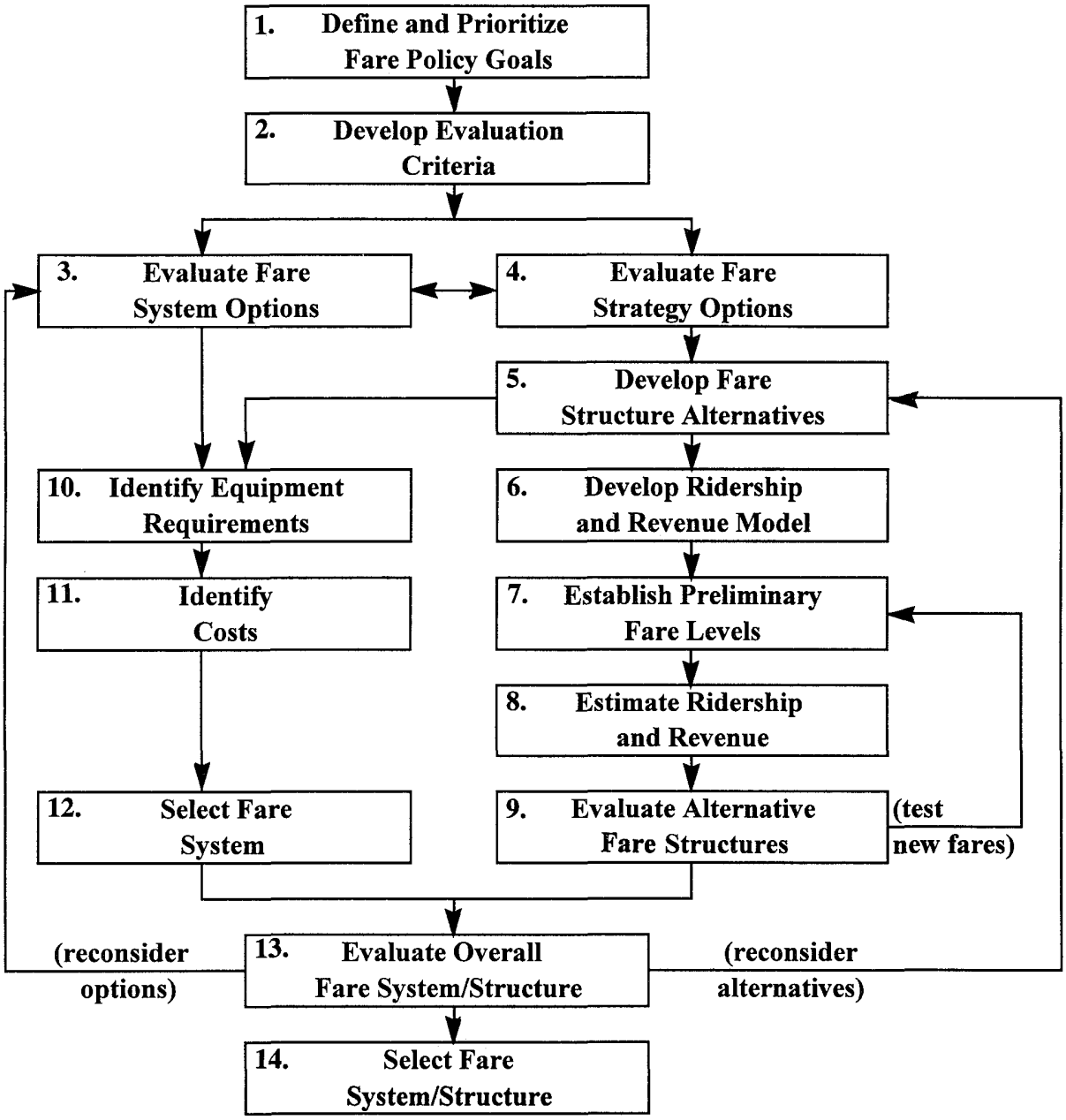

Figure 1. Fare policy and structure and technology decision-making process.

- Specific elements of each option.

STEP 5. Develop Fare Structure Alternatives. Inputs and considerations are as follows:

- Fare strategy options under consideration,
- Technology options under consideration,
- Possible fare payment methods (e.g., single ride, multi-ride, period pass, stored value, and post payment),
- Policy constraints,
- Equipment constraints, and
- Evaluation of overall fare system (if necessary).

Decision points are as follows:

- Whether or not to keep existing structure,
- Whether or not to keep existing technology and equipment,
- Strategies and payment methods to be included in fare structure alternatives (i.e., to be tested for ridership and revenue impacts), and
- Form(s) or elements of individual strategies and payment methods (e.g., if distance-based, zonal versus mile-based; if market-based, types of passes, multi-ride discounts, or both).

STEP 6. Develop Ridership and Revenue Model. Inputs and considerations are as follows:

- Ridership and revenue trends, by market segment and fare category;
- Elasticities, by market segment;
- Survey results (optional); and
- Choice model (optional).

Decision points are as follows:

- Type and complexity of model,
- Source of elasticities (e.g., trends, modeling, other systems, and industry standards),
- Types of elasticities (e.g., overall system, by mode, peak versus off-peak, and other market segments), and
- Sources of other data (e.g., system trends and surveys).

STEP 7. Establish Preliminary Fare Levels. Inputs and considerations are as follows:

- Existing fare levels,
- Revenue needs,
- Goals,
- Fare structure alternatives,
- Fare structure evaluation results (regarding ridership and revenue estimates), and
- Policy constraints (e.g., regarding maximum cash fare or maximum pass price).

Decision points are as follows:

- Minimum and maximum cash fare levels;
- Type and amount of discount for multi-ride options (if included in structures);
- Pass breakeven levels and prices;
- Levels of peak and off-peak differential, modal differential, or distance-based pricing (if included in structure); and
- Transfer policy and pricing.

STEP 8. Estimate Ridership and Revenue. Inputs and considerations are as follows:

- Fare model and elasticities,
- Fare structure alternatives, and
- Preliminary fare levels.

Decision points are as follows:

- Whether or not to test different fare levels (i.e., if none meet revenue or ridership goals).

STEP 9. Evaluate Alternative Fare Structures. Inputs and considerations are as follows:

- Ridership and revenue estimates,
- Evaluation criteria and weighting of criteria, and
- Implementation and marketing requirements and schedule constraints.

Decision points are as follows:

- Whether or not to test different fare levels and
- Whether or not to include different combinations of fare strategies or payment methods.

STEP 10. Identify Equipment Requirements. Inputs and considerations are as follows:

- Media and technology options,
- Equipment requirements and costs (e.g., purchase price, implementation expenses, and ongoing operating costs),
- Technology evaluation criteria and criteria weightings,
- Preliminary fare structure selected, and
- Fare collection strategy or strategies under consideration.

Decision points are as follows:

- Whether or not to reconsider media and technology options,
- Degree of automation of media sales,
- Ancillary equipment required or desired (e.g., addfare machines), and
- Media preparation (central pre-encoding versus point-of-sale).

STEP 11. Identify Costs. Inputs and considerations are as follows:

- Equipment requirements,
- Purchase prices (and life cycle costs),
- Implementation expenses,
- Ongoing operating expenses, and
- Expected cost savings associated with new equipment.

Decision points are as follows:

- Whether or not to reconsider media and technology options and
- Whether or not to reconsider equipment.

STEP 12. Select Fare System. Inputs and considerations are as follows:

- Type of existing fare collection system (e.g., barrier or POP),
- Mode(s) of service,
- Preliminary fare structure selected,
- Evaluation criteria and weighting scheme, and
- Media and equipment requirements of different collection systems.

Decision points are as follows:

- Preferred fare collection system,

- Type of fare control (open versus closed system), and
- On-board versus off-board collection.

STEP 13. Evaluate Overall Fare System and Structure. Inputs and considerations are as follows:

- Media and equipment acquisition and operating and maintenance costs,
- Benefits of media and technology and collection system,
- Costs and benefits of fare structure selected, and
- Goals and priorities.

Decision points are as follows:

- Whether or not to reconsider fare structure alternatives and
- Determine breakeven revenue (i.e., what revenue increase will cover costs of improvement).

STEP 14. Select Fare System and Structure. Inputs and considerations are as follows:

- Fare system and structure evaluation results and
- Goals and priorities.

Decision points are as follows:

- Responsibilities for individual implementation activities and
- Implementation schedule.

The remainder of this chapter reviews the procedures and issues involved in the first two steps, Define and Prioritize Fare Policy Goals and Develop Evaluation Criteria. The other steps are discussed in the remainder of the report.

Defining Fare Policy Goals

Overall Transit Goals

Ultimately, fare policy simply represents one means of pursuing overall goals for the transit agency. Cervero (*4*) identified the following types of general transit goals through a survey of 99 transit agencies:

- Service-related goals. These include the following:
  - Increasing service effectiveness and ridership,
  - Providing high-quality services, and
  - Improving the mobility of the transportation-disadvantaged and providing travel alternatives to the automobile.
- Management goals. These include the following:
  - Improving cost-efficiency and implementing cost controls and
  - Maintaining a stable revenue base.
- Relational goals. These include the following:
  - Marketing services effectively and encouraging broad public support and
  - Coordinating transit with regional comprehensive goals and promoting interagency cooperation.
- Community goals. These include the following:
  - Conserving energy,
  - Improving environmental quality,
  - Stimulating economic development and encouraging desirable land use patterns,
  - Reducing traffic and parking congestion, and
  - Ensuring passenger safety.

Fare policy goals should address these types of goals, either directly or indirectly. The direct role of fares in pursuing the above service and management goals has long been recognized; however, recent legislation (such as the Clean Air Act and the Intermodal Surface Transportation Efficiency Act [ISTEA]) has increased the need for the transit industry to explore how fare policy can be used within broader regional efforts to improve air quality and congestion management. This need was spelled out at the 1993 Workshop on Fare Policy and Management in Woods Hole, Massachusetts. This workshop represented the first systematic effort to identify the key issues facing transit fare decision makers and to develop an agenda for research since a similar workshop was held in the same location in 1980 (Future Directions for Transit Pricing) (*5*). The 1980 workshop followed a 1979 conference (Forum on Recent Advances and New Directions) (*6*). The 1993 Workshop is discussed briefly below.

The Woods Hole Fare Policy Workshop

The purpose of this workshop, convened by the Transportation Research Board (TRB) in cooperation with the Federal Transit Administration (FTA), was to define a set of fare-related research issues. Working groups (made up of invited researchers, operating agency staff, government officials, and equipment vendors) addressed issues in the following four categories:

- Changing roles of transit and fare policy;
- Fare collection technology issues;
- Finance, economics, and pricing; and
- Management and operations.

In addition to the working group sessions, resource papers were presented in each of the four areas, and several agency staff presented status reports on their agencies' fare restructuring or technology improvement efforts; an overview of TCRP Project A-1 was presented as well. The gathering provided an excellent opportunity for the exchange of information on current activities and ideas related to all aspects of fare policy, structure, and technology. On the basis of the recommendations of the working groups, a set of research problem statements was developed within the four subject areas.

Establishing Fare Policy Goals

Of course, setting and prioritizing fare-related goals is complicated by the competition among goals. In particular,

increasing ridership and providing high-quality service typically conflict with financial goals. Although transit agencies do not aim to cover their entire costs, they are pressured to minimize expenses and recover some of their operating expenses through the farebox. Simultaneously, they face social pressures because transit is considered a public good and is expected to provide a social benefit (i.e., through maximizing ridership and improving the mobility of the transportation-disadvantaged); moreover, there are concerns in this regard related to balancing the maximization of net social benefit and the distribution effects of a pricing strategy.

Because fare policy is crucial to a transit agency's efforts to achieve these general goals, identifying an appropriate set of fare-related goals and prioritizing these goals is crucial to making decisions. The specific goals and the relative weights attached to them will largely dictate decisions related to fare strategy, fare level, and fare technology. The basic types of fare policy goals and their relative importance within the transit industry are discussed below.

Types of Fare Policy Goals

Depending on specific needs and situations, transit agencies will identify different sets of goals for their fare structures and systems. On the basis of discussions with agencies, review of fare policy statements, and review of previous studies of this subject, the research team for Project A-1 developed a set of common fare policy goals; these are summarized in Table 5. Although not every goal will apply to every agency, these are considered to be generally applicable, regardless of size of agency or modal composition. The only real exception is the goal of improving modal integration—which will not be a concern in a single-mode system.

These goals are grouped into four basic categories: customer-related, financial, management-related, and political. Table 5 also lists goals related to strategy and structure and technology and system issues. Some of the individual goals apply to both strategy and technology.

Customer-related goals relate to how the structure and system are perceived and used by riders and the effect on transit system use. Financial goals relate to how the fare structure and system affects costs and revenues. Management-related goals relate to how the fare structure and system affect the agency's ability to manage and deliver service. Finally, political goals relate to the political viability of the fare structure and system or the need to address specific legal constraints. There is some overlap among these categories because some goals address more than one area of concern (e.g., "maximizing social equity" relates to the effect of the system on the riders, but it is often an important political concern as well). Furthermore, most of the management goals ultimately affect rider perceptions and financial issues. Thus, although this categorization is useful in defining the various goals, individual agencies may well arrive at a different distribution—or perhaps a different set of categories altogether.

The individual goals listed in Table 5 are defined as follows:

- Increase ridership and minimize revenue loss—This goal seeks to maximize ridership subject to a maximum acceptable reduction in revenue. If there is no limit on the reduction in revenue, this goal can be obtained by reducing all fares to zero.
- Maximize social equity—This goal concerns the agency's ability to ensure equivalent levels of mobility for equivalent fares and/or that those riders most in need of the service—and with the least ability to pay—are not adversely affected by a change in the fare structure. The first point can be addressed by setting fares on the basis of either the costs of the service or on the benefit received. The second point can be addressed by offering discounted fare instruments with a low overall purchase price.
- Increase ease of use—This goal relates to the convenience of using the system. For instance, does the system have an "inconvenient" cash fare (e.g., $0.85) and require the payment of exact fare? Are prepaid options available? How easy to use is the fare equipment?
- Increase fare options—This goal is to improve the ability of customers to choose a fare option that best meets their needs. This is addressed by offering a range of options (e.g., prepaid and discounted options).
- Reduce complexity—This goal emphasizes making the fare system simpler and more easily understood by customers.
- Increase revenue and minimize ridership loss—This goal seeks to maximize revenue—or perhaps to obtain a specific revenue target—while minimizing the accompanying ridership loss.
- Reduce fare abuse and evasion—This goal supports increased revenue by making it more difficult for people to avoid paying the proper fare.
- Improve revenue control—This goal also supports increased revenue and has a minimal impact on ridership by reducing the possibility of revenue being diverted from the transit agency.
- Reduce fare collection costs—These costs include those of selling prepaid fare media, such as passes, and those of collecting and counting farebox revenues. Actions to increase ease of use (such as by allowing payment with dollar bills) or to increase fare options often increase the costs of fare collection.
- Increase prepayment and reduce use of cash—Reducing the use of cash can improve revenue control while increased prepayment can improve the agency's finances by allowing the agency to obtain revenue sooner; however, prepaid fares can make fare abuse easier and, depending on the method used for prepayment, either increase or decrease fare collection costs.
- Improve data collection—This goal relates to upgrading the type and quality of data that can be generated through the fare system.
- Improve modal integration—This goal emphasizes improving connections within the system, and possibly with adjacent systems, especially connections between line haul and feeder systems, and between different modes in a system.

TABLE 5 Fare policy goals

Policy Goal	Goal Applies to	
	Strategy	System/Technology
Customer-related		
increase ridership/ minimize revenue loss	X	
maximize social equity	X	
increase ease of use (i.e., convenience)	X	X
increase fare options	X	X
reduce complexity	X	X
Financial		
increase revenue/ minimize ridership loss	X	
reduce fare abuse and evasion	X	X
improve revenue control		X
reduce fare collection costs (administrative/operating)	X	X
increase prepayment/ reduce use of cash	X	X
Management-related		
improve data collection		X
improve modal integration	X	X
increase pricing flexibility	X	X
maximize ease of implementation	X	X
improve fleet/demand management	X	X
improve reliability of fare equipment		X
improve operations (i.e., maximize throughput)	X	X
Political		
maximize political acceptability	X	
achieve recovery ratio goal/requirement	X	

- Increase pricing flexibility—This is related to the agency's ability to add new fare strategies or payment options or change the existing structure.
- Maximize ease of implementation—This goal relates to the difficulty an agency will face in introducing a new fare structure or new equipment. Difficulty depends on the number of different fare options (and how they differ from the current options), the nature of the fare levels, and the complexity of the new technology.
- Improve fleet and demand management—This goal addresses the ability of the agency to improve the allocation of vehicles by shifting demand from peak to off-peak periods.
- Improve reliability of fare equipment—This goal is related to minimizing the rate of malfunctions or amount of downtime of the fare collection and distribution equipment.
- Improve operations—This is related to the agency's ability to maximize how quickly customers board vehicles or pass through faregates.
- Maximize political acceptability—This goal relates to the likelihood of acceptance of the new structure or system by the public and by local decision makers on the basis of such factors as equity, complexity, potential, or impact on revenue.
- Achieve recovery ratio goal and requirement—If there is

a legally mandated minimum farebox recovery ratio or a goal, the agency will need to attain this level through the fare structure.

Relative Importance of Fare Policy Goals

Many fare policy goals are in competition with each other. For example, a fare strategy that maximizes ridership tends to reduce revenue (and vice versa). Similarly, it is impossible to increase fare options and reduce complexity simultaneously. Therefore, as suggested above, a transit agency must identify which goals it considers most important. Establishing fare policy is a balancing act—the goals must be prioritized if the policy is to lead to a useful fare structure or system.

In general, the fare policy emphasis among U.S. transit agencies seems to have experienced a slight shift over the past decade, from financial to customer-related goals. In the aforementioned 1983-1984 survey of transit professionals, Markowitz found that "achieving revenue generation targets" was considered the most important goal of establishing fares; nearly three-quarters of the respondents identified that goal as being "very important." Customer-related goals were not considered as important; roughly half of the respondents felt that "keeping fares simple" and "encourage new ridership" were very important. Just over a third considered "provide mobility for the disadvantaged" very important—and 15 percent felt that it was "not important."

A more recent (1987) survey was conducted in which all Canadian transit operators were asked to "rate the importance of various fare collection criteria" (*7*). Responses were received from 20 agencies; on the basis of these ratings, the relative importance of each of 28 objectives was established. (It is noteworthy that 15 of the 28 possible objectives were considered "very important" and that only 3 objectives were considered relatively unimportant). The most important types of objectives to these agencies were 1) that the fare system be easily understandable by all riders and 2) that it increase the security of the agency's revenues (e.g., by minimizing fare evasion). The other objectives identified as being very important included the following (in some cases, very similar objectives presented in the report have been grouped here):

- Acceptability by the community as reasonable,
- Potential for increased revenue generation,
- Accommodation and compatibility with different fare media,
- Minimization of passenger boarding times, and
- Improvement of fare statistics (including ease of use by staff).

Thus, although still considered very important, increasing revenues (through fare strategies rather than through reducing fare evasion and fraud) was rated as somewhat less important in this survey than were customer-related goals. This represents a change from the previous survey. The least important objectives in the 1987 survey were 1) fare differentiation (particularly regarding impact by distance traveled and provision of benefits for low-income riders) and 2) integration with other regional transit services.

The shift in emphasis suggested by the 1987 survey has been confirmed through more recent discussions with transit agencies; the researchers found that, although all transit agencies want to generate revenues through fares, many agencies are focusing on reversing the ridership declines of recent years. This customer-related orientation has been reflected in an increased emphasis on goals such as increasing the convenience of fare payment, simplification of fare structures, and improving modal integration. All of these goals ultimately contribute to the overall goal of increasing ridership. Over the past few years, some agencies have simplified their fare structures to attract riders. For instance, BSDA in St. Louis recently introduced a revised fare structure that reduced the number of different fare instruments from 16 to 8 (*8*). This was done by eliminating fare differentials between local and express (and "premium") service, reducing the number of prepaid options, and simplifying transfer pricing. DART changed from a zonal to a flat fare structure in 1990. In both cases, increasing ridership was considered the most important goal.

Other agencies are seeking to increase ridership (while minimizing revenue loss) by increasing the number of fare options available—while also attempting to improve ease of use of the system. NYMTA, for instance, had planned to move from a very simple fare structure—flat fare, no multi-ride instruments or discounts—to a multiple option electronic fare system. The new structure, on hold because of budgetary constraints, was slated to include an unlimited-ride pass, a volume discount, and free intermodal transfers. Increasing ridership was identified as the most important goal for the NYMTA; at issue in selecting fare levels was minimizing the accompanying revenue loss. Equity was also a major concern.

Of course, like NYMTA under its newly imposed fiscal constraints, most transit agencies cannot afford to lose any revenue, even in attempting to fill empty vehicles. Any fare changes they plan must generate increased revenues. The shift in emphasis can be seen, however, among these agencies as well, since the goal has more and more become one of "increasing revenues while minimizing ridership loss," rather than simply increasing revenues. Some agencies have been so bold as to seek to meet revenue targets while increasing ridership—or at least avoiding any loss. This phenomenon has been achieved in several cases through carefully planned, market-based pricing strategies and is discussed further in Chapter 3.

Traditionally, a fare change has been synonymous with a fare increase, which has typically resulted in a revenue increase accompanied by a ridership loss. Beginning in the mid-1980s, however, transit agencies began to introduce "market-based" or "consumer-based" pricing, recognizing the potential benefits associated with offering different fare instruments targeted to different market segments. This was part of a general move toward a focus on the transit rider—the "customer." In line with this emphasis on customer-related goals, the fare structure increasingly has been seen as important to the transit agency's marketing program. This was shown in Markowitz' survey, where nearly 90 percent of the respondents agreed that fares "should be used to market transit" (*3*). As discussed further in

Chapter 3, increasingly, marketing is seen as crucial in introducing consumer-based fare strategies.

Finally, some agencies have adopted reducing the use of cash (i.e., through maximizing prepayment) as a major fare policy goal. For instance, the Southeastern Pennsylvania Transportation Authority (SEPTA) in Philadelphia has aggressively priced and marketed prepaid options (discounted tokens and passes) over the past decade and has achieved a level of prepayment approaching 80 percent of all boardings (*9*). The CTA also has established a long-range goal of a "cash-free system." The Authority took the first major step in this direction with its 1990 fare restructuring in which discounted tokens and two types of passes resulted in a level of prepayment of over 55 percent (*9*). The CTA recently has taken a more important step with its decision to implement electronic fare collection equipment and media.

Developing Evaluation Criteria

Once an agency defines policy goals, the next step in fare development and evaluation is to establish appropriate evaluation criteria. These criteria facilitate the assessment of the relative merit of each option or alternative under consideration. In general, evaluation criteria are derived from the policy goals of and constraints facing an agency. Because these goals and constraints differ from one agency to the next, appropriate evaluation criteria will also vary somewhat. The researchers have identified a comprehensive set of policy goals that would seem to cover the most common agency concerns. The fare-related constraints facing transit agencies are discussed in the following paragraphs as is the development of criteria.

Constraints in Fare-Related Decisions

In addition to the policy goals, various constraints may influence a transit agency's fare-related decision making and, thus, must be addressed in developing evaluation criteria. These constraints may be legal (e.g., the existence of a legislatively mandated farebox recovery ratio), funding-related (e.g., lack of sufficient capital funds to allow purchase of new fare collection equipment), or related to service or operational requirements (e.g., the need to address multijurisdictional issues). Constraints also may be political in nature; for instance, the Board or upper management may have mandated that a certain fare option (e.g., a monthly pass or an off-peak discount) be introduced or that the base fare not exceed a certain level.

Constraints tend to differ depending on the size of the transit agency and may have differing implications depending on the fare element in question (i.e., fare strategy development versus selection of equipment). Tables 6 and 7 present typical constraints faced by transit agencies in making strategy- and technology-related decisions. As indicated, in each category, certain constraints are related to policy issues, while others are based on technology issues.

Constraints such as these can affect the types of fare strategies—and specific pricing levels—and/or technologies that an agency considers. In some instances, one or more constraints may be significant enough to eliminate an option at the outset—or, alternatively, to mandate its inclusion. For instance, an agency contemplating modifications to its fare system may be unable to consider upgrading its fare collection equipment at the present time because of budgetary constraints. Thus, it must focus solely on changes to the fare structure or actual pricing levels. In other cases, the existing constraints may represent concerns rather than barriers. For instance, concerns over the reliability of a new technology or type of equipment may figure into an agency's consideration of technology options but will not necessarily result in the elimination of that option; rather, the agency will want to review additional evidence as to the option's reliability as part of its evaluation process. Thus, evaluation criteria should address an agency's constraints as well as its goals.

Selecting Appropriate Criteria

In developing evaluation criteria, personnel must understand that a single set of criteria will not necessarily be appropriate for all fare system elements. Just as different constraints affect fare strategies and technologies, some of the goals—and hence criteria—that apply to strategies may not be relevant in evaluating technologies. In other cases, a single goal may concern both structure and technology, although the specific criteria addressing that goal will stress different issues. Table 8 presents a suggested set of criteria and indicates how each applies to the individual policy goals; the criteria are separated into fare strategy and system/technology.

These sets of criteria have been developed to reflect 1) the criteria used by several transit agencies in making fare-related decisions, 2) discussions of evaluation criteria in the literature, and 3) the judgment of the project research team. There are some differences among the various sources, including the use of certain agency-specific criteria in some cases and variations in the wording of the individual criteria. Not every criterion will be appropriate for every agency or in every evaluation effort. Many agencies using these criteria in evaluating options probably will want to make adjustments to reflect their own particular situations; however, these lists should apply to most transit agencies, regardless of size or types of service provided.

The criteria are defined below. We have also identified possible measures for each criterion; however, as explained above, it may not be possible to apply certain quantitative measures (e.g., change in ridership) in the initial level of evaluation.

Criteria Applied to Evaluation of Fare Strategies

Customer criteria are defined as follows:

- Impact on ridership—The ability to produce an increase in ridership—or minimize ridership loss; Measure—The predicted change in total ridership;
- Impact on equity—The ability to ensure equal levels of mobility for equivalent costs (i.e., fares) to the full range

TABLE 6 Constraints in fare structure development

Constraint	Type of Constraint		Size of System	
	Policy-Related	Technology-Related	Large	Small-Med.
limits of current fare equipment		X	X	X
revenue needs (e.g., minimize revenue target)	X		X	X
need to integrate new mode (e.g., rail) into system	X		X	
legally-mandated farebox recovery ratio	X		X	X
multi-jurisdictional issues	X		X	
policy constraints (e.g , need for pass, maximum cash fare)	X		X	X
legal constraints (e.g , result of legal challenge)	X		X	

TABLE 7 Selection of new equipment and technology

Constraint	Type of Constraint		Size of System	
	Policy-Related	Technology-Related	Large	Small-Med.
funding limitations	X		X	X
need for coordination among regional operators	X		X	
schedule issues (e g., vis a vis need for new structure)	X	X	X	X
implementation concerns (e g , keeping system running)		X	X	X
concerns re ending up with outdated technology		X	X	X
concerns re reliability of new technology		X	X	X
lack of knowledge re emerging technologies		X	X	X

of users of the transit service; Measure—The predicted shares of trips by key market groups or the change in average fare paid (between existing and proposed fare structure) for key market groups;

- Convenience—The ease of use of the proposed fare structure, including minimization of the frequency of purchase transactions; Measure — The qualitative assessment, based on usage requirements as well as availability of prepaid options;
- Range of options—The number and types of fare options (e.g., prepaid options, discounted options) available to the rider; Measure—The qualitative assessment of the nature and variety of options or the potential to add options; and
- Complexity—The simplicity or ease of understanding of the fare structure, based on the number of options and pricing levels available and the degree of difficulty in differentiating among them; Measure—The qualitative assessment of the simplicity of the fare structure.

Financial criteria are defined as follows:

- Impact on fare revenue—The ability to produce an increase in fare revenue—or to minimize revenue loss; Measure—The predicted change in fare revenue;
- Impact on fare abuse and evasion—The ability to minimize fare abuse or evasion by riders (e.g., underpaying the fare or not paying the fare at all); Measure—The assessment of ease of abuse or evasion possible with a particular strategy; the estimate of additional revenue from reducing fare abuse and evasion;
- Impact on fare collection costs—The ability to minimize the administrative and operational costs associated with a fare strategy; includes the effect on staffing requirements (fare collection, monitoring, accounting, marketing, security); Measure—The estimated change in fare collection costs; can be calculated on the basis of number and type

TABLE 8 Evaluation criteria for fare strategy and system elements

Policy Goal	Evaluation Criteria	
	Strategy	System/Technology
Customer-related		
increase ridership/ minimize revenue loss	impact on ridership	
maximize social equity	impact on equity	
increase ease of use (i.e., convenience)	convenience/ ease of use	convenience/ ease of use
increase fare options	range of options	
reduce complexity	complexity/ease of understanding	
Financial		
increase revenue/ minimize ridership loss	impact on fare revenue	
reduce fare abuse and evasion	impact on fare abuse/evasion	security (re duplication, impact on abuse)
improve revenue control		accountability (re revenue control)
reduce fare collection costs (administrative/operating)	impact on fare collection costs	cost of media, equipment, facilities
increase prepayment/ reduce use of cash	impact on prepayment	
Management-related		
improve data collection		1
improve modal integration	2	
increase pricing flexibility		flexibility (re adding options)
maximize ease of implementation	ease of implementation	
improve fleet/demand management	impact on fleet/ demand mgmt.	
improve reliability of fare equipment		reliability of technology
improve operations (i.e., maximize throughput)		operations impact (on throughput)
Political		
maximize political acceptability	political acceptability	
achieve recovery ratio goal/requirement	3	

notes:

1 - any tech. improvement will likely improve data collection

2 - related to actual pricing of options and transfer policy

3 - related to actual pricing of options

of options, predicted number of transactions, and so forth; and
- Impact on prepayment—The ability to reduce the use of cash in the system by increasing the use of prepaid media; Measure—The estimated change in the percentage of boardings using cash or percentage of fare revenue collected in cash

Management and political criteria are as follows:

- Ease of implementation—The difficulty the agency can expect to face in implementing a new fare structure or a fare change; based on the differences between the existing structure and the new or modified structure; Measure—The qualitative assessment of the level of effort required from different agency departments in instituting a new fare structure;
- Impact on fleet and demand management—The ability to improve the allocation of service resources (e.g., alter the peak and base ratio of vehicles) by shifting demand from busy to less busy time periods; Measure—The estimated shift of ridership between periods (e.g., peak to off-peak); the assessment of ability to better match demand to periods of service availability; and
- Political acceptability—The likelihood of acceptance of (or opposition to) the fare structure changes by the public and by local decision makers; can be based on various factors, including equity, complexity, impact on ridership, or impact on revenue; Measure—The qualitative assessment of the extent to which the structure will address key local concerns and the likelihood of acceptance.

Criteria Applied to Evaluation of Fare System and Technology Options

Criteria related to system and technology options are defined as follows:

- Convenience—The ease of understanding and use of the media and technology; Measure—Assessment on the basis of the ease of purchasing and using the fare medium and fare distribution and collection equipment;
- Security—The ability to prevent, or at least minimize, counterfeiting, duplication, or modification (e.g., so as to increase the amount of value on a farecard); Measure—Assessment on the basis of the technological sophistication of the medium and the nature of anti-counterfeiting features;
- Accountability—The ability to improve revenue control and reduce employee theft; Measure—Assessment on the basis of data collection and monitoring capabilities;
- Cost of production of media—The ability to minimize the cost of producing the fare media; Measure—The estimate of the unit cost on the basis of industry experience, manufacturers' quotes, or both;
- Fare collection cost (applied to type of fare collection system)—The ability to minimize the administrative and operational costs associated with a type of fare collection system; includes the effect on staffing requirements (e.g., fare collection, monitoring, accounting, and security); Measure—The estimate of the change in fare collection costs associated with implementing a new system;
- Cost of equipment and facilities and stations—The ability to minimize procurement, installation, and maintenance costs of fare distribution, collection, and control equipment, as well as cost related to adapting facilities or stations for new equipment; Measure—The estimate of the total cost associated with implementing a fare technology and system;
- Flexibility—The ability to add fare strategies or to modify the existing structure; Measure—The assessment of capabilities of technology, equipment, and requirements (e.g., programming or adding equipment) for making changes;
- Operations impact—The ability to improve throughput (i.e., rate of speed with which riders enter facilities and vehicles); Measure—The estimate of number of passengers per minute (e.g., passing through a turnstile or boarding a bus), as indicated by industry experience, manufacturers' tests, or both; and
- Reliability—The ability to minimize breakdowns and malfunctions of equipment and to minimize maintenance costs; Measure—The estimate of rate of failures as a percentage of total transactions or in-service time as a percentage of total operating time on the basis of industry experience.

The application of these criteria in evaluating fare strategies is addressed in the next chapter; their use in evaluating fare technology options is discussed in Chapter 8.

CHAPTER 3

FARE STRATEGIES AND PAYMENT OPTIONS

INTRODUCTION

In this report, fare strategy refers to the general fare collection and payment approaches. Strategy is thus a fundamental component of the fare structure, which also includes the fare levels and the payment options (e.g., single-ride or multi-ride instruments, period passes, stored value tickets, or post payment). This chapter discusses the various strategies and payment options. The alternatives are defined, advantages and disadvantages of each are presented, a methodology for evaluating strategies is suggested, and the usage patterns of each type of strategy and payment option within the transit industry are summarized. Finally, the overall fare structures of different sizes and types of transit agencies are reviewed.

TYPES OF FARE STRATEGY

Fare strategies fall into two basic categories: flat and differentiated. With the former, riders are charged the same fare, regardless of the length of trip, time of day, or speed or quality of service. With the latter, fares vary according to one or more of those parameters.

The different types of strategies are summarized as follows:

- **Flat fare**—The simplest, most common fare strategy is one based on a flat fare. It may be—and often is—combined with one or more type of prepaid fare option.
- **Distance-based or zonal pricing**—Distance-based fares (zonal charges or surcharges beyond a certain distance) are often considered on the theory that people should pay more for longer trips. This is typically the most complicated type of structure, for both the rider and the transit agency.
- **Time-based (e.g., peak/off-peak) differential**—A time-based method of charging is often considered because: 1) the peak period market is generally less sensitive to and has a greater ability to pay for fare increases; and 2) the costs of providing service and accommodating additional riders are significantly higher in peak than in off-peak hours. On the other hand, time-based pricing further complicates the fare structure. The peak/off-peak differential may involve all off-peak hours or, alternatively, a late-night, weekend, or Sunday-only discount.
- **Service-based (e.g., bus or rail) differential**—Differentiating fares by mode (i.e., a higher fare for rail than for bus) or by "speed" (i.e., an express bus surcharge) is often contemplated as a means to reflect 1) the higher level of service provided on rail, 2) the longer trip distances typically traveled by rail riders, and 3) the higher operating costs of rail service. Moreover, because rail riders typically display lower elasticities to fare increases, they may be considered good candidates for higher fares than bus riders.

Another type of differentiated pricing strategy widely used by the transit industry is market-based, or consumer-based, pricing. This strategy offers differential fares according to frequency of use and willingness to prepay. Market-based pricing is the offering of passes and discounted tickets (or tokens). This is often seen as a way to price discriminate among different ridership markets (e.g., frequent versus infrequent users) and to reduce cash handling requirements by increasing prepayment. This strategy often is included in a flat fare structure and also may be used with any of the other differentiated strategies.

The above strategies are addressed in this chapter, along with another important consideration: transfer pricing policy. Transfer pricing policy is a key element in any agency in which transferring between routes or modes is at all common. Agencies either do not offer transfers (i.e., they charge full fare for each boarding), offer a reduced transfer charge, or offer free transfers. If an agency's service is structured so as to encourage—if not require—extensive transferring between routes or modes, the agency must carefully consider the convenience of free transfers versus the loss of revenue under such a policy.

The distribution of the flat and basic differentiated fare strategies (distance-based, time-based, and service-based) and the advantages and disadvantages of these strategies are discussed in the following paragraphs. Market-based pricing and transfer pricing policies are reviewed separately, because they can be used in conjunction with any of the other strategies.

DIFFERENTIATED FARE STRATEGIES

The relative advantages and disadvantages of flat versus differentiated fare strategies have been debated for years, with researchers arguing the benefits of differentiation and transit managers opting predominantly for flat fares. The principal arguments for differentiation have focused on efficiency and equity considerations and are summarized as follows:

- It has been widely argued that the higher operating costs associated with serving longer trips, providing peak period service, and operating "premium" (rail or express bus) service should be reflected in the fare charged. Otherwise,

the users of long-distance, peak, or premium service are effectively cross-subsidized by the shorter-distance, non-peak, or local bus riders. It is also argued that the former tend to be in higher income brackets than the latter and that flat fares, therefore, essentially result in a regressive transfer of income from the lower to higher income groups (*10*).

- The users of the higher-cost services (long-distance, peak, and premium) have tended to display lower elasticities than those using the lower-cost services. Therefore, the differentiated fares have a higher revenue-generating potential than do flat fares.

Distribution of Differentiated Strategies

Despite these arguments, however, the transit industry generally has been cool to the distance-based, time-based, and service-based approaches. Table 9 shows the incidence of differentials among those transit agencies responding to the APTA Fare Summary. As indicated, in 1994, 37 percent of the bus agencies reported zonal surcharges, while 27 percent reported speed surcharges (i.e., for express bus), and a mere 6 percent had time-of-day differentials. Only in commuter rail is there a predominance of differential pricing, with 16 of the 17 agencies reporting distance-based fares; nearly a quarter of these agencies also have time-of-day pricing. These percentages have changed very little over the past decade or so, although, as is discussed below, some agencies have moved from zonal to flat strategies. APTA reported that 38 percent of the respondents to its 1982 Fare Summary had zonal charges; the percentage remained the same in 1991 and dropped slightly in 1994.

Advantages and Disadvantages and Potential of Differentiated Strategies

Although some transit agencies do have fare structures that include distance-based, time-based, or service-based pricing, most U.S. agencies have rejected these options in favor of the simpler flat fare structures. In fact, regarding distance-based systems, Lago points out that "... the zone surcharges typically include a large zone covering the suburban neighborhoods. Sometimes a CBD zone is also included" (*11, p.1*). Thus, many of these agencies are not realizing the benefits attributed to distance-based strategies, because, for most riders, the fare structure is essentially flat.

Agencies' general reluctance to employ differentiated strategies is rooted in the perception that the benefits of these approaches do not compensate for the practical disadvantages and implementation obstacles. The relative advantages and disadvantages of the different strategies are summarized in Table 10; these advantages and disadvantages—as well as the general potential of the strategies—are discussed below.

If nothing else, the relative lack of differentiated pricing among U.S. transit agencies underscores the "political" nature of fare policy decision making. Following the extensive analysis (Cervero and others) and discussion (it was a major topic at the 1980 Woods Hole workshop) of the benefits of differentiated versus flat fare arguments in the early 1980s, it was expected, at least within the research and planning community, that these approaches would receive greater attention and, ultimately, more widespread acceptance by transit agencies.

For instance, Markowitz (*3*) found, in his 1983 and 1984 survey, that the transit professionals who responded overwhelmingly felt that all of the major differentiated pricing strategies were "good" or "very good" ideas. On the basis of the survey results, Markowitz felt that "... transit professionals are both aware of them (fare differentials) and agree in principle that they should be part of an ideal fare structure" (*3, p. 45*). Although they supported the concepts, however, "... as practicing professionals rather than theoreticians, they balance their support with concerns about the adequacy of their analytical tools to provide the necessary guidance, the marketability of fare differentials to the public, and the ability of their fare-collection systems to adapt" (*3, p. 45*).

Markowitz concluded, on the basis of the survey findings, that there appeared to be potential for increasing the adoption of differential pricing strategies, but that obstacles related to analysis, operational feasibility, and marketability (and simplicity) would have to be overcome—through further research,

TABLE 9 Incidence of fare differentials

Type of System*	No. of Systems	No. w/ Zonal or Distance-Based Fares	% of Total	No. w/ Time of Day Differential	% of Total	No. w/ Speed Surcharge	% of Total
bus	293	109	37%	17	6%	79	27%
heavy rail	15	5	33%	1	7%	1	7%
light rail	19	4	21%	2	11%	1	5%
comm. rail	17	16	94%	4	24%	0	0%

* These categories are not mutually exclusive
Source: APTA Fare Summary, 1994

TABLE 10 Advantages and disadvantages of alternative strategies

	Fare Strategy Options				
	Flat Fare	Market-Based	Distance-Based	Time-Based	Service-Based
Advantages	-Easiest to understand -Simplest and least expensive to implement and administer -Lowest level of fare abuse	-Generally considered equitable; offers ability to pay less -Can make fare increase politically acceptable -Can minimize ridership loss with fare increase -Maximizes prepayment -Most convenient option	-Should produce greatest revenue -Considered equitable; longer trip has higher cost	-Should increase ridership -Allows management of fleet usage through shift to off-peak -Considered equitable; commuters pay more	-Relatively easy to understand -Considered equitable; higher quality or higher priced service has higher cost -High revenue potential; low fare abuse -Allows management of fleet usage through shift between services
Disadvantages	-Places inequitable burden on those making short trips -Increase will cause greatest loss of riders	-Generally produces least revenue -Potentially high level of fare abuse -Requires extensive marketing to maximize ridership -Highest media production and distribution cost	-Difficult to use -Difficult to implement and administer; may require special equipment -Potentially high level of fare abuse -May be unpopular with users with long trips	-Potential for conflicts with drivers -Potential for fraud (agents on rail) -May require equipment modifications (or new equipment)	-May be unpopular among users of higher cost service -Complicates transfers (e g , may require payment of "upgrade" fare in transferring)

further advances in fare collection equipment, and the development of guidance for decision makers. Whether such developments would be sufficient to convince transit officials to pursue differential pricing is unclear. As explained in the previous chapter, there is an increasing emphasis on developing easy-to-understand fare structures. Although simplicity may not be as important to riders as transit officials think it is, this perception apparently remains as strong as it did a decade ago.

Along with ease of use and implementation and administration, the major argument against distance-based pricing in particular has been the technological obstacle—i.e., the large investment in new fare equipment needed to make it work effectively. Although electronic fare technology may make it easier to implement and administer distance-based strategies—especially graduated pricing or "stage fares"—technology is by no means an insurmountable barrier to the approach. A zonal structure can be implemented on bus or commuter rail service without any special equipment, although proper fare payment must be more closely monitored by the driver or conductor than in a flat fare structure. Zones can also be accommodated without undue difficulty in barrier-free systems (i.e., light rail and some commuter rail agencies), although the automated vending machines must be capable of selling multiple-price tickets and, therefore, will be somewhat more costly. Only in a gated system with graduated fares is technology likely to be a real barrier. Such systems require exit as well as entry control, as can be seen in the Washington Metropolitan Area Transit Authority (WMATA), San Francisco's Bay Area Rapid Transit (BART), and Baltimore's Mass Transit Administration (MTA); the cost of equipment—and the concomitant programming—is, therefore, significantly higher than in a system requiring entry control only. Of course, an automated bus fare system (i.e., using some type of stored value cards) will also require exit control—unless the driver remains directly involved in the fare transaction.

As with the concern over simplicity, technological requirements seem to be more of a perceived obstacle than a real one. In Europe, distance-based pricing is quite common. At some transit agencies there, a multi-zone ticket is used; the ticket is validated on board the vehicle or else inspected randomly in barrier-free systems (*7*). It is also noteworthy that, although it has long been felt that one of the benefits of adding electronic fare collection technology in rail agencies was the enhanced capability to introduce distance-based pricing, two of the largest agencies—CTA and the Metropolitan Transportation Authority-New York City Transit (MTA-NYCT)—will be implementing flat fares on their new electronic fare collection systems.

Thus, it seems unlikely that the U.S. transit industry will significantly expand its interest in distance-based pricing in the foreseeable future, regardless of the capabilities of emerging technologies. Transit agencies by and large simply do not seem willing to address the complexities associated with designing, implementing, administering, and marketing such a strategy.

As is explained in Chapter 4, several agencies have in fact eliminated—or at least reduced the number of—zones; DART shifted to a flat fare structure in 1990, while Seattle/King Co. Metro greatly reduced the number of zones (to two) in 1977 and New Jersey Transit (NJT or NJ Transit) has simplified its zonal structure in recent years. Other agencies that have eliminated zonal fares in recent years include those in Minneapolis/St. Paul and Norfolk, Virginia.

The potential for time-based differential pricing is also unclear. Whereas the disadvantages of this strategy are not seen to be as strong as those of distance-based, the advantages are also considered less significant; in particular, time-based pricing is not likely to generate as much revenue as a distance-based alternative. The major objection to this strategy is that it adds to the overall complexity of the fare structure. Some agencies worry about the potential for conflicts between riders and drivers or ticket agents regarding the changeover between peak and off-peak periods; however, this has not been a major problem at most locations.

Although use of time-based pricing is now low, the expansion of electronic fare collection may spur interest in the coming years. The ability to program fareboxes and turnstiles to deduct automatically the appropriate time-of-day charge from fare cards makes this strategy easy to administer. When CTA implemented an off-peak discount in 1990, it did so on buses only. The differential was not instituted on rail because of concerns with potential revenue loss—i.e., through ticket agents entering fares as off-peak during the peak period and pocketing the difference. Electronic fare collection will obviate this problem—at least where stored value cards are used. NYMTA strongly considered including an off-peak discount as part of its new automated fare structure in order to increase ridership and shift demand from the peak to the less crowded off-peak. Although this strategy has not been recommended as part of the new fare structure, it is an option.

Service-based differentials do not present the same types of complications as do distance- and time-based options. Nevertheless, very few agencies have different fares for rail and bus services. The CTA eliminated its bus-rail differential in 1990. Agencies recently introducing or planning to introduce light rail service (e.g., in St. Louis and Dallas) have tended to simplify their overall fare structures by pricing light rail the same as bus. BSDA in St. Louis also recently (1993) eliminated its express bus surcharge as part of the fare simplification effort; Orange County Transportation Agency (OCTA) similarly removed its express differential in 1992. The nature of these and other agencies' considerations of differential pricing of all types are discussed further in Chapter 4.

In summary, the differentiation of fares based on distance, time of day, or service quality has not expanded over the past decade, contrary to the expectations of researchers. In fact, some agencies have eliminated differential strategies, signaling an increasing focus throughout the industry on convenience and ease of administration and use—and less of a concern with equity (referring to the notion that riders should pay more on the basis of the amount of service consumed, the cost of providing the service, or the quality of the service received). This push for convenience and ease of use and administration also has resulted in greater consideration of prepaid options targeted to different market segments; market-based pricing is discussed below.

MARKET-BASED PRICING

The transit industry has long been aware that its ridership consists of market segments. In recent years, however, the industry has gained a greater understanding of the benefits of offering a range of fares and payment mechanisms targeted to the different market segments. Like consumers of all products, transit riders display differing levels of sensitivity to price. Thus, market-based or consumer-based transit pricing takes advantage of these differences and offers a range of pricing options.

The transit market segments can be defined in various ways, including trip purpose (e.g., work, shopping, and recreation) and frequency of use (e.g., occasional use, regular but low frequency, and high frequency). Market-based pricing targets the different segments by offering one or more of the following types of pricing mechanisms:

- One or more type of unlimited ride pass (e.g., a weekday-only pass as well as an everyday pass; also, a 1- or 2-week pass as well as a monthly pass) or
- A bulk purchase or volume discount (e.g., on multiple-ride tickets or tokens or on a stored-value farecard).

Offering significant discounts for prepayment of fares represents one of the most important elements of market-based pricing. This strategy is commonly referred to as "deep discount" pricing. Discounting in the form of unlimited ride passes has long been common in the industry; however, deeply discounting single-ride fares for the general public by offering relatively large volume discounts (i.e., 20 percent or greater) for bulk purchase of tickets or tokens is relatively new. Richard Oram largely brought this concept to the industry's attention in his 1988 report *Deep Discount Fares: Building Transit Productivity with Innovative Pricing* (*12*). In that report, and in a subsequent report prepared for CTA (*13*), Oram examined the experiences of several transit agencies that had instituted deep discounting strategies.

The Deep Discounting Concept

As described by Oram in his 1988 report, deep discounting "... is a strategy based on building commitment to transit use through substantial discounts on prepaid tickets or tokens. These prepaid discounts, a minimum of 25 percent of the base fare, are achieved by raising cash fares to create a significant differential between the cash and ticket (or token) price, or by reducing the ticket price" (*12, p. iii*). Oram goes on to explain that "The deep discount fare strategy motivates riders to increase their usage by providing major savings on a multi-ride purchase of tickets or tokens. Deep discount fares in effect surcharge riders who do not take advantage of savings opportunities easily available to them and continue to pay cash. Yet,

TABLE 11 Deep discount pricing

Frequency of Use	Sensitivity to Price	
	Low	High
Low	cash fare	cash or discount fare
High	cash or discount fare	discount fare

Source: PPTN Revenue Management Workshops

since these people choose not to save, they can be assumed to largely continue using transit despite the higher fare. That is, they demonstrate fare insensitivity, to an even greater extent than is usual for the aggregate transit market" (*12, p. 3*).

This last point is key to the concept. Namely, deep discount pricing involves stratification of the market on the basis of two primary factors frequency of use and sensitivity to cost (and to savings).

In other words, given a choice of fare options, transit users will select one depending on a combination of these factors. A transit agency can therefore target its fare mechanisms to these different types of riders. The combinations of frequency, sensitivity, and type of fare payment are shown in Table 11. As indicated in the exhibit, riders who fall into the low-usage, low-price-sensitivity category will typically pay the cash fare, even if it is higher than other options (i.e., on a unit cost basis). At the other extreme, high-usage, high-price-sensitivity riders will tend to buy discounted options such as passes and multi-ride tickets or tokens, with the most frequent riders generally opting for unlimited-ride passes. Those in the high-usage, low-price-sensitivity group also probably will use some form of prepayment, for convenience if not for price. Finally, the low-usage, high-price-sensitivity riders will tend to buy discounted tickets or tokens, if available.

On the basis of his research, Oram suggests that riders in this last group will tend to increase their frequency of usage once they have purchased multi-ride instruments. Thus, although they are paying less per ride than they would if paying cash, they are ultimately contributing more to the farebox because they are paying for a greater number of rides than they would if not prepaying for multiple rides. This notion, coupled with the fact that many riders will continue to pay the higher cash fare, is fundamental to one of the key goals of deep discounting: to increase revenue and ridership simultaneously—or to at least avoid the loss of ridership that typically accompanies a general fare increase.

Benefits of Deep Discounting

Although the potential to minimize ridership loss, or perhaps even increase ridership, is the most frequently cited benefit of a deep discounting strategy, the concept—and market-based pricing in general—offers other important benefits as well. These include the following:

- Reducing the use of cash in the system, thereby reducing cash handling costs and improving revenue control;
- Making a fare increase more politically acceptable, given that riders are given the choice of paying a discounted fare; in some cases, the discounted fare (unit price) may be even lower than the previous cash fare; and
- Providing the transit agency with a positive marketing angle, particularly if the discounted per-trip price is lower than the previous cash fare.

Each of these can be an important goal on its own, and each has served (alone or in combination) as the primary impetus for pursuing a deep discount strategy by various transit agencies. For instance, SEPTA, the first agency to use deep discounting extensively, sought to maximize prepayment and thereby reduce the use of cash in the system in instituting deep discounting; political acceptability has also played an important role, as is discussed below. CTA, meanwhile, was primarily concerned with raising revenue while minimizing ridership loss in restructuring its pricing (*14*).

Disadvantages of Deep Discounting

Although the approach can benefit a transit agency, there are drawbacks and disadvantages relative to a general fare increase. First, introducing deep discounting increases the overall complexity of a fare structure through the addition of one or more new fare media (e.g., a book of tickets). Each additional payment option increases the potential for confusion among riders—as well as among prospective riders. Additional fare options also mean more administrative effort for the transit agency—there are more options to monitor and account for and more media to produce and distribute.

Regarding the last point, a proliferation of fare options may lead to some "self-selection" among outside sales outlets. For instance, when BSDA in St. Louis introduced 10-ride tickets, many of the sales outlets decided not to advertise or sell the tickets, because they were already selling various fare media—including a weekly pass priced very close to that of the tickets. Because BSDA relied on the outlets to advertise the new tickets, knowledge of the option was limited; a survey of riders done about 6 months after the tickets were introduced revealed that only about 40 percent of the respondents were even aware of the discounted tickets. The combination of limited advertising, the difficulty in obtaining the tickets, and the availability of a similarly priced, unlimited-ride, weekly pass resulted in little use of the discounted tickets.

In short, an agency must be sure that it can "accommodate" a new discount fare option. Agencies having distance-based

fares may find that deep discounting is particularly difficult or unwieldy to apply. Some agencies may decide that the advantages of minimizing the number of options included in their fare structures outweigh the potential benefits of instituting deep discounting.

Another potential drawback of a deep discount fare option is, ironically, the equity concerns it may raise. Whereas the discounted option is designed to offer a break to those who do not wish to pay the higher cash fare, taking advantage of the discount requires an initial payment that is usually much higher than the cash fare. Low-income groups often complain that even a discounted ten-pack of tokens or tickets requires too large an outlay of cash. For instance, SEPTA had to issue a discounted two-pack of tokens—priced at the same unit cost as a ten-pack—in response to complaints and lawsuits over the equity of its pricing structure. (As it turned out, SEPTA had no need to worry that the two-pack would be too popular: very few tokens are sold in two-packs, and relatively few are even sold in the five-packs introduced at the same time.)

Another potential disadvantage of a deep discount approach is that it may produce less revenue than will an across-the-board fare increase. This depends on the nature of the cash fare increase. If a transit agency is committed to a specific new fare level, the introduction of a discounted fare along with that cash fare will generate less revenue than will that same cash fare without a lower-priced option. What is more often considered, though, is a cash fare of, say $1.00 versus a cash fare of $1.25 coupled with a ten-ride instrument for $9.00. In other words, a deep discount strategy typically involves a higher cash fare than does an across-the-board fare hike.

Of course, this last point can also be an issue for some transit agencies. For example, for its last fare increase, the management of Boston's MBTA proposed a discount option for its rail service ($1.00 cash, 10 tokens for $7.50), but the Board of Directors felt that the cash fare should be as low as possible and selected a rail cash fare of $0.85, with no discounted option. Thus, even though the discount option would have enabled riders to pay less than they would with the selected option, the Board members considered the cash portion of the discount structure too high.

Despite these disadvantages, however, market-based pricing and deep discounting have become popular among U.S. transit agencies, as is discussed below.

The Extent of Market-Based Pricing and Deep Discounting

Market-based pricing strategies have become quite widespread in the transit industry. The 1993 APTA Fare Summary reveals that three-quarters of North American agencies now offer one or more type of unlimited ride pass, and more than 40 percent offer some type of volume discount—i.e., through bulk purchase of tokens or tickets.

As summarized in Table 12, the APTA Fare Summary indicates that 43 percent of the reporting bus agencies provide discounts on multiple tokens and tickets. As shown in the table, the most common percentage discount is between 10 and 20 percent. However, over 40 percent (53) of these agencies offer discounts of 20 percent or more, with 15 percent (19) offering discounts greater than 30 percent. The incidence of discounting is even greater among the rail agencies. Of the 13 heavy rail agencies, 7 have some type of volume discount, while 10 of the 16 light rail agencies offer discounts; the percentage of commuter rail agencies with discounts—53 percent—is nearly identical to that for heavy rail.

The incidence of unlimited-ride passes is summarized in Table 13. As indicated, the monthly pass is by far the most common type—67 percent of the bus systems have such an option. However, some systems also offer passes for shorter periods, with 1-week passes being more common than 2-week passes. Nearly a third of the bus agencies offer some type of very short-term (typically 1- or 3-day) pass, usually aimed at out-of-town visitors. As shown in Table 13, 10 of the 13 heavy rail agencies offer passes, as do all 16 of the light rail agencies and 13 of the 17 commuter rail agencies.

Thus, the provision of prepaid discounted fare options has become quite prevalent in the transit industry. Although deep discounting—and market-based pricing in general—can generate revenue while retaining ridership, the strategy is often implemented for "policy" reasons. In other words, many agencies offer discounted media in response to pressure from riders or consumer groups, often as a means of offsetting the negative reaction to a cash fare increase.

The Recent Experience with Deep Discounting

Measuring the level of "success" of deep discounting depends on an agency's specific goals and objectives for the strategy, as well as the evaluation parameters being used. The effect on ridership and revenue—i.e., the goal of meeting revenue targets while minimizing ridership loss—is certainly a key parameter. However, another important measure may be the extent of prepayment generated by the strategy and the concomitant reduction in the use of cash. An agency may well consider this one of its most important goals in establishing discount fare options.

Deep discounting (and market-based pricing in general) offer various potential benefits to an agency. Thus, to evaluate the success of the strategy at individual agencies, it is necessary to consider an agency's decisions in making fare changes as well as to examine ridership and revenue impacts. For instance, does an agency with deep discounting retain the basic discount structure when it finds it necessary to modify its fare structure?

A caveat is necessary in attempting to assess the impacts of deep discounting—or any fare changes, for that matter—on ridership and revenue. It is always a challenge to isolate, with a high degree of certainty, the effect of fare changes on ridership and revenue. Exogenous factors (e.g., employment levels, fuel prices, and weather) all must be considered, along with seasonal variations and changes in the level of service provided by the transit agency. Furthermore, some agencies have experienced fairly steady declines in ridership over the past decade or so because of increasing suburbanization, decentralization of both population and employment, and other factors.

Unfortunately, the effect of such factors has been exacerbated by the recent recession. Since the beginning of the 1990s,

TABLE 12 Incidence of fare discounting among transit systems

Type of System*	No of Systems	Total No. w/ Disc. Tix/Tokens	% of Total	No. of Systems w/ Discount (from Base Fare) of			
				<10%	10-19%	20-29%	>30%
bus	291	126	43%	23	50	34	19
heavy rail	13	7	54%	2	2	1	2
light rail	16	10	63%	3	5	0	2
comm. rail	17	9	53%	1	6	2	0

Source: APTA Fare Summary, 1993

* These categories are not mutually exclusive

TABLE 13 Incidence of passes among transit systems

Type of System*	No. of Systems	Total No. with Passes	% of Total	No. of Systems with Each Type of Pass **			
				month	2-week	1-week	other***
bus	291	216	74%	196	5	27	89
heavy rail	13	10	77%	8	2	5	4
light rail	16	16	100%	16	2	4	16
comm rail	17	13	76%	13	0	8	5

Source: APTA Fare Summary, 1993

* These categories are not mutually exclusive.
** Some systems have more than one type of pass.
*** Other types of passes include 3-day and 1-day Visitors' Passes and 3-12 month passes.

many agencies have experienced significant ridership and revenue losses because of sharply increasing unemployment rates and overall reductions in consumer spending. This has masked any post-1990 fare-related impacts. Whereas some agencies reported increased ridership along with revenue gains following deep discounting before that time, the number of clear "success stories" since 1990 is much smaller (*9*). On the other hand, several of our case study agencies have experienced apparent success with the concept in the last few years; these experiences are discussed in Chapter 4.

Even in those cities where there has not been clear evidence of the strategy's continuing positive impact on ridership and revenue, however, transit agencies typically have opted to retain their deep discount structures when raising base fares. Although agencies across the country have been forced to raise fares in recent years to offset their growing operating deficits, many of these agencies also have recognized the role of deep discounting in helping to slow ridership loss and to meet the other types of goals suggested above. In some cases, the amount of the discount has been reduced; in others, the discount has been increased. Some agencies, including those discussed here, have chosen to increase pass prices significantly rather than to eliminate volume discounts. In short, deep discounting has proven successful enough to be adopted widely by the transit industry. Although the specific goals for the strategy vary from one agency to the next, the basic approach increasingly is seen as a fundamental element of a transit pricing structure.

TRANSFER PRICING AND POLICY

Transfer pricing and policy are major issues that relate to both the pricing and convenience of transit service. The ideal transit network provides every rider with a one-seat ride; that

is, every rider boards close to home and alights within a short walk of his or her final destination. Unfortunately, this is not always possible; most transit systems are set up so as to encourage at least some transferring. The grid network in some systems requires a great deal of transfer activity. Other systems restructure their bus service so as to feed rail lines or other "trunk" (i.e., express) service. In other cases, completing a trip requires transferring from a vehicle operated by one operator to that operated by another. Finally, some systems establish timed transfer centers or pulse points, at which several routes converge. The basic service philosophy underlying a route network should be a primary consideration in establishing a transfer pricing and usage policy. The pricing policy also must consider how different options affect revenue—i.e., the convenience of a free or low-priced transfer versus the forgone revenue from such a strategy—as well as administrative and operational issues associated with the options.

The basic pricing options for transfers are as follows:

- Free transfers,
- Low-priced transfers (i.e., a fraction of the full cash fare),
- No transfers (i.e., a full fare for each boarding), and
- "Upgrade" fares for transferring between different operators' services.

Table 14 summarizes the transfer pricing policies in effect at those agencies included in the APTA Fare Summary. As shown, most (63 percent) bus agencies offer free transfers, while another 28 percent offer reduced transfers (i.e., priced less than the full fare). Only 9 percent of the bus agencies do not offer any reduced price transfers. The situation at rail agencies is different. On heavy rail, 69 percent of the agencies provide free or reduced transfers between rail and bus; virtually the same number offer free or reduced transfers between rail lines, although the bulk of these are free. For light rail, the percentage of agencies with free or reduced transfers to or from bus is over 80 percent. This is largely because many agencies with light rail redesign their bus routes so that they feed the rail line, thereby requiring transferring for many riders.

As suggested above, transfer pricing should be established on the basis of the agency's service design, coupled with revenue needs and the extent of current transfer activity. The nature of the transfer pricing and usage policy affects revenue and ridership. Free or low-price transfers produce higher ridership and less revenue than do full fare per boarding structures (assuming the same full fare). The revenue is affected both by the pricing itself and the potential for abuse—e.g., giving or selling transfers to other riders, who would otherwise pay a full fare. Requiring some amount for the transfer lessens—but does not eliminate—the incidence of such abuse, because a rider will not automatically request a transfer even if he or she has no intention of using it. Evidence of this was found in Chicago. When the cash fare was $0.90 and the fare plus transfer was $1.00, many riders simply paid $1.00 even though they did not want a transfer; they would then give the transfers to people waiting to board. When the prices changed so that it was no longer convenient to overpay the fare slightly, transfer purchase and usage dropped significantly.

Interoperator or Intermodal Transfers

The issues associated with interoperator transfers differ from those in intraoperator transfers. An interoperator transfer agreement must be established that allows the two (or more) agencies to account for the fare revenues paid in using the two systems. The mechanisms used for such transfers can include the following:

- Acceptance of transfers issued by connecting carrier (with no additional charge),
- Acceptance of passes issued by connecting carrier (with no additional charge),
- Acceptance of passes issued by connecting carrier (with upgrade charge),
- Payment of upgrade fare, with proof of purchase of a ticket, and
- Use of multi-operator stored-value cards.

TABLE 14 Transfer pricing policies

Type of System*	No. of Systems	Transfer Pricing (Same Mode)			Transfer Pricing (Rail/Bus)		
		free	reduced	full fare	free	reduced	full fare
bus	291	184	81	26	na	na	na
heavy rail	13	6	2	5	3	6	4
light rail	16	3	3	10	7	6	3
comm. rail	17	5	0	12	na	na	na

* These categories are not mutually exclusive.
Source: APTA Fare Summary, 1993

There are various examples of these different approaches. For instance, in Orange County, California, OCTA and the Metrolink commuter rail service offer a free transfer to or from the other service with presentation of some form of prepaid instrument. OCTA has somewhat different arrangements with other connecting operators; a discounted fare ($0.30) is paid for transferring to or from Amtrak commuter rail, while inter-agency transfers with other transit systems are free (e.g., North San Diego Transit District, La Mirada Transit) or $0.10 (e.g., Los Angeles County Metropolitan Transportation Authority [LACMTA], Long Beach Public Transportation Co.)

The use of electronic fare media (e.g., stored-value farecards or combination passes and stored value) facilitates interoperator—or intraoperator—transfers. For instance, electronic media can be programmed to include the fare structures of multiple operators, thus allowing use of a single card on more than one system. The TransLink program in the San Francisco Bay area, discussed in Chapter 7, is the most advanced current example of this approach.

Transfer Policy

In addition to the pricing of transfers, the transfer policy must address the use of transfers, including the number of transfers that will be permitted per full fare (i.e., one, two, or unlimited times within a given time limit), the amount of time allowed for a transfer (e.g., 1 or 2 hours after the initial full fare boarding), and whether the transfer can be used for round-tripping or "stop-overs" (i.e., reboarding and continuation on the same route). Agencies differ considerably in their transfer policies, and some agencies change their parameters—and pricing—periodically.

For instance, OCTA has modified its transfer policy several times during the past 3 years. Prior to July 1991, transfers were free; at that time, a $0.05 charge was instituted (for the first transfer only; subsequent transfers were free), but round-tripping and stop-overs became permitted (within a 2-hour period). Round-tripping and stop-overs were eliminated a year later, when the agency sought to increase revenues and reduce transfer abuse. Finally, as of July 1994, the transfer became free again, in an effort to increase ridership.

An interesting variation on the policy regarding stop-overs is that offered by DART in Dallas. DART provides a "Stop and Go" permit: for an additional $0.25—i.e., beyond the regular cash fare—a rider receives a ticket that allows him or her to stop along a route for up to an hour and then reboard a bus in the same direction on the same route. In other words, if a rider wishes to stop and go shopping or have lunch and then continue on, he or she will not have to pay the full fare on the second boarding. TTDC in Norfolk, Virginia, has a similar ticket.

In addition to revenue and ridership, the transfer policy also affects operations, particularly the role and responsibilities of the bus operator. Depending on the parameters for transfer use, the operator will have to check a transfer user's transfer form for acceptable time (i.e., within the allowable usage period), route, direction, or combinations thereof. The more restrictive the policy (e.g., no round-tripping or stop-overs on a single route), the greater the potential for operator-rider conflicts. Minimizing such conflicts is a major concern at many transit agencies, and the transfer system in general is widely viewed as a major operational and administrative problem area. Other administrative concerns include the requirements for printing, daily distribution, and accounting for transfers, as well as potential theft of rolls of transfer forms from buses.

Some agencies have considered eliminating free or low price transfers in favor of a fare per boarding that is lower than the existing fare. Depending on the fare reduction, however, the agency probably will face either a major revenue loss (i.e., if the new fare allows a rider two boardings for less than the former combined fare plus transfer cost) or a large ridership loss. The latter will occur if the fare per boarding results in a significantly greater fare for two boardings than the former combined fare plus transfer cost; such a case probably would generate major public opposition to the proposed change, even though many riders would be receiving a fare reduction. In systems designed to require considerable transferring, the number of riders who transfer at least once can be quite high. At CTA, for instance, approximately 45 percent of cash and token users (i.e., non-pass users) use a transfer in their trip. A similar percentage transfer in OCTA's bus system, which is set up as a grid. A recent survey of riders at DART revealed that over 60 percent of riders have to transfer at least once, and 25 percent transfer two or more times per linked trip. Any change in the transfer policy affects many riders.

One approach for eliminating transfers now receiving some attention is the use of 1-day passes in lieu of transfers. Santa Clara County Transit District (SCCTD) sells day passes (priced at twice the peak cash fare or $2) on board its buses and at light rail ticket vending machines. These passes, stamped with the date, eliminate the need for operators to check for proper time, route, or direction as was the case with transfers. Furthermore, there is only one transaction per day for each rider purchasing a day pass, rather than the two or more required for each linked trip in a transfer system.

The principal disadvantage of a day pass is the potential for abuse (i.e., illegal sharing), because a day pass is good for unlimited riding. Muni in San Francisco experienced a tremendous revenue loss when it attempted to replace transfers with day passes. Rather than issuing dated passes on the bus, Muni used its visitor pass, which is sold by pass sale outlets and requires the user to scratch off the current day; many riders failed to scratch off a date and used a single pass for several days. Muni ultimately reinstated transfers. Another drawback of introducing day passes and eliminating transfers is that such an arrangement may not appeal to a rider who makes only a single linked trip per day (i.e., travels one-way by transit, then gets a ride from someone in the other direction); typically, this is not a large market but still should be considered. Finally, the administrative requirements associated with accounting for transfers are exacerbated with day passes, because of the higher value of the passes compared to transfer forms. The use of day passes in lieu of transfers is certainly worth considering; however, there are concerns that must be addressed if such

a strategy is to represent an operational and administrative improvement over a transfer system.

The most common transfer pricing strategy is free transfers. As revenue needs change, however, an agency with free transfers may decide to impose a small transfer charge. An "equity" argument, similar to that for distance-based pricing—that the rider is typically traveling further than a single-seat rider—can be made for charging for transfers. A more compelling argument is that the transit agency has failed to provide a one-seat ride and is forcing the rider to transfer to complete most trips. From that perspective, transfers should always be free—or very low cost. The penalty associated with transferring depends on the frequency of service and the extent to which schedules of intersecting routes are coordinated.

In summary, issuing transfers with cash fares should be considered when a significant percentage of riders requires two or more vehicles to complete most trips. The transfer can be offered at no charge, or it can be set at a fraction of the base fare. The rationale for imposing a transfer charge, however small, may be to reduce the extent of abuse or simply to recover some revenue. On the other hand, the fact that a transferring rider is being inconvenienced by having to take a two-seat ride argues for a free transfer. Establishing a reasonable transfer policy is a major challenge to all transit agencies.

EVALUATION OF FARE STRATEGY OPTIONS

Transit agencies rarely consider the full range of fare strategies each time they evaluate their fare structures; a typical fare review tends to focus on fare levels and possibly payment options (e.g., whether to introduce a new type of pass). Nevertheless, many agencies consider alternative strategies at least once; this may occur in conjunction with a major route or service restructuring or as part of a periodic comprehensive fare evaluation. To provide guidance to agencies in considering differentiation strategies, the researchers have developed a suggested evaluation methodology for fare strategies.

Each fare strategy presents certain advantages and disadvantages relative to the others; however, these options are not mutually exclusive and, in fact, two or three are often combined within a single fare structure. The specific strategy options to be considered should be selected on the basis of the agency's policy goals, the existing fare structure, the existing technology and technology options being considered, the mode or modes of service, the size of the agency, and the nature of trip-making among the different market segments.

Various alternative approaches to these options exist. For instance, a market-based strategy can include different types of period passes as well as discounted multi-ride tickets or tokens. A distance-based strategy can have either a zonal or a mileage-based structure. A time-based strategy can feature a peak/off-peak cash fare differential or perhaps a pass that can be used only during the peak—or only during the off-peak. Finally, a service-based strategy can involve price differentials for all different modes and levels of service (e.g., local bus, express bus, and rail) or for different modes (bus versus rail) or level of service (local versus express bus) only. At this stage in the decision-making process, the researchers focus on assessing and comparing the relative merits of the basic fare strategies.

Rating the Options

Table 15 presents ratings of the five strategies on the basis of the evaluation criteria identified in Chapter 2. For each criterion, the researchers assigned a rating as follows: "3" connotes a "high" rating, "2" a "medium" rating, and "1" a "low" rating. The researchers developed ratings on the basis of review of the literature, discussions with other professionals, and direct past experience in fare evaluation. These ratings are, of necessity, subjective—in contrast to the objective ratings that can be made (for quantifiable criteria such as ridership, revenue, and costs) when considering specific fare levels (i.e., on the basis of market research, modeling, industry experience, and actual cost information).

To illustrate the rating scheme, let us review the "impact on ridership" ratings. Flat fare is rated "2" for this criterion. An increase in the base fare in a flat fare strategy invariably results in a loss of ridership; however, introducing distance-based pricing (without simultaneously reducing the base fare) generally will result in an even greater loss of ridership; therefore, distance-based receives a "1." A service-based strategy, assuming a premium over the base fare (i.e., for express bus service or rail), also receives a "1" for ridership. A market-based strategy (e.g., with a multi-ride discount) may produce a gain in ridership—or at least minimal loss—even with an increase in the base fare; this option is therefore rated "3." A time-based strategy, assuming a discount from the base fare for some time period, should have a more positive ridership impact than a flat fare, but less than a market-based strategy; thus, we have rated time-based a "2."

The ratings for ridership and the other quantitative criteria (i.e., those related to equity, revenue, and costs) are preliminary at this level of evaluation and may change depending on the fare structure and technology, as well as the actual pricing levels under consideration. Some agencies may choose to omit the quantitative criteria at this preliminary stage, preferring to use the qualitative criteria to screen the initial options. In other words, an agency can focus on criteria such as convenience, complexity, ease of implementation, and political acceptability in narrowing the strategy options for further consideration. Alternatively, some agencies will skip this preliminary stage altogether, instead choosing (or eliminating) one or more strategies on the basis of their own experience or perhaps on the personal biases or preferences of key decision makers. Even if the methodology presented here is not followed strictly, the guidelines and background information should be useful to an agency in developing and pursuing its own methodology.

Developing a Weighted Rating Scheme

The ratings shown in Table 15 are "unweighted." In other words, all criteria have been treated as being equally important. On the basis of the rating scheme, the market-based strategy

TABLE 15 Fare strategy evaluation—unweighted

Evaluation Criteria	Weight	Ratings of Fare Strategy Options				
		Flat Fare	Market-Based	Distance-Based	Time-Based	Service-Based
Customer Criteria						
impact on ridership	1	2	3	1	2	1
impact on equity (e.g., redistributive effects)	1	1	3	3	2	2
convenience (i.e., ease of use)	1	2	3	1	2	2
range of options	1	1	3	1	2	2
complexity (i.e., ease of understanding)	1	3	2	1	2	2
Financial Criteria						
impact on fare revenue	1	2	1	3	1	3
impact on fare abuse/evasion	1	1	1	3	2	3
impact on fare collection costs (administrative/operating)	1	3	1	1	2	2
impact on prepayment (i.e., reduced use of cash)	1	1	3	2	2	2
Management/Political Criteria						
ease of implementation (e.g., marketing, training)	1	3	2	1	1	2
impact on fleet/demand management	1	2	2	2	3	3
political acceptability	1	1	3	3	3	2
Total Score		22	27	22	24	26

Rating Key: 3=High, 2=Medium, 1=Low

receives the highest overall ranking, although it is just a single point above the service-based strategy. In fact, only five points separate the first and last strategies.

What this suggests is that it is difficult to eliminate any of these strategies solely on the basis of such a rating scheme. What makes more sense is to assign differential weights to the criteria that reflect an agency's priorities in developing a new fare structure or system. For instance, if an agency's primary goal is to increase revenue, then that criterion should be given more weight in the evaluation process than the others. Alternatively, an agency may decide that increasing ridership is its most important goal. Of course, a transit agency seldom enters a fare restructuring process with a single goal; thus, it may be appropriate to assign a range of weights.

Although each agency should develop its own weighting scheme in order to best reflect its own priorities, two examples of weighted evaluation scenarios are provided. Table 16 presents a "customer-driven" weighting scheme and the resulting ratings. In this scenario, the customer-related criteria have been assigned the highest weight ("5" in this case). Because

TABLE 16 Fare strategy evaluation (customer-driven)

Evaluation Criteria	Weight	Ratings of Fare Strategy Options				
		Flat Fare	Market-Based	Distance-Based	Time-Based	Service-Based
Customer Criteria						
impact on ridership	5	10	15	5	10	5
impact on equity (e.g., redistributive effects)	5	5	15	15	10	10
convenience (i.e., ease of use)	5	10	15	5	10	10
range of options	5	5	15	5	10	10
complexity (i.e., ease of understanding)	5	15	10	5	10	10
Financial Criteria						
impact on fare revenue	1	2	1	3	1	3
impact on fare abuse/evasion	1	1	1	3	2	3
impact on fare collection costs (administrative/operating)	1	3	1	1	2	2
impact on prepayment (i.e., reduced use of cash)	1	1	3	2	2	2
Management/Political Criteria						
ease of implementation (e.g., marketing, training)	1	3	2	1	1	2
impact on fleet/demand management	1	2	2	2	3	3
political acceptability	3	3	9	9	9	6
Total Score		60	89	56	70	66

Unweighted Ratings Key:
3 = High
2 = Medium
1 = Low

Weighting:
5 = Highest Priority
3 = Medium priority
1 = Low priority

customer-related and financial goals work against each other to a certain extent, we have assigned the financial criteria the lowest weight ("1"). In the third category of criteria, management and political, two criteria have received a weight of "1," and the third (political acceptability) is assumed to be moderately important in this case (weight of "3"). The ratings shown reflect the unweighted ratings (Table 15) multiplied by the weight shown for each criterion. The ratings are summed for each strategy. Thus, on the basis of these weights and ratings for the customer-driven scenario, the market-based strategy ranks highest—by a considerable margin. The time-based strategy is a relatively distant second, followed by service-based, flat fare, and distance-based.

An alternative weighting scheme is shown in Table 17. This is a "financial-driven" scenario, placing the heaviest weights on those criteria related to increasing revenue and reducing costs. While the customer-driven scenario assigned the lowest weights to the financial criteria, this scenario does the reverse. All three management and political criteria have been given moderate weights; ease of implementation and impact on fleet and demand management are deemed to be of greater importance in this case than in the customer-driven scenario. In the

TABLE 17 Fare strategy impact evaluation (financial-driven)

Evaluation Criteria	Weight	Ratings of Fare Strategy Options				
		Flat Fare	Market-Based	Distance-Based	Time-Based	Service-Based
Customer Criteria						
impact on ridership	1	2	3	1	2	1
impact on equity (e.g., redistributive effects)	1	1	3	3	2	2
convenience (i.e., ease of use)	1	2	3	1	2	2
range of options	1	1	3	1	2	2
complexity (i.e., ease of understanding)	1	3	2	1	2	2
Financial Criteria						
impact on fare revenue	5	10	5	15	5	15
impact on fare abuse/evasion	5	5	5	15	10	15
impact on fare collection costs (administrative/operating)	5	15	5	5	10	10
impact on prepayment (i.e., reduced use of cash)	5	5	15	10	10	10
Management/Political Criteria						
ease of implementation (e.g., marketing, training)	3	9	6	3	3	6
impact on fleet/demand management	3	6	6	6	9	9
political acceptability	3	3	9	9	9	6
Total Score		62	65	70	66	80

Unweighted Ratings Key:
3 = High
2 = Medium
1 = Low

Weighting:
5 = Highest priority
3 = Medium priority
1 = Low priority

financial scenario, the service-based strategy is ranked highest, by a considerable margin over the distance-based scenario. The other options are rated relatively close to one another, with flat fare ranked last.

These two examples demonstrate that the ratings and rankings can be expected to vary significantly depending on 1) the specific unweighted ratings, 2) the nature of the weighting scheme (i.e., which criteria are given the higher weights), and 3) the relative size of the weights (i.e., the ratio between the highest and lowest weight). The tables presented here are felt to be useful guidelines, but each agency ultimately must select its own weighting scheme.

The next section of this chapter reviews the range of payment options used in transit fare structures.

FARE PAYMENT OPTIONS

In addition to selecting a basic fare strategy and establishing fare levels, a transit agency must select the specific type or

TABLE 18 Applicability of fare payment media to fare options

Fare Options	Payment Media						
	Cash	Token	Paper Ticket	Magnetic Ticket	Smart Card	Debit Card	Credit Card
Single-ride	1	1	1	1	1	0	1
Multi-ride	0	1	1	1	1	1	1
Period Pass	0	0	1	1	1	1	1
Stored Value	0	0	0	1	1	1	1
Post Payment	0	0	0	1	1	0	1

1 = works well or can accommodate
0 = not well-suited or cannot be used

types of fare payment options that riders can use to access the system. The basic types of payment options are as follows:

- Single-ride,
- Multi-ride,
- Period pass,
- Stored value, and
- Post payment.

These are generic options. The actual fare instruments or payment media are what the rider uses to access the transit system; certain payment media may also be used to purchase a fare instrument. The generic payment options can thus be in various forms of media, depending on the type of fare collection technology in place. The basic types of payment media are as follows:

- Cash,
- Token,
- Paper ticket,
- Magnetic ticket,
- Smart card,
- Debit or ATM card,
- Credit card, and
- Transit voucher.

Table 18 shows the relationship between the payment options and the fare media. In other words, single-rides can be paid for with cash, tokens, paper tickets, magnetic tickets, smart cards, or even credit cards. At the other end of the spectrum, stored value options require some type of electronic medium (e.g., magnetic or smart cards). Post payment requires either a credit card or magnetic or smart card (coupled with a billing function). Debit or ATM cards are used as a method of purchase only; the legal requirement that a receipt be issued with each usage presents a substantial barrier to their use for direct fare payment. On the other hand, at least one transit agency—the Phoenix transit system—has begun to accept commercial credit cards (e.g., MasterCard, VISA, American Express, and Discover) for fare payment on buses; this program is discussed in Chapter 7. Transit vouchers (typically called TransitChek, CommuterChek, or some other similar name) are currently used predominantly as a method of purchase, although at least one agency—WMATA—issues vouchers (called Metrochek) that can be used as farecards on Metrorail or exchanged for media for use on Metrobus or other regional providers' services. The fare media are discussed in Chapters 5 through 8, as they represent a fundamental element of the technology used by an agency.

The characteristics and advantages and disadvantages of the different types of payment options are discussed below.

Single-Ride

The single-ride option (using cash, token, or ticket) still is the most common within the industry, although some transit agencies have succeeded in converting most of their riders to some form of multiple-ride prepayment (through passes and bulk purchase options). Table 19 shows the incidence of exact change requirements among the agencies reporting to APTA. As noted earlier, most transit agencies offer some type of multi-ride option (most frequently period passes), as well as single-ride fares. The single-ride is inevitably the most expensive option for the rider on a per-trip basis (i.e., where multi-ride or pass options are available). The ease of use or convenience depends on the specific fare medium (cash versus others) and the exact fare level and is related to the number of transactions required for the rider, in addition to the need to carry exact change. Where the fare must be paid in cash using exact change, a single-ride option can be the least convenient option for the rider; however, the level of inconvenience depends on the fare

TABLE 19 Exact fare (cash) requirements among transit systems

Type of System*	No. of Systems	Required at all times	% of Total	Required at some times or some rtes.	% of Total	Not Required	% of Total
bus	291	264	91%	6	2%	21	7%
heavy rail	13	3	23%	0	0%	10	77%
light rail	16	0	0%	1	6%	15	94%
comm. rail	17	2	12%	0	0%	15	88%

* These categories are not mutually exclusive.
Source: APTA Fare Summary, 1993

level; for instance, a $1.00 fare is relatively convenient, while a fare requiring a combination of coins can be quite inconvenient. On the other hand, the use of cash means that there is only one rider transaction—i.e., boarding the vehicle or passing through the gate.

From the agency's point of view, this is generally the most expensive option as well—at least where cash is used—given the high cost of counting and processing coins and dollar bills and the potential for employee theft. The use of dollar bills presents its own set of operational and maintenance problems, particularly in agencies with older, non-registering fareboxes. The use of tokens or tickets is significantly less costly to the transit agency, both in terms of handling cost and potential for theft; however, this option requires an extra transaction on the part of the rider—i.e., the off-board purchase of the token or ticket. Furthermore, to penetrate the market effectively, the tokens or tickets must be widely available.

In general, although many transit agencies—particularly the larger ones—would love to eliminate the use of cash single-rides, they acknowledge that it will be difficult to do so, especially on buses. Some rail agencies, such as WMATA's Metro and BART, have succeeded in eliminating cash in favor of stored-value magnetic cards. Even at those agencies, however, a single-ride is possible. The largest transit agency in the United States (i.e., MTA-NYCT) offers only single-rides (with tokens or with stored-value fare cards); however, this is expected to change eventually, because the agency plans to implement, when the budgetary situation allows, a new fare structure that probably will feature many of the payment options discussed here.

An interesting variation on the single-ride fare is the aforementioned "stop and go" permit offered by DART in Dallas. Another noteworthy arrangement is found in Switzerland. The Swiss Half Fare Card can be purchased for CHF125 at railway stations. This is an annual card that requires a photo to be affixed and the card to be "validated" on purchase. It is then valid for 12 months from date of purchase and is used as a permit to allow the user to buy a half-fare ticket for each trip taken. The ticket and card are shown to the inspector as proof of payment. The card can be used throughout the country. A monthly Half Fare Card can also be purchased for CHF85. It does not require a plastic ID and is transferable.

Multi-Ride

Prepaid multi-ride options typically take the form of a book of tickets or a "pack" of tokens, although stored-value media can also be programmed to allow a specific number of trips. Multi-ride options offer the rider the convenience of purchasing a group (typically 10, but sometimes available in other denominations, as well) of rides at one time. There is then only a single transaction—at time of boarding. Another benefit of multi-ride fare options is that they are often sold at a discount compared to the price of a single-ride. As discussed above, multi-ride options are the key instrument in deep discount payment strategies.

Multi-ride tickets and tokens offer two key advantages over period passes for certain market segments. First, they are not time-limited and, therefore, appeal to the occasional rider, who wants the convenience of a prepaid option but does not travel frequently enough to warrant purchasing a pass. Second, they are generally cheaper to buy than passes and, thus, permit low-income riders to obtain a discount without having to produce the full price of a monthly pass; of course, some agencies address this concern by offering weekly or biweekly passes.

Multi-ride options, like any prepaid fare instruments, are generally less costly to the transit agency than having to handle cash; the actual benefit depends on the medium used. On the other hand, as with any non-cash fare media, there is a substantial distribution and sales cost, as well as the cost of producing the media. Again, these costs vary depending on the specific medium (i.e., tokens, tickets, or cards). Costs associated specifically with electronic payment methods—i.e., those involving magnetic stripe or smart cards—are identified in Chapter 8.

Period Pass

Period passes are used widely by the transit industry. This prepaid option allows unlimited rides within a specified period.

The most common period is a calendar month, but passes also are offered by some agencies for other periods, including 2 weeks (or, more commonly, 14 days), 1 week (usually 7 days), 1 to 3 days (aimed at the tourist or convention market), or even a year. The 1-year pass is rare but is available on certain commuter rail agencies and in Europe. Denver RTD offers the EcoPass, a heavily discounted (as little as $150 per year) annual pass available only through employers; however, an employer must purchase the EcoPass for all of its employees.

Types of Passes

The standard pass offers unlimited rides for the specified period, but there are variations on this form. CTA, for instance, until recently offered a "weekday only" pass. CTA and several other agencies (e.g., Norfolk, Virginia, and Bridgeport, Connecticut) also experimented with a "fare cutter card," which required that the rider pay an additional amount ($0.25 in Chicago) on boarding with a pass. It may also be necessary to pay a premium in a zonal or multi-modal system, i.e., if the rider has a pass covering only certain zones or modes and wishes to travel beyond the area covered. MBTA, for instance, offers a range of different priced passes, covering different zones on bus as well as various combinations of bus, rail, and commuter rail; the rider must pay a premium to "upgrade" to a higher-cost mode or zone. Passes can also be restricted to peak—or off-peak—hours only, or there may be a cap on the number of rides allowed with the pass.

An interesting pass option is offered to visitors to Europe: the Eurail Flexipass. It can be purchased in the United States for $280 and is good for "5 days within a 15 consecutive calendar day period." The first day use is validated at any railway station at a ticket window. Thereafter the passenger self-validates it when used (writes in date of use). There are variations of this pass, but the key point is that it can be used almost anywhere in Europe on intercity rail, commuter rail, local transit agencies and most ferries. The only restriction is that it must be purchased in the United States before going to Europe. Similar plans are offered for other countries.

When passes are in the form of electronic media (magnetic or smart cards), variations are possible. For instance, the passes can be combined with multi-ride or stored-value options for use in multi-operator regions or on multi-modal systems. Examples of such combined time and trip/value-based passes are found in the Washington, DC, and San Francisco areas.

WMATA offers 2-week passes that can be used on buses within Arlington County (unlimited rides) and rail ($15 stored value), in addition to a range of bus-only and rail-only passes; one pass—the Bus/Rail Super Pass—allows unlimited trips on both modes for a 2-week period. WMATA also offers other variations on the period pass: a 1-day pass ($5) that can be used only after 9:30 AM or all day on weekends and holidays, a 14-day rail pass ($50) that is valid for 14 consecutive days beginning with the first use, and a 28-day rail pass ($100) valid for 28 consecutive days.

In the San Francisco area, the BART-Plus card can be used on BART as well as on nine participating bus services in the region. Each card is a 2-week flash pass for use on the bus services and has a certain amount of stored value for use on BART; the stored value varies from $15 to $50, depending on purchase price ($24-$57). A BART-Plus Premium card is also available; this can be used on additional bus services. The Bay area is implementing a new joint fare program (TransLink) that allows use of a single farecard at several different agencies. A similar effort—the Metrocard project—is being pursued for agencies in Southern California. These two programs are discussed further in Chapter 7. NYMTA is exploring the potential for establishing some type of joint fare program between MTA-NYCT and the two commuter railroads in the area (Metro North Commuter Railroad and the Long Island Railroad [LIRR]).

Advantages and Disadvantages

For the rider, there are three principle advantages of a pass over other options: saving on transit usage expenditures (depending on the level of usage), travelling as often as desired without increasing one's overall expenditure, and the convenience of making a single purchase for a month (or other period) of travel. Passes are also convenient in that they can often be purchased through the mail (if such an option is provided by a transit agency) or at work (if the employer participates in an employer pass program). Many employers subsidize employee purchase of passes. The only real disadvantage of a pass for riders is that the purchase price may be too high for very-low-income individuals. Monthly passes generally cost at least $20, with those at some agencies priced over $60—as indicated above, WMATA charges $100 for its 28-day pass. Some riders have difficulty producing the necessary amount each month. This is the reason many agencies offer smaller time increments on their passes, multi-ride fare options, or both. Other drawbacks include the monetary loss associated with losing one's pass, and the fact that some people cannot always predict the number of days they will be using transit during a given month (i.e., because of out-of-town travel). These are not serious disadvantages.

For the transit agency, passes are a decidedly "mixed bag." They are appealing in that they generate increased ridership and "loyalty" among riders. They also reduce the use of cash in the system, often a major goal. Secondary advantages include improved cash flow through the float from the initial payment, and decreased boarding times for pass users; the extent to which an agency actually benefits from these will depend on the level of pass usage. A measurable change in boarding times will also depend on the type of fare collection equipment and the form of the pass. For instance, if each pass must be visually inspected by a ticket agent or driver, the boarding time may actually be slower than with other options.

On the other hand, passes present significant problems to transit agencies, chiefly in terms of lost revenue. The biggest loss is the forgone revenue from riders taking considerably more trips than the "breakeven" trip rate. Monthly passes are typically priced equivalent to between 30 and 40 trips per month—i.e., at a base fare of $1.00, the pass would cost $30 to $40. Thus, if the pass is $40, someone taking 45 trips in a

month essentially gets 5 free trips. A key issue is how many of these trips he or she would have made without a pass, and how many are induced by the possession of a pass. Nevertheless, it is clear that many pass users far exceed the breakeven rate, particularly at the larger agencies. For instance, CTA has found over the past several years that its pass users take, on average, over 100 trips (boardings) per month; CTA's breakeven rate has been in the range of 48 to 52. (There has been disagreement within the industry as to whether the breakeven rate should be measured against the base cash fare or the per trip discounted multi-ride fare; if measured on the latter, for example, CTA's breakeven rate has been 58 to 62 in recent years.) One approach to limiting this form of revenue loss is to "cap" a pass at a certain maximum number of rides per month or other period; automated fare collection equipment can facilitate such an approach. NYMTA considered this option but rejected it.

Two other sources of revenue loss have been pass "abuse" (i.e., illegal sharing of a pass with non-passbuyers) and counterfeiting. Estimates of the former are difficult to develop, because there is no clear method for tracking who (i.e., besides the buyer) is using a particular pass. Similarly, other than through careful checking of individual passes, and including photos on passes or else requiring the presentation of identification, there is currently no way to prevent such sharing. Counterfeiting of flash (as opposed to automated magnetic stripe) passes has been a significant problem at some transit agencies; even passes that include holograms have been successfully duplicated. The increasing sophistication of computer graphics software and color printers and copiers have made it increasingly difficult to prevent counterfeiting.

For the above reasons, passes are held in considerable disfavor among many transit managers. Passes are very popular with riders, however, and thus tend to be popular with policy makers (i.e., board members and local political leaders). A key aim, therefore, is to minimize the revenue loss through careful pricing and through the development of technological advancements that will allow better control over pass usage and foil attempts at duplication. Despite the appeal of passes, some agencies have sought to eliminate them. CTA removed all period passes (in January 1995), although the agency subsequently reintroduced them (at a higher price) in July 1995. LACMTA similarly attempted to eliminate passes (in September 1994), in conjunction with a general fare increase (from $1.10 to $1.35); however, a local organization representing several groups filed a class action lawsuit against the agency, and the U.S. District Court issued a temporary restraining order blocking the change. LACMTA implemented a modified fare increase in February 1995, pending resolution of the suit, but this change included a monthly pass (increased from $42 to $49). In contrast, CTA did not experience major opposition to its removal of passes—unlike the case in Los Angeles, the CTA action did not accompany a cash fare hike.

Stored Value

The emerging form of prepayment is known as stored value, in which a particular dollar amount is programmed on a magnetic or integrated circuit ("smart") card. The price of a trip is then deducted each time the card is used. The price of each trip may vary (e.g., peak versus off-peak or by distance) or all trips may be the same price. Because the system is automated, a change in the fare structure can be essentially transparent to the user. In fact, in a complex fare structure, this represents a key advantage of stored-value cards to the rider: he or she does not have to understand the details of the fare structure to use the system; rather, he or she simply inserts a farecard into the reader, and the proper amount is deducted—or, if the card contains insufficient funds, this is indicated.

Another advantage of stored value is that the rider decides how much value to purchase at any one time. Because a volume discount is typically offered (e.g., in WMATA's Metrorail system, the rider receives 10 percent on a card of more than $20), there is a benefit to purchasing a larger amount. Yet, someone short on cash or planning to take only a few rides does not have to pay as much as for a multi-ride option or a pass.

One of the most important capabilities of stored-value options is that they can facilitate regional (i.e., multi-operator) integration without forcing every agency to adopt the same fare structure. As indicated above, automated media can contain several different payment options, and a single card can thus be used at more than one agency—provided, of course that the participating agencies have installed the necessary fare equipment. As indicated earlier, regional integration projects have been initiated in northern and southern California; these projects, as well as the regional integration concept in general, are reviewed in Chapter 7.

The primary disadvantage of stored-value options is the cost of purchasing and implementing the necessary fare collection equipment. The actual cost of producing the cards varies, depending on the stock and the type of card. Magnetic cards can be produced quite cheaply; the price of smart cards is still quite high. Costs are discussed in Chapter 8. Stored-value options are discussed in greater detail in Chapters 5 through 8.

Post Payment

Post payment of fares, like its use in retail and other service industries, involves the use of some type of electronic medium to access the transit system. The rider—or perhaps his or her employer—is billed subsequently on the basis of the amount of transit usage during the previous week or month. Post payment of fares has thus far seen very limited use in transit settings; of course, credit cards can be used in some locations (in automated vending machines—discussed in Chapter 5) to purchase other fare media. Phoenix has two post payment options. As indicated above, the transit agency accepts credit cards for fare payment, and the agency also has a program linked to employers—employers are billed for their employees' transit use during the month. Several other agencies are considering introducing similar programs. The U.S. Department of Transportation (USDOT) funded a post payment demonstration at the Merrimack Valley, Massachusetts, RTA (*15*), as well as two previous projects (Portland, Oregon, and Lower Naugatuck Valley, Connecticut) involving subsidies to users of specialized services for the elderly and disabled.

Besides the technological and equipment requirements, post payment has certain administrative implications. In contrast to prepayment, there are negative cash flow implications. The approach also necessitates new accounting and control requirements. The transit system in Phoenix (known as Valley Metro) avoids one of the key requirements normally associated with credit card use by not performing an on-line account verification of each credit card account when it is used on the buses; the agency thus accepts the risk of fraudulent charges; however, the agency "batches" each card user's charges once a week, which restricts the risk to 1 week's worth of rides, and the credit card clearinghouse informs Valley Metro of any invalid cards. As explained in Chapter 7, the agency is satisfied with the arrangement and feels that it is less costly than issuing and administering its own fare media. On the basis of Phoenix's experiences with both types of post payment, the basic approach shows considerable promise; the post payment concept is discussed in greater detail in Chapter 7.

FARE STRUCTURES OF NORTH AMERICAN TRANSIT AGENCIES

This section provides a summary of the fare structures in place at a sample of North American transit agencies as of August 1995 (unless indicated otherwise); this information comes from the following main sources:

- Direct contact by members of the Project A-1 team and
- The 1995 APTA Fare Summaries.

The agencies included in this review are 15 heavy rail systems (12 also include bus service), 13 light rail and bus systems, and 28 bus-only systems (10 large, 18 medium and small).

Heavy Rail Systems

The current (as of mid 1995) fare structures at the 15 North American heavy rail agencies are summarized in Table 20; both rail and bus fare structures are presented. As shown, these agencies utilize a broad range of types—and combinations—of fare strategies, payment options, and fare levels.

Fare Strategies

Regarding basic fare strategy, most of the agencies have flat fares on rail—only three have distance-based or zonal structures: WMATA and BART have distance-based structures, while Baltimore MTA is zonal. The situation changes dramatically on the bus side—6 of the 12 multi-modal agencies have zonal structures. Only two of the agencies have peak/off-peak differentials: WMATA and CTA, although the latter offers an off-peak discount ($1.25 versus the peak cash fare of $1.50) on bus only. WMATA's off-peak rail fare structure is zonal in nature, as opposed to the peak distance-based structure.

Only one of the heavy rail and bus agencies has a true service-based differential: MBTA's rail fare is $0.85, while the base fare on bus is $0.60 (the bus fare can be as high as $2.25 because of the zonal bus structure). Several of the other agencies effectively have service-based differentials because they have zonal structures on bus but not on rail. For instance, on STCUM in Montreal, the cash rail fare is a flat $1.75, while the bus fare ranges from $1.75 to $3.50, depending on the number of zones crossed. The agencies in Los Angeles and Cleveland also have zonal structures on bus only and, therefore, have service-based differentials.

With regard to transfer policy, the agencies are mixed in their approach. Of the 12 multi-modal agencies, four offer free intermodal transfers (although the Greater Cleveland Regional Transit Authority [GCRTA] charges $0.25 for bus-to-rail transfers; rail-to-bus is free), five have reduced fare transfers (i.e., $0.10-$0.40), and the other three (MTA-NYCT, MBTA, WMATA) have no transfers (i.e., full fare must be paid for each boarding). Virtually all of the agencies with bus service have the same bus-bus transfer policy as intermodal; MTA-NYCT and WMATA are exceptions—bus-to-bus transfers are free.

Payment Options and Fare Levels

Regarding market-based pricing, most of these agencies offer one or more types of unlimited-ride pass, and many also offer multi-ride or volume discounts. MTA-NYCT does not offer any type of prepaid or discounted option but eventually may introduce a range of options, probably including a monthly (and possibly weekly) pass and some type of volume discount. Six of the agencies offer a 1- or 2-week pass, and several also provide 1-or 3-day passes, predominantly for visitors.

The prices of the passes—and thus the breakeven rates—vary considerably. For monthly passes, the range among the North American agencies is $27 (lowest-price pass at MBTA) to over $100 (top prices at BART and LACMTA); the most expensive pass among the flat fare systems is CTA's $88. There is a wide range of pass prices within some of the distance-based/zonal systems. In Boston, for instance, the range is $27 to $72. The pass prices and breakeven rates are summarized in Table 21. As shown, the average monthly pass price is $58 (assuming the lowest-priced pass where there is a range). The lowest price weekly pass is the Baltimore MTA's $11, while the highest is MBTA's $18. The range of breakeven rates (as compared to the base cash fare) for monthly passes is 25 rides (STCUM) to 100 rides (WMATA's 28-day rail pass compared to the lowest single-ride fare). Most fall between 30 and 40 rides per month; the average is about 45, although without WMATA, BART, and CTA, the average falls to just under 35.

The multi-ride discounts are most typically in the form of 10-ride tickets or 10 tokens, although SEPTA also offers two-and five-packs of tokens—priced at the same unit cost as the 10-pack—and GCRTA in Cleveland and STCUM have five-and six-ride instruments, respectively. Of perhaps greatest significance is that virtually all of these agencies (excluding MTA-NYCT and BART) offer an "intermediate-priced" prepaid option—i.e., one that provides a discount and can be purchased for significantly less than the price of a monthly pass; this can

TABLE 20 Fare structures of rapid transit systems

Mode	Fare Type	Phil (SEPTA)	Chicago (CTA)	Boston (MBTA)	Miami (MDTA)	LA (LACMTA)	Atlanta (MARTA)	Wash (WMATA)	San Fran (BART)	NYC (NYCTA)	Cleveland (GCRTA)	Baltimore (MTA)	NY/NJ (PATH)	Phil/NJ (PATCO)	Toronto (TTC)	Montreal (CT)
rail	cash	$1.60	$1.50	(2) $0.85	$1.25	$1.35	$1.50	(3) $1.00	(4) $0.90	$1.50	$1.50	$1.25-$1.75	$1	$.75-$.85	$2 00 2 @ $3	$1.75
	discount token/ticket	$1 15 (2 @ $2.30)	$1 25 (10 @ $12.50)		$1 00 (10 @ $10)	$0 90 (10 @ $9)	$1 24 (20 @ $25)	(3)	(4)		$1 43 (5 @ $7.15)	$1 20 (10 @ $12)	-- (10 @ $10)	$ 75 (10 @ $7.50-8.50)	$1 30 (10 @ $13)	$1 17 (6 @ $7)
	transfer (rail/bus)	$0.40	$0.30	full fare	$0.25	$0.25	free	full fare	free	full fare	(5) free	$0.10	free		free	free
	1 day pass			3-day: $9				off-pk: $5							$5	
	weekly pass	$17		$18			$12	2-wk: $50			$13 50	(6)$11				
	monthly pass	$64	$88	$27-72	$60	$49	$45	$100	$56-104		$54	$42-75			$67	$43
bus	cash	$1.60	(1) $1.50	$0.60-2.25	$1.25	$1 35(loc) $3.35(exp.)	$1.50	$1.00-4		$1.50	$1.25-1.50	$1.25-$1.75			$2 00 2 @ $3	$1 75-3.50
	discount token/ticket	$1 15 (2 @ $2.30)	$1 25 (10 @ $12.50)		$1 00 (10 @ $10)	$0 90 (10 @ $9)	$1 24 (20 @ $25)				$1 19-1 43 (5 @ $5 95) (5 @ $7.15)	$1 20 (10 @ $12)			$1 30 (10 @ $13)	$1 17 (6 @ $7)
	transfer (bus/bus)	$0.40	$0.30	full fare	$0.25	$0.25	free	free		free	free	$0.10			free	free
	1 day pass			3-day: $9											$5	
	weekly pass	$17		$18			$12	(3) 2-wk:			$11 25-13 50	(6)$11				
	monthly pass	$64	$88	$20	$60	$49-102	$45	$20-34			$45-54	$42-75			$67	$43-56

Notes:
(1) CTA offers a $1.25 off-peak bus fare.
(2) A few stations require two tokens to board and exit.
(3) Distance-based; maximum fare is $4. $1 fare applies for first 3 miles. In peak, surcharge based on distance. Off-peak zonal structure applies. 5% added value if rider buys card for more than $10; 10% if more than $20. There are 8 different 2-week flash passes, for the various jurisdictions. Several include stored value for rail.
(4) Max. fare $3.55. Base fare applies for first 6 mi.; surcharge is dist.-based. $32 value for $30 card, but only available at outside vendors.
(5) There is a $.25 fee to transfer from bus to rail
(6) Baltimore offers a weekly pass for Zone 1 only.

be important in addressing certain equity concerns confronting transit agencies.

The multi-ride per-trip price and percent discount for all of the agencies covered in this section are summarized in Table 22. As indicated, the percentage discount for the multi-ride options varies considerably, from a low of 4 to 5 percent to a high of 35 percent; the average for those agencies that have discounted options is 19 percent. The two agencies (the two Canadian agencies) with the highest base fares counter the high fares by offering the largest discounts. Conversely, three of the agencies with the lowest base fares (the Port Authority Transit Corporation of Pennsylvania and New Jersey [PATCO], MBTA, and the Port Authority Trans-Hudson System [PATH]) do not offer multi-ride discounts. In general, the lower-fare agencies have the lowest percentage discounts, if any.

As indicated in Table 22, 10 of the 15 North American agencies have base fares of $1.25 or greater; the two Canadian agencies have the highest, at $2.00 for the Toronto Transit Commission (TTC) in Toronto and $1.75 at STCUM. TTC, however, offers two trips for $3.00. The highest fare overall is WMATA's top fare of $4.00, although the base fare is only $1.00. Only three agencies (PATCO, BART, and MBTA) have base fares under $1.00, and BART's top fare is $3.55. MBTA's zonal bus fare tops out at $2.25, but the base bus fare, at $0.60, is very low for a major transit system; MBTA's flat rail fare is also very low, at $0.85.

Thus, the largest transit agencies have a broad range of fare structures, from the simplest conceivable structure—MTA-NYCT, with a single fare option and a flat fare—to complex structures such as WMATA, which has roughly twenty different prepaid options. By and large, though, the complexity in these systems is found in the range of market-based options offered, rather than in the existence of differentials on the basis of distance, time-of-day, or type of service. Although distance-based/zonal pricing is found in over half the bus services, few rail services have such structures. Peak/off-peak pricing is very rare among these agencies, and service-based differentials are primarily attributable to the fact that some of the bus operations are zonal and the corresponding rail service is not. Virtually all of these agencies offer various prepaid options, including passes as well as multi-ride discounts.

Light Rail Systems

Table 23 summarizes the fare structures of thirteen North American light rail and bus agencies. Several of the heavy rail agencies (MBTA, LACMTA, Baltimore MTA, GCRTA, and TTC) also operate light rail, but these are not included in this exhibit. As with the heavy rail agencies, both light rail and bus fare structures are presented.

Fare Strategies

Five of these agencies have zonal structures, three on both bus and rail (Pittsburgh PAT, Portland TRI-MET, and Vancouver's BC-Transit), and two on bus only (Buffalo's Niagara Frontier Transportation Authority [NFTA] and Denver's RTD). The number of zones ranges from TRI-MET's three to PAT's

TABLE 21 Monthly pass breakeven rates

Heavy Rail Systems	Lowest Monthly Pass Price	Base Fare	Number of Trips for Breakeven
Washington	$100.00	$1.00	100.0
San Fran. (BART)	$56.00	$0.90	62.2
Chicago	$88.00	$1.50	58.7
Miami	$60.00	$1.25	48.0
Phil. (SEPTA)	$64.00	$1.60	40.0
Los Angeles	$49.00	$1.35	36.3
Cleveland	$54.00	$1.50	36.0
Baltimore	$42.00	$1.25	33.6
Toronto	$67.00	$2.00	33.5
Boston	$27.00	$0.85	31.8
Atlanta	$45.00	$1.50	30.0
Montreal	$43.00	$1.75	24.6
Phil. (PATCO)	none	$0.75	NA
NJ (PATH)	none	$1.00	NA
NY City	none	$1.50	NA
average	$57.92	$1.31	44.6

Light Rail Systems	Lowest Monthly Pass Price	Base Fare	Number of Trips for Breakeven
San Diego	$48.00	$1.00	48.0
New Orleans	$40.00	$1.00	40.0
Vancouver	$54.00	$1.50	36.0
Sacramento	$45.00	$1.25	36.0
Buffalo	$44.00	$1.25	35.2
St. Louis	$35.00	$1.00	35.0
Portland	$31.00	$0.95	32.6
San Fran. (Muni)	$32.00	$1.00	32.0
Pittsburgh	$40.00	$1.25	32.0
San Jose	$30.00	$1.00	30.0
Dallas	$30.00	$1.00	30.0
Calgary	$43.00	$1.50	28.7
Denver	$27.50	$1.00	27.5
average	$38.42	$1.13	34.1

note: These prices are as of mid-1995.

Large Bus Systems	Lowest Monthly Pass Price	Base Fare	Number of Trips for Breakeven
Cinc. (wkday only)	$39.00	$0.80	48.8
Oakland	$39.00	$1.10	35.5
Minneapolis	$44.00	$1.25	35.2
Houston	$35.00	$1.00	35.0
Westchester Co.	$40.00	$1.15	34.8
Salt Lake City	$25.00	$0.75	33.3
Mil. (4x wkly pass)	$34.00	$1.10	30.9
Phoenix	$28.00	$1.00	28.0
Seattle	$30.50	$1.10	27.7
Honolulu	$25.00	$1.00	25.0
average	$33.95	$1.03	33.4

Small Bus Systems	Lowest Monthly Pass Price	Base Fare	Number of Trips for Breakeven
Albany	$37.50	$0.75	50.0
Lafayette	$21.00	$0.50	42.0
Long Beach	$30.00	$0.75	40.0
Little Rock	$28.00	$0.80	35.0
Madison	$32.00	$1.00	32.0
Spokane	$24.00	$0.75	32.0
Bridgeport	$27.00	$0.85	31.8
Reading	$27.00	$0.95	28.4
Dayton	$25.00	$0.90	27.8
Tucson	$20.00	$0.75	26.7
Louisville	$20.00	$0.85	23.5
Allentown	$24.00	$1.10	21.8
Grand Rapids	$27.00	$1.25	21.6
Las Vegas	$20.00	$1.00	20.0
Norfolk (fare cutter)	$19.00	$1.10	17.3
Savannah	none	$0.75	NA
Richmond	none	$1.00	NA
Syracuse	none	$0.75	NA
average	$25.43	$0.88	30.0

Overall Average	$38.93	$1.09	35.5

TABLE 22 Multi-ride discounts

Heavy Rail Systems	Multi-Ride Price per Trip	Base Fare	Percentage Discount
Toronto	$1.30	$2.00	35%
Montreal	$1.17	$1.75	33%
Los Angeles	$0.90	$1.35	33%
Phil. (SEPTA)	$1.15	$1.60	28%
Miami	$1.00	$1.25	20%
Baltimore	$1.24	$1.50	17%
Chicago	$1.25	$1.50	17%
SF (vol. disc.)	$0.84	$0.90	7%
Wash. (vol. disc.)	$0.95	$1.00	5%
Cleveland	$1.43	$1.50	5%
Atlanta	$1.20	$1.25	4%
Phil. (PATCO)	$0.75	$0.75	0%
NJ (PATH)	$1.00	$1.00	0%
NY City	no disc.	$1.50	NA
Boston	no disc.	$0.85	NA
average (disc. options)	$1.13	$1.31	19%

Light Rail Systems	Multi-Ride Price per Trip	Base Fare	Percentage Discount
Denver	$0.73	$1.00	27%
Calgary	$1.20	$1.50	20%
Buffalo	$1.00	$1.25	20%
St. Louis	$0.80	$1.00	20%
Portland	$0.85	$0.95	11%
San Fran. (Muni)	$0.90	$1.00	10%
Dallas	$0.91	$1.00	9%
Pittsburgh	$1.15	$1.25	8%
Vancouver	$1.38	$1.50	8%
San Diego	no disc.	$1.00	NA
New Orleans	no disc.	$1.00	NA
Sacramento	no disc.	$1.25	NA
San Jose	no disc.	$1.00	NA
average (disc. options)	$0.99	$1.13	15%

note: These prices are as of mid-1995.

Large Bus Systems	Multi-Ride Price per Trip	Base Fare	Percentage Discount
Seattle	$0.73	$1.10	34%
Milwaukee	$0.85	$1.10	23%
Houston	$0.80	$1.00	20%
Oakland	$0.90	$1.10	18%
Minneapolis	$1.05	$1.25	16%
Phoenix	no disc.	$1.00	NA
Salt Lake City	no disc.	$0.75	NA
Honolulu	no disc.	$1.00	NA
Cincinnati	no disc.	$0.80	NA
Westchester Co.	no disc.	$1.15	NA
average (disc. options)	$0.87	$1.03	22%

Small Bus Systems	Multi-Ride Price per Trip	Base Fare	Percentage Discount
Louisville	$0.45	$0.85	47%
Grand Rapids	$0.70	$1.25	44%
Allentown	$0.70	$1.10	36%
Tucson	$0.50	$0.75	33%
Norfolk (fare cutter)	$0.80	$1.10	27%
Las Vegas	$0.75	$1.00	25%
Richmond	$0.75	$1.00	25%
Madison	$0.75	$1.00	25%
Dayton	$0.71	$0.90	21%
Lafayette	$0.40	$0.50	20%
Bridgeport	$0.70	$0.85	18%
Reading	$0.85	$0.95	11%
Savannah	$0.70	$0.75	7%
Little Rock	$0.77	$0.80	4%
Albany	$0.73	$0.75	3%
Syracuse	no disc.	$0.75	NA
Long Beach	no disc.	$0.75	NA
Spokane	no disc.	$0.75	NA
average (disc. options)	$0.68	$0.88	23%

Overall Average	$0.92	$1.09	20%

TABLE 23 Fare structures of light rail systems

Mode	Fare Type	Buffalo (NFTA)	Calgary (CT)	San Fran (MUNI)	Pittsburgh (PAT)	Portland (TRI-MET)	Sacramento (SRTD)	San Jose (SCCTA)	St Louis (Bi-State)	Vancouver (BC-Transit)	San Diego (SD Trolley)	N Orleans (St. Chas.)	Dallas (DART)	Denver (RTD)
rail	cash	$1.25	(1)$1.50-1.80	$1.00	$1.25-$3.50	$.95-1.25	$1.25	(4) $1-2.50	$1.00	(6) $1.50-3	$1.00-1.75	$1.00	$1.00	(7)$0.50 -4
	discount token/ticket	$1 00 (5 @ $5)	$1 20 (10 @ $12)	$0 90 (10 @ $9)	$1 15-3 15	$ 75-1 15	-- (10 @ $12.50)		$0 80 (10 @ $8)	$1 38-2 80 (10 @ $13.75-28)			$0 91 (11 @ $10)	$0 73 (10 @ $7.25)
	transfer (rail/bus)	free	free	(2) free	$0.25	free	(3) free	full fare	(5) $0.10	free	free	$0.10	free	free
	1 day pass			$6	$3			(4)$2-4	$3	off-pk:$4 50		$4		$3
	weekly pass				$11-30				$11			3 day: $8	3 day: $6	
	monthly pass	$44	$43	$32	$40-113	$31/$41	$45	(4)$30-50	$35	$54-106	$48	$40	$30	$27 50
bus	cash	$1.25-1.85	$1.50-1.80	$1.00	$1.25-$3.50	$.95-1.25	$1.25	(4) $1-2.50	$1.00	(6) $1.50-3	$1.50-3.00	$1.00	$1.00	(7)$0.50 -4
	discount token/ticket	$1 00-1 60	$1 20 (10 @ $12)	$0 90 (10 @ $9)	$1 15-3 15	$ 75-1 15	-- (10 @ $12.50)		$0 80 (10 @ $8)	$1 38-2 80 (10 @ $13.75-28)			$0 91 (11 @ $10)	$0 73 (10 @ $7.25)
	transfer (rail/bus)	free	free	(2) free	$0.25	free	(3) free	full fare	(5) $0.10	free	free	$0.10	free	free
	1 day pass			$6	$3			(4)$2-4	$3	off-pk:$4 50		$4		$3
	weekly pass				$11-30				$11			3 day: $8	3 day: $6	
	monthly pass	$44-52	$43	$32	$40-113	$31/$41	$45	(4)$30-50	$35	$54-106	$45-70	$40	$30	$27 50

Notes:
(1) Calgary has an express surcharge of $0.30.
(2) SF allows a free transfer within 2 hours of boarding.
(3) Sacramento allows one free transfer within 90 minutes.
(4) San Jose has an express bus surcharge of$0.50, and a premium bus surcharge of $1. San Jose's daily passes: $3 for express, $4 for premium. San Jose's monthly passes: $40 for express, $50 for premium.
(5) St. Louis charges $.10 for the first transfer only. All transfers after the first are free
(6) Vancouer's basic off-peak fare is $1.50
(7) Denver's basic off-peak fare is $0.50, and its peak fare is $1; there are also zone and express surcharges. RTD offers an annual pass (the EcoPass).

six (including a downtown reduced fare zone). Among the other eight agencies, four (Calgary's CT, San Jose's Santa Clara County Transportation Authority [SCCTA], Dallas' DART and San Diego's Trolley) have express service premiums, and one of these (SCCTA) also has a premium surcharge. The BSDA system in St. Louis had both express and premium surcharges but simplified its fare structure when it opened the light rail line in July 1993. Three agencies—SCCTA, PAT, and BC-Transit—have some type of time-of-day differential. SCCTA offers a $0.50 off-peak discount. PAT has a light rail surcharge of $0.40 for cash payments during the peak; this is aimed specifically at discouraging the use of cash. Finally, BC-Transit offers an off-peak, 1-day-only pass for $4.50.

Transfers are used at all but one of these agencies and are either free (at nine agencies) or relatively low-priced; PAT charges $0.25, while BSDA and New Orleans charge $0.10. SCCTA does not offer a transfer; however, it does provide a daily pass priced at twice the cash fare and good for unlimited boardings during the day it is purchased. The transfer policies vary in terms of number of transfers allowed per fare—i.e., some permit unlimited transfers during a specific period, while others allow only one transfer.

Payment Options and Fare Levels

All of these agencies offer a monthly pass, and two (PAT and BSDA) also have weekly passes; seven have 1-day passes. Nine of the agencies offer multi-ride discounts in the form of tickets or tokens. These are discounted by all but Sacramento's SRTD, which sells tickets as a convenience only, because they are priced the same as the single-ride base fare.

The monthly pass prices range from the Denver RTD's $27.50 to PAT's highest priced pass—$113. Among the non-zonal structures, the highest price is San Diego Trolley's $48. As indicated in Table 21, the average monthly pass price for these agencies is approximately $38—considerably lower than that of the heavy rail systems. The pass breakeven rates fall in a range of 27.5 (Denver) to 48 (San Diego). The average rate is roughly 34.

As shown in Table 22, the multi-ride discounts range from 8 percent (Vancouver) to 27 percent (Denver). The average discount for the applicable agencies is 15 percent. The base fares at the light rail agencies are, as a group, significantly lower than those at the heavy rail agencies. Only five of these light rail agencies charge base fares of more than $1.00. The single most common base fare is $1.00, currently in place at 7 of the 13 agencies (on light rail; San Diego's bus service has a $1.50 base fare). TRI-MET ($0.95) has the lowest base fare, although zonal surcharges can increase the fare to $1.25.

Thus, light rail agencies' fare structures are more similar to one another than are those of the heavy rail agencies. More of the light rail agencies have distance-based/zonal structures than do the heavy rail agencies (over 38 percent, compared to 20 percent). Otherwise, the light rail fare structures tend to be quite similar, particularly in terms of transfer policy and availability and pricing of market-based options. The general transfer policy—i.e., allowing free or low-cost intermodal transfers—is necessitated to a great extent by the typical design of

TABLE 24 Fare structures of large bus systems

Fare Type	Milwaukee (MCTS)	Phoenix (Valley Metro)	Seattle (METRO)	Houston (METRO)	Minn -St Paul (MTC)	Salt Lake City (UTA)	Honolulu (HPTA)	Cincinnati (Metro)	Westchester County	Oakland (AC Transit)
cash										
all times	$1 10	$1 00		$1 00		$0 75	$1 00	P=$0 80-$1 40	$1 15-$1 75	$1 10-$2 35
peak			P=$1 10-1 60		P=$1 25			OP= $0 65-$1.25		
base			OP=$.85-1.10		OP=$1.00					
discounted token/ticket	10 for $8 50	$10 tickets, no discount	no discounted tickets	$0 80 (10 @ $8) tokens & tickets	$ 80-1 05 (10 @ $8) (10 @ $10 50)	sells 10 ride tickets @ no discount	no tickets used	(see note)	no discounts on single rides	$0 90 (10 for $9) tickets
transfer fee	free	free	free	free	free	free	free	10 cents	35 cents	25 cents
1 day pass			$1 70 (note)		(see note)					
weekly pass	$8 75			$9						
monthly pass		$28	$30.50 - $57	$35	$34-65	$25	$25	(see note)	$40 - $60	$39
zones	no	no	yes	yes	yes	no	no	yes	yes	yes
express fees	yes	yes	yes	yes	yes	yes	no	no	yes	yes
notes	uses transit vouchers; 52% prepaid	accepts credit cards; has a half-month pass @ $14; 38% prepaid	3 mo passes avail @ $109-$159; annual passes avail @ $336-$633; day pass, for weekend only; large pass subsidy plan; has family fare plan		has a 3 day pass, a day pass & a holiday pass; 64% prepaid; uses tokens & punch cards; no tickets	uses tokens & punch cards; no tickets; $1 25/day visitor pass	45% prepaid	has a Mon-Fri pass sold at $39; single-ride tokens at no discount	30% prepaid	machines dispense transfers

each system's bus network to provide feeder service to rail. The similarities in the fare structures also are the result, to some extent, of the nature of the fare collection systems at these agencies: all of the light rail agencies utilize the barrier-free, proof-of-purchase fare collection approach, which is discussed in the next chapter.

Bus-Only Systems

This section discusses the fare structures at single-mode (i.e., bus-only) U.S. agencies. This discussion does not attempt to cover all bus agencies but focuses on 28 agencies of varying size and characteristics. Comparative fare information on these is presented in Tables 24 and 25. Table 24 includes 10 of the larger bus agencies, while Table 25 addresses 18 medium and smaller agencies.

These agencies were selected by the project team as examples of agencies with leading practice. Thus, some over-emphasis on specific innovations (such as "deep discount" pricing) exists in this sample relative to overall industry practice; this was considered appropriate in order to maximize the amount of information provided in this "state-of-the-art" review. The fare structures of these agencies are compared and contrasted below.

Fare Strategies

The larger bus agencies display the greatest level of fare differentiation of any of the categories of agencies. For instance, 4 of the 10 large bus agencies reviewed here have zonal fare structures, while 3 have peak/off-peak differentials. All but two (Honolulu and Cincinnati) of the large agencies also have express service surcharges. Among the medium and small bus agencies, 5 of the 18 have zonal structures and 6 have express surcharges. Only one of these agencies (Louisville) offers an off-peak discount, although three other small agencies have time-differentiated passes: Madison and Albany have weekday-only passes, and Tucson offers a weekend-only pass.

Regarding transfer policy, all of the bus agencies reviewed here offer free or low-price transfers between buses. Of the 10 large agencies, 7 have free transfers, with the other 3 charging $0.10, $0.25, and $0.35, respectively. Of the 18 smaller agencies, 12 offer free transfers, and another (Richmond) offers free transfers with tickets only; a rider paying cash must pay $0.10 to transfer. The other five small agencies charge $0.05 - $0.15 for a transfer.

Payment Options and Fare Levels

Most of the bus agencies reviewed offer passes. Among the large agencies, all but Milwaukee provide monthly passes, and Milwaukee has a weekly pass instead. Fifteen of the smaller agencies have monthly passes, although Norfolk's pass is a "fare cutter" card—an additional $0.25 cash payment is required with each use of the pass. The agencies in Richmond, Syracuse, and Savannah do not offer passes at all. Four of these bus agencies have short-term (1- to 3-day) passes, although only one of the smaller agencies—Madison—does so.

TABLE 25 Fare structures of smaller bus systems

Fare Type	Albany (CDTA)	Grand Rapids (GRATA)	Dayton (MVRTA)	Louisville (TARC)	Savannah (CATA)	Allentown (LANTA)	Madison (Metro)	Tucson (TMTS)	Lafayette (GLPTC)
cash									
all times	$0 75	$1 25	$0 90		$0 75	$1 10	$1 00	$0 75	$0 50
peak				$0 85					
base				$0.50					
discount	$0 73	$0 70	$0 71	$0 45	$0 70	$0.70	$0 75	$0 50	$0 40
token/ticket	(10 @ $7.25)	(10 @ $7.00)	(7 @ $5.00)	(10 @ $4.50)	(10 @ $7.00)	(10 @ $7. &	(10 @ $7.50)	(20 @ $10.)	(10 @ $4.00)
transfer	free	free	free	free	0.05	0.05	free	free	$0.10
1 day pass							$3 00		
weekly pass			$6.50						
monthly pass	$37.50	$27.00	$25.00	$20.00		$24.00	$32.00	$20.00	$21.00
zones	yes	no	no	no	no	no	no	no	no
express fees	yes	no	yes	no	no	no	no	no	no
special notes	pass readers also has $30 weekday-only pass; pass prices to be reduced in late 1993 40% recovery required by State 30% prepaid	change 9/93	change 5-93 buses read magnetic cards tokens also sold for reduced @ 20/$9 00	change 10-93	has no passes, emphasizes tickets 20% prepaid	change 4/93 drivers sell tickets punchcards 45% recovery required by Board	uses weekday & full mo passes; weekday pass is $28 pass prices raised in early 1993 to higher than above 65% prepaid	Sat/Sun pass sold @ $1 50 46% prepaid	25% prepaid

TABLE 25 Fare structures of smaller bus systems (continued)

Fare Type	Las Vegas (RTC)	Little Rock (CAT)	Norfolk (TRT)	Reading (BARTA)	Richmond (GRTC)	Spokane (STA)	Syracuse (Centro)	Long Beach (LBT)	Bridgeport (GBTD)
cash									
all times	$1 00	$0 80	$1 10	$0 95	$1 00	$0 75	$0 75	$0 75	$0 85
peak									
base									
discount	$0 75	$0 77	$0 80	$0 85	$0 75	undiscounted	undiscounted	undis-	$0 70
tok/tick	(20 @ $15)	(10 @ $7.70,	(10 for $8)	(15 @ $8.50)	(10 @ $7.50)	sold singly	(10 @ $7.50)	counted	(10 for $7)
transfer	free	$0.10	free	$0.15	$0.10	free	free	$0.05	free
1 day pass									
weekly pass					ended 1992				
monthly pass	$20.00	$28.00	FareCutter	$27.00	no	$24.00	no	$30.00	$27.00
zones	no	no	yes	yes	yes	no	yes	no	no
express fees	no	yes	yes	yes	yes	no	no	no	no
special notes	28% prepaid	23% prepaid	eliminated trans fee w/start of timed trans ; vouchers; eliminated mo pass 1982; Fare Cutter $19 & $29, + $ 25/ride 50% recovery required by Board 15% prepaid	high cost recovery 38% prepaid	transfer fee w/ cash only; free w/ tic wk pass was eliminated 2/92 fare chg, 7/93 60% recovery goal adopted by Board 40% prepaid		has no month or week passes; stresses tokens 25% prepaid	transfer machines 25% recovery required by State 25% prepaid	also has mo Fare Cutter Cards ($20 + 25cents/trip 33% recovery required by State 35% prepaid

The prices of the monthly passes range from $19 (Norfolk) to $65 (Minneapolis/St. Paul's top pass price), with 17 agencies' passes falling in the $20 to $30 range. The average pass price for the larger agencies is nearly $34 and for the smaller agencies about $25.50. As shown in Table 21, the breakeven rates vary between 25 (Honolulu) and 49 (Cincinnati's weekday-only pass) for the larger agencies, and between 17 (with Norfolk's "fare cutter card") and 50 (Albany). The average breakeven rates are 33 and 30, respectively. Comparing these figures to those for the rail agencies shows that—at least for the overall categories—the pass prices and breakeven rates decrease significantly as the agencies become smaller.

The use of multi-ride tickets or tokens, though not as common as passes, is quite widespread among the bus agencies, particularly the smaller agencies. Of the 10 larger agencies, 5 offer multi-ride discounts, as do 15 of the 18 smaller agencies. Three of the latter provide a small discount (3 to 6 percent); however, the option is provided for convenience rather than to provide significant savings; two other small agencies, along with three of the larger group, have a multi-ride option at no discount. Table 22 shows that the percentage discount among the applicable programs ranges from 16 to 34 percent for the larger agencies, and 3 to 47 percent for the others. The average percentage discounts are 22 percent and 23 percent, respectively. Although there is a substantial range, the bus discounts tend to be greater than those on the rail agencies. Of the 20 bus agencies that have any kind of multi-ride discount, 13 (65 percent) offer a discount of 20 percent or more. In contrast, only 9 of the 16 rail agencies (45 percent) with discounts are at that level.

As would be expected, the bus agencies as a group have lower base cash fares than do the rail agencies. Similarly, the smaller bus agencies tend to have lower fares than do the larger bus agencies. As shown in Table 22, 5 of the 10 larger agencies have cash fares greater than $1.00, in contrast to 3 of the smaller group. At the lower end, 2 of the larger agencies have fares less than $0.85, while 10 of the smaller agencies fall at that level. Six of the bus agencies charge exactly $1.00.

In summary, the bus-only agencies have implemented a broad range of fare structures. The larger bus agencies reviewed here display a significantly higher application of distance-based and time-based differential pricing than do the rail agencies, and several of these employ both strategies. As is the case with the rail agencies, most of the bus agencies offer unlimited-ride passes, and several bus agencies offer innovative options, including fare cutter cards and weekday-only passes. The use of multi-ride discounts is quite widespread among the smaller bus agencies in particular, and virtually all offer a multi-ride option at least as a convenience option. Finally, in looking at the overall distribution of fare levels, the cash fare tends to get lower as the size of the system decreases. Within each category, though, there is considerable variation; for instance, one of the largest agencies—the MBTA—has a base fare on bus that is lower than all but one of the agencies presented here, and a rail fare that is lower than eight of the smaller bus agencies' fares.

The next chapter reviews the methodology used by various transit agencies in developing and evaluating fare structure modifications. This information, along with a review of the ridership and revenue impacts of fare changes, is based on a dozen case studies of U.S. agencies.