U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-265 227

Transit Fare Prepayment

Huron River Group, Inc, Ann Arbor, Mich

Prepared for

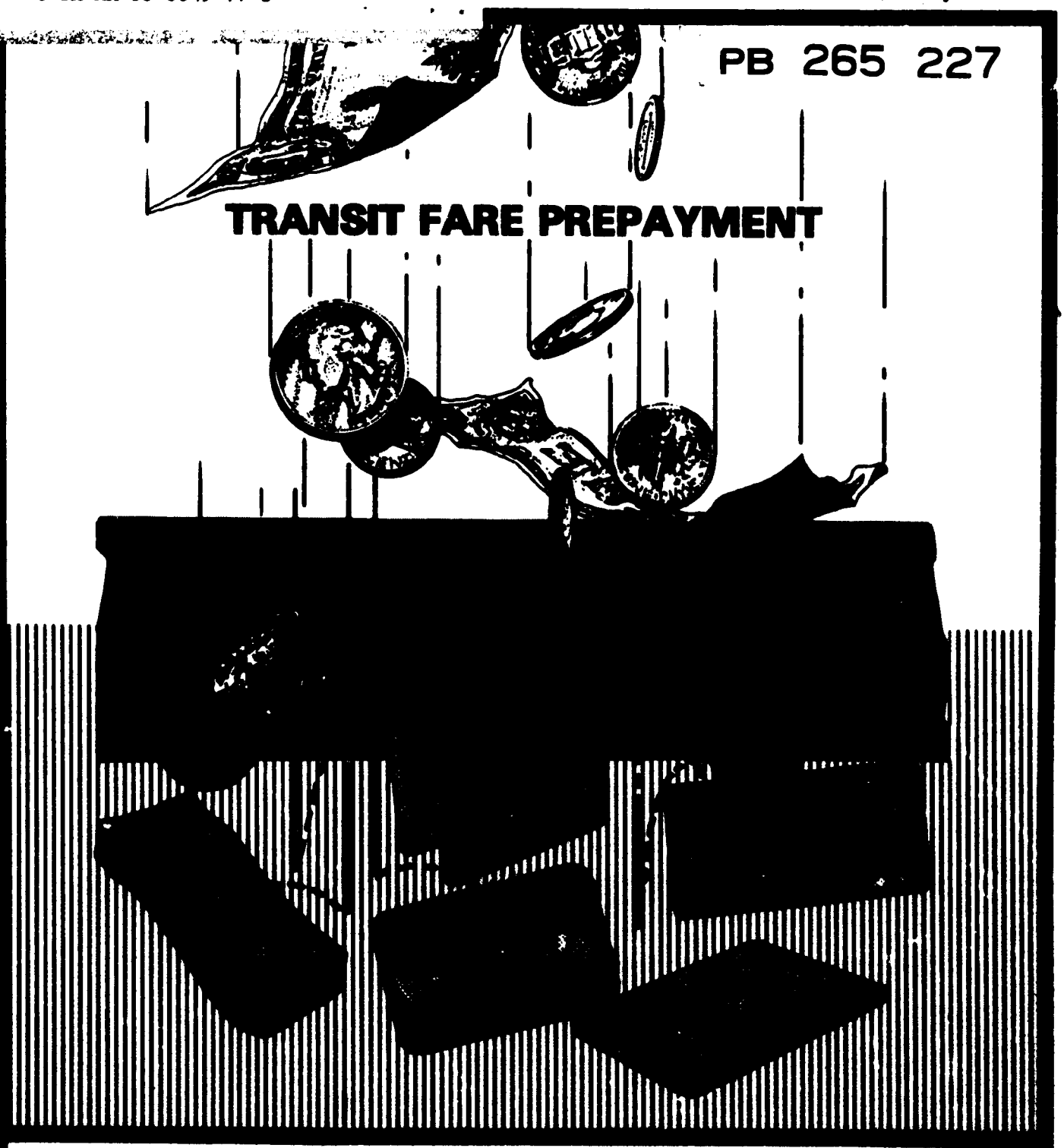
Transportation Systems Center, Cambridge, Mass

Aug 76

UMTA-MA-06-0049-77-3

PB 265 227

TRANSIT FARE PREPAYMENT



Prepared for
U.S. DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION
Office of Transportation Management and Demonstrations
Office of Service and Methods Demonstrations
Washington DC 20590

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTA-MA-06-0049-77-3		

4. Title and Subtitle	5. Report Date
TRANSIT FARE PREPAYMENT	August 1976
	6. Performing Organization Code
7. Author(s) W. R. Hershey et al.	8. Performing Organization Report No. DOT-TSC-UMTA-76-7
9. Performing Organization Name and Address The Huron River Group, Inc. 209 East Washington Ann Arbor, MI 48108	10. Work Unit No. MA-06-0049 11. Contract or Grant No. DOT-TSC-1056
12. Sponsoring Agency Name and Address U. S. Department of Transportation Urban Mass Transportation Administration 400 Seventh Street, S. W. Washington, D. C. 20590	13. Type of Report and Period Covered Final Report July 1975-January 1976 14. Sponsoring Agency Code

15. Supplementary Notes

This study is part of a Service and Methods Demonstration Program administered by the Office of Transit Planning of the Urban Mass Transportation Administration and contracted through the Transportation Systems Center.

16. Abstract

Fare prepayment encompasses all methods of paying for transit rides other than by cash, namely, tickets, tokens, punch cards, passes, and permits. The purpose of this study is the examination of the overall ridership and revenue impacts of ongoing and completed prepayment programs.

This study examines past and current experience with fare prepayment programs and draws conclusions concerning their potential. The major objectives of this study are 1) to survey ongoing and completed transit fare prepayment programs; 2) to identify key features and problems related to prepayment; 3) to measure public response to fare prepayment; 4) to assess advantages and market potential of fare prepayment; 5) to analyze cost-effectiveness of fare prepayment; and 6) to identify the best application of and implementation structures for fare prepayment. To achieve these objectives, three separate and complementary approaches are utilized: 1) a history and background that traces transit fare prepayment as far back as 1860 and follows its development through to the current state of the art; 2) a survey of 146 U.S. transit operators; and 3) a discussion of transit user attitudes. The Appendices contain questionnaires, samplings and tabulations of survey responses, and rankings of the selected transit systems.

This study concludes that fare prepayment can be an important element of a transit system's marketing program, both for attracting and holding riders and for building the system's image.

17. Key Words	18. Distribution Statement
Fare, Passes Management, Operations & techniques Ridership Surveys	Available to the Public through the National Technical Information Service Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	188	PC A09 MF A01

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Report No. UMTA-MA-06-0049-76-3

TRANSIT FARE PREPAYMENT

W. R. Hershey
D. J. Forkenbrock
M. J. Berla
B. A. Miller
M. E. Dewey

The Huron River Group, Inc.
209 East Washington
Ann Arbor, MI 48108

AUGUST 1976
FINAL REPORT

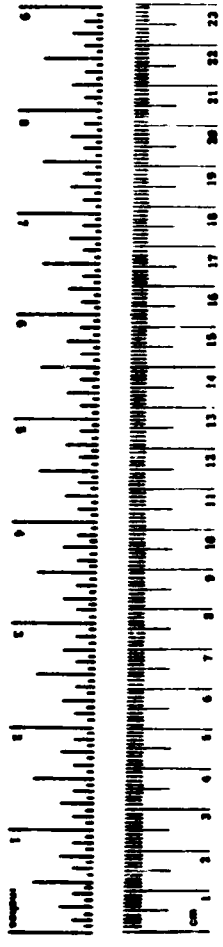
Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION
Office of Transportation Management and Demonstrations
Office of Service and Methods Demonstrations
Washington, DC 20590

METRIC CONVERSION FACTORS

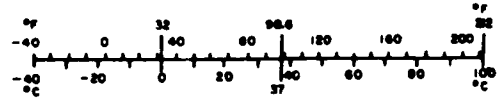
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

This study is part of a Service and Methods Demonstration (SMD) Program that is being administered by the Office of Transit Planning of the Urban Mass Transportation Administration (UMTA) within the U.S. Department of Transportation. The study has been contracted through the Transportation Systems Center, another part of the U.S. Department of Transportation.

The authors wish to thank the hundreds of transit operators who so helpfully provided information for this study. Special appreciation goes to MTTA personnel in Tulsa, PAT personnel in Pittsburgh, and SEMTA personnel in Detroit for their assistance in surveys of transit users. We are very grateful to the University of Pittsburgh and the five companies in Tulsa whose cooperation and assistance were indispensable in our surveys of their employees. Staff members of the American Public Transit Association were extremely helpful in providing much of the historical data included in the study.

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EXECUTIVE SUMMARY

This study examines past and existing experience with fare prepayment programs and draws conclusions concerning their potential. The study has the following major objectives:

- Survey, examine, and summarize ongoing and completed transit fare prepayment programs.
- Identify the key features and problems associated with transit fare prepayment.
- Measure and analyze public response to transit fare prepayment.
- Assess the advantages and market potential of transit fare prepayment.
- Analyze the cost-effectiveness of transit fare prepayment.
- Identify best applications of and implementation structures for transit fare prepayment.

Three separate and complementary approaches were taken in satisfying the above objectives: (1) a history and background of fare prepayment, based primarily on library research, but also drawing on the opinions of veteran transit operators; (2) a survey of U.S. transit operators and a discussion of current operational issues; and (3) a discussion of transit user attitudes, based on several previously published studies as well as four separate user surveys performed in selected transit systems specifically for this study.

Fare prepayment types are differentiated primarily by differences in boarding procedures and by conventions limiting the period of validity and the number of times they can be used. The major types of prepayment are:

- Tickets
- Tokens
- Punch Cards (also called commutation tickets or punch passes)
- Passes
- Permits

Newer and lesser-used forms are magnetic stored fare cards and credit cards, both of which require sophisticated technology to be used.

Prepayment types can be divided in two classes: (1) those which allow the purchaser a fixed number of rides, usually over an unlimited time period (tickets, tokens, punch cards); and (2) those which are valid for an unlimited number of rides over a fixed time period (passes, permits).

HISTORY AND BACKGROUND

Season tickets for railroad commuters in Pittsburgh existed as early as 1860. Tickets and tokens came to be sold in quantity in the early 1900's for the convenience of the passengers and to eliminate the need for conductors to make penny change. The use of weekly passes began in the 1920's, rose to a peak during World War II, and declined until a recent resurgence in the 1970's. Day passes have generally been reserved for special uses, such as Sunday riding, but a few operators have made them available on regular service with considerable success. Monthly passes are a relatively recent form; the earliest ones appeared in the mid-1960's, and they have proliferated rapidly since the early 1970's. Sunday and weekend passes were in use in the 1930's, but they, too, generally lay dormant until the recent flurry of transit marketing activity. Annual passes and permits saw their first use recently in college towns, where the student ID card often serves as a pass or permit on the buses.

Automatic fare collection (AFC) is a recent development that has generally been confined to rail systems, where the large capital expenses are more easily justified than they can be on buses. The principal consideration driving AFC development has been its substitution of passenger self-service for labor-intensive booth, counter, or conductor sales of some prepayment instrument. Other reasons for implementing AFC include reduction of fraud, facilitation of intermodal transfers, facilitation of complex zoned fare structures, flexibility for fare structure alterations, provision of credit or third-party payment opportunities, cash flow advantages to the operator, reduction of cash security problems, and convenience to the rider.

SURVEY OF U.S. TRANSIT OPERATORS

Based on postcard and telephone surveys of U.S. transit operators, it is estimated that approximately 93 percent of U.S. transit systems have some form of fare prepayment. Many have two or three forms of prepayment available. In the telephone survey, 41 percent of all prepayment plans were found to be

associated with certain limitations or privileges with the remaining plans being available to the general public. Limitations are based on:

- Rider age
- Other rider attributes (mobility handicapped, student, employment or client status, etc.)
- Day or time of applicability
- Area or service type available

The most common of these by far is rider age, due to the widespread use of prepayment designated for students and senior citizens. Beyond the need and desire to establish special prepayment forms for special situations and rider attributes is the general feeling among transit operators that fare prepayment is an effective marketing tool.

In about half of all plans found, the prepayment instrumert is not transferable from user to user and therefore is at least theoretically limited to a particular user, or in some cases a family or household. Enforcement of limitations by person, time of use or trip, etc. was noted by many operators as problematic. Many volunteered that such limitations are simply not generally or effectively enforced. Few of the operators indicated substantial concern about fraud and pass misuse.

Several questions in the telephone survey of transit operators asked for various measures of effectiveness of fare prepayment plans. These measures were:

- Ridership changes due to fare prepayment.
- Revenue changes due to fare prepayment.
- Changes in administrative costs due to fare prepayment.
- Staff level changes due to fare prepayment.
- Impact on coin handling and counting due to fare prepayment.
- Number of pass/permit holders.
- Percentage of passengers using fare prepayment.

The telephone survey resulted in a disappointing lack of hard data on most of these measures (only 10-12 percent of the transit operators said they had facts to back up their ridership and revenue change estimates), so results from this part of the study should be considered with caution. The rough, qualitative judgment of transit operators is apparently that prepayment plans in general

increase ridership more often than not and probably never decrease ridership. They further report that plans usually have no observable effect on revenue, but that prepayment-induced revenue increases, where they occur, outnumber decreases by three to one. Most plans are reportedly used by only small percentages (less than 10 percent) of boarding passengers, but for each type of plan there are a few examples of systems where prepaid riders are estimated to constitute 20 percent or more of the ridership.

Fare prepayment's administrative costs, impacts on staff level, and impacts on coin handling and counting seldom appear to be significant. The highest administrative costs seem to be associated with short-term prepayment instruments, simply because of the need to distribute and sell more of them for a given number of rides. Common distribution mechanisms include:

- On-board sales
- Booths or counters
- Mail order
- Third party purchase and distribution (employers, schools, social agencies)
- Vending machines (AFC only)

On-board sales are usually allowed only in systems without exact change fare policies, unless day passes are being sold. In systems with exact change policies, fare prepayment is seen as a convenience for passengers, allowing them to buy trips in bulk so that they are not required to produce the exact fare for each trip.

Most prepayment plans found in the telephone sample are offered at an actual or potential discount in comparison to payment for transit rides by straight cash fare. The practice of discounting is generally motivated by one or more of the following:

- A social policy judgment that some groups deserve a lower fare than the general rider.
- A general feeling that a discount is appropriate for bulk purchase of any good.
- A marketing judgment that both discount and convenience aspects of prepayment will encourage additional patronage.
- A public policy judgment that providing lower cost (to the rider) public transit is a desirable and effective way to achieve some other end.

Bulk discounts are offered on about 70 percent of multiple-ride prepayment plans (tickets, tokens and punch cards). Under these arrangements the passenger pays less per ride than the amount of the cash fare. In most of the multiple-ride plans available to the general public, the discount is less than 30 percent. The effective discount, if any, provided by a pass, however, depends on the frequency of its use. Most monthly passes are priced at 40 times the one way fare, and most weekly passes are priced at 10 times the one way fare. Permits fall into two classes, (1) those which are generally provided free or at a nominal cost to the user, merely serving as a qualification method for some lower cash fare (senior citizen and student ID cards) and (2) those which are sold at a substantial cost and used to cover some specified cash value (rather than percentage) of the normal fare for each trip. The amount of discount with the first type of permit, as with the multiple-ride plans, is a fixed percentage per ride. The discount with the second type of permit, however, depends on the amount of use, as is the case with passes.

Several approaches were taken in the effort to determine whether certain settings are more suitable than others for prepayment. No significant findings were made, but there did seem to be high use of prepayment in college towns and a few other cities with a single, large institution in a centralized location.

TRANSIT USER ATTITUDES

Previously published studies of transit riders in Portland OR found that monthly pass users rated cost and convenience equally in their decision to buy the pass. A postcard survey of monthly pass purchasers in St. Louis MO found that 12.5 percent had not been transit riders before the pass was available. In Houston TX, 43 percent of the United Gas Pipe Line (UGPL) Company's employees use transit, thanks largely to an incentive program whereby UGPL subsidizes transit permits. A study of Metro Passholders in Seattle WA showed that the pricing structure of the pass favors passengers who make long trips. A survey of pass holders in Westport CT found that 88 percent of daytime riders and 96 percent of commuters use the inexpensive annual pass. In Chapel Hill NC a study shows the effectiveness of raising parking rates and distributing annual transit passes along with parking stickers. A study in Warren MI ranked preferences for method of fare collection among potential users of a hypothetical jitney system, and in Flint MI a study of Maxi-Cab passengers found that paying only once per month for the service was a popular feature.

A survey in Sacramento CA found that 42 percent of riders there use the system's day pass.

Four user surveys were performed in connection with this study. The first, among users of express commuter services in southeastern Michigan, found that the choice among alternate prepayment options is largely an economic one. Most of these passengers seem to estimate carefully the number of trips they will be making in the coming month before choosing either the duration-limited pass or a slightly more expensive, trip-limited punch card. When their future trip-making is uncertain, these passengers tend to be risk-averse, and hence choose the punch card in order to put a ceiling on their cost per trip. The responses obtained in a survey of riders in the MTTA bus system in Tulsa OK indicated that the more affluent commuters, like respondents to the Michigan survey, tend to make their choices among available payment methods on the basis of expected cost per trip. A 25-trip punch card, the most economical payment method for transit usage of fewer than 3 trips per day, was the predominant choice among Tulsa commuters.

Economic considerations do not hold, however, among all transit users, as other findings from the Tulsa on-board survey show. Low income riders in Tulsa tend to prefer the 25-cent cash fare or the 50-cent day pass over the discounted punch cards for the "convenience," they say. The $5.00 front-end cost of MTTA's punch card, though seemingly not very great, may be a deterrent to its use by people with limited resources, even though the cards would save them money in the long run. The payment preferences of the young and the old tend to be aligned with those of the low income groups, primarily because a large share of these age groups have limited incomes.

Employer-sponsored programs to distribute and sometimes subsidize transit prepayment were studied by conducting surveys in Tulsa and Pittsburgh. Non-participants as well as participants in the programs were questioned in order to help explain why some people are more attracted to the plan than others.

The Tulsa and Pittsburgh (PAT) transit systems differ in many ways, including their basic fare structures. MTTA's flat fare system is more conducive to simple, convenient prepayment plans than is PAT's zone system. Approximately 40 percent of MTTA's passengers use a punch card to board. PAT's permit is disliked by some passengers because of the need to drop coins in the farebox as well as display the permit. Nevertheless, the permits offer a cost savings if used frequently enough, which helps to explain the sale of 216,000 monthly permits and 1,600 annual permits during 1975 in Pittsburgh.

PAT offers an incentive for people to participate in employer-administered payroll deduction program by providing a permit free in the twelfth month after the person stays in the program for eleven consecutive months. This feature plus the convenience of purchase by payroll deduction have helped to attract on the order of a hundred new transit users from among 6,000 eligible University of Pittsburgh employees and have probably caused an equal number of University transit users to ride more than they did previously.

In Tulsa the results of the employer-sponsored programs are, as expected, more dramatic, since many of the firms in the punch card distribution program pay half the cost of the punch cards. Survey results from five companies in Tulsa indicate that one fourth of a company's employees might be expected to switch to transit when the employer offers a 50 percent subsidy of a transit prepayment plan.

CONCLUSIONS

The study concludes that day passes have significant, but largely undiscovered advantages related to providing passenger convenience, encouraging off-peak travel, and meeting the needs of low-income passengers. They can be sold by the driver, even in exact fare systems, and therefore do not require the passenger to make a special trip to a prepayment outlet. Day passes not only enable people to consolidate several trips into a single day at a low price, but offer a convenient means for commuters to pay for round trips.

Another conclusion notes that employer-sponsored programs for distributing prepayment forms have been effective and are also deserving of more attention from transit operators. Merely the sale of transit passes and other prepayment instruments at a place of work can increase transit visibility and encourage more people to ride. Employer subsidies of transit fares can be especially effective. Plans that offer transit passes in conjunction with parking privileges (modeled after Chapel Hill NC) also have potential, whether organized through employers or through municipal government.

Transit operators need to balance their set of prepayment programs and then periodically review those programs to assure that they continue to meet passengers' needs. Since fare prepayment programs are relatively easy to establish, planning and evaluation of these programs is often incomplete. The lack of quantitative information about prepayment among many transit operators is clear evidence of the need for a more systematic approach toward this aspect of transit marketing.

1. INTRODUCTION

1.1 WHY STUDY FARE PREPAYMENT?

For many years transit operators have offered their patrons the opportunity to pay for transit rides in advance through the purchase of various forms of tickets, tokens, and passes. In the last five years public response to fare prepayment has been especially dramatic. Increasing numbers of operators are now looking for innovative ways to realize the full potential of prepayment. It is to assist them in this pursuit that the present research was undertaken.

Why has there been a resurgence in prepayment recently? What features of prepayment attract riders to transit? Is it cost savings primarily or is it convenience? Do all people respond in the same way? What combinations of various types of prepayment complement one another? How does implementation of prepayment affect transit operations?

This study explores these and other related questions. The issues discussed in this report have no doubt been contemplated by most transit operators at one time or another. Until now, however, few of the innovations and experiences of individual operators have been disseminated for the benefit of other operators. Many of the 146 U.S. transit operators interviewed in the course of this study expressed much interest in what the operators of other transit properties are doing in the area of prepayment. The staffs of at least two of the larger transit systems have actually conducted their own surveys of other operators to learn more about the current state of the art in fare prepayment. These observations point to the need for dissemination of information about fare prepayment.

In this volume we will recount some of the history of fare prepayment, explore operational issues, and present the attitudes of a few of the transit passengers who use prepayment today.

1.2 OBJECTIVES OF THE STUDY

This study is part of a Service and Methods Demonstration (SMD) Program that is being administered by the Office of Transit Planning of the Urban Mass Transportation Administration (UMTA). The study has been contracted through the Transportation Systems Center, another part of the U.S. Department of Transportation. UMTA has recognized that relatively simple and inexpensive modifications to some part of a transit system's operations can often bring highly fruitful results. The SMD Program therefore was designed to develop, demonstrate, and evaluate new techniques and methods that will increase the

level of service in a cost-effective manner. An overall objective of the SMD Program is to bring new techniques into full operational application and to demonstrate the use of proven techniques.

As part of the SMD Program, this study examines past and existing experience with fare prepayment programs and draws conclusions concerning their potential. The study has the following major objectives:

- Survey, examine, and summarize ongoing and completed transit fare prepayment programs.
- Identify the key features and problems associated with transit fare prepayment.
- Measure and analyze public response to transit fare prepayment.
- Assess the advantages and market potential of transit fare prepayment.
- Analyze the cost-effectiveness of transit fare prepayment.
- Identify best applications of and implementation structures for transit fare prepayment.

1.3 STRUCTURE AND CONTENT OF THE REPORT

Following this introductory section is a brief section devoted to defining prepayment and developing a perspective from which to view the basic prepayment types. The remainder of the report contains three major parts. The first part, Section 3, traces transit fare prepayment as far back as 1860 and follows its development through to the current state of the art. Automatic fare collection is briefly summarized, and some of the more recent and innovative distribution and marketing techniques are also discussed. The history includes numerous examples of past and ongoing experience with fare prepayment. Section 4 reports the results of a survey of 146 U.S. transit operators who were asked a detailed set of questions relating to their use of prepayment. National use of prepayment is summarized by prepayment type, and various issues are discussed, including the effects of prepayment on ridership and revenue, the pricing of prepayment forms, and other administrative issues. The third major part, Section 5, investigates prepayment from the point of view of the passenger. Completed user surveys from other sources are summarized. Surveys designed especially for this study are described, and the results are presented and analyzed. Conclusions of the study are presented in Section 6.

2. WHAT IS TRANSIT FARE PREPAYMENT?

Prepayment is broadly defined here as any method of fare payment other than paying cash at the time a transit trip is taken. In addition to the conventional prepayment forms such as tickets, tokens, punch cards, and passes, we also consider some of the special distribution and subsidy methods that make certain programs innovative. Credit card billing for transit rides is also included in the definition, even though, strictly speaking, it involves post-payment rather than prepayment.

2.1 DEFINITIONS

Transit fare prepayment is the purchase of evidence that can later be decremented, surrendered, or verified as a substitute for cash in payment for transit rides. Prepayment types are differentiated primarily by differences in boarding procedures and by conventions limiting the period of validity and the number of times they can be used. Tickets, tokens, punch cards, passes, and permits are examples of distinct prepayment types. A prepayment instrument is defined as the physical piece of paper, cardboard, plastic, or metal that a passenger uses to board a vehicle or pass through a turnstile in a station. Some paper and cardboard prepayment instruments are printed on safety paper, which has a special background design that makes the instrument harder to counterfeit.

Tickets are paper slips or cards that are surrendered to the driver or conductor. Some tickets have a stub that is torn off and returned to the passenger as a receipt. Each ticket is generally valid for one ride. Sometimes, however, tickets are a straight replacement for cash, and the correct number and denominations of tickets must be placed in the farebox to substitute for the cash fare. Most tickets do not carry expiration dates, but some transit operators include such dates so as to limit the liability from outstanding tickets, to discourage counterfeiting, or to guard against their appreciating as cash fares inflate.

Tokens are usually metal, coin-like disks that are placed into a turnstile at the entrance to a rapid transit station or into a farebox on a vehicle. They do not have the potential for theft that coins do, and their collection, unlike that of tickets, can be unattended in rapid transit applications.

Punch cards have been called many different names, such as "punch tickets", "multiple-ride tickets", "commutation tickets", and "punch passes". They are

cards or slips of paper with areas in which holes are to be punched by the driver, usually one hole per ride. Every time a hole is punched, the residual value of the card is, in effect, decremented. When a specified number of holes has been punched, the card no longer has any value. Throughout this report we shall refer to this mechanism of payment as a "punch card", even though many transit operators may have other names for it. Like tickets, the majority of punch cards do not carry expiration dates.

Passes are paper, or sometimes plastic, cards that transit users display to the driver or to a person at a pass gate. A photograph identifying the eligible passholder is occasionally placed on each pass to facilitate limiting use to a specific individual. The passenger rides as many times as desired until the pass expires. Some passes for privileged users like senior citizens have no expiration date, because the transit services are provided free to these people for an indefinite period of time.

Permits are similar to passes in appearance, and like passes, they must be shown to the driver or gatekeeper before a passenger can ride. They differ from passes in that the passenger deposits a certain amount of cash into the farebox as well as flashing the permit. Permits are sometimes preferred over passes in zoned fare systems, where passes specific to zones would become unwieldy. Thus the permit is a mechanism for charging differential fares while requiring only one version of the prepayment instrument. Some permits are sold at a nominal rate or are given out free and serve to designate their bearers as persons entitled to discounted rides. The predominant use of permits today is to designate senior citizens and students as privileged classes of riders.

Automatic fare collection is a subject that embraces many of the technological developments that have mechanized some fare collection tasks normally performed manually. Many of these tasks have to do with prepayment.

The magnetic stored fare card, which is functionally almost the same as a punch card, contains a variable number of rides or dollar value, magnetically encoded on a strip of material much like recording tape. It is inserted into a special reader in a rapid transit station, and the value is read, electronically decremented, and the new value recorded on the strip. Magnetic stored fare cards are commonly sold in vending machines, have more flexibility than punch cards, and require minimal human monitoring.

Credit payment is actually postpayment rather than prepayment and is still at the experimental stage. The passenger inserts a credit card into an automatic reader on the vehicle and is billed at the end of the month according to the

number of rides taken and possibly the distance traveled or number of zone crossings involved.

Multiple ride prepayment forms are a class of prepayment types that include tickets, tokens, punch cards, and magnetic stored fare cards. The purchaser buys a fixed quantity of rides, and the prepayment instrument is usually valid for an unlimited length of time.

2.2 SUMMARY OF FEATURES SPECIFIC TO INDIVIDUAL PREPAYMENT TYPES

The definitions above describe each prepayment type in terms of important and distinguishing features. Table 2-1 presents a more complete listing of the features that tend to be consistent for each prepayment type. Advantages and disadvantages listed in the last two columns of Table 2-1 apply to both the passenger and the transit operator. (Note that Table 2-1 is in two parts on successive pages.)

2.3 CLASSES OF PREPAYMENT TYPES

Two features in Table 2-1 are especially important in characterizing a given prepayment plan: quantity of rides and duration of the prepayment instrument. Can the nature of the basic prepayment types be generalized with respect to these two features?

Figure 2-1 places the major prepayment plans observed into two-dimensional space, the vertical dimension being duration of the instrument to expiration (regardless of how many trips have been made), and the horizontal dimension being maximum number of trips the instrument allows.

At the upper right corner of Figure 2-1 are two special, unlimited-use, unlimited-duration instruments: the transit employee pass and the senior citizen (and handicapped, student, etc.) discount permit. Nearest the lower left corner is the most restricted instrument observed in our national survey, a 10-trip punch card which expires 30 days after purchase. Other varieties of instruments are placed in their appropriate locations in the space.

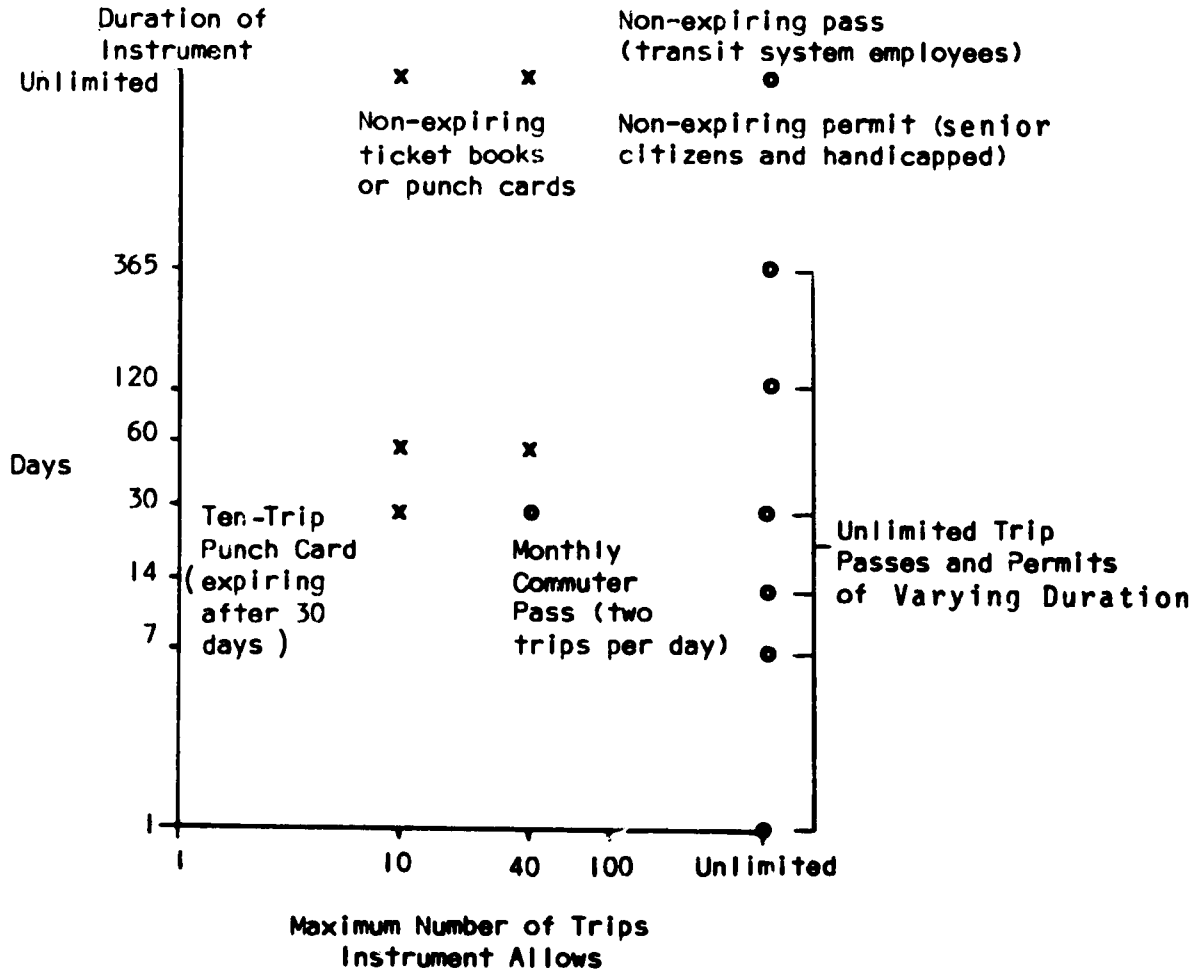
In theory, prepayment could be limited in one dimension and unrestricted in the other. Unlimited-trip passes are usually limited as to their duration, and multiple-trip ticket books or punch cards need not have expiration dates. However, in practice, further limits are imposed. In the case of tickets and punch cards, operators seem to want to protect themselves against having to honor old prepayment instruments when the fare structure may have risen subsequent to

TABLE 2-1. SUMMARY OF PREPAYMENT TYPES AND FEATURES
Part I

PREPAYMENT TYPE	FEATURE			
	Quantity of Rides	Duration	Boarding Procedure	Cost Compared to Cash
Tickets	Sold in strips or books in widely varying quantities. Usually one ride per ticket, though sometimes used as substitute for cash in different denominations.	Usually unlimited. Sometimes expire to limit transit operator's liability or minimize abuse.	Surrender ticket to driver or conductor. Sometimes a stub is returned to the passenger.	Less than or equal to cash.
Tokens	Sold one at a time or in multiples of some convenient quantity. Usually one ride per token.	Unlimited until revaluation or replacement of all tokens in the system.	Insert token in turnstile for admittance to rapid transit station, or place token in fare box.	Less than or equal to cash. Sometimes required in lieu of cash.
Punch Cards	One card good for fixed quantity of rides.	Usually unlimited. Sometimes expire to limit transit operator's liability or minimize abuse.	Hand card to driver, who punches to indicate a trip is being used up. Passenger retains card.	Less than or equal to cash.
Magnetic Stored Fare	Can be "stored fare" or "stored value". Flexibility in specifying number of rides per card depends on sophistication of system.	Usually unlimited. Sometimes two successive uses must be some minimum period apart, like 10 minutes, to avoid abuse.	Insert card into special reader. Reader deducts cost of trip electronically and returns card to passenger.	Usually must be used instead of cash. Can be less than or equal to cash.
Passes	No fixed quantity of rides.	Day, week, month, quarter, year or for a weekend, summer or semester.	Show pass to driver, conductor, or gatekeeper for visual verification.	Cost comparison depends on price, duration of pass, and frequency of riding.
Permits	No fixed quantity of rides.	Day, week, month, quarter, year or for a weekend, summer or semester.	Show permit to driver for visual verification. Insert required number of coins in farebox.	Cost comparison depends on price, duration, cash drop, and frequency of riding.

TABLE 2-1. SUMMARY OF PREPAYMENT TYPES AND FEATURES
Part 2

PREPAYMENT TYPE	FEATURE Safeguards Against Abuse	Types of Systems Where Found	Advantages	Disadvantages
Tickets	"Safety" paper, multi-color printing. Sometimes expiration date.	All types.	Usually no expiration date. Attractive to infrequent riders.	Cumbersome to separate from coins and count.
Tokens	Slug detection mechanism in turnstile. Monitor turnstiles in stations with consistent slug use. Dye or replace tokens to revalue.	All types, usually flat fare.	Usually count along with coins. Easy to carry.	Hard to revalue.
Punch Cards	"Safety" paper, multi-color printing. Sometimes expiration date.	All types, usually flat fare.	Easy to carry (compared with tickets) Usually no expiration date. Attractive to infrequent riders.	Easy to counterfeit. Become mutilated and thus time-consuming for driver to straighten and punch.
Magnetic Stored Fare	Electronic safeguards, (relatively tamper proof).	Rapid transit only, so far.	Very flexible. Change in fare structures are programmed. May reduce labor costs.	High capital costs. Presently too expensive for buses.
Passes	Sometimes photo-ID or signature if not transferable. Coding of male vs. female. Change design and colors with every new pass.	All types. Especially for commuter service, flat fare systems.	Easy to carry. May induce off-peak use of transit. Gives some persons a sense of membership and loyalty.	Make passenger counts difficult. Most are easy to counterfeit and abuse. Usually attractive only to frequent riders.
Permits	Sometimes photo-ID or signature if not transferable. Coding of male vs. female. Change design and colors with every new permit.	All types. Has advantages in zoned fare systems.	Most equitable for zoned systems. Gives some persons a sense of membership and loyalty.	Cash drop is inconvenient. Passengers counts difficult. Most are easy to counterfeit and abuse. Usually attractive only to frequent riders.



x Individual trip instruments (token, ticket, punch card)
● Boarding Pass or Reduced-fare Permit

Figure 2-1. Classification of Prepayment Instruments by Maximum Trips and Duration

their sale. (Also, there may be some desire to raise the effective cost-per-trip, by causing some fraction of these instruments to expire before they have been exhausted.)

In the case of a time-limited, unlimited-trip pass (or permit), the possibility of an effective limit on the number of trips for which it may be used arises in the case of a special service. For example, a monthly pass which allows free boarding of a twice-a-day commuter service effectively limits the maximum number of trips to two times the number of work days in a month.

An overriding consideration that seems to influence most passengers in their choice of fare payment method is the cost per trip. As we will see, the cost of each trip to a given user is in general a function of the two features addressed in this conceptual scheme (number of rides and duration of the prepayment instrument), plus the cost of the prepayment instrument and the user's frequency of riding.

3. HISTORY AND BACKGROUND OF FARE PREPAYMENT

Fare prepayment for public transit has existed almost as long as transit itself. Over the years operators have tried a wide variety of formats to induce the rider to take multiple rides or to use the transit facilities for a certain period of time. Response to the various types of prepayment has been as wide-ranging as their formats. Plans which meet the needs of the times have sometimes achieved incredible market penetrations. Other plans never became popular and were eventually discontinued. This historical perspective of fare prepayment is presented in the conviction that examining the emergence of present practices in fare prepayment can provide valuable insights for future policy formulation.

The approach taken in this section is to present separately the chronology of each prepayment type and each prepayment-related aspect of transit. Thus we have a series of short stories rather than one long story. If the reader is interested in the development of a particular form of prepayment, it should be relatively easy to locate the desired subsection. The section begins with some prefatory material on fare structures that is basic to the understanding of issues in prepayment. For the purpose of discussion, the general forms of prepayment are divided into the two major classes defined in Section 2, multiple-ride types and pass/permit types. A review of recent trends in the changing transit environment closes Section 3, with special emphasis on new opportunities for prepayment.

3.1 BASIC FARE STRUCTURES

3.1.1 Zoned Versus Flat Fares

A distinction that is pertinent to a discussion of prepayment forms is the one between the flat fare and the zoned fare. The flat fare is based on a single price for a transit ride, regardless of distance traveled or the cost of providing service. The other type, the zoned fare, is predicated on a "base" fare for travel within a zone, plus incremental amounts for each additional zone entered.

Flat fares for transit service were frequently used when transit was confined to the boundaries of central cities [38]. They tended to discriminate against the short-haul rider, however. In an effort to charge passengers more fairly according to the relative value of the service received, zoned fares were established. It follows that large systems were the first to use zones, because of the wide disparity in possible trip lengths. The shift toward use of zoned fares is reflected in the fact that while in 1933 only three transit companies out

of 311 in the U.S. had zoned systems [21], in 1973 a study of 100 of the largest U.S. transit operators found that 73 percent had zones [73]. Thirty-two of the zoned systems had zones only in the suburbs and flat fares within the city limits.

The 1973 study also indicated that on the average, today's short-haul passengers are not benefiting from zoned fare structures, because the base fare paid by the short haul rider in the average zoned fare system is nearly the same as the average flat fare. (The average base fare in the zoned fare systems was 33 cents, while the average flat fare in the remaining systems was 32.25 cents.) It must be realized, however, that a transit authority switching from zoned to flat fare will either require greater subsidies to maintain a low fare for everyone, or it must equalize everyone's fare at the higher average fare in the zoned system (to the displeasure of short-haul riders). Recently transit systems in areas as large as Los Angeles County have adopted inexpensive, flat fares at increased subsidy levels in efforts to simplify their systems and thereby induce more people to start using transit [17].

Rapid transit systems have traditionally used the flat fare because of its simplicity where large numbers of people must be processed very quickly. Flat fares not only expedite the collection of cash, but also facilitate the design and administration of prepayment schemes. A recurring problem in designing prepayment programs in zoned systems has been to make the programs equitable to all users while keeping them simple enough to be administered easily.

3.1.2 Exact-Change Fares

Throughout most of transit's history drivers have made change for passengers and have sold tickets, passes, and tokens on the vehicles. But a rash of bus robberies in the late 1960's and the killing of a bus driver during a robbery in Washington DC in '968 put an end to this practice in most transit systems. Under the new "exact change" policies, transit operators locked their fareboxes so that the money was inaccessible, making it necessary for passengers to deposit the exact amount of the fare.

In Washington DC some token users suffered inconvenience and greater expense, because they could no longer purchase tokens on the buses when the exact fare policy was initiated. Although the DC Transit System quickly arranged for 300 token sales outlets in stores and banks when exact fares were first required, some riders chose to pay the 27 cent fare in cash rather than go to an outlet to buy the 25 cent tokens [15]. Before exact fare was implemented, approximately two-thirds of DC's riders used tokens, but this proportion dropped to one-half of all riders after on-bus sales of tokens were discontinued. AC Transit in

Oakland, CA also reported a decrease in the use of tokens when they implemented an exact fare plan [51].

Some operators saw the provision of new prepayment forms as one method of minimizing the inconvenience caused by exact fares. AC Transit started selling ticket books by mail shortly after their exact fare plan started. They also developed new "youth fare" tickets for school districts to sell. RTD in Southern California distributed a leaflet prior to implementing its exact fare plan in 1969 entitled, "How to Make Exact Fare Convenient" [32]. In this leaflet RTD described the various prepayment forms available as alternatives to paying cash: monthly passes, tokens, tickets, commuter punch cards, and senior citizen permits. The leaflet also listed ticket outlets and supplied instructions for ordering tickets and passes by mail.

3.2 MULTIPLE RIDE PREPAYMENT FORMS: HISTORICAL TRENDS

3.2.1 Tickets

Offering a series of tickets at a convenient, rounded price as a means of purchasing multiple rides is the most widely used form of fare prepayment. It is also the oldest. Commuters in Pittsburgh were buying season tickets to ride the steam railroads as early as 1860 [65]. At the same time, a Pittsburgh family who wished to take a Sunday afternoon pleasure ride on the railroads could purchase family tickets as a package.

In the early 1900's many street railway companies had a flat fare of five cents, and they often wrote this rate into their franchises as a hedge against future political pressures to reduce fares [40]. Where fares were less than a nickel, tickets were frequently sold in strips or books for convenience of payment. In Washington DC a quarter bought six tickets; in Cleveland, a passenger could buy five tickets for 15 cents; and in Milwaukee, 30 tickets carried a price of 50 cents. The rationale behind these systems was simply stated in 1917 as follows:

> Tickets would in this way greatly reduce the labor and the delay which fall to the lot of the conductor if he has to make penny change for a large number of passengers. They are convenient also for the passenger, and if the initial payment for a set of tickets is not too great, say 25 or 50 cents at a maximum, it will not be a hardship for any regular rider to purchase them [21].

As early as 1933 there were at least 36 different ways to buy tickets among the 206 cities that had populations greater than 25,000. The vast majority of companies offered tickets in quantities of six or less and for a total cost not

exceeding 50 cents. The result of this practice was that up to 85 to 90 percent of all passengers bought the tickets [21]. In 1958 the American Transit Association (ATA) recorded over 60 ticket merchandising schemes (four tickets for 90 cents, five for $1.15, etc.) among 475 cities [12].

A lingering problem has been to provide a suitable ticket format for use in zoned transit systems. Some systems accept tickets only for the base fare and require cash payments for additional zone increments. In other systems tickets are treated the same as cash and are sold in a variety of denominations. The passenger buys the appropriate denomination for the trip (s)he routinely makes, and thereby has to drop only one ticket into the fare box. Any combination of tickets that sum to the correct amount is also acceptable. Another method is to offer a one-trip ticket that is punched to designate the origin and destination zones. Such a ticket is shown in Figure 3-1.

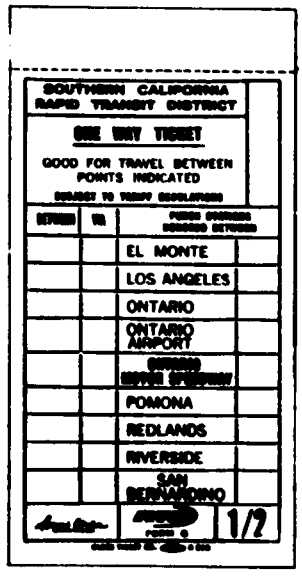


Figure 3-1. One-Way Ticket for Use in a Zoned Fare System (Reprinted by permission from reference [32].)

3.2.2 Tokens

Tokens are the form of transit prepayment most similar to cash. They do not expire unless a fare change necessitates replacement of all tokens in the system with tokens of a different size or type. A simpler approach is merely to start charging a higher price for existing tokens. Such an action has to be kept highly secret until the last moment, however, in order to prevent hoarding.

The New York City Transit Authority reported extensive speculation prior to a subway fare increase in 1966, even though the increase was not announced until shortly before the price of tokens was raised. After that experience, their solution has been to announce the expiration of old tokens, retool their turnstiles to accept only the new tokens, and immediately start sales of the new tokens [10]. Transit users in Washington DC began purchasing up to $80 worth of tokens at a time in 1968, anticipating a token revaluation. To cope with the situation the Washington Metropolitan Transit System considered dyeing all tokens and accepting undyed tokens only at their old value [16].

Like tickets, tokens are subject to counterfeiting. The more advanced turnstiles can detect and reject slugs, but at least one rapid transit operation favors a less costly approach to thwarting slug users. Turnstiles in the Port Authority Transit Corporation's (PATCO) rapid transit line (serving commuters into Philadelphia) accept coins or magnetic cards in admitting people to track areas. They also accept slugs, but PATCO personnel carefully monitor the turnstiles at which slugs are repeatedly inserted. Such surveillance, coupled with strong enforcement, has allowed PATCO to limit its intake of slugs to about $90 worth per year [21].

3.2.3 Punch Cards

Punch cards were originally valid for a limited period of time, usually a week for local transit and a month or more for the steam railroads [21]. The more recent trend, however, has been to offer cards that do not expire. These cards are functionally equivalent to most tickets and tokens and do not discriminate so heavily against the infrequent rider. According to a survey of transit operators performed in connection with this study, only about 13 percent of current punch cards (and an equal percentage of tickets) have expiration dates.

One of the early punch cards, in St. Louis, was actually a comprorise between the unlimited card and the type of card that expires. The St. Louis Public Service Company offered a 12-ride card for $1.00. If a passenger rode

more than 12 times during the week, possession of the used card entitled the holder to a reduced rate of five cents per ride on subsequent rides. The passenger could get a refund if the number of rides taken during the week, multiplied by the regular cash rate per ride, was less than the price of the card. More than 150,000 of these punch cards were sold weekly when they were first issued, but the number decreased to about 50,000 per week as the Depression started. The trend from a six to a five-day work week made the 12 trip card less attractive to commuters, and the card was eventually discontinued [21].

The Globe Ticket Company, a supplier of tickets and punch cards to the transit industry, recommends that all punch cards be issued with expiration dates. Globe claims that abuse is less likely for any prepayment mechanism if validity is limited to a certain period of time. (We have not seen any concrete evidence to support this claim, however, from any of the transit operators who were interviewed in connection with this study.) In most applications the ticket company favors tickets over punch cards from a security standpoint. Globe's "premise of control" is that abuse of the system is minimized when the patron must give up something (a ticket) to get something (a transit ride). When Globe's clients wish to offer a prepayment medium that does not expire, Globe recommends tickets rather than punch cards [48].

The Long Island Railroad attempts to minimize abuse of its punch cards by offering exactly two rides each day and printing the date for each ride on the card. If a rider misses a day, (s)he forfeits those rides. This plan has been used over 30 years, and both monthly and weekly punch cards are available. A similar plan was started in 1972 by the Mass Transit Administration in Baltimore, using tickets instead of punch cards. Their student tickets are issued in books monthly, and each ticket is marked with the date on which it is to be used.

Like tickets, punch cards present somewhat of a problem in systems with zone fares. Some punch cards, such as the one shown in Figure 3-2, require a punch for the price of the ticket and a punch for each ride. Others use a tear-off method to indicate the valid zone (Figure 3-3). The stub that is torn off is used for auditing purposes and clearly indicates the date of issue and value of the ticket.

Punch cards with extensive restrictions on their use have generally not been successful. The Southern California Rapid Transit District, for example, once sold a 35 cent shopper's card that was valid for only one day (see Figure 3-4). It was restricted to use only in central Los Angeles between 9 a.m. and 3 p.m. A passenger could ride as many as ten times on the card at a substantial

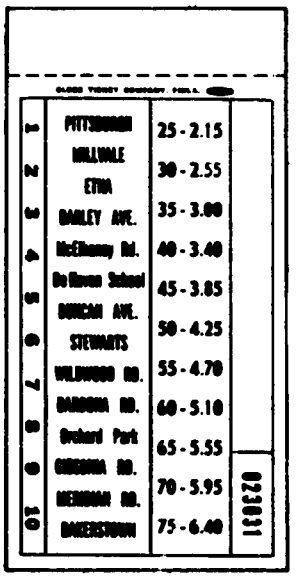


Figure 3-2. Punch Card for Use in a Zoned Fare System
(Reprinted by permission from reference [29].)

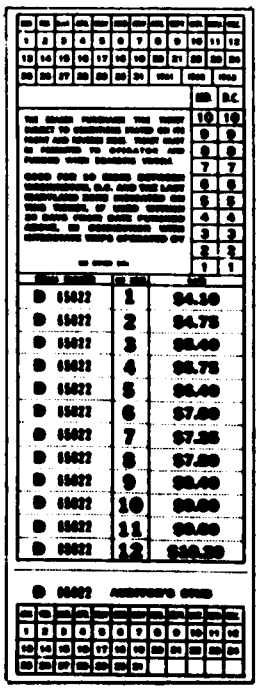


Figure 3-3. Punch Card with Tear-Off Method to Indicate Zones
(Reprinted by permission from reference [29].)

discount below the cash fare and even get a 30 cent credit toward the bus trip home. Few people took advantage of the deal, and the card was discontinued in 1968. A minibus system with a straight 10 cent fare proved to be more popular among shoppers.

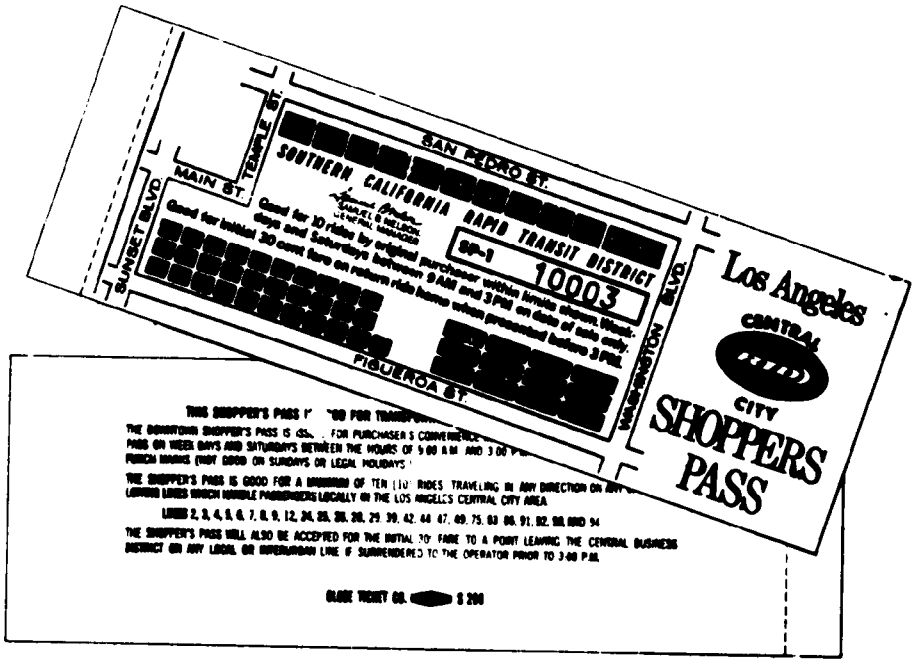


Figure 3-4. RTD Shoppers Pass (c. 1971)
(Reprinted by permission from reference [32].)

3.3 PASSES AND PERMITS: HISTORICAL TRENDS

3.3.1 Day Passes

The day pass is a prepayment form that entitles the user to as many rides as (s)he wants on one day. While day passes are popular in Europe, there apparently has not been as much use of them in the U.S. Day passes were offered by U.S. transit companies as early as 1933 for use on weekends and for special purposes (covered in a later section), but their adoption as a payment method for regular riders on weekdays came later. Today it seems that approximately half of all day pass plans are for Sundays, weekends, holidays, or other special purposes. In a sample of 146 transit operators we interviewed in connection with this study, 13 have day passes. Of those 13, only 7 have passes that are designed for unrestricted use on any day of the week. One of these 7 operators is in Tulsa, where over 17 percent of the passengers board by buying a day pass (priced at twice the regular

fare) from the driver. Some very interesting day pass use patterns have emerged in the results of a survey of Tulsa passengers. Those results are presented in a subsection of Section 5 entitled "The Tulsa On-Board Survey".

3.3.2 Weekly Passes

The weekly pass was once a more widely used form of fare prepayment than it is today. In its most common form the weekly pass allows unlimited travel on a transit system for a seven day period beginning on Sunday and ending the following Saturday. The first weekly pass in the United States was offered in 1919 by the Milwaukee Electric Railway and Light Company in Racine WI [70]. As Figure 3-5 shows, the number of transit companies with weekly passes was at a plateau while transit was experiencing its wartime popularity; the post-World War II decline in transit ridership was accompanied by a decline in the number of companies that offered these passes. Figure 3-5 shows a maximum of 53 companies offering weekly passes in 1934-35. Altogether 94 different companies have had weekly passes at one time or another, according to the records of the American Transit Association.

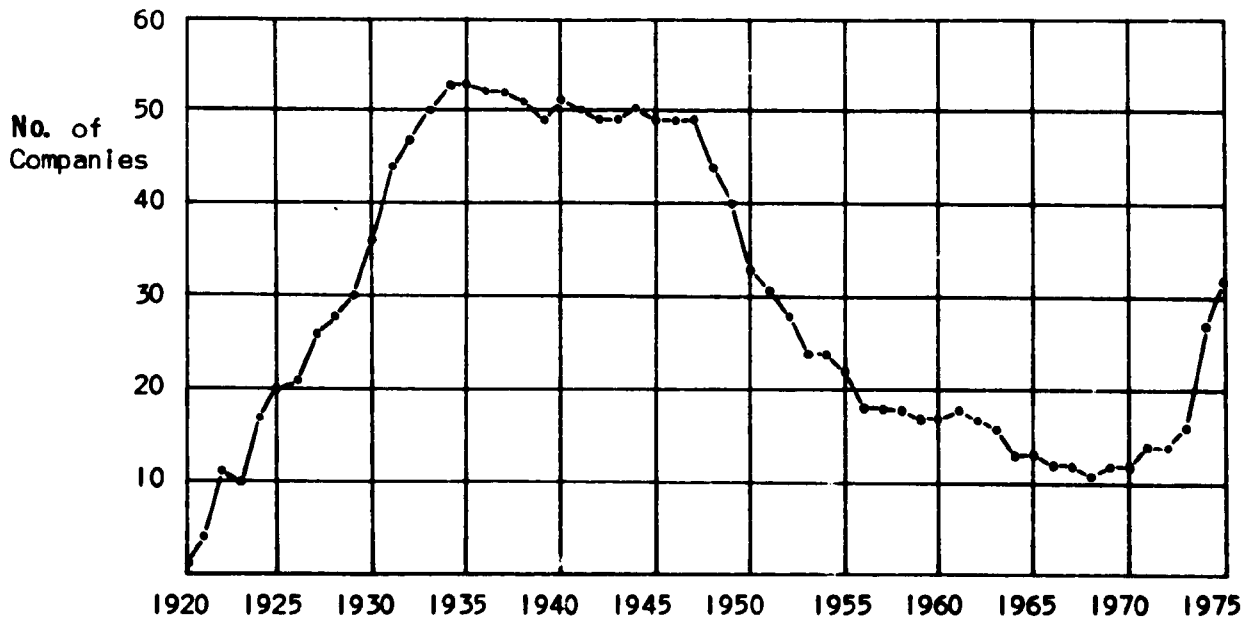


Figure 3-5. Transit Companies with Weekly Passes
(Source: Reference [70])

Favorable public reaction toward the weekly pass has been shown throughout its long period of use. The American Transit Association has recorded six instances of companies discontinuing weekly passes and then restoring them due to pressure from the public or from a city council [11]. When weekly passes were the rage, in 1933, the ATA's Committee on Fare Structure had glowing reports for this innovative means of charging for transit rides:

> [The weekly pass] gives the holder a sense of proprietorship in the system which no other fare structure gives; it facilitates loading; helps to speed up the service; makes possible closer headways or a saving in vehicles; it helps to distribute the loads now to be found at transfer points; it avoids the daily irritation of the patron by giving him a chance to pay his weekly transportation charges all at one time; it holds the possibility of inducing companion riders; it makes for a greater use of the facilities of the system during the off-peak hours and it tends to hold patronage [21].

In the early days of weekly passes, the price was usually set at 15 or 16 times the one-way fare. Eventually the common policy was to charge a price based on two rides per day for six working days per week, or twelve times the one-way fare. With passes at this rate, pass sales increased, but transit companies expressed concern about the group of riders who made considerably more than twelve trips per week: messenger boys for stores, telegraph messengers, postmen, traveling salesmen, and bill collectors. While the companies recognized the good will that the weekly pass generated among frequent riders, it was felt that these "privileged" passengers were not paying their fair share of transit costs. The marginal cost of providing service to the messengers and salesmen, however, was actually very low, because they did much of their riding during the under-patronized midday hours.

Weekly passes were usually transferable from one user to another, a further concern among revenue-conscious transit managers. But there was no reasonable way of enforcing the use of a pass by only one person. Such enforcement is still difficult today, even with magnetically encoded cards and photo-identification passes. Furthermore, in spite of the broad privileges offered with weekly passes, abuses were still possible--counterfeiting, handing the pass out the window for multiple use on the same vehicle, etc.

The colors and designs on weekly passes were usually changed every week so that drivers could more easily detect expired passes. In the 1940's Washington DC's Capital Transit Company had a particularly unique scheme to vary the appearance of their weekly passes. On their "pictorial weekly pass" they featured a

different photograph each week depicting a chosen sculpture or painting currently on display in the city. A 1948 description of the pass was quite enthusiastic:

> These colorful passes are appreciated for their own artistic sake. often taken home and shown to friends. In fact, they have become collectors' items'...A lot of good will is created for the company, when it becomes known to the citizens and the leaders of the community that their transit company is cooperating in making the city a better place to live and work [28].

Weekly passes were relatively easy to price and distribute in systems with flat fares, and most transit systems fell into this category when passes were gaining popularity in the 1920's. Zoned fare structures, however, required differently priced passes for trips of different lengths if riders were to be treated equitably. An alternate solution was to offer a permit rather than a pass in zoned systems so that a single price could be charged for the permit itself and incremental charges could be made at time of boarding, according to the length of the passenger's trip. One might surmise that the growing use of zoned fare structures helped lead to the decline of pass offerings because of the pricing complexities inherent with passes, but we have found no evidence to support this theory.

In spite of claims made by the ATA's 1933 Committee on Fare Structures that the weekly pass held patronage and provided for speedier and more convenient service, transit patronage underwent a long post-World War II decline in the presence of a substantial number of weekly pass plans. The alleged advantages of using a weekly pass were apparently not important enough to keep large numbers of riders from flocking from transit to private automobiles. To the extent that passes made the difference for some people between using or not using transit, this potential for retaining riders disappeared as weekly passes were dropped from fare structures. Reasons given by transit managers for eliminating weekly passes included the following [11]:

"Passes did not prove popular because of high price."

"Revenue did not increase in proportion with riding."

"Pass eliminated when token fare was increased."

"Need for additional revenue."

In general the revenue potential of cash fares looked better to transit managers than that of the unlimited weekly passes.

Passes offered some operational advantages that disappeared, of course, when the passes were eliminated. In street car companies they helped to ease the cost-reducing transition from two-man to one-man operations. The motorman, whose

duties were formerly confined to driving the car and watching out for the safety of the passengers, was suddenly required to assume the conductor's duties of explaining and collecting fares. The passenger who flashed a pass to board was a welcome relief for motormen. Hindsight suggests that perhaps innovative uses of passes in other situations would have alleviated some of transit's many other problems too.

3.3.3 Monthly Passes

Much of the discussion of weekly pass characteristics pertains also to monthly passes, since both are license for unlimited riding during a specified period. Until very recently, however, monthly passes were not as numerous as weekly passes, partly because transit companies assumed that patrons would be unwilling to pay for a month's worth of rides all at once. American Public Transit Association (APTA)* records show only a few isolated cases of monthly passes until the late 1960's. Two examples of early use were a $4.00 monthly pass for unlimited riding in Rockford IL and a $2.00 student monthly pass in St. Petersburg FL. Both were used only for a short time in the 1940's.

The limited use of monthly passes in transit until recently may seem surprising when one considers the early popularity of this type of pass on commuter railroads. But the railroads sold tickets and passes in advance through ticket agents. They could minimize the number of personnel and ticket offices at outlying locations, if they could sell a month's worth of rides at a time to a substantial number of commuters. The economic incentives to offer passes were not so great among bus operators, who sold most of their tickets on the buses. In transit systems passes were also subject to more abuse and more frequent use than they were on the railroads. Because of long trip lengths, infrequent service, and a limited number of routes, use of railroad passes for more then two trips per day was unlikely. On the other hand, buses and rapid transit offered many more opportunities to use and to abuse a pass.

An early implementation of a monthly pass by the Bi-State Transit System in St. Louis in 1963 is worthy of note. At that time Bi-State Transit was the only major metropolitan area transit system which had an unlimited-ride monthly pass as an integral part of its fare structure [27]. Sales of the $12.00 monthly pass reached 10,650 per month one year after it was initiated. Pass users comprised 7.2 percent of daily passengers.

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*The American Transit Association and the Institute for Rapid Transit merged in 1974 to form APTA.

Base fare in the Bi-State system was 25 cents, but a 15 cent transfer charge and a 5 cent bridge charge raised the fare to as much as 45 cents for some passengers. The pass, which was offered to everyone at the $12.00 price, was obviously a better deal for the passengers who normally paid a 45 cent cash fare than for the persons who only paid 25 cents. It was therefore most popular among passengers who had to transfer and/or cross the bridge. Outside the central fare area, extra charges were made for express service and additional zones. In other words, the pass functioned as a permit outside this central area. (Bi-State rider surveys relating to pass use are described in Section 5.)

Although Bi-State Transit charged a single price for its monthly pass and assessed extra zone charges for trips outside the central city area, not all transit operators have favored this approach. Some of the attractiveness of the pass is lost when a passenger must dig for change as well as show the pass. Bi-State replaced the monthly pass in the late 1960's with a weekly pass whose price was determined by distance traveled, type of service, and hours of use [18]. The price of the monthly pass was thought by Bi-State officials to be too much for passengers to pay at one time.

In 1971 the Southern California Rapid Transit District (RTD) implemented a novel scheme for making a pass valid for a specific number of zones. At the time of sale, pressure sensitive stamps were affixed to the pass to indicate that it was valid for one zone (no stamp), two zones (1 stamp), three zones (2 stamps), four zones (3 stamps), or five zones (4 stamps). When a passenger boarded an RTD bus with this pass, the driver issued a zone check for the zone limit shown on the pass [32].

APTA records show sharp increases in monthly (and weekly) pass use after 1970. According to their records, fifteen major U.S. transit operators were offering monthly passes by 1975. Data collected from transit operators in connection with the current study also reflect the recent upward trend in pass use. In a sample that includes almost all major transit operators as well as many of the smaller operators, we found 36 systems having monthly passes in August 1975. (A list of these appears in Appendix B.)

3.3.4 Weekly and Monthly Permits

Some early transit companies saw the permit card as an alternative to the weekly unlimited pass. It helped to reduce the inequity brought about by frequent riders (messenger boys, salesmen), since it permitted reduced payment rather than free passage for each ride. The more a person rode, the cheaper was the cost of

each ride. On the other hand, the transit company gained some revenue from each ride, which was not the case with the weekly pass.

When factories and offices were operating on a six-day work week, many electric railway properties tried the weekly permit. They found that the average number of rides taken on each card was approximately sixteen per week. This was significantly less than the average 22 rides per week taken with a weekly pass. The ATA Committee on Fare Structures concluded in 1933:

> Apparently, although [the weekly permit] is obviously more scientifically correct than the unlimited week pass and does not single out any one group as conspicuous beneficiaries, it is psychologically wrong and fails as a producer of patronage [21].

Some companies, however, had more praise for the weekly permit. One transit operator claimed that the weekly permit helped considerably in the establishment of a zoned fare system. The permit card allowed this company to charge different rates for different lengths of rides and for different types of service (local vs. express).* Sometimes in a zoned system the purchase price of the permit would vary as well as the fare required per ride.

In the early 1930's weekly permits usually cost from 25 to 40 cents. The cash fare for each ride was then usually 5 cents [21]. But even at seemingly nominal rates per ride, weekly permits did not have the popularity that weekly passes did. By 1958, ATA records showed the existence of only one weekly permit plan in the U.S. After 1958, however, the number of transit operators with weekly permits showed a modest increase at the same time that use of weekly passes was decreasing. Perhaps permits held a slight revenue advantage over passes by eliciting from passengers at least some fare for each ride.

Like monthly passes, monthly permits were not used very much during transit's early years. The earliest instance of a monthly permit we found was the United Transit Company's "Thrifti-Ride" card in Providence RI. These cards were first offered in 1956, when United Transit raised all its fares five cents. By purchasing a $.25 weekly card or a $1.00 monthly card, passengers became eligible to pay the old fare rates. Cincinnati Transit tried a somewhat different approach to pricing its monthly permit for express service in 1964. Rather than selling a low-cost permit like the "Thrifti-Ride" card, Cincinnati Transit charged

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*It has already been mentioned that Bi-State Transit's monthly pass in 1964 functioned as a permit outside the central area. The Port Authority of Allegheny County finds that permits offer this same kind of flexibility in its zoned system today.

$11.00 for their monthly "Club Flyer" cards and then required only 15 cents for each ride with the card [30]. The latter type of pricing, with a substantial cost for the permit itself and a low cost per ride, seems to be the most prevalent approach toward pricing permits for regular passengers.

The most common use of permits in public transit today is to facilitate discounted fares for certain classes of users, such as students and senior citizens. Passengers simply obtain a permit (usually free or at a nominal charge) from the transit operator or the appropriate social agency or school. By displaying this permit to the driver, the passenger proves his or her eligibility for a reduced fare.

Occasionally a transit permit is accepted by community facilities other than just transit. The Rochester Transit System (RTS), for instance, started a "Teen Fun Pass" in 1968 [50]. It was actually a photo-identification permit that sold for $2.00 and entitled teenagers to reduced admission prices at theatres and special events, as well as discounts on all RTS buses. Many similar programs have emerged recently throughout the country.

3.3.5 Weekend, Off-Peak, and Other Special Passes

The need to increase transit patronage on weekends and holidays was recognized quite early in transit's history. The ATA Committee on Fare Structures described the situation in 1933 as follows:

> Since the advent of the private automobile pleasure riding on public vehicles as such has almost entirely ceased. This has caused a vast change in the loading for Sundays and holidays and in many cities for Saturdays. There are, however, a few places where Saturday riding is still the heaviest of any day of the week. However, since service has to be given on these days as well as on regular business days, though to be sure it is usually curtailed, the device has been adopted of offering bargain rates to induce traffic and thus improve the load factor [21].

Regardless of the regular fare, passes for a Sunday or holiday usually sold for 25 cents in the early 1930's. Passes for the entire weekend typically cost 35 cents. Transit companies usually assumed that the average passenger would use one of these passes for three rides per day. Most companies found that the passes stimulated business, although the effect was usually to retard the rate of ridership decrease rather than to bring about a net increase in riding.

Today most operators tend to price Sunday and weekend passes at low levels. The common philosophy is that buses are on the streets anyway; bargain rates will help put more passengers on the buses and will at the same time improve public relations. Because this type of pass has such a short duration, it is often sold by the driver. In exact change systems, of course, passengers must pay the exact price of the pass.

A recent and apparently successful example of a Sunday pass is the Chicago Transit Authority's (CTA) "Sunday Super Transferpass", which sells for 70 cents and allows unlimited riding all day Sunday. In fall of 1974, CTA counted sales of these passes at 70,000 per Sunday and estimated that each was used for an average of four rides. Some weekend passes, like Pittsburgh's $1.00 Big Buck pass, encourage families to take recreational trips together. As many as four persons can ride on one Big Buck pass for as many times as they wish during a weekend.

The concept of system-wide fare reductions during periods of low ridership has been applied to off-peak passes as well as weekend and holiday passes. Three kinds of off-peak passes were used as early as 1933: (1) a pass good in any of the off-peak hours of a single day (2) an evening pass good for hours after the peak evening period (3) a weekly pass good only in off-peak hours. Part of the motivation for offering these passes, and off-peak fare reductions in general, was the belief that riders would switch from peak periods to off-peak periods and thus reduce crowding during rush hours [21].

The ATA Committee on Fare Structures predicted in 1933 that the effect of off-peak passes would be to attract new riders rather than to shift ridership from the peak periods [21]. When a pass is designed for riders other than commuters, trip inducement is certainly more likely than the shift effect. For example, in New York recently the MTA's "Night on the Town" pass attracted 47,000 new riders in its first three months of use. This 75 cent ticket is good for unlimited riding between 6 p.m. and 2 a.m. and also entitles the passenger to discounts at many restaurants, night clubs, and theatres.

A recent trend has been to offer off-peak passes at reduced rates to special classes of riders, such as senior citizens and the handicapped. It has been assumed that these persons usually do not need to travel during peak periods and that they deserve a reduction in fare during periods when the transit system has excess capacity. Some transit operators, however, accept senior citizen and other reduced fare passes and permits at any time of day. A more detailed description of such plans is presented later in this report.

Shopper's passes have long been used to encourage people to shop in central business districts. ATA records show evidence of this kind of special pass in the 1940's, and there may have been some earlier. Sometimes the plans simply provided for a refund for a transit trip already taken. A study in 1957 estimated that fare refund plans for shoppers were used in about 50 cities in the United States [61]. The study noted that St. Louis had a particularly complex plan.

A St. Louis shopper asked the bus driver for a "Co-Transit Ticket" that had space for eight adhesive "validation stamps". The person then received one validation stamp for each $1.00 purchase in participating stores. A ticket bearing 4-7 stamps was good for one free transit token worth 20 cents and a ticket bearing 8 stamps was good for two tokens.

Today many merchants follow the relatively simple procedure of refunding all or part of the cost of a transit trip when a customer makes a large enough purchase and presents a transit fare receipt. Other merchants purchase regular tickets or tokens in bulk and give them to customers with purchases that exceed a certain amount.

3.3.6 Annual Passes and Permits

College communities seem to be the first areas to have experimented with annual passes and permits and other long-term prepayment methods. Conditions for the success of these kinds of prepayment are perhaps more favorable in college environments than anywhere else.

In an effort to counteract the growing numbers of automobiles on and near its campus, Indiana University took over a small local bus system in 1967 [31]. The University established an annual pass that sold for $45 and semester passes for regular Fall and Spring semesters that sold for $20. Michigan State University established its own bus system in 1964 and offered $12 passes that were valid for an entire school term. Passes were the most popular form of fare payment in Michigan State's system. These and other universities have found that sales of yearly or school term passes fit naturally into the periodic routine during which students characteristically set up their living arrangements and purchase books and other essentials.

Not all campus bus services are owned by the schools. Some are the result of special arrangements with local transit operators. This is the case at the University of North Carolina in Chapel Hill and at Louisiana State University in Baton Rouge. Chapel Hill Community Transit offers a $30 annual pass, while the Capital Transit Corporation in Baton Rouge is financed by student assessments that are collected with tuition. Louisiana State University students voted in 1974 to assess themselves for transit services. Since all students pay for the service, student identification cards serve as passes.

Transit operators that serve the general public have tried annual prepayment forms only in the last few years. The Port Authority of Allegheny County (PAT) first offered an annual permit in July 1973. This permit, like PAT's weekly and monthly permits, allows a 30-cent discount each time the permit holder rides.

Seattle's Metro system started selling a $150 annual pass in October 1974.

In Westport CT a newly formed transportation district began service in August 1974. A key feature of the new system was its inexpensive annual pass. Cash fare is 50 cents, but an adult can buy a $25 annual pass that allows unlimited riding for an entire year. Eighty-eight percent of Westport daytime riders use an annual pass to board, according to a survey of passengers in October 1975. (Survey results are summarized in Section 5).

3.4 RECENT TRENDS AFFECTING PREPAYMENT

3.4.1 Going Public

As private transit operators experienced continuing ridership declines and rising costs in the 1960's some could no longer stay in business. Public transit authorities were formed to take over the failing private operations, and taxes were used to keep the systems running. This trend continued into the 1970's. One study reports that eighteen of the country's 100 largest transit systems changed from private to public ownership between 1971 and 1973, but none changed from public to private [73]. The American Public Transit Association reports that publicly owned transit systems constituted 33 percent of all transit systems in 1974 and carried 90 percent of revenue passengers [66].

The trend to public ownership seems to coincide with the trend to more use of passes in fare structures. Passes acquired the image of being a less cost effective method of fare collection than cash while private operators were eliminating weekly passes in an effort to increase revenues. One might conclude that publicly owned operators, which are no longer required to return a profit, may be more willing to give passes another try. At least one transportation expert sees the increase in the use of prepayment as part of the increased marketing activites that have accompanied the trend to public ownership [63]. When a transit system goes public, it is often management's first chance to consider a serious program of marketing. From a current marketing point of view, prepayment is a device that can make transit more attractive and that may ultimately lead to increased ridership.

Public transit subsidies have also opened possibilities for the practice of charging no fare for transit. Several cities, such as Seattle WA and Portland OR, have already had success with the no-fare service in limited zones. One writer has included free transit in a definition of "prepaid transit", arguing that special taxes that are used to support transit constitute prepayment

[35]. Free transit is considered here to be a separate issue from fare prepayment and hence outside the scope of this study.

When transit systems receive Federal and state tax money, they of course must operate in conformance with the policy directives of those levels of government. A recent piece of Federal transportation legislation, Section 5 of the National Mass Transportation Act of 1974, is having a big impact on fare structures, and hence on prepayment. Before transit operators can receive Section 5 funds, they must be charging no more than one-half the peak hour fare to elderly and handicapped persons during non-peak hours [67]. Common ways to implement such a policy are to sell passes or tickets to senior citizens and handicapped persons at half the regular price or to provide such eligible persons with identification cards or permits that must be displayed when the reduced rate is paid. Reduced fares for senior citizens have come into widespread use in the last three or four years. It is assured that this use of special prepayment forms for senior citizens and handicapped persons will continue to increase as transit operators increasingly come into conformance with the Section 5 requirements.

3.4.2 Para-Transit and New Opportunities for Prepayment

Para-transit is a rapidly growing, broad class of passenger transportation services that are usually considered distinct from conventional line service. The list includes car rentals, taxicabs, dial-a-ride systems, jitneys, subscription buses, and car and van pools [42]. Some of these have made interesting uses of prepayment because of the special nature of the services. The current Federally-recommended multi-modal approach to transportation planning necessitates at least a cursory look at the experience with prepayment and postpayment in para-transit.

Proposals have been made to automate short-term car rentals by applying the same types of techniques that have been used in Valley Transit District's credit card system.* A customer would use a specially encoded credit card to gain access to and use a vehicle parked at a "stand" [42]. The user would drive the vehicle to his or her destination and return the vehicle to another stand. The card would electronically identify the user for billing and liability purposes. No such systems presently exist in the United States.

*Valley Transit District passengers carry a plastic credit card. The card is inserted into a special reader when the passenger boards and disembarks, recording the passenger's user number on a magnetic type cassette. Information about the trip is also recorded, so the cost of each trip can be calculated and billed to the user at the end of the month [19].

Dial-a-ride services in general have not shown particularly innovative payment plans. The personal nature of dial-a-ride, however, sometimes makes it attractive to social agencies, who can make arrangements with dial-a-ride operators to transport their clients. These arrangements often take the form of a third party payment, enabling the clients to ride free or at a reduced rate.

Subscription bus services for commuters have had perhaps the most use of fare prepayment of any of the para-transit modes. One of the earliest and most successful commuter express services, in Reston, Virginia, offered a well-balanced set of prepayment plans that served the needs of nearly all types of possible users [5]. The infrequent rider could pay a one-way fare at a premium rate. The passenger who rode often, but not every day, would usually purchase a book of ten tickets and could use them over an unlimited period of time. Passengers who rode nearly every day could buy a monthly pass, which offered potentially the lowest cost per ride. Few persons used the monthly pass, however, and it was eliminated in 1972. The current choice of fare payment methods includes a 10-trip punch card and the one-way fare. Reston's unique system for sales and fare collection has been quite effective. One passenger on each bus receives free rides in return for selling and punching cards, collecting one-way fares, and generally monitoring the service.

A commuter subscription service that did not succeed in attracting significant number of riders was the Maxi-Cab project in Flint MI beginning in 1968 [58]. The service was door-to-door for relatively short home-to-work trips and was aimed at General Motors blue collar workers. Subscribers were required to buy a monthly pass; no other payment method was available. The price of the pass was based on the length of route and the number of persons subscribing. A survey of Maxi-Cab users is summarized in the first part of Section 5.

3.4.3 Payroll Deduction

Another recent development for which little data exists is the use of payroll deduction for payment of transit passes. The MBTA's experience with a "Prepaid Pass" program in Boston suggests that transit operators may benefit by enlisting large employers to help market and distribute transit passes. After its inception in March 1974, the program in Boston grew to include over 21,000 participants in more than 115 companies by December 1975. The passes are actually permanent cards that can be replaced whenever the MBTA feels that replacements are necessary. Payments for the privilege of having a pass are deducted from each participant's paycheck every month and paid in a monthly lump sum by the employer to MBTA. If an employee remains in the program for eleven months, the twelfth month is free. The

payroll deduction program is presently the only way that passes can be purchased for MBTA service. Pittsburgh offers a similar payroll deduction program for purchase of monthly permits, but individuals can also buy the permit with cash at designated outlets.

The attractiveness of payroll deduction is that it seems to offer advantages to all involved. Employers reduce the need to supply employee parking and gain a favorable public image. The transit operator saves on administrative expenses by dealing with bulk quantities of passes and receiving payments in a few large monthly sums. Passengers have the convenience of not having to pay cash for each ride and not even having to be concerned about making monthly payments.

3.4.4 Transit as an Employee Benefit

An extension of the payroll deduction concept is the subsidization of transit rides by employers. For many years companies have subsidized automobile travel by providing free parking for their employees. This provision of parking lots is an employee benefit that transit riders have not been able to use. A few employers have finally recognized the inequity and are doing something about it.

In Houston the United Gas Pipe Line Company (UGPL) buys transit permits for its employees that cover the basic adult fare on any bus, seven days a week. The permit user pays only the extra zone or transfer charges, if any. Cost to the company is as much as 90 cents a day per employee, but it is felt to be justified. Part of UGPL's reason for implementing the program was to "help reduce the number of cars on the road during rush hour and do our part to ease the fuel crisis". [55] In January 1976, 43 percent of UGPL's 685 employees were riding transit to work. (See early part of Section 5 for UGPL survey results.)

In Tulsa OK over a dozen firms buy punch cards in bulk and sell them to employees. Some of these companies partially subsidize the cost of the passes to encourage their employees to ride. Many of these employees were participants in an in-depth survey that was conducted in connection with this study. Results are presented in Section 5.

Another firm that offers to pay bus fare for its employees is Midwest Federal Bank of Minneapolis. The bank's president presents a convincing case for offering transit as an employee benefit:

> You have to die to appreciate life insurance. You have to be sick to appreciate hospitalization. You have to break a leg to appreciate long-term disability. You have to have a toothache to appreciate dental insurance. You have to retire to appreciate a pension plan. You have to spend money to enjoy a vacation plan. You have to be sued to appreciate legal insurance. But anyone living near MTC lines can surely appreciate bus fare reimbursement. It is our most popular fringe benefit. [52]

3.5 AUTOMATIC FARE COLLECTION AND HARDWARE DEVELOPMENT

3.5.1 AFC Technology

Automatic (or automated) fare collection (AFC) has developed over the past ten years from basic mechanical technology in turnstiles, change sorters, and single-function vending devices to complex systems capable of change-making, automatic vending of many different fare-payment instruments, and flexible fare collection with extensive security provisions and data output. Development of this technology has opened new opportunities in the structure of transit system revenues and the monitoring of operations, and has occurred over roughly the same period as the resurgence of passes, permits, and other multiple-ride instruments in American transit.

In broad definition, AFC technology includes any equipment used in the revenue collection process which eliminates a function which would have been performed by a human operator. Such functions include:

- collecting fare while monitoring entry
- sale of single-ride or multi-ride instruments
- dispensing of transfers or zone checks
- making change
- verification of fare or payment adequacy
- deduction/cancellation of partial value of a multi-ride instrument
- calculation of appropriate fare for multi-fare systems
- data generation and storage for revenue and other operating measures
- handling and processing of cash revenue

Table 3-1 shows the wide variety of equipment currently available to automate these functions. The major thrust of recent development in this field has been the integration of such devices into complete revenue collection and processing systems, especially utilizing other recent developments in magnetic recording and electronic processing data.*

3.5.2 Potential Benefits of AFC

The principal consideration driving AFC development has been its substitution of passenger self-service for labor-intensive booth, counter, or conductor sales of some prepayment instrument. Additional labor cost savings in revenue handling

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*The scope of this section does not allow technical discussion of AFC technology as developed for BART, Washington Metro, Montreal, PATCO, Illinois Central Gulf, and many British, European, Japanese and other systems. The reader is referred to references [2, 3, 4, 8, 11, 19, 20, 22, 25, 39, 41, 45, 56, 62, 68, 69, 71, 72, 74] for exhaustive discussions of these technical details.

TABLE 3-1. AUTOMATIC VERSUS MANUAL METHODS FOR REVENUE COLLECTION FUNCTIONS

Function	Manual (Method(s)	AFC Example(s)
Collecting fare while monitoring entry	Bus driver with farebox Entry gate with ticket collector	Turnstiles Power gates
Sale of single-ride or multi-ride instruments	Ticket/token sales booth Driver or conductor sales Franchised counter sales	Token vendors Ticket vendors
Dispensing transfers (or zone checks)	Bus driver with transfer cutter or punch	Transfer vendors
Making change	Ticket/token both Bus driver	Money changers (sometimes included in ticket vendors)
Verification of fare or payment adequacy	Farebox inspection plate Sales booth inspection On-board inspectors Driver inspection of transfers	Registering/display fareboxes Ticket & token vendors Turnstile cash acceptor Transfer readers
Partial value cancellation or deduction	Bus driver/conductor with punch	Ticket cancellers/ cutters Entry/exit gates with data recognition
Fare calculation for multi-fare systems	Driver/conductor with zone checks Entry and exit fare payment	Complex ticket vendors Entry/exit gates with data recognition
Data generation and storage	Manual counts, logs, tallies Ticket stubs	Registering fareboxes Turnstile/vendor/gate registers (both available with or without electronic data output) Station/system-level data and control consoles
Revenue handling and processing	Hand sorting, counting, bankfacing, wrapping Exchanging/emptying vaults	Programmable counters/ sorters Vacuum revenue extraction Automatic vault emptying/sorting

and record keeping are possible, depending on the extent of system integration and reduction of the number of transactions by multiple-ride prepayment.

Subsidiary reasons for AFC development and implementation have included:

- reduction of fraud, particularly by underpayment in multi-fare systems and fraudulent transfers
- facilitation of intermodal transfers where at least one mode requires AFC on a cost-saving basis (can include parking as an honorary mode)*
- facilitation of a complex zoned or graduated fare structure
- flexibility for fare structure alterations, special fare classes, and special fares for different times
- more accurate data retrieval
- provision of credit or third-party payment opportunities
- cash flow advantages to the transit operator if substantial use is made of multiple-ride prepayment
- reduction or elimination of cash security problems on vehicles
- convenience to the rider of a flexible prepayment instrument, possible volume discounts, and/or secure provision of change.

Conventionally implemented prepayment schemes such as tickets, passes, and punch cards share the last four areas of potential benefit above with AFC, but except in special cases of very high utilization do not allow noticeable cost savings in revenue (i.e., coin) processing. Extensive sale of single-trip prepayment mechanisms generates exactly the labor costs which AFC is primarily intended to reduce. Multiple-trip prepayment devices are a transitional case in which savings from fewer transactions and cash flow advantages may or may not balance the marginal costs of counter or agent sales.

Except in the case of two-person bus crew operations, the major areas of labor cost saving afforded by AFC implementation are in rail systems which require a fare payment instrument other than cash and thus need a large corps of station agents. If all transit and commuter services operated with a single flat cash fare, only relatively elementary** AFC equipment consisting of cash-accepting

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*See especially [45] on such interface problems.

**But not trivial, since one of the major problem areas in AFC technology is the engineering of extremely reliable coin sorting, counting, and change making equipment. [69] Further development of automatic methods of coin and bill handling is a high priority to minimize processing costs for both bus and rail operations, as is wider implementation of data retrieval technology integrated with management systems software.

turnstiles, registering fareboxes, and money changers (or an exact fare policy) would be required. The important monitoring and passenger information functions of station agents could be served by a combination of minimum agent staffing in large stations, roving trouble-shooters, closed-circuit television monitoring, and direct information phone lines. Bus drivers, would, of course, continue to serve additional roles as fare collectors, monitors, and purveyors of information.

However, addition of any complications to this fare structure for marketing, equity, or other policy reasons introduces a need for information processing and decision-making by human or electronic means. Large metropolitan systems almost inevitably have such complications, including:

- zoned or graduated fares
- transfers and interline fares
- special fares for rider classes (students, elderly, etc.)*
- special fares for different times of day or week
- fare prepayment or postpayment (credit).

With such complications come also opportunities for the subtler forms of passenger fraud. The more advanced information-processing forms of AFC are designed to cope with some or all of these requirements.**

3.5.3 Advanced AFC: Rail and Bus Applications

Advanced AFC systems to date have been implemented almost exclusively in rail operations with distance-dependent fare structures. While not entirely problem-free, such system technology is well-developed in a variety of forms and can readily be applied, at least in newly constructed systems. Most urban rail systems have elementary forms of AFC equipment in the form of turnstiles and transfer and/or token vendors, as well as coin processing equipment, but rely on various forms of agent controls and ad hoc arrangements for complications such as special fares, passes, transfer acceptance, and distant fare zones. Retrofitting of advanced AFC equipment to existing U.S. rail transit would be difficult in many cases because of station design and other fixed investments, as well as labor union considerations.

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*American transit operators who may bemoan the proliferation of special fare classes should consider the concessionary fare structure of London Transport, which among other things gives discounts to shipwrecked mariners [72].

**Although they are not always fully successful. BART's AFC system design did not include provision for special classes of riders. Offering of reduced fares has required a special counter sales mechanism for reduced-rate fare cards. [72] Fraud resistance of the BART magnetic code technology has also been an issue [6].

Such retrofitting would probably not be justified unless a graduated fare structure was strongly required (as may soon be the case in New York). The Port Authority Trans-Hudson system (PATH) in New York recently abandoned tokens and fare zones and developed an improved system using only coin-accepting turnstiles, changemakers, and remote TV surveillance.

Registering fareboxes and coin processing equipment are found in some larger U.S. bus systems, but other use of AFC equipment for buses in the U.S. has been confined to two UMTA-funded demonstrations, one of which remains in operation in Derby, Connecticut, using a novel credit card approach.

Advanced AFC application to buses and tram or light rail systems is in early developmental stages in the U.S. The Urban Mass Transportation Administration is preparing a demonstration of a pilot bus AFC system which uses an adaptation of the basic stored-value magnetic strip farecard technology used in BART and soon to be used in Washington (WMATA) Metrorail [74]. European equipment for bus AFC is available in the U.S. [14, 20, 22], and coded card equipment which could be used as a part of an integrated bus AFC system is available from at least two U.S. firms [19, 46].

Bus system AFC is problematic in that no immediate labor savings are available, because the vehicle driver is required whether or not (s)he is monitoring fare collection. (The current UMTA bus AFC prototype equipment allows for driver-monitored cash and token payments via an adapted registering farebox, thereby retaining some driver responsibility). As a result, cost-effectiveness of bus AFC is highly dependent on other system factors such as potential fraud reduction, facilitation of zone fare structures, commonality of the fare instrument with a rail AFC system, and potential patronage benefits from convenience features.

Mass production costs of bus AFC equipment are unknown in detail but likely to be quite high in comparison to conventional fareboxes. Bus AFC applications with zone fares suffer in comparison to rail station implementation, because a driver data entry console must be provided to update current bus location, and because each vehicle must be supplied with at least one processing terminal for the farecards or coded tickets. Rail applications typically can use fewer processing terminals (gates) than the number of system vehicles. A secondary problem is that vehicles out of service for maintenance or repairs may force an uneconomic duty cycle on the AFC components, or alternatively, that elaborate logistical arrangements would be required to keep AFC equipment always in operable vehicles.

British, European, and Japanese implementation of rail system AFC is well advanced and very similar to comparable U.S. development for BART and WMATA [14,

43, 44, 57, 71, 72]. Bus AFC development in Britain and Europe is considerably more advanced than in the U.S., in the sense that widespread use is made of on-board ticket vendors and ticket canceling devices for self-service fare payment using single and multiple-ride tickets. By American standards, such systems use highly complex zone fares, and use of tickets finely priced according to trip length is a tradition of long standing. Enforcement of proper fare according to trip, however, is normally by random inspector checking of ticket validity as passengers are riding rather than by 100 percent entry-exit checking. Fare payment is thus basically an honor system, although with sanctions for offenders. European operators claim a negligible rate of fraud with this system [44], which has been contested in at least one case [72].

Extensive British and European use of self-service ticketing in buses and light rail is largely a consequence of complex zoned fares, which slow passenger entry times by factors of two and more in comparison with flat fare systems. Significant savings in curb time for boarding are achieved by a combination of extensive pre-purchase of tickets from off-vehicle vending machines and franchised counter sales, and use of double entry doors on many vehicles. Passengers needing to buy a ticket from the driver or motorman enter through one door, while ticket-holders enter in parallel, interfacing with automatic equipment. All these measures, encompassing vehicle design, AFC equipment, extensive ticket availability, and inspector fare enforcement, constitute a technology-policy complex which replaces or is replacing the bus or tram conductor. This complex serves to avoid the low average speeds and thus heavy operating cost penalties and low service levels which would result from totally manual and on-board collection of complex zone fares in single-person operation.

American operators in the now-distant past generally adopted flat fares and single-stream passenger entry with the passing of on-board transit conductors, and recently have further speeded entry with exact fare policies, thereby sidestepping the problems which have given rise to British and European technology. Boarding times in most U.S. buses are primarily determined by passenger capabilities in negotiating entry steps rather than by the time required to pay the fare. Faster boarding times (shorter curb times) would be highly desirable in some U.S. bus operations with flat fares. These could only be attained with dual entry streams, in which case different bus designs would be required along with some measure of AFC equipment to handle the passenger stream further from the driver. In that instance, extensive or exclusive use of prepayment instruments for that second passenger stream could be necessary to accommodate a fare structure dependent on rider class, time, etc.

American bus operations with zone fares might fruitfully adopt European practice in this area, but would have to confront the problem of potential underpayment fraud. Only two basic solutions are possible: full payment on entry and random enforcement as in Europe or full entry-exit checking and additional payment if necessary upon ride termination. Existing U.S. operations use various versions of the latter, which has the problem that time savings in boarding may be used up in secondary transactions upon leaving the vehicle. AFC technology can markedly reduce such transaction times, and is being developed with such applications in mind. It is an open question at this point whether the savings by fraud reduction and higher speed in this mode can justify the additional cost of AFC. Applicability of random inspection enforcement in the U.S. is questioned by most observers, but might be useful where transit police are present regardless.

3.5.4 Credit Cards for Transit Fares

A few U.S. transit operators with relatively long-term pass or permit plans allow charge sales of these instruments on major credit cards. Other operators have evaluated possible credit sales and have rejected them on the grounds that the handling costs of credit billing would be too high, and that the cash flow drain from shifting a major portion of revenue from current to delayed payment would be intolerable.

Conventional credit sales processing entails coding of each charge slip for the amount of the sale and subsequent processing, mailing, and collection, and is generally uneconomic for individual purchases of less than about $5.00. Data processing capability that can economically record and process large numbers of relatively small transactions for later billing is a prominent feature of telephone and computer time-share operations, however.

AFC as currently implemented is not immediately usable for automatic credit billing, because the coded tickets or fare cards contain no passenger-specific information which would allow accumulation of charges to individuals. No capability for permanent recording of all information on each trip made is provided; data accumulation is by registers only. In addition, introduction of credit billing for individual trips would probably require a level of system integration not currently present, to allow on-line checking of account validity for charges with (presumably) a central file of accounts. System-level integration of this general type was proposed and rejected for BART; data processing is primarily handled at the gate or station level in the current system.

A development effort to combine existing AFC technology with individual account processing as is now found in 24-hour banking terminals would be of interest if

substantial ridership (and/or revenue) gains could be expected from introduction of credit fare payment. There is no strong evidence available to evaluate potential passenger response to such implementation.

An UMTA-sponsored demonstration project encompassing a number of innovations has been in full operation since early 1973 with headquarters in Derby CT--the Valley Transit District. The only method of fare payment possible in that system is by a special credit/identification card issued by application to system subscribers [19]. Other system innovations and demonstration intents included:

- special vehicle design for improved access by elderly and handicapped persosn
- mixed service options including fixed route, dial-a-ride, and "bus rental"
- a finely-zoned fare structure with options for variable fares depending on instantaneous vehicle load in dial-a-ride service and several other features
- special provisions for variable percentages of third-party fare prepayment by social service and health agencies.

Service is currently provided with eight vehicles to a moderately urbanized and rural area including four towns along the Naugatuck River, not far from New Haven. Only the elderly, handicapped, and low income were eligible riders for most available service until late 1975.

Each passenger must insert his or her plastic system credit card into a specially built service recorder, which is similar to an AFC entry-exit gate. The information on the card consists solely of the passenger's signature and a passenger account number, coded as a set of holes much like those in a computer card. A service recorder replaces the farebox on each vehicle, and serves to record service mode, time, zone, and passenger account numbers on a standard magnetic tape cassette. Service mode and zone are entered by the driver through a push-button console; passenger credit cards must be inserted upon both entry and exit to determine trip length.

Cassettes are removed from buses daily to be read and processed by a central computer, which accumulates account balances, produces monthly billings to passengers and third-party agencies, and generates several kinds of operating reports. Because all fare calculation is by computer, a wide variety of charges and allocations of service costs can be made.

Technical problems with the service records have been minimal, relating primarily to component reliability in a difficult environment. Passengers rapidly

learned to use their credit cards with facility. The costs of processing and billing individual accounts are substantial in this pilot system, and some problems of unpaid accounts among persons with limited and fixed incomes were noted by one of the system managers.

Experimentation is continuing in Valley Transit. More conventional fare payment by cash and discounts for prepayment on accounts have been introduced as the system has been opened to general public riders. The option for variable trip cost in dial-a-ride mode depending on the number of passengers riding has been dropped. That feature was intended to encourage informal grouping of trips by neighbors and thereby increase productivity. It proved to be confusing to passengers, who were reluctant to accept different fares for the same point-to-point trip, depending on the number of other unrelated passengers who were using the service concurrently.

While providing an extremely interesting test of bus AFC/credit technology and a European-style fare structure, applicability of results from Valley Transit operations to larger general public systems appears limited. Experience with general public response as well as that of special rider groups will be of much interest as further reports become available.

4. OPERATIONAL ISSUES IN FARE PREPAYMENT: A SURVEY OF U.S. TRANSIT OPERATORS

A major purpose of this research is to document current experience with fare prepayment programs. To do this we went directly to U.S. transit managers and marketing directors, the people who presumably know best what is being done in fare prepayment and how well it works. The approach involved two steps: 1)a very brief postcard mail-back survey including nearly all sizable transit operators listed in two major transit industry directories [1, 9]; and 2) a more selective telephone survey of 146 transit operators, consisting of a detailed list of questions about prepayment. The postcard survey results, with over 59 percent of transit operators responding, provided a fairly good picture of the extent of fare prepayment in the transit industry and served as the basis for selecting a sample of interesting cases for the more detailed telephone interviews.

In the telephone interviews with transit managers and marketing directors our purpose was to determine the extent, variety, and combinations of prepayment plans currently in existence and to develop an understanding of the most useful plans and the techniques for applying them. In the first part of each interview we asked for system-related measures such as population served, daily ridership, and fleet size. Then we asked a series of questions about each of the prepayment plans used in the particular system. Some of these latter questions dealt with the characteristics of the prepayment plan, and others were related to the plan's effect on the system. We found a total of 387 current and 21 historical prepayment plans among the 146 systems interviewed.

Several outputs resulted from these survey efforts. A discussion of the sampling techniques and survey procedures and a tabulation of the postcard responses appear in Appendix A.

Appendix B lists all cities represented in the sample of telephoned transit operators, with a few of the key system variables for each one and a summary of cities with plans of each format. Appendix C presents a tabulation of the responses to the questions we asked in the interviews. In the first part of this section we summarize the incidence of the various prepayment forms and the prevalent combinations in which they seem to occur. We also discuss measures of prepayment effectiveness and indicate the ways in which these measures are used in this study. The remainder of the chapter is devoted to a number of issues in fare prepayment, approached primarily from the viewpoint of the transit manager.

4.1 SUMMARY OF PREPAYMENT PLANS CURRENTLY IN USE

4.1.1 Nationwide Incidence of Prepayment

Approximately 93 percent of U.S. transit systems have some form of prepayment as here defined, and many have two or three forms of prepayment available. As reported in the postcard survey of operators, adjusted to reflect consistent definitions of terms (see Appendix A for details), 48 percent of operators have tickets available, 41 percent have passes of one sort or another, 35 percent have punch cards, 32 percent have permits, and 26 percent have tokens. Note that these percentages sum to well over 100 percent because most operators have a variety of prepayment plans. These percentages represent best overall estimates of prepayment usage in U.S. transit systems.

Table 4-1 summarizes the incidence of the various prepayment types among the operators who were telephoned. Because a primary purpose of this study is to examine innovative uses of prepayment and to assess their potential, the sample chosen for telephone interviews is not representative of the entire industry but reflects our judgement that some operators could provide more useful information than others about effective use of fare prepayment. (The sampling procedure is described in Appendix A, and Table B-2 in Appendix B lists the systems with plans in each category shown in Table 4-1.)

4.1.2 Combinations of Prepayment Types

Twenty-six percent of the interviewed operators who offer prepayment to their patrons limit the offering to a single format (tickets only, passes only, etc). Another 38 percent provide two format choices; 26 percent have combinations of three prepayment formats; and the remaining 9 percent offer four format types. The actual combinations and quantities of each are illustrated in Table 4-2. Table 4-2 does not reflect actual numbers of plans, since a ticket/pass combination, for example, might include two different tickets and three pass plans.

From Table 4-2 one can deduce that punch cards are offered together with passes (and whatever else) in 31 of the 138 cases*, while tickets are offered with passes in 29 cases. These two pairs seem to dominate the set of possible two-way combinations.

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*Add together "Number of Systems" for: [pass, punch card] + [ticket, pass, punch card] + [token, pass, punch card] + [pass, permit, punch card] + [ticket, token, pass, punch card] + [ticket, pass, permit, punch card] + [token, pass, permit, punch card] = 31.

TABLE 4-1. INCIDENCE OF PREPAYMENT FORMATS
AMONG 146 TRANSIT SYSTEMS IN THE TELEPHONE SURVEY

Format	Number of Systems With Each Format	Percentage of Systems With Format
Tickets (combined)	60	41
1-9 Trips	30	
10-19 Trips	30	
More Than 19 Trips	13	
Tokens	44	30
Passes (combined)	76	52
1 Day	15	
2-6 Days	4	
Weekly/Bi-Weekly	10	
Monthly	34	
2-11 Months	15	
Annual	8	
Unlimited	14	
Permits (combined)	54	37
General Use	4	
Senior Citizens and/or Handicapped	44	
Students	16	
Punch Cards (combined)	53	36
1-9 Trips	2	
10-19 Trips	30	
More Than 19 Trips	24	
No Prepayment	8	5

4.1.3 General Public Versus Special Plans

Aside from the general categorization by plan format, prepayment plans may be classified by limitations placed on their use by:

- rider age
- other rider attributes (mobility handicapped, student, employment, or client status, etc.)
- day or time of applicability
- area or service type available.

By far the most common limitation found among plans in the sample was by age; over 40 percent of all plans identified were available only to students (through high school age) and/or senior citizens (or senior citizens and handicapped).

TABLE 4-2. COMBINATIONS OF PREPAYMENT TYPES AMONG 138 SAMPLE SYSTEMS

Combination	Number of Systems	Histogram
ticket	10	XXXXXXXXXX
token	4	XXXX
pass	5	XXXXX
permit	4	XXXX
punch card	6	XXXXXX
stored fare	3	XXX
credit card	1	X
other	3	XXX
ticket, token	6	XXXXXX
ticket, pass	7	XXXXXXX
ticket, permit	5	XXXXX
ticket, punch card	3	XXX
token, pass	7	XXXXXXX
token, permit	3	XXX
token, punch card	5	XXXXX
pass, permit	6	XXXXXX
pass, punch card	11	XXXXXXXXXXX
ticket, token, pass	2	XX
ticket, token, permit	2	XX
ticket, token, punch card	4	XXXX
ticket, token, other	1	X
ticket, pass, permit	9	XXXXXXXXX
ticket, pass, punch card	3	XXX
ticket, permit, punch card	1	X
ticket, pass, permit	3	XXX
ticket, pass, punch card	2	XX
ticket, permit, punch card	1	X
pass, permit, punch card	7	XXXXXXX
permit, punch card, other	1	X
ticket, token, pass, permit	4	XXXX
ticket, token, pass, punch card	1	X
ticket, pass, permit, punch card	3	XXX
ticket, permit, punch card, other	1	X
token, pass, permit, punch card	4	XXXX

Table 4-3 shows the percentage of plans in each format type available only to some special age group.

Most of the permits in the sample were available only to senior citizens, or to senior citizens and the mobility handicapped. These permits are mostly of recent initiation, in response to state and Federal level requirements for reduced fares to these rider classes, as are the 21 percent of all passes which are also available only to senior citizens. An additional 11 plans, or just under 3 percent of all plans in the sample, are available only to the handicapped (and thus are classified as "unlimited" by age in Table 4-3). Plans available

TABLE 4-3. RIDER AGE LIMITATIONS BY PLAN FORMAT

Format	N	Eligible Ages for Plan		
		Unlimited	Students	Sr. Cit. & Handicapped
		Percent		
Tickets or Tokens	133	75	16	9
Passes	114	62	17	21
Permits	65	15	24	61
Punch Cards	73	61	27	11
All Formats*	385	59	19	22

*Includes other plans not separately listed.

only to senior citizens or handicapped or both constitute 25 percent of all prepayment plans in the sample (22 percent from Table 4-3 plus the 3 percent above).

Section 5 of the National Mass Transportation Act of 1974 requires that operators, in order to be eligible for operating subsidies, offer a minimum 50 percent discount to the elderly and the handicapped, at least during off-peak hours. Since some proof of eligibility is usually desired, permits provide a logical format for these rider classes. Unlike permits designed for use by the general public, these special "identification cards" carry only a nominal first-time cost, if any. Beyond this distinction, they function similarly to conventional permits, by allowing the bearer to ride at reduced rates. Of all plans used to provide lower fares to senior citizens and handicapped persons, 60 percent are permits, with passes accounting for an additional 24 percent. Passes so used are either free or are purchased monthly for a reduced amount. Sixteen percent of the transit systems surveyed currently provide free transit to senior citizens, most of them limiting the privilege to off-peak hours.

While Section 5 specifies that reduced fares to senior citizens and handicapped persons must be provided at least during off-peak hours, many operators have chosen not to place limits on the time of day. Sixty-six percent of all prepayment plans for senior citizens and 59 percent for the handicapped have no time restrictions on their use.

One respondent noted that originally an off-peak limitation was imposed in his system, during which time an estimated 30,000 trips per month were made by

senior citizens. When the restriction was removed, the figure rose to an estimated 50,000 trips per month. The operator judged that very few of the aged currently ride during peak hours, even though the sudden ridership increase seems to contradict this judgment.

Prepayment instruments used to provide reduced transit fares for kindergarten through high school students account for a fifth of all plans found, including substantial numbers of plans in all formats. Use of such plans is often the result of a contractual arrangement between a school board and the transit operator. In three-quarters of the student plans the net fare is less than 70 percent of the regular fare.

The freedom given to the students in the use of their reduced fare privileges varies among systems. In 45 percent of the systems with student provisions, validity is limited to weekdays, and in 52 percent the trip must be to or from school.

Aside from prepayment plans used to implement special fares for the elderly and handicapped or kindergarten through high school students, relatively small numbers of plans are available only to other specially defined groups, including college students, employees in special programs, clients of social service agencies, etc. In aggregate, just under 12 percent of all plans are directed at such miscellaneous special groups.

Limitations on plan usage by time, day, area, or particular service generally correspond to user types mentioned above in obvious combinations. That is, reduced-fare plans for senior citizens and handicapped are often limited to off-peak hours, kindergarten through high school student plans may be limited only to school trips on weekdays, etc. Major exceptions to this observation are a handful of weekend promotional fare plans and plans good only on express or commuter services. In aggregate, such additional limitations affect six percent of plans not otherwise restricted to particular population groups.

In summary, then, among 146 systems examined in detail via telephone interviews, 138 have some form of prepayment. Among them, these systems offer 387 current prepayment options and have information on 21 plans that have been discontinued.* Of the total of about 400 plans, 25 percent are limited to senior citizens and/or handicapped, 19 percent are for kindergarten through high school

*No particular pattern is evident in the discontinuations. By types, they were: tickets - 6; tokens - 7; passes - 3; permit - 1; and punch cards - 4. All but two were terminated between 1967 and 1975; our informants were not generally able to discuss events more distant in the past.

students, 12 percent are limited to other special groups, and an additional 6 percent are restricted in time, area, or service type.

Unrestricted plans available to the general public thus comprise 38 percent of the sample, and are shown by format in Table 4-4.

TABLE 4-4. FORMATS OF UNRESTRICTED GENERAL PUBLIC PLANS

Format	No. of Plans
Tickets	38
Tokens	34
Passes	42
Permits	4
Punch Cards	32
Magnetic Storage	3
Credit Card	1
Total	154

4.2 RECENT PREPAYMENT IMPLEMENTATION

4.2.1 Plans Initiated Since 1960

Chapter 3 traced the history of transit fare prepayment by format types, generally indicating the recent growth in its use. Figure 4-1 dramatically illustrates this phenomenon by showing the number of plan implementations by year since 1960 among the 146 systems in the telephone survey sample. Figure 4-1 should be interpreted with care, since start dates were available for only 271 of the 387 current plans in the sample. It is likely that plans with earlier start dates are under-represented in Figure 4-1, but very substantial recent growth would still be indicated over 1973-5, given any reasonable distribution of the 116 plans for which start dates are missing.

4.2.2 Reasons for Plan Implementation

A final, open-ended question on the telephone survey of transit operators asked why each plan was established. Only 40 percent of those asked felt able to reply, and the answers recorded were very difficult to classify fruitfully. The overwhelming majority of answers dealt with one or another aspect of marketing. Aside from responses indicating a generalized desire to increase ridership, provide greater convenience, and improve service, a theme of some interest was an apparent feeling that relatively long-term prepayment such as a monthly pass could serve to "hook" passengers on the system.

Discussions with transit managers and marketing directors indicate that they feel a principal advantage of prepayment is its ability to cause an

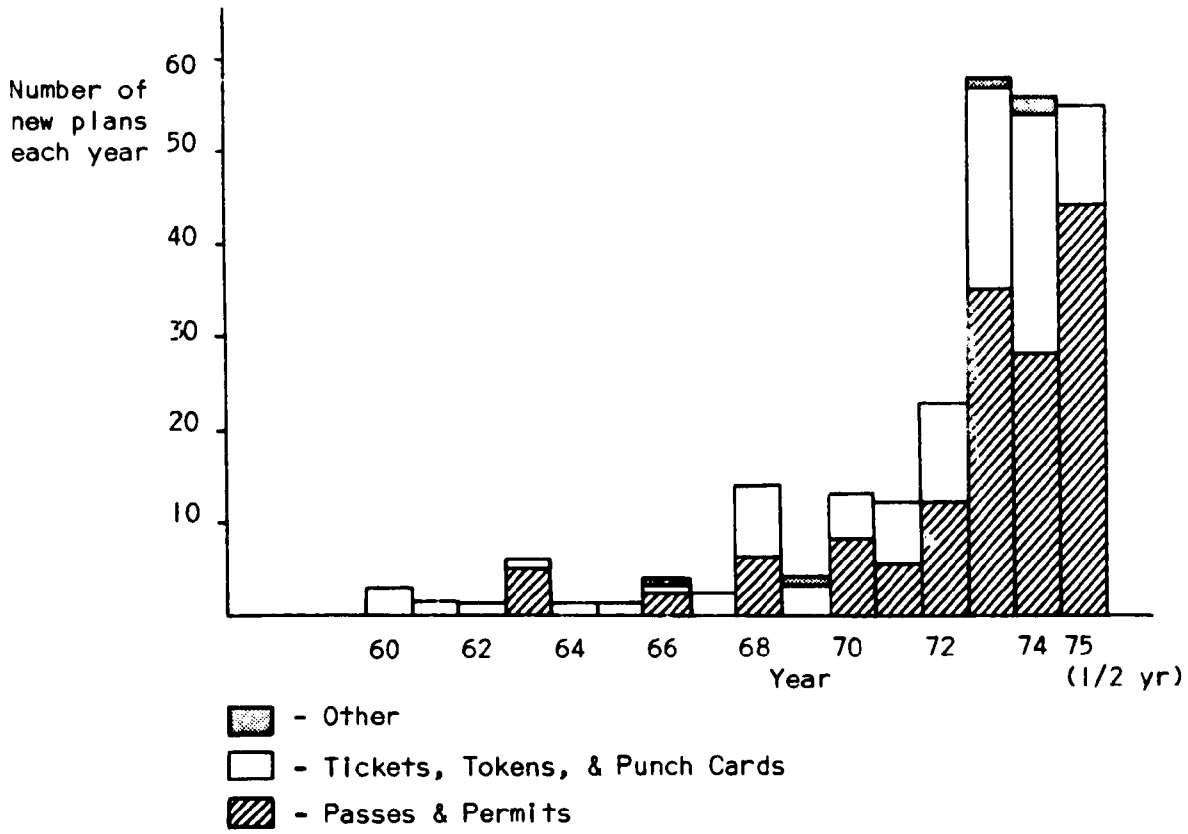

Figure 4-1. New Prepayment Plan Installations Since 1960

individual to use the transit system for more trips than (s)he would have made on a cash fare basis. Passes are assumed to appeal especially to regular riders because these people can predict fairly accurately how many rides they are going to make for some reasonable duration into the future. Once purchased, so the marketing directors tell us, the pass is likely to induce its owner to use it for the sporadic and impulsive trips that were not anticipated when the pass was purchased. This type of trip, because it is usually made outside of peak hours, is easily accommodated by the system. The respondents to the telephone interviews did not give us sufficiently hard data to test this hypothesis, but data from the surveys of permit users in Pittsburgh (Section 5) are some indication of the use of these devices for trips made in addition to commuting trips.

A second way in which prepayment is used to induce unexpected trips is in attracting new passengers to the system. The marketing directors generally feel

that a nonuser of transit will be more inclined to consider transit as a real transportation option if (s)he is familiar with the transit system and how to use it. Among all the devices used by marketing personnel to inform the potential rider about the system, free or reduced price tickets or other prepayment forms can sometimes provide the extra initial push that is needed to get the person on the bus. Once on board, of course, the new rider can experience the supposed joys of transit riding first-hand. Several transit personnel told us of programs to supply newly-arrived residents to the city with such promotional fare prepayment instruments.

Chapel Hill NC has a unique arrangement that provides incentives for automobile users to use transit. The University of North Carolina includes a free bus pass with every campus parking permit. Relatively heavy use of those particular passes on the system has been observed. The same idea may have potential in municipal systems that manage both parking and transit. More details of the program in Chapel Hill are discussed in Section 5.

Another incentive program that may have potential, but that we have not observed in practice, is based on the introductory offer concept used notably in magazine subscriptions sales. The service is provided at a reduced rate for some introductory period and then raised to the normal rate after the customer is in the habit of using the service. The concept would work best with individualized prepayment instruments whose sales can be monitored closely and tracked to the purchaser, such as renewable monthly or annual passes. As an example, the first three months of use of the pass would be at half price and thereafter at the full pass price. A more gradual price increase might also be tried. Such a plan would obviously be subject to some abuse, but the overall effect might be quite positive, as it is with magazine subscriptions.

Besides the desire to increase ridership with prepayment tied to marketing schemes, transit operators gave several other reasons for implementing prepayment programs. These included providing some special fare mechanism for a new service element and meeting reduced-fare requirements for elderly and handicapped. Cost reduction was given as a reason only in the case of magnetic stored-fare AFC implementation.

Introduction of exact fare policies has historically sparked prepayment implementation to offset the inconvenience of carrying exact change, but the presence or absence of an exact fare requirement does not currently seem to affect the number of prepayment plans offered in a system. Of the 146 transit

operators surveyed, 69 percent now require exact change for cash fares, with the rest allowing drivers to make change for passengers. To test for a relationship between exact fare policies and incidence of prepayment plans, we computed the average numbers of plans in systems with and without exact fare. The exact fare systems had an average 2.92 plans per system, while systems which provide for change-making had 2.91 plans per system.

However, systems with and without exact fare differ in the frequency with which they discount tickets, tokens, or punch cards they may offer. (Note that a precise discount level can only be identified for such instruments, good for a fixed number of rides). Exact fare systems offer such plans at some discount in 60 percent of cases, whereas systems which still make change provide some discount for 83 percent of such plans. Thus exact fare systems have proportionally more plans which are simple cash replacements.

4.3 GENERAL MEASURES OF PREPAYMENT EFFECTIVENESS

4.3.1 Available Data

The following questions in the telephone survey of transit system personnel were asked in an attempt to assess the effectiveness of each prepayment plan and the costs of administering it:

P23. Do you feel that total system ridership was affected by the implementation of this plan? [don't know; decreased; no change; increased]

P24. Is there data available that would support your estimate of ridership change? [no; yes]

P25. Do you feel that there was a change in system operating revenue as a result of this plan? [don't know; decreased; no change; increased]

P26. Is there data available that would support your estimate of revenue change? [no; yes]

P27. How did this plan affect management's total administrative costs of fare collection? [no information; decreased; no change; increased; initial increases followed by a decrease]

P28. Was staff added to administer the program? [no; one or two; three to five; more than 5]

P29. Has the plan generated noticeable savings in the cost of coin handling and counting? [no; yes]

P30. (Pass or permit plans only:) Do you have an estimate of how many persons are (pass/permit) holders at any given time? [actual number]

P31. What percentage of boarding passengers use a (pass, permit, ticket...) to board? [under 10%; 11-20%, 20-40%; more than 40%; don't know].

Tabulations of responses to these questions are presented in Appendix C.

It is evident from an examination of the response categories above that the precision of the data is relatively low. In questions P23 and P25, for example, we reduce the answer to one of three choices. Furthermore, the meaningfulness of these choices is limited by the lack of quantitative information that might be associated with a change in either direction. In other words, if our respondent said that his/her system's ridership increased as a result of a given prepayment plan, we do not know whether that change was one percent or one-hundred percent. But a further refinement of the response categories would probably not have been useful. In roughly a quarter of all cases the respondents did not know whether there existed any effects of an individual prepayment plan on ridership and revenue, let alone the quantity of such effects. We can use questions P24 and P26 to judge the quality of the data from questions P23 and P25 respectively. Only 12 percent of respondents had data that would support their answers to the question on ridership change, and only 10 percent of respondents had data that would support their answers to the question on revenue change.

The quality of the data on administrative costs of prepayment is really no better than it is on ridership and revenue changes. Again, response categories are very limited and the information available to the respondents on these questions (P27, P28 and P29) was generally limited.

Question P30 applies only to pass and permit plans, but it asks for data that many transit operators are likely to have. The question asks actual number of pass or permit holders at any given time, which for a monthly pass, for example, is simply the average number of passes sold per month.

Question P31 produces a measure we have called "penetration", which is the respondent's estimate of the percentage of all daily passengers who board using a given prepayment type. The answers to this question were generally more subjective than the answers to question P30, but many operators keep records of this data or have done periodic studies that give them a fairly good idea, within the ranges of our response categories, of the correct percentages for their various payment methods.

Other than carefully studied AFC implementation, transit system implementation of prepayment has seldom proceeded with explicit prior statement of quantified objectives and a program of measurement and evaluation of program impacts.* The

*Several exceptions have been larger systems such as the MBTA (Boston), which have acted on specific consultant recommendations and attempted to monitor results.

general attitude has been to "try it and see what happens". This is a rational approach for interventions or innovations which are relatively easy and inexpensive to put in place or remove, which class includes almost all prepayment mechanisms studied here.

Most transit operators have used an implicit minimum criteron of success or effectiveness for their prepayment programs. Stated simply, it is:

> The program should increase ridership while not decreasing revenue and not significantly increasing costs.

Obviously, a preferred criterion would be to increase ridership and revenue while decreasing costs. In the case of reduced fare programs mandated by grant or other subsidy sources, the operator may have no criterion of effectiveness except to comply with regulations at minimum cost.

In any case, a program will be implicitly judged ineffective if it does not achieve some minimum level of participation or "penetration". That threshold level appears to be very low, since 42 percent of the sample programs were reported to be used by fewer than 10 percent of boarding passengers, and operators could not judge the penetration level of another 20 percent of programs. It is likely that operators would be aware of the usage level of high-penetration programs in their system, so most of the "don't know" responses probably refer to programs with less than 10 percent penetration.

4.3.2 Ridership and Revenue Changes

For the roughly 400 plans of all types offered among the 146 sample systems, 45 percent were thought to have caused increases in ridership, none were thought to have caused decreases, and for the remainder, the respondent said either there was no change (33 percent) or (s)he could not judge the effect (22 percent). The responses for revenue effects were slightly different. Of the same plans, 26 percent were thought to cause revenue increases, 9 percent were thought to cause decreases, and for the remainder the respondent either saw no effect (39 percent) or said (s)he did not know whether there was any (25 percent).

Despite our low confidence in the accuracy of these numbers in indicating the very-hard-to-measure effects of prepayment, the responses can be viewed as votes cast by transit managers for or against prepayment. Viewed in that framework the popularity of prepayment among transit operators seems to be reasonably high.

Table 4-5 shows operator responses to same questions by type of prepayment plan. Passes and permits were reported to be above average in increasing ridership,

and passes also were reported to increase revenue more frequently than average.

TABLE 4-5. REPORTED RIDERSHIP AND REVENUE EFFECTS FOR ALL SURVEYED PLANS

Prepayment Format	N	Ridership Change Percent ?	-	N/C	+	Revenue Change Percent ?	-	N/C	+
Tickets	79	17	0	44	39	20	8	53	19
Tokens	54	25	0	45	30	25	6	47	23
Passes	114	18	0	24	57	22	13	29	36
Permits	65	17	0	29	54	30	17	35	18
Punch Cards	73	36	0	27	37	33	1	36	30
All Formats*	385	22	0	33	45	25	9	39	26

*Includes other plans not separately listed.

(Table entry is percentage of plans in each format reported to have listed effect. Percentages sum by rows. Row totals may not equal exactly 100% because of rounding. "N"=number of plans; "?"=effect not known; "-"=decrease; "N/C"=no change; "+"=increase.)

System operators are obviously biased observers of program effects in their own systems. It is plausible that some or many of our respondents reported that prepayment plans in their systems caused an increase in ridership simply becuase general system ridership has recently increased. To test for the presence of this effect, we compared the recent total system ridership trend, as reported elsewhere in the telephone survey, with the reported effects of plans in that system. No significant relationship existed.

Table 4-5 shows the reported performance of all sample plans, of which a majority are restricted to special users. Ridership and revenue changes attributed to unrestricted plans available to the general public are shown separately in Table 4-6 in the same format as Table 4-5.

Passes remain the prepayment format most frequently reported to result in increased ridership and revenue; punch cards show similar results; and too few permits remain in the sample to be indicative.

TABLE 4-6. REPORTED RIDERSHIP AND REVENUE EFFECTS FOR UNRESTRICTED GENERAL PUBLIC PLANS

Prepayment Format	N	Ridership Change Percent ?	-	N/C	+	Revenue Change Percent ?	-	N/C	+
Tickets	38	16	0	37	47	24	11	45	21
Tokens	34	32	0	44	24	32	3	47	18
Passes	42	21	0	24	55	27	2	27	44
Permits	4	0	0	50	50	0	0	50	50
Punch Cards	32	37	0	19	44	25	0	34	41
All Formats*	154	27	0	30	43	28	4	38	31

*Includes other plans not separately listed.

The contrast in reported effects between all plans and general public plans is greatest in the case of passes. Elimination from the sample of the free or highly discounted passes (used primarily for senior citizens and handicapped) nearly eliminates reported instances of decreased revenues, while retaining the reported frequency of increased ridership.

In summary, the rough, qualitative judgment of transit operators is apparently that prepayment plans in general increase ridership more often than not, and probably never decrease ridership. They further report that plans in general most often have no observable effect on revenue, but that revenue increases, where they occur, outnumber decreases by three to one.

Transit operators report that single-ride instruments (tickets and tokens) most often cause no change in either ridership or revenue. Passes are thought most often to increase both ridership and revenue, especially when highly discounted or free passes for special groups are eliminated from consideration. Permits are almost exclusively used to allow large discounts to special groups; in such use transit operators say they mostly increase ridership but increase and decrease revenues with about equal frequency. Punch cards generally increase ridership and revenue, but less frequently than passes, according to the operators.

There are examples in most classes of prepayment of systems and plans with substantial ridership and revenue effects; many of them are discussed individually elsewhere in this report. Taken in general, however, a majority

of prepayment plans are reported either to have no effect or unknown effects on ridership and revenue. The only exceptions to this pattern are permits used for special rider groups and passes, for which slight majorities are reported to increase ridership. As would be expected from the presence of discounting in at least some plans of all types, ridership increases are always reported more frequently than revenue increases.

4.3.3 Penetration and Passholders

Twenty-one percent of all plans were reported to be used by more than twenty percent of boarding passengers in the systems where they occur. No format dominates those comparatively high-penetration plans which are available to the general public; tickets, tokens, passes, and punch cards are all represented about equally in that group.

The percentage of boarding passengers using a particular form of prepayment seldom exceeds 50 percent system-wide. Exceptions are systems requiring prepayment for entry or special situations such as extremely low-priced, long-term passes in Westport CT and several college towns (Chapel Hill NC; Charlottesville VA; Davis CA; Kent OH and Lawrence KS). Special services such as commuter expresses, park and ride, and work or school subscription runs frequently have high prepayment percentages as a result of operating policy or special fares. As discussed further in Section 5, such services are an important market segment for prepayment because of the nature of both the riders and trips served. They are recognized as such by most operators.

Among passes available to the general public, the highest penetrations in absolute terms are found in the shorter-term day and week passes--approximately 40 percent of system ridership in each of Sacramento CA (day); Milwaukee WI (week), and Richmond VA (week). Other short-term passes have much lower penetration levels, however. No monthly or longer-term passes were found that are used by such high percentages of system riders (again, except for Westport and several college towns noted above).

It is tempting to ascribe this difference to the higher first cost of longer-term passes, but not necessarily accurate, since most of the latter are very recently initiated, are increasing in sales, and probably have not yet reached their full potential. In the handful of cases where day or week passes compete with month passes in the same system and data is available (St. Petersburg FL; Sacramento CA; Tulsa OK) the shorter-term passes outsell the longer ones by large margins. The relative sales of weekly ($2.60) and monthly ($10.00)

permits in Pittsburgh is instructive, however; monthly permits outsell the weeklies by better than two to one.

Systems with monthly general public passes accounting for somewhat more than 20 percent of ridership* include Los Angeles (SCRTD); Portland ME; Ann Arbor MI; and Portland OR. The first two are the oldest general monthly pass programs found, both having been started in 1968. Most other such plans were reported to be used by 5-15 percent of riders, and mostly were in their first year of operation.

Except for students (kindergarten through college), plans of all types which are targeted at special rider groups generally are used by low percentages of system ridership, almost by definition.

Distinct from measures comparing prepayment use with general system ridership are the measures that express the number of prepayment users as a fraction of the service area population. Pass- or permit-holders per capita for monthly general public plans vary widely, from a low of about 0.7 passholders/1000 service area population in some newly started plans to a high of about 11.5 passholders/1000 population in a few well-received monthly pass plans. A rough average of monthly passholders per capita in older plans is 9.2 per 1000 service area population, or about one percent.

Pass-holders per capita for weekly general public plans vary similarly, with Richmond VA and Milwaukee WI at the top of the range with 54 and 24 holders per 1000 population, respectively. Annual plans have sales a factor of 1/10th of monthly plans, except for the Westport CT, annual pass (priced at $25), which has 227 pass-holders per 1000 population.

4.3.4 Administrative Costs of Prepayment

Administrative costs resulting from the use of fare prepayment seldom appear to be significant. The vast majority of transit operators reported that prepayment brought no important change in their cost of operation; 23 percent of all prepayment plans were reported to have contributed to higher administrative costs; and ten operators reported overall administrative costs were lowered with the introduction of specific prepayment plans.

Among the operators reporting higher administrative costs, tickets and passes were most frequently cited as the plans bringing about the increases. The bulk of the added costs, they noted, lie in printing, distribution, and record-keeping. Systems that number their tickets tended to incur highest

*In total among available plans. SCRTD has three major plans which collectively but not individually account for over 20 percent of riders.

costs. In an effort to reduce costs, one private operator has printed an advertisement for a local bank on his punch cards. The bank pays the entire printing bill for the cards.

Twenty operators reported the need for additional staff in connection with fare prepayment. Most of these increases involved a single person, although five systems each required more than five additional staff members. Most operators indicated that they were able to spread any additional administrative tasks among existing personnel.

Of the seven transit systems reporting a decrease in administrative costs due to implementation of prepayment, five had established long-term passes. Two of these were annual; two were valid for a school year; and one was a permanent pass for senior citizens. Four of the five plans were reported to be used by more than half of each system's total riders. In these systems reduced coin handling has reportedly resulted in significant savings.

In all, 20 systems with 32 plans reported noticeable savings in coin handling. About half of those systems had at least one plan with greater than 20 percent penetration. Permits, which require a cash drop, and tokens, due to their similarity to coins, seldom offer savings in coin handling. Almost half of the systems reporting a savings in coin handling also indicated increases in net revenue due to the prepayment.

Prepayment plans with weekly or monthly expirations are associated with increases in administrative costs somewhat more frequently than are other plans. Plans involving prepayment for a single day have a surprisingly low incidence of extra cost, probably due to a more numerous incidence of on-board sales.

The underlying message of the interviews was that relatively few operators are fully aware of administrative costs relating to their prepayment plans. For nearly 75 percent of prepayment plans, the survey respondents indicated either that there had been no change in such costs or that they did not have enough information to make a judgement. Costs of distribution to sales outlets are usually spread over several plans, and accounting is embedded in the entire coin-counting and revenue-recording procedure.

Given the generally low percentages of riders using most prepayment plans, it is hardly surprising that neither added costs in printing, distribution, or staff time nor cost savings from reduced coin handling are

noted frequently. Large systems with aggressive plans have usually added staff in the marketing department to plan and publicize passes, etc. and increased the tasks assigned to existing counter sales and information personnel.

One potential benefit to the transit operator in extensively used longer-term prepayment is the effective interest earned by having fares paid in advance of the expenses incurred to provide service. Monthly, semester, and annual passes are sometimes mentioned as highly beneficial to an operator's cash flow picture as a result of this. Tickets, tokens, and punch cards also contribute in that a population of such instruments is built up among riders, representing a perpetually renewed loan from users to the sysrem.

In addition, there is some loss rate among tickets, tokens, or punch cards held by the public, through which some fraction of the value sold in these formats never is redeemed for rides. The effective fare paid with such instruments is thus slightly greater than the nominal value as sold, partially offsetting discounts, sales commissions, and other costs of production and distribution.

No reliable data is available to evaluate the magnitude of these effects, but sample calculations on reasonable assumptions indicate that the combined effect of effective interest and excess income from never-redeemed tickets, etc. is almost certainly very small (0.25 percent) in proportion to total system revenues, but of the same order of magnitude as printing and distribution costs for the prepayment instruments used.

4.4 DISTRIBUTION MECHANISMS

Like any other commodity or service, transit prepayment is likely to be used more when it is more readily available. Conveniently located distribution points are therefore important if substantial usage of prepayment is to be expected. Possible locations for distribution include sales on board the transit vehicle; through the mail; at the user's place of employment, school, or frequented social welfare agency; and at sales counters throughout the service area.

4.4.1 Counter and On-Board Sales

Sales counters are often found at the transit office, banks, city offices, and department stores. Banks constitute the most frequently used outlet other than transit offices themselves. Typically banks do not credit the transit operator's account with revenue collected through sales of

transit prepayment until the end of the month. Along with the traffic generated into the bank, the interest earned on the money serves as an incentive for the bank to participate. Department stores and other vendors often receive a commission (usually 2 percent) for selling tickets and other forms of prepayment.

Thirty-eight percent of all prepayment plans are available at more thar five counter locations (some at more than a hundred), 14 percent are available at two to five locations, 28 percent can be purchased at one location only (typically the transit office); and 15 percent are not sold over-the-counter. (The last group are generally provided by a third party, such as an agency, school, or employer).

Among all types of prepayment plans, tokens, punch cards, and passes have the widest distribution, with over forty percent being offered at more than five locations. Permits are usually available at a single location, such as a school or social agency. This reflects the predominant use of permits as a means of obtaining lower fares for designated classes of riders.

The number of sales locations per capita varies considerably among the systems surveyed. There is a tendency, however, for large systems to have fewer locations per capita (approximately 6,000 to 8,000 persons per outlet) than medium sized systems (4,000 to 5,000 persons per outlet). Smaller systems commonly sell prepayment only at their own offices.

The larger numbers of current and potential riders per outlet in larger systems does not necessarily point to inadequate distribution, however. More important is the concentration of activity centers, particularly work places. Many systems with well received prepayment plans have numerous sales locations in the downtown area and relatively few on the periphery of the service area.

Only 19 percent of all prepayment plans are sold on vehicles. The survey of transit operators has shown that in systems with exact fare policies, on-board sales are seldom offered, usually for reasons of driver safety. In fact only 15 percent of all such systems offer some form of on-board sales, compared with 37 percent in systems where change is made.

Tickets and punch cards are available on the bus more frequently than other forms of prepayment.* Only two systems offer on-board sales of permits (neither system has exact fare restrictions). Since most permits are used

*One private operator provides an incentive for his drivers to sell ticket books: for every 10 books sold, the driver is entitled to a free hamburger at a local fast food restaurant.

by special groups of riders who obtain them through social agencies and/or schools, infrequent on-board permit sales are to be expected. Seventy percent of all token plans offered in systems without exact fare policies are sold on board, far in excess of the 37 percent average for all types of plans in such systems.

Roughly two-thirds of plans were reported to have sales of prepayment instruments by mail, (although in many smaller systems the response to our question about sales by mail was answered roughly, "Well, I guess so, but we hardly ever..."). Several operators had mail-in application forms for passes, punch cards, etc. available on vehicles. Renewals of monthly passes are sometimes available by mail.

Use of vending machines was reported only in systems with magnetic stripe stored-fare or stored-value cards, but token vendors are also used in some rail rapid systems, and in banks which distribute tokens in Chicago.

4.4.2 Credit Sales

Only one system surveyed has an explicit system-sponsored credit payment plan (Valley Transit District, Derby CT--discussed in Section 3). Six operators offering passes or permits of two week or longer terms accept major credit cards as a means of payment. Others have considered but rejected payment by general credit cards, because of the fee charged the seller with such plans (typically 5 percent); one operator with sales outlets at banks suggested use of a cash advance from the bank's card as a means of paying cash for a transit pass. Monthly pass renewals by mail are an implicit form of credit in some systems in which the passholder is billed monthly for renewal, with the interval allowed for payment including part of the month billed for.

4.4.3 Third Party Payment and Payroll Deduction

Slightly over a third of all surveyed plans are purchased from the transit operator by some organization (third party) and then distributed to special classes of riders, usually resulting in free transit service for the rider. A wide variety of third party organizations use this mechanism including:

- Employers (8.6 percent of all plans*) who resell some prepayment instrument to their employees, either over a counter or through payroll deduction, with or without a discount. Sometimes a free employee benefit.

*Percentages sum to more than total incidence of third party payment because several plans are used by more than one third party.

- Schools (8.8 percent of plans) who provide free or discounted transit service to students. These include public schools, parochial, special education, and college programs.
- Social service agencies (12.5 percent of plans) who provide clients with free or discounted fares.
- Stores (4.4 percent of plans) who give shoppers free tickets or tokens.
- Others such as hospitals, draft induction centers, state and other government subsidy programs for various groups, etc. (As an example, a condominium complex in Kalamazoo MI distributes tokens to residents as a marketing tool.)

Of the plans available through third parties, about 25 percent each are tickets, passes, and tokens. Punch cards comprise 20 percent, and permits account for 6 percent of all such payment plans. Stores generally purchase single trip formats for their shoppers, with tickets and tokens used about equally. Passes are popular with social welfare agencies, closely followed by tickets. Employers appear to favor punch cards as the method of third party payment.

About 40 percent of the plans distributed by third parties (15 percent of all plans) are available no other way, and typically have been created as a result of third party requests to the transit operator to develop some prepayment mechanism that meets their needs. The remainder of plans paid for and distributed this way are sold in any case by the transit operator and are adopted for use by third parties as well.

Eleven plans offered by nine systems* are available through payroll deduction among the systems surveyed by telephone. Formats used include passes, punch cards, tickets, and one permit. Transit prepayment at a worker's employment location, either through counter sales, payroll deduction, or with employer subsidy, is a major area for transit marketing activity. Section 5 explores employee responses to two plans of this general type. The Urban Mass Transportation Administration is sponsoring a detailed examination of the monthly renewal Prepaid Pass program in Boston, which is available only to employees of participating companies, and only by payroll deduction.

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*Los Angeles (SCRTD); Orange County Transit District; Boston (MBTA); Portland OR (Tri-Met); Pittsburgh (PAT); Springfield IL; San Antonio TX; Charlottesville VA; Charleston WV.

4.4.4 Security Safeguards

About half of all plans found are freely transferable from user to user and therefore treated as negotiable instruments; the remaining half are at least theoretically limited to a particular user, or in some cases a family or household.

Table 2-I in Section 2 of this report lists security mechanisms commonly used for each prepayment format. The means available for tickets, tokens, and punch cards are well known and traditional. Some long-term or unlimited passes and permits are produced in the same fashion as many driver's licenses, with a photograph of the eligible user laminated into the pass. Such instruments are relatively expensive to produce initially, costing approximately 15 cents each in materials, and are kept permanently by the user. Many systems charge a small one-time fee to issue such instruments. Renewal (if required) in such cases is by purchase of a color-coded validation sticker or similar device.

The MBTA Prepaid Pass is a permanent card, coded by sex of holder and numbered, which is assumed to be renewed monthly. Except in "extraordinary circumstances", employees who withdraw from the program may not rejoin for six months. The MBTA is studying further security issues and retains the right to replace all passes in the system with a new color or design at any time. Retrieval of passes upon withdrawal from the program or general change of passes is the responsibility of the distributing employer.

Such quasi-permanent instruments, limited to a particular person, are subject to various limitations or charges for replacement in case of loss. The Ann Arbor (MI) Transportation Authority, for example, routinely makes two photo identification passes at time of first issue, retaining one on file for possible replacement, and charges $1.00 to replace a lost pass. Other systems charge substantial penalties, ranging up to $15.00, for replacement. Boston will replace a pass free after a ten-day waiting period, only when the loser appears in person at one of two transit offices, and no more frequently than once a year. Other monthly pass instruments are replaced each month, coded for month of validity by color or otherwise, with no provision for replacement in case of loss.

Enforcement of limitations by person, time of use or trip, etc. was noted by many operators as problematic. Many volunteered that such limitations are simply not generally or effectively enforced. A novel free-ride, unlimited term pass for senior citizens and low income persons in Tuscon AZ includes a magnetic code which is used to trigger a counter by insertion upon boarding.

Few operators indicated substantial concern about fraud and pass misuse, although one monthly pass program was reportedly terminated in part because an area bar rented out passes by the day to its customers. Problems with school children who hand passes out rear windows of buses to friends waiting outside have been endemic since at least the 1930's. Many operators use tickets, punch cards, or permits for school use in part because of that problem with any unlimited-use instrument.

4.5 PRICING ISSUES AND EFFECTS

4.5.1 Pricing Policies

Most prepayment plans found in the telephone sample are offered at an actual or potential discount in comparison to payment for transit rides by straight cash fare. The practice of discounting is generally motivated by one or more of the following:

- a social policy judgment that some groups deserve a lower fare than the general rider (elderly, students, handicapped, low income, etc.),
- a general feeling that a discount is appropriate for bulk purchase of any good, presumably because lower handling costs accrue to the seller in bulk sales and should at least in part be passed on to the consumer,
- a marketing judgment that both discount and convenience aspects of prepayment will encourage additional patronage by introducing previously reluctant potential users to the service, and by inducing additional trips by current users, in a way which is cost-effective to the transit system viewed alone,
- a public policy judgment that providing lower cost (to the rider) public transit is a desired and effective way to achieve some other end or avoid some other cost in a larger framework than the transit system, even at the cost of a higher subsidy to the transit system.

The first motivation is responsible in the main for a slight majority (56 percent) of all prepayment plans found. Pricing for these plans is fundamentally a matter of policy, considering cross-subsidization among groups of citizens, alternative means of achieving the social goals implicit in these programs, and other such issues. A class of riders which has historically been offered discounts as a matter of local or transit operator policy is school children. In our opinion, this policy deserves more explicit debate and consideration

than it has generally received; such detailed consideration has recently been given to discounts for the elderly and handicapped at the national and state levels.

The second motivation is potentially susceptible to a detailed accounting of the costs and cost savings of particular plans in particular systems, with the level of discount contingent upon the results of such analysis.

In general, however, there is only marginal and conditional justification for "bulk discounts" in transit riding on this narrow basis, because any prepayment adds to the total number of transactions involved in collecting revenue, given that payment or checking is involved each time the service is used. If a single major transaction sufficiently simplifies or shortens subsequent transactions, savings can be realized, as in the case of a long-term pass. If, as is commonly the case with tickets, tokens, permits, and sometimes punch cards, the initial transaction does not simplify subsequent ones and may sometimes complicate them, there is generally an additional cost rather than cost savings to be expected.

In most cases the additional cost is probably not especially large, as indicated in Section 4.3.4 above. At a minimum, few operators perceive it to be significant, and some see cost savings.

The third motivation--marketing--is by far the most commonly quoted reason for general public initiation, and is the major focus of this report. Aside from the general discussion in Section 4.3.2 above, detail issues such as differential effects for various discount levels, pass or permit duration, and actual pass usage compared to pricing are discussed below.

Heavily discounted* prepayment for the general public is a service element in some systems which are designed to make a significant impact. It is an extreme case of marketing, responsive to the fourth motivation above. Where it exists--in several college towns and the affluent suburban community of Westport CT--it appears to be an effective part of a strategy to maximize ridership, accepting a high subsidy cost. As in plans developed to allow discounts to special rider groups, pricing in such systems is determined more by policy than by consideration of marginal cost-effectiveness.

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*In some cases found, it is a heavy potential discount rather than an explicit discount, i.e., very low price long-term passes.

4.5.2 Explicit Discounting

Discounts are offered on about 70 percent of prepayment plans where a fixed number of rides is purchased (multiple-ride plans), and on 60 percent of multiple-ride plans available to the general public. Of all multiple-ride plans, about a quarter are discounted more than 30 percent below cash fare and an additional 9 percent are free. Most of these heavily discounted or free plans are not available to the general public; only ten unrestricted plans were found with discount levels greater than 30 percent or free.

Tickets, tokens, and punch cards differ slightly in the frequency with which they are discounted: 65 percent of tickets, 61 percent of tokens, and 79 percent of punch cards showed some level of discount. The single discount observed most frequently is 50 percent, a consequence of state and Federal half-fare requirements. Plans are about equally spread among other discount levels, including some as high as 80 percent to special groups and some that are free.

The ridership and revenue effects reported by operators varied far less with discount level than might be expected. Table 4-7 shows the ridership and revenue effects attributed to multiple-ride plans by surveyed operators. Note that entries in Table 4-7 are not percentage changes in ridership or revenue.

TABLE 4-7. RIDERSHIP AND REVENUE EFFECTS BY DISCOUNT LEVEL FOR TICKETS, TOKENS, AND PUNCH CARDS

Discount Level (percent)	Ridership Change					Revenue Change			
		Percent				Percent			
	N	?	-	N/C	+	?	-	N/C	+
None	61	20	0	49	31	23	5	61	11
1-15	39	38	0	21	41	41	0	28	31
16-30	33	27	0	33	40	21	6	43	30
31-50	34	21	0	38	41	26	6	41	27
Over 50	11	18	0	36	46	18	18	27	37
Free-100	18	28	0	50	22	17	5	56	22

(Table entry is percentage of plans at each discount level reported to have listed effect. Percentages sum by rows. "N"=number of plans; "?"=effect not known; "-"=decrease; "N/C"=no change; "+"=increase.)

Examination of Table 4-7 shows that the reported effects of non-discounted plans are paradoxical: 31 percent were said to increase ridership (at no discount), but only 11 percent to increase revenue. Further, no plans were said to decrease ridership, but 5 percent were indicated to decrease revenue. Interpretation must be very cautious in the light of these inconsistencies.

At the low discount level (1-15 percent) where 31 of the 39 plans listed are available to the general public, about 40 percent of plans had unknown effects, 41 percent were reported to increase ridership, 31 percent to increase revenue, and none to decrease revenue.

Only one general public plan was observed in the highest discount category short of free (over 50 percent). Eighteen percent of all such plans had unknown effects; about half were thought to increase ridership; and twice as many (37 percent) were thought to increase revenue as were thought to decrease revenue (18 percent).

Reported effects of free plans were also apparently paradoxical. Twenty-two percent of such plans were said to have <u>increased</u> revenue. Perhaps these plans were judged to increase paying ridership on one leg of a round trip, the other leg of which was free, but that is only speculation.

In general, the ridership and revenue effects reported for discounted plans support the assertion that discounts at all levels can generate marginal additional ridership to a level that maintains or increases revenue. There is no indication that higher discount levels increase ridership more frequently than lower levels. Note, however, that we have no information on the <u>amounts</u> of ridership increases, only whether or not some increase was observed.

In those cases where ridership increases are reported with no change or an increase in revenues, this implies that the loss in revenue caused by giving discounts for trips that would have been made anyway is balanced or overcome by a larger number of new marginal trips induced by the discount. (We have no way to distinguish, from the survey of operators, the relative contributions of additional trips made by old users versus trips made by new users). Not surprisingly, plans with higher discounts were reported to show revenue decreases more often than plans with lower discounts.

4.5.3 <u>Potential Discounts: Pass Duration and Usage</u>

The effective discount, if any, provided by a pass depends on the frequency of its use. Most permits in current use--those directed at special rider groups--do provide a specified percentage discount level, sometimes with various restrictions on time of use, etc. That class of permits is generally provided

free or at nominal cost to the user, merely serving as a qualification method for some lower cash fare. The effects of such discounting via permit are not distinguishable from the effects of explicit discounts in multiple-ride instruments discussed above.

Of more interest are permits which are sold at substantial cost to the general public and used to cover some specified cash value (rather than percentage) of the normal fare for each trip. Most passes in general use actually are used as permits for some potential trips on the offering system, such as extremely long trips, special express services, or trips in or out of political jurisdictions that have restrictive agreements with a transit operator requiring exact revenue accounting. In those cases, the passenger must pay some additional cash surcharge as well as showing the pass.

Most monthly passes and permits of the latter type are priced at or slightly below the equivalent of 40 rides per month at the cash fare covered by the pass or permit. Many also eliminate transfer charges if any exist. A commuter riding exactly twice a day, five days a week would ride an average of 43.3 times a month, and would thus receive an 8 percent effective discount with a pass priced at 40 rides, and more if the commutation trip would have required a transfer charge. Most commuters, however, have vacations, holidays, and other days off for illness, etc. For a two-week vacation, ten holidays, and five sick days per year, the average number of commutation trips per month drops to 39.2. However, a rider may elect not to buy a pass for a month in which his or her vacation falls, resulting in an average number of trips in non-vacation months of approximately 40.8. Unless a pass is also used for non-commuting trips, the effective discount is thus likely to be very small.

In general, studies of actual monthly pass usage and the resultant effective discount are rare, but fragmentary evidence from the 1964 St. Louis study discussed in Section 3 above [27] and two recent studies in Portland ME and Kingston PA suggest that: (a) pass holders on the average may ride substantially more frequently than 40 times per month, and (b) that when system passes are honored on services with a higher-than-normal cash fare, they are much more frequently used on those services than elsewhere.

Weekly passes are priced over a wider range of equivalent cash fares, but most commonly at the equivalent of ten rides. An interesting contrast exists between Milwaukee and Cleveland in the pricing and usage of otherwise equivalent weekly passes. Table 4-8 compares the two systems and their prepayment plans. (The fare structure shown for Cleveland is that in effect at the time of our survey. It was dramatically changed in October 1975,

TABLE 4-8. WEEKLY PASSES: MILWAUKEE VERSUS CLEVELAND, SEPTEMBER 1975

Features	Milwaukee	Cleveland
Urban area population	1,252,457	1,959,880
Service area population	1,000,000	1,750,000
Transit system vehicles	523	1,154
Daily transit trips	150,000	272,000*
Transit trips/vehicle/day	287	236
Transit trips/capita/day (service area population	0.150	0.155
Base fare	50¢	50¢
Zones	Yes	Yes
Prepayment available to general rider	Tickets (no discount Weekly pass	Tickets (no discount Weekly pass
Prepayment distribution	Many locations, Commission Sales	Many locations, Commission Sales
Weekly pass price	$5.00=10 base fares	$7.75=15.5 base fares
Surcharge above pass for express service	10¢	10¢
Pass plan started	1930	1932
Pass sales/week	24,000	3,000
Pass sales/week/1000 capita	24	1.7
Pass penetration	40%	3% (est.)
Avg. trips taken/pass	15.5	?
Effective discount	35%	?

*With fare level effective September, 1975. Current ridership substantially higher.

with the base fare halved and numerous other changes. The weekly pass was retained in the new fare structure, priced at 15 times base fare).

The transit systems in relationship to area population are highly comparable, except that Cleveland has rail transit service and Milwaukee does not. The fare structures were nearly identical until Cleveland's change; Milwaukee had a smaller fare reduction in May 1975 to the values shown. Both cities are large, industrial, and in the northern Midwest, with similar demographic structures. The two situations are probably as closely comparable as inter-city comparisons can be, and Cleveland has a weekly pass priced exactly at the level that Milwaukee's pass would need to be to have zero effective discount.

Milwaukee's pass use is credited by the operator for significant coin handling savings, increased ridership, and increased revenue (the latter two presumably against a hypothetical state, since the pass has a long history and thus no "before" state for comparison is available). Passes in Milwaukee are printed weekly with promotional notes for community events. Pass use and penetration figures are from recent studies quoted to us during the telephone interview.

With pass sales per capita in Milwaukee a factor of 14 above those in Cleveland, it seems fair to credit much of the difference to the effective discount of 35 percent on their transit fares achieved by Milwaukee pass users.

4.6 THE SETTING FOR PREPAYMENT

One purpose of this study was to determine whether certain settings are more suitable than others for prepayment. Several approaches to this problem were taken with, unfortunately, no significant findings that could be used as guidelines for prepayment application.

4.6.1 City Size

City size, represented by service area population, was compared with the penetration of individual prepayment types in each transit system to determine whether there is a covariation between these two measures. Initially there appeared to be an inverse relationship between population and prepayment penetration. In other words, smaller cities appeared to have a better chance of attracting a large share of their ridership to prepayment plans. However, population also tends to be positively related with the number of prepayment plans offered. Because of competition among the various plans, each one's share of the market may be slightly smaller than it would be if fewer plans were offered. By analyzing groups of cities with equal numbers of prepayment plans, we were able to look at large cities and small cities on a more comparable basis. The apparent relationship between size and prepayment penetration then disappeared, indicating that large cities with a given number of prepayment plans are as likely to achieve a certain level of penetration as small cities with the same number of plans.

4.6.2 Urban Environment

In addition to city size, more complex attributes of prepayment environments were studied in an attempt to identify types of markets in which prepayment might be found to work best.

The classification of urban environments has been studied by B.J.L. Berry, R.L. Forstall, and others [7, 24]. These researchers derived a variety of urban dimensions by subjecting a large number of census variables to a data-reducing technique known as factor analysis. The dimensions in turn form a basis for sorting cities (urban environments) into classification groups.

Berry and Forstall applied factor analysis to 97 differentiating variables derived from the 1960 Census for each of 1792 United States cities with greater than 10,000 population. Fourteen urban dimensions (factors) emerged, accounting for 77 percent of the original variance in the 97 primary variables.

The Forstall classification resulted in well over 100 city groupings for the 1792 cities. In the current study of transit prepayment, the cities in our telephone sample of 146 transit operators were widely distributed among the Forstall groups, with only two or three groups including more than two cities. Simpler classes were needed in order to achieve a meaningful analysis. Preliminary consideration of city characteristics and prepayment success (i.e. a high percentage of riders using prepayment) seemed to show similar degrees of prepayment success among cities with similar economic bases. Therefore, the Forstall groups were consolidated into eight classes by combining groups with similar descriptive characteristics, with economic base serving as the final distinguishing criterion.

Between the extremes of no industry and high industrial concentration (greater than 35 percent of the labor force engaged in manufacturing) the groups used were: (1) resort towns; (2) institutional centers, (e.g. college, government, or military); (3) commercial/transport centers; (4) metropolitan centers with less than 20 percent industry; (5) suburbs of metro centers; (6) moderate industrial centers, including many older metropolitan centers; (7) cities with high industry and declining growth; and (8) high status, growing industrial centers.

The only group which could clearly be differentiated as containing highly successful, high penetration prepayment was the second--institutional centers--which included the college towns previously mentioned with extremely low-priced semester or longer-term passes. These pass programs show evidence of having been implemented in part to encourage transit use as a way to avoid serious parking and congestion problems. A university is a large, centralized employer (or quasi-employer of students) with substantial control over its

campus and budget flexibility to subsidize transit at a high level in trade-off against other costs. Universities further operate in a tradition of relative paternalism toward staff and students which has made actions of this sort more likely than among general employers. Major universities in larger cities, (such as in Milwaukee and Baton Rouge), also subsidize transit with some prepayment mechanism, but the effect is less strong because it is relatively buried in a larger system with more general ridership.

Generalizing from this experience, cities or areas with a large, single employer in a centralized location are likely markets for prepayment forms for commuters. This, of course, is also the conclusion reached by many transit operators who offer more prepayment options and market them most extensively on special commuter and work or school subscription services, or restrict such services only to prepaid passengers.

A demonstration effect appears to be evident among the college towns mentioned, especially between Kent OH and Charlottesville VA. The latter city has a university-operated transit system which is explicitly modeled on Kent's, with a manager who came from Kent. California seems also to show an inter-city demonstration effect, with several areas recently initiating monthly and day pass programs modeled on experience in Los Angeles and Sacramento.

In sum, the variation of prepayment offerings and responses for general public ridership, particularly the use of passes of various sorts and substantially discounted punch cards, has not been shown to relate significantly to characteristics of the general urban environment. Subservices which are basically commuter-oriented have long been areas of high prepayment potential and remain so, in our judgment and that of many of the surveyed transit operators.

Our general observation is that widespread use of and response to prepayment for general ridership is most closely related to the details of pricing, availability, and balance among plans offered. Especially for the newer forms of passes, innovative and relatively successful plans are found in systems with aggresive marketing programs.

5. TRANSIT USER ATTITUDES TOWARD FARE PREPAYMENT

Why do individuals choose a particular method of prepayment over cash fare or competitive prepayment forms? Is the average user of prepayment different from the average transit rider? Does prepayment attract new patrons or increase transit use by established patrons? Which trip patterns (work, school, shopping) are most compatible with prepayment? To answer these questions, we turn to the individual rider.

In the first part of this chapter are summaries of surveys ranging from on-board questionnaires to household interviews. Some reports focus on a particular prepayment plan; some are general, on-board rider surveys; and some involve detailed comparisons between classes of riders, prepayment users, and the general population. The summaries are presented as brief case studies in the section below entitled, "Previously Published Studies."

Four user surveys were conducted in connection with this project for the specific purpose of investigating attitudes toward prepayment. They are described in the subsequent parts of this section. Patrons of Southeastern Michigan Transportation Authority (SEMTA) express commuter buses in suburban Detroit were queried as to their method of payment among four choices: cash, 10-trip punch card, 40-trip punch card, or monthly pass. Two types of surveys were conducted in Tulsa OK, an on-board general ridership survey highlighting prepayment, and employee surveys in companies that sell transit punch cards. In Pittsburgh questionnaires were completed by persons who purchase monthly transit permits through a payroll deduction program offered by their employer.

5.1 PREVIOUSLY PUBLISHED STUDIES

5.1.1 Portland, Oregon

Tri-Met personnel conducted an analysis of monthly pass users in July 1975 [54]. Mail-back questionnaires were distributed at three main purchasing locations and to customers who use mail order. The 951 returns represent a 38 percent response rate.

Tri-Met concluded that there is no "average" monthly pass customer, although some market segments seem to exhibit more use of passes than others. More than three quarters of the respondents buy passes every month. In the initial months that the pass was offered, pass sales increased at the rate of 10 percent per month, but the researchers estimate that most of

the new pass holders had been transit patrons previous to the pass's introduction. Penetration into the suburbs, they say, is growing. The pass is transferable, but in 87 percent of all cases, the pass holder is the only person who uses it.

Fifty-eight percent of the customers use the pass primarily for work; shopping is the heaviest secondary use. Eighty-one percent of pass customers are bound for downtown Portland. Pass holders travel mainly during peak hours (67 percent of all pass trips), and as might be expected, most secondary travel occurs off-peak. Ninety-four percent say they use their passes daily, and twenty six percent also ride on weekends.

An open-ended question on the reason for purchase elicited approximately equal numbers of responses for two major categories, cost and convenience. 677 mentioned "convenience; no need to bother with change; etc" whereas 636 said "economical; saves on gas and parking, etc." Thirty suggested concern for the ecology, and several single answers were recorded. Reasons for not purchasing in a given month were typically vacations, holidays, and other constraints that limit the number of trips. Comments and suggestions included a slightly lower price, variety in terms of duration, a multiple-ride option, family plans, and improved distribution mechanisms.

5.1.2 St. Louis, Missouri

The Bi-State Transit System conducted a postcard survey of pass purchasers and an on-board survey of pass users and non-users in 1964 [27]. The post card survey found that 12.5 percent of the pass purchasers in July of that year had not been regular transit riders before the implementation of the monthly pass. This was interpreted to indicate that the pass in itself had proved attractive to certain previous non-users of transit.

As could be expected, pass users rode more frequently than the average passenger who paid cash fare. The average pass user rode more than 50 times per month, and several made over 100 trips per month. Ninety-five percent of pass holders used the system predominantly for home-to-work trips, but many of these persons reported use of the passes for other types of trips too. A substantial market was untapped, however, since 44 percent of non-pass users rode ten or more times per week. Many of these persons could have enjoyed a cost savings by buying the monthly pass but for various reasons did not.

The reasons given for not using a pass included (1) not being a regular rider (45.8 percent); (2) price (10.0 percent); (3) working only five days per week (5.8 percent); (4) using the bus only one way (6.0 percent); (5) too much money to pay at one time (5.4 percent); and more than eleven other minor reasons.

Although passes were distributed only through certain banks and department stores, a mere 1.7 percent of non-pass users stated that inconvenience of purchase was their main reason for not using a pass. Another 1.5 percent said they did not know where to buy a pass. It appears that not having passes available on the buses was only a slight deterent to their use. Six percent of non-pass users indicated "no particular reason" for not using a pass. The indifference implied in this response indicates that these persons might have been motivated to purchase a pass, if the program had been marketed more vigorously.

5.1.3 Houston, Texas

In October 1975, 201 employees of the United Gas Pipe Line Company (UGPL) responded to a questionnaire relating to their use of the Houston Transit System (HouTran). They were participants in a program that is designed to discourage automobile use. UGPL buys for each participant a permit, called a "Rider's License," that can be displayed instead of paying the base HouTran fare. The permit-holder pays all additional zone charges.

This program was initiated in conjunction with the transfer of many UGPL employees to Houston from Shreveport LA. Only 32 percent of the participants had used transit before the new program was offered. Furthermore, only 18 of the employees who had moved from Shreveport had used transit there. Now 43 percent of UGPL's 685 employees are using transit, thanks largely to the incentive program. The researchers believe that the shock of learning about automobile commuting costs in Houston helped significantly in attracting the former Shreveport residents to the new pass program. It should be noted that UGPL also offers carpooling incentives and subsidies. Twenty-five percent of the employees take advantage of this program in 46 carpools.

5.1.4 Seattle, Washington

The Metro Transit staff has researched user motivation, both in the use of prepayment and in general riding habits [23, 33. 34]. Metro offers seven prepayment plans, including an annual Metro Pass, non-discounted ticket books, a monthly permit, and several specialized passes.

In June 1975, 600 transit users and 600 non-users were interviewed by telephone [33]. Respondents are classified according to bus riding frequency. Categories have been defined as follows: (1) nonriders ride less than twice a month, (2) light riders average between two and six trips a month, (3) occasional riders travel seven to twelve times a month, (4) frequent riders ride 13 to 29 times a month, and (5) regular riders average thirty or more trips a

month. By design non-riders comprise half the sample. The riders consist of 50 percent light, 15 percent occasional, 14 percent frequent, and 21 percent regular riders.

Respondents were asked to indicate whether each of nine service attributes was important or not important in encouraging ridership. The attributes are ranked in Table 5-1 according to the percentages of respondents who thought them to be "important". In the overall rankings the two suggested prepayment methods (discounted tickets and a monthly pass) scored third and fourth among the nine choices.

TABLE 5-1. ITEMS RATED FOR ENCOURAGING RIDERSHIP
PERCENTAGE INDICATING "IMPORTANT" IN SEATTLE TELEPHONE SURVEY

Items By Response Rank	Respondent Ridership Class: Nonrider (0-1 trips/mo)	Light (2-6 trips/mo)	Occasional (7-12 trips/mo)	Frequent (13-29 trips/mo)	Regular (30+ trips)
	Percent				
1. Driver Courtesy	85.1	91.4	91.3	94.0	87.6
2. Bus Shelters	84.8	82.1	77.2	82.4	85.5
3. Discounted Tickets	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5. More Frequent Service	70.4	64.6	65.?	65.8	71.8
6. More Bus Routes	72.6	66.7	58.7	63.5	66.1
7. More Modern Equipment	57.5	58.4	59.8	64.7	71.6
8. More Weekend Service	46.7	53.9	48.9	45.?	50.0
9. No Zones	43.8	35.0	30.8	31.7	35.0

Source: Reference [33]

Close examination of the response percentages for the two prepayment methods leads to some intriguing observations. As a group the regular riders rated discounted tickets more important than monthly passes in encouraging ridership (88.1% for tickets vs. 78.5% for passes). Among nonriders and

light riders, however, passes were thought to be more important by a slight margin. Thus we see that regular riders, who are the only persons in a position to use monthly passes economically, are less optimistic about the attractiveness of the passes (compared with discounted tickets) than those who ride very seldom or not at all.

A separate survey was aimed solely at purchasers of Metro's $150 annual "Metro Pass" [23]. Questionnaires were mailed in March 1975 to all Metro Pass holders, and 196 (69 percent) were returned. Nearly all pass holders ride daily, but patterns of use and demographics both vary according to the amount of cash fare the pass user would pay without the pass. Twenty-one percent of pass-owners would otherwise pay 30 cents or less (normally riding through 1 or 2 zones), 50 percent would pay 40 cents (3 zones), and 29 percent would pay 50 cents or more (4 or more zones). Only one type of Metro Pass is issued, and it is valid for up to three zones without extra payments. Riders who travel four or more zones must pay additional zone charges and are less satisfied with the pass than are other riders because of the necessity to carry change. Metro Pass holders who travel three zones clearly have the most economical and convenient arrangement. Inequities experienced by the one- and two-zone riders are the consequence of simplifying the pricing and boarding procedures for the pass.

Table 5-2 shows that one- and two-zone Metro Pass holders use transit more frequently and more for nonwork trips than other pass holders. They also own distinctly fewer cars. The researchers note that many of the one-and two-zone riders can be characterized as inner-city transit dependents, while riders who travel through three or more zones tend to be auto-owning commuters who prefer the bus over driving.

In July, 1975 a nine person "focus group" in Seattle debated the merits of a hypothetical monthly pass [34]. The discussion generated the following list of features that were considered to be desirable:

- Low cost - a better deal than cash
- Transferable among different users
- Valid all day, every day
- No zone restrictions
- Cost proration for mid-month purchase
- Non-replaceable.

The prime markets for the proposed monthly pass were considered to be commuters and students; the discussion participants guessed that purchasers would mostly be persons who already used transit.

TABLE 5-2.
SELECTED SEATTLE METRO PASS SURVEY TABULATIONS

Item	1-2 Zone Riders (N=40)	3 Zone Riders (N=98)	4+ Zone Riders (N=56)	Total (N=196)
	Percent			
Frequency of use				
More than 10 per week	87	36	48	50
8 to 10 per week	13	62	50	48
Less than 8 per week	0	2	2	2
Total	100	100	100	100
Use the bus most of the time for:*				
Commuting to work	98	99	94	97
Shopping trips	55	11	20	23
Visiting friends	48	5	11	16
Personal business	45	10	20	21
Recreation	33	7	12	14
Number of Autos in Household				
None	71	14	24	28
One	16	40	30	33
Two	11 (29)	39 (86)	30 (76)	30 (72)
Three or more	2	7	16	9
Total	100	100	100	100

*Survey respondents could check multiple responses to this question.

Source: Reference [23]

5.1.5 Westport, Connecticut

The Westport Transit District operates nine "minnybuses" on a regular route system through the affluent city of Westport. Service began in August 1974 [37]. Daytime routes converge on a central transfer point and account for approximately 80 percent of the passengers. The remaining 20 percent are commuters, who use a special system of routes in the early morning and evening to travel to and from a train station. The system is vigorously marketed, and inexpensive annual passes are offered to encourage frequent use of the buses. In October 1975 passes were being used by 88 percent of the daytime riders and by 96 percent of the commuters. The fare structure is shown below.

Annual Passes

Adult	$25.00
Single Child	20.00
Husband & Wife	35.00
additional child	12.00
Senior Citizen	15.00
husband & wife	25.00

Widowed, divorced	25.00
additional child	12.00
10-Ride Punch Card	3.00
Cash Fare	0.50.

An on-board survey of 717 (40 percent of daily total) daytime riders in October 1975 found that 84 percent of the riders are under 20 years old [64]. Major trip purposes are shopping, recreation, and school trips. Approximately 81 percent of the riders do not have driver licenses, but only 4 percent of the riders have no car in their household. Fifty-four percent of the respondents could not have made the trip in the absence of Minnybus. The daytime system is seen by some observers largely as a replacement for the automobile trips that were formerly made by parents in chauffeuring their children.

A separate on-board survey on the commuter routes in October, 1975 found that nearly all 164 respondents owned automobiles [64]. Approximately 20 percent of the commuters, however, have eliminated an additional family car as a result of the service. When commuters were asked if they felt the cost of an annual pass is "just right," "too little," or "too much," 67 percent said "just right," 26 percent said "too little," and 2 percent said "too much." Eighty-three percent of the commuters said they would be willing to pay ten dollars more for the annual pass, while ten percent said they would not be willing to pay an additional ten dollars.

A telephone survey of the general public in October 1975 found that 40 percent of the 131 respondents had ridden the buses at some time during the system's 14-month history [64]. Another telephone survey asked 39 former pass holders why they had chosen not to renew their annual passes. (Approximately 1,000 persons did not renew their annual passes after the first year.) Fifty percent of the respondents said "not enough use;" the remaining responses fall into eight different categories. Most persons who did not renew were women who had purchased the pass on the family plan and found that they did not use it. There was also a large number of people who had bought the pass initially to support the system but who had never expected to use it.

The philosophy behind Westport's annual pass is to help people forget the cost of public transportation, much as the fixed costs of owning an automobile are forgotten. In addition, the passes are priced low enough to encourage nearly all types of potential riders to buy them. With cash fare at 50 cents, a child with a $12 pass only has to ride twice a month to make the pass worthwhile. Adults

must ride once a week or more. If an adult makes one round trip per day, the cost works out to approximately five cents per ride.

Despite the attractiveness of the annual pass, some infrequent riders sought a new form of payment that would cost less than 50 cents per ride, yet not require them to purchase a year's worth of rides in advance. In September 1975 the District began offering a 10-trip punch card for $3.00, with a valid period of 60 days. Sales of the new punch card have averaged 10 to 12 per week, not enough to make any measurable impact on the sales of annual passes.

5.1.6 Chapel Hill, North Carolina

A municipally owned bus system began operating in the university community of Chapel Hill in August 1974 [26]. At the same time, the price of annual campus parking permits was raised from $10 to $72. Several prepayment schemes were offered to users of the new bus service, including an annual pass. (The pass can be purchased from the town for $30, but the University of North Carolina sells it for $24 to faculty, staff and students. The University entered into a two-year contract with the town to purchase bus passes instead of building more parking spaces.) The bus pass is also included free with every campus parking permit sold. Although the system is available to anyone, most of its patrons are associated with the University. The Chapel Hill approach would not necessarily work in any city, but it is a well-documented test case of a unique combination of inexpensive transit prepayment and parking disincentives. The prepayment features are of special interest here, since only 14 percent of the rides are paid for by cash.

Questionnaires were mailed to 1700 households before the service started and to the same households eight months later. Response rates were 40 percent and 34 percent respectively. These surveys, in addition to asking demographic, economic, and travel information from the head of the household, listed twenty attributes of transit service. Respondents indicated each attribute's importance (on a 5-point scale) in their decision to use the bus for work trips. Safety and reliability were felt to be the most important attributes, except among senior citizens, who generally prefer clean vehicles and weather protection at bus stops. Minimal cost does not take precedence, although its importance increased among transit users who responded to the second survey. Preferences seem to differ between socioeconomic groups and between riders and nonriders.

One of the findings of the Chapel Hill study was that 49 percent of passengers who boarded with a bus pass also had a parking permit. The researchers concluded from this observation that "the University policy of

including a bus pass with each parking permit has been very effective in increasing bus usage." Two other major conclusions were stated by the researchers as follows:

- The combination of high University parking rates and the availability of an annual pass has induced many non-captive riders to use the bus system.
- Using the bus system produces changes in citizens' perceptions of the importance of most transit service characteristics. The implication of this fact is that persons may not be able to give meaningful attitudinal responses regarding a transit service before they have experienced the service.

5.1.7 Warren, Michigan

Potential users of a hypothetical demand-responsive jitney system were interviewed in Warren MI, a suburb of Detroit, in 1971 [36]. The purpose of the survey was to rank transit system characteristics in the order of their importance to the respondents. One exercise consisted of ranking fare collection methods. Figure 5-1 shows the relative preferences for these methods.

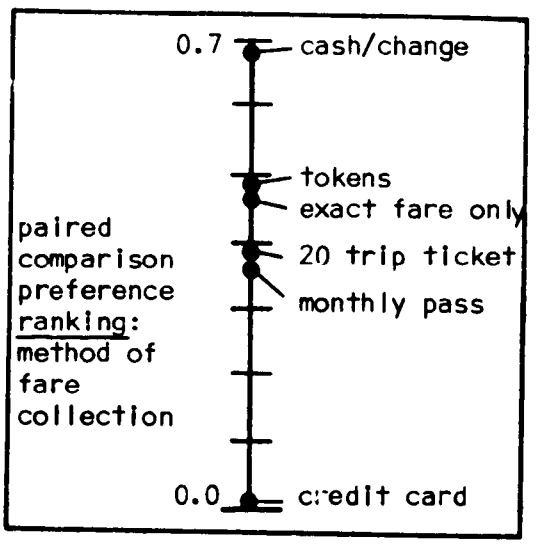


Figure 5-1. Preference Scale Values for Six Methods of Fare Collection

(Source: Reference [36].)

It would be inadvisable to use a survey of this type to determine which prepayment forms to include in a fare structure. The respondents in this survey were not transit users, but members of the general public. Furthermore,

preferences can vary widely when transferred from a hypothetical to a real-life situation, as was concluded in the Chapel Hill study summarized above.

5.1.8 Flint, Michigan

As explained in the section recounting the history of prepayment, a door-to-door paratransit service called Maxi-cab was started in Flint in 1968 [58]. A monthly pass was the only form of payment available, and the price was based on the length of route and number of persons subscribing.

A survey in 1971 attempted to determine the attitudes of Maxi-Cab users toward the service [58]. Both current users at the time of the survey and former users were included. One of the questions asked whether the respondent liked or disliked certain features. The responses for two features, paying once per month and using a flash pass to board, are shown in Table 5-3.

TABLE 5-3. LIKES AND DISLIKES OF MAXI-CAB'S SERVICE

Who?	Feature	No Answer	Like	Dislike	No Opinion
		Percent			
Users	Pay once/month	6.0	88.4	.9	4.6
	Flash pass to board	30.6	21.8	9.3	38.4
Former Users	Pay once/month	7.9	78.3	4.6	9.2
	Flash pass to board	18.4	40.1	2.6	38.8

(Entries in each row may not sum to exactly 100% due to rounding.)
(Source: Reference [58])

The feature, "Flash pass to board", presumably addresses the issue of convenience of boarding, since it is easier to show a pass than to produce the exact amount of cash or surrender a ticket. Among both users and former users, the relatively low percentage of "like" responses and the high percentages of "no answer" and "no opinion" responses indicate that most Maxi-Cab users did not feel strongly about the flash pass as a boarding device.

"Paying once per month" was liked by 88.4 percent of users and disliked by almost none. The percentage of former users who liked this feature, however, is lower, and the percentage who disliked paying once per month is higher. Although paying once per month was a popular feature among

users, the size of the single monthly payments or the inadequacies of the system in serving persons with less than a daily need for the service may have been deterents to use of Maxi-Cab. This service no longer exists.

5.1.9 Sacramento, California

Regional Transit District personnel distributed mail-back questionnaires on board all buses for a single day in May, 1975 [47]. Twenty-nine percent of the riders claim to have paid 25 cents cash, 19 percent paid 15 cents in cash or token (seniors or students), 5 percent used a monthly pass and 42 percent used a day pass. The results are noted here to underscore the popularity of the day pass, whose potential is possibly being overlooked by many transit operators. We will have more to say about the day pass in the conclusions of this report.

5.1.10 Conclusions from Previously Published Studies

The studies summarized above are so varied that the set of conclusions is quite large. We must also note that only the highlights of each study could be presented here and that additional conclusions can be found in the original versions of the studies. Some of the main points mentioned above are the following:

- Monthly passholders in Portland OR ranked cost and convenience about equally as their reason for purchasing a pass.
- In St. Louis it was concluded that the monthly pass in itself had proved attractive enough to some previous non users of transit that they started riding.
- The United Gas Pipeline Co. in Houston stimulated a significant level of transit use among its employees by subsidizing transit permits.
- Respondents to a telephone survey in Seattle rated discounted tickets and monthly passes high among items for encouraging ridership.
- A survey of Seattle annual pass users revealed the ridership response to an inequitable pricing policy that favors passholders who normally ride through three zones: Pass holders who ride short distances (1 or 2 zones) are less numerous and ride more frequently than passholders who normally ride through three zones.
- Despite the popularity of Westport CT's inexpensive annual pass, there was felt to be a need for a multiple ride (punch card) pre-payment form that would bridge the gap between the annual pass and the cash fare.

- In Chapel Hill NC the combination of high university parking rates and the availability of an annual pass induced many non-captive riders to use the bus system.
- Another conclusion from Chapel Hill was that using the bus system produces changes in citizens' perceptions of the importance of most transit service characteristics. This conclusion led us to discount the results of a survey that queried members of the general public in Warren MI about their preferred method of payment for a hypothetical demand-responsive jitney system.
- In Flint MI paying once per month was a popular feature among users of the Maxi-Cab service, but the size of the single monthly payments or the inadequacies of the system in serving persons with less than a daily need for the service may have been deterrents to use of the system.
- The popularity of a day pass in Sacramento CA (used by 42 percent of riders) indicates its potential for other locations.

5.2 THE SEMTA DASH SURVEY

The Southeastern Michigan Transportation Authority (SEMTA) is responsible for public transportation in the seven-county area surrounding the Detroit metropolitan area. In July 1973 SEMTA initiated the first of a group of work-trip subscription services between several suburban locations and major work-trip generators. Most of the users are white collar workers employed by the automobile companies headquartered in and around Detroit. Direct Access Shuttles (DASH), as the commuter services are called, have a combined daily (round trip) ridership of approximately 250 persons. On October 16 and 17, 1975, HRG conducted on-board surveys on 13 DASH runs presently operated by SEMTA. Survey methodology is discussed in Appendix D, and the questionnaire, with summary tabulations, is reproduced in Appendix E.

At the present time, DASH patrons have the following choices of payment for their trips:

a. A cash fare based on trip length.
b. A ten-trip punch card priced at 7.5 times cash fare (or 75 percent of cash fare, per trip); no expiration date.
c. A 40-trip punch card priced at 110 percent of the monthly pass (or approximately 61 percent of cash fare, per trip); no expiration date.

d. A monthly pass priced at 22.5 times cash fare (or approximately 52 percent of cash fare per trip for a 44-trip month); valid for calendar month.

The wide choice of prepayment forms available and the relatively homogeneous group of users were prime considerations in choosing the DASH services for a detailed investigation. The main focus of the DASH survey is on the decision process by which passengers choose a particular prepayment form over the rest.

5.2.1 Payment Method and Frequency of Use

To test the hypothesis that the preferred method of fare payment is related to expected rides, we asked respondents to estimate how many DASH trips they had made in the past 20 work days (question 3); and how many they would make in the next 20 work days (question 4). Past as well as future expected behavior was investigated, because each respondent typically had used some portion of his/her prepayment instrument at the time (s)he responded to the survey. Each person's choice of prepayment (at some time in the past) was presumably affected by expected travel both before and after the event of completing our questionnaire. (Ideally, perhaps, each person should have been surveyed at the time (s)he was making the decision for the next purchase, but that would not have been practical.)

Tables 5-4 and 5-5 show cross-tabulations of the responses to questions 3 and 4 respectively with payment method. Persons who had used DASH less than one month have been excluded from the tabulations. (The percentages are based on row totals).

Payment method is shown to be highly related to both past and future number of trips. While the 40-trip punch card dominates all other choices, it is far less dominant for patrons who have made (or expect to make) more than 34 trips in the past (or next) 20 work days. For this frequent use the monthly pass shares the market almost equally with the 40-trip punch card.

Persons who are deciding how to pay for a month's worth of work trips would be expected to be sensitive to the relative prices of the payment methods available. The break-even point between monthly pass and 40-trip card turns out to be 36.4 trips. That is, patrons who make 36 DASH trips or fewer in one month will spend less by purchasing a 40-trip punch card (as long as they know that they will eventually use the remaining trips in subsequent months).

Persons who will make 37 or more DASH trips in a given calendar month, (the duration of the pass), will pay less per trip by buying the pass. The

TABLE 5-4. PAYMENT METHOD VERSUS ESTIMATED NUMBER OF DASH TRIPS IN PAST 20 WORKDAYS

DASH Trips		Payment Method				Total
		Cash	10-Trip Card	40-Trip Card	Pass	
Less than 20	N	2	7	21	5	35
	Row %	6	20	60	14	100
20-29	N	1	4	21	0	26
	Row %	4	15	81	0	100
30-34	N	0	2	26	4	32
	Row %	0	6	81	13	100
More than 34	N	0	3	53	52	108
	Row %	0	3	49	48	100
Total	N	3	16	121	61	201
	Row %	2	8	60	30	100

TABLE 5-5. PAYMENT METHOD BY EXPECTED NUMBER of DASH TRIPS IN NEXT 20 WORKDAYS

DASH Trips		Payment Method				Total
		Cash	10-Trip Card	40-Trip Card	Pass	
Less than 20	N	2	6	15	0	23
	Row %	9	26	65	0	100
20-29	N	1	4	20	3	28
	Row %	4	14	71	11	100
30-34	N	0	1	25	1	27
	Row %	0	4	92	4	100
More than 34	N	0	3	62	61	126
	Row %	0	2	49	48	99
Total	N	3	14	122	65	204
	Row %	1	7	60	32	100

(Percentages may not total exactly 100% because of rounding.)

data presented in Table 5-6 supports the hypothesis that this is the kind of analysis individual decision-makers are applying. The mean number of

expected trips among passholders is 38.5, and the standard deviation* is relatively small.

TABLE 5-6. MEAN NUMBER OF TRIPS BY PAYMENT METHOD FOR DASH

Time Period	Payment Method				Overall
	Card	10-Trip Card	40-Trip Card	Pass	
Past 20 work days	15.5 (13.8)	17.9 (13.1)	28.7 (11.6)	36.1 (9.4)	29.6 (12.4)
Estimate for next 20 work days	19.0 (15.1)	21.9 (14.0)	31.0 (9.9)	38.5 (4.4)	32.3 (10.4)

The values within parentheses are standard deviations.

The maximum savings between using a monthly pass and using 40-trip punch cards is not very great, it should be noted. For a typical DASH run, the cash fare might be $1.25 for a one-way trip; the pass would cost $28 (22.5 x cash fare); and a 40-trip punch card would cost $31 (110 percent of cost of monthly pass, or 62 percent of cash fare, per trip). Typically, there are 21.6 week days in a month. By using 40-trip punch cards, (which are valid indefinitely), a patron would spend $33.40 for a month's worth of DASH round-trips. The pass, costing $28, would save the patron $5.40, or about 16 percent.

But note that this is true only if the month is a full work month and the patron has a schedule which allows him/her to use the DASH service for both work trips every work day. If, through a combination of work schedule and personal circumstances, the patron makes only 35 trips in a month, then the 40-trip punch card provides those trips at a slightly lower cost per trip than the pass.

5.2.2 A Model for Choice of Payment Method

Because the 40-trip punch card is priced so closely to the monthly pass, there seems to be a substantial degree of competition between the two. Persons who expect to make almost all their work trips on DASH in the coming month, (and who have a choice, because they are not already committed to using up part of a previously purchased punch card), will make a choice based on a number of factors, not all of which are expected out-of-pocket costs.

*The standard deviation is a statistical measure of the "spread" among various values of the data. In this case a small standard deviation would indicate that the expected numbers of trips are fairly close together for most of the passengers surveyed.

One of these other factors is uncertainty. People are not likely to have a single value for the number of trips they expect to make by transit over some future time frame; but rather they appear to hold an implicit probability distribution* of that value. They may take some vacation time next month. Or they may stay downtown several times, and use another mode for their trip home. Or they may expect to have some number of lunch-hour errands that would require that they drive to work. (DASH passes and punch cards are only valid on DASH services and therefore unusable on other SEMTA buses during midday).

Thus we suggest a model in which (1) the number of an individual's expected trips is described by a probability distribution, and (2) the economic value of each of the payment plans is weighted by the individual's assessment of that distribution. For example, Figure 5-2 illustrates a hypothetical distribution for one individual.

This individual expects to make about 30 to 40 trips in the coming month, but almost certainly more than 25 and fewer than 46, the maximum possible in riding DASH. Since the economic breakeven point, (between the 40-trip punch card and the monthly unlimited trip pass), is at 35-36 trips (the vertical line), a person with this probability distribution would have no strong preference between the two.

For this individual we would expect other factors to come into play, such as convenience, fear of loss, desire to put an absolute ceiling on travel costs, etc.

Figure 5-3 presents a series of hypothetical probability distributions representing major classes of individuals who might have the fare payment

*A probability distribution, probability curve, or more formally, probability density function, is a function of some variable quantity, like number of trips. For any specified value of the variable quantity, one can use the probability curve to determine the probability (expressed as a fraction between 0 and 1) that the specified value will occur. A probability distribution can be depicted as a curve on a graph where the horizontal axis is the variable quantity and the vertical axis is the range of probabilities from 0 to 1. Thus to find the probability that a person will make exactly 30 trips in the next month, one would find the point on the horizontal axis that corresponds to 30 trips, draw a vertical line upward until reaching the curve, then draw a horizontal line from that point on the curve to the vertical axis. The number on the vertical scale where this horizontal line intersects is the probability P(N) that the individual will make 30 trips during the next month (N=30.)

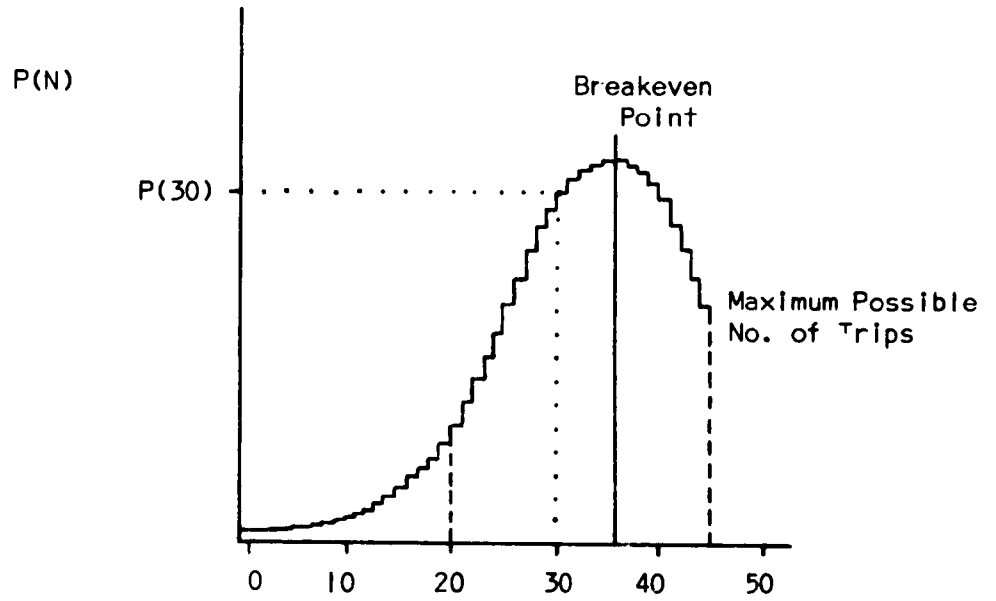


Figure 5-2. Probability Distribution for the Number of Trips an Individual Expects to Make

options offered in the DASH service. Extreme peaking indicates that the individual is relatively sure of the number of trips (s)he will be making, whereas a broad, bell shape suggests uncertainty.

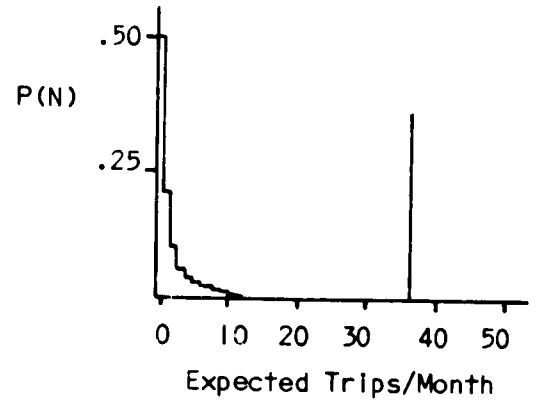
Figure 5-3a shows a probability distribution for a very infrequent rider. This person only rides if his/her car breaks down or the weather is extremely bad. (S)he expects to use DASH one or two times a month, but certainly no more than five. We would expect this person to prefer to pay the cash fare.

Figure 5-3b presents the typical occasional rider. The most probable number of rides is about 10. We hypothesize that most persons with this approximate distribution would prefer to buy a 10-trip punch card rather than the 40-trip card, which would have to carried for several months before being exhausted.

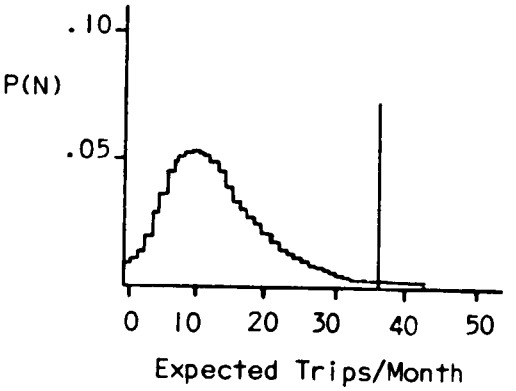
Figure 5-3c is for a normal distribution peaking at about 30 trips. This rider might be expected to prefer to use the 40-trip punch card, but in a group of persons who each have this distribution of expected rides per month, some might be expected to use the 10-trip card.

Figure 5-3d displays a much more highly-peaked distribution, centering on about 25 trips. In a group displaying this distribution, we would expect relatively few persons to choose any option other than the 40-trip punch card.

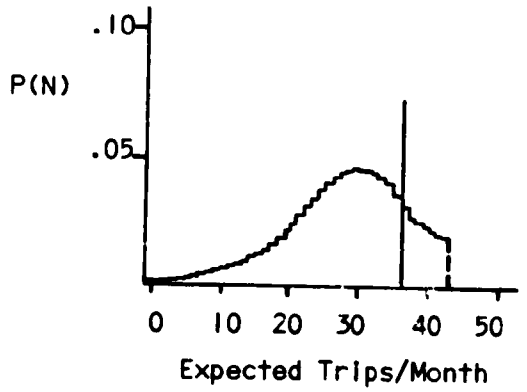
Figure 5-3e shows a broad distribution centering on 35 trips, the breakeven between the punch card option and the monthly unlimited trip pass. People



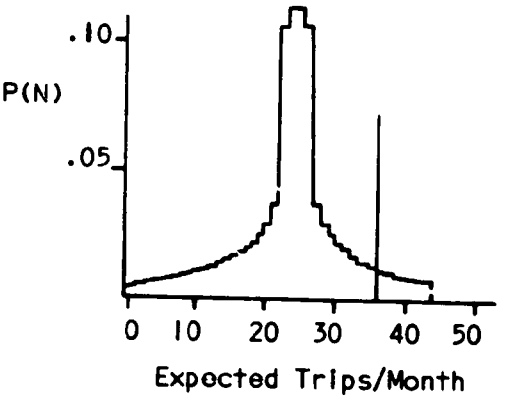
a. Very Infrequent Rider (Cash Fare)



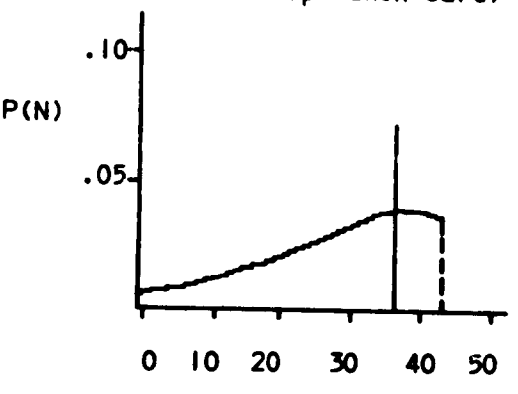
b. Occasional Rider (10-Trip Punch Card)



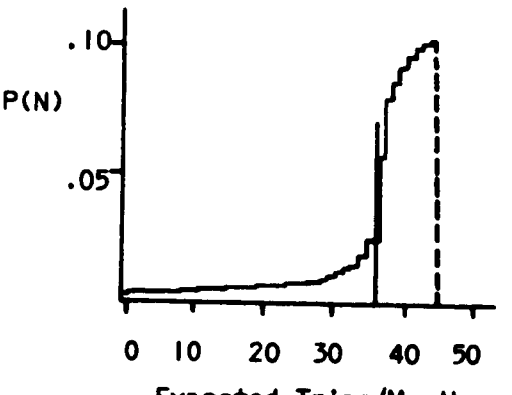
c. Average Rider (40-Trip or possible 10-Trip Punch Card)



d. Predictable Average Rider (40-Trip Punch Card)



e. Uncertain Rider 40-Trip Punch Card or (Monthly Pass)



f. Predictable Frequent Rider (Monthly Pass)

Figure 5-3. Hypothetical Probability Distributions of Major Classes of Riders

who wanted to put a ceiling on their total travel expenses would lean to the pass option, while those who wanted to put a ceiling on their cost-per-ride would lean to the punch card.

Finally, Figure 5-3f is the distribution for a person who is quite sure (s)he will be making a number of trips greater than the breakeven number. There is little reason for such a person to choose other than the unlimited-ride monthly pass, and we would thus expect a large proportion of persons holding this distribution to choose passes.

5.2.3 What Happens When a New Punch Card is Introduced

Several other questions from the DASH survey may help to illuminate the relative attractiveness of the various payment methods. One question (number 16) asked respondents how they paid for their trips before the introduction of the 40-trip punch card, in December 1974. Another question (number 2) asked the respondents how they paid for their trips on the day of the survey. The cross tabulation of the responses to these two questions in Table 5-7 is a rough indication of the shifts people made when the 40-trip punch card was introduced.

The table shows that prior to introduction of the 40-trip punch card, the monthly pass was the dominant payment method. (Total column in Table 5-7 shows 105 passholders out of 173 people riding prior to December 1974.) There was a radical shift in the distribution when the 40-trip punch card (priced at 110 percent of the monthly pass) was introduced.

Seventy-three percent of those patrons who formerly used the 10-trip punch card had shifted to the 40-trip card by October 1975. The same fraction of those who said they formerly used both the monthly pass and the 10-trip card also shifted to the 40-trip card.

There was considerably more loyalty to their previous choice on the part of those who had used the monthly pass prior to introduction of the 40-trip punch card. But even here, almost half switched to the new prepayment form, despite the fact that, for a full month's trips, the cost is higher than that of the pass.

Forty-five of the surveyed patrons started using DASH after December 1974, when the 40-trip card was introduced. As with the earlier starters, they prefer the monthly pass and 40-trip punch card. However, they tend to favor the 40-trip punch card over the monthly pass to a greater extent than those who started using DASH before the 40-trip punch card was made available.

Thus there appears to be a rather stable distribution of payment preferences among DASH patrons, with a slightly sharper preference for the

TABLE 5-7. CHANGES IN PAYMENT METHOD AFTER INTRODUCTION OF THE 40-TRIP PUNCH CARD

Payment Method Prior to Dec. 1974		Payment Method in Oct. 1975				
		Cash	10-Trip Card	40-Trip Card	Monthly Pass	Total
Cash	N	2	0	0	0	2
	Row %	100	0	0	0	100
10-Trip Card	N	1	10	32	1	44
	Row %	2	23	73	2	100
Pass	N	0	2	51	52	105
	Row %	0	2	49	49	100
Pass and 10-Trip Card	N	0	1	16	5	22
	Row %	0	4	73	23	100
Didn't Ride Prior to 12/74	N	1	3	34	7	45
	Row %	2	7	76	15	100
Total	N	4	16	133	65	218
	Row %	2	7	61	30	100

Percentages based on row totals.

40-trip card among those who have entered the DASH market since it became available, (or, alternatively, a slightly greater prefe ence for the monthly pass among patrons who began using DASH before the 40-trip punch card became available). This may be evidence that the additional option has somewhat expanded the market for DASH; but hard evidence on this question is lacking, since there has been no controlled experiment designed to test it.*

5.2.4 Knowledge of Prices Among DASH Users

We turn now to three other groups of questions designed to throw light on the issue of payment preferences. The first set (questions IIa through IId) asked the respondent whether (s)he was familiar with the prices of the four payment options presently available. Table 5-8 presents the data.

Not surprisingly, the percentage of all respondents who know the price of a given option is related to the number of persons who use that option, since the knowledge of the price of a given option was highest, in every case, among those who used that option (circled entries). When we asked respondents

*One design for such an experiment would be to vary the order of introduction of prepayment methods in a set of newly-started commuter lines, tracking the distribution of payment choices over time, until all lines had reached an identical fare structure.

TABLE 5-8. KNOWLEDGE OF ALTERNATIVE FARES BY PAYMENT METHOD

How Respondent Paid for Today's Trip	N	Percentage of Respondents Who Say They Know the Price of: Cash Fare	10-Trip Card	40-Trip Card	Monthly Pass
Cash	7	100	86	83	67
10-Trip Card	18	72	94	78	78
40-Trip Card	135	87	93	99	93
Monthly Pass	65	67	82	94	98
All Respondents*	225	81	90	96	93

*Missing answer excluded from percentages.

whether they know the prices of the three payment options other than the one they themselves used, the percentage who said they knew the prices was 90 percent for all payment methods except cash fare. Only 80 percent of respondents who used one of the other three payment methods knew the cash fares.

5.2.5 Reasons for Choice of Payment Method

Each respondent answered a set of questions pertaining to the decision (s)he made when (s)he chose one method of payment over the other three. Among the pass users, lowest cost per trip was the overriding concern. Low cost per trip was also important to 40-trip punch card users, but uncertainties about future travel needs strongly influenced the decision to buy this form of prepayment. One question (question F1) asked 40-trip punch card users, "Why did you buy a 40-trip ticket rather than a monthly pass?" Responses are shown in Table 5-9.

Note that half of the 40-trip cardholders say they ride almost every day but are too uncertain about their projected use of DASH to be willing to pay the higher price of the 40-trip punch card. It would appear that many DASH users are risk-averse; specifically, they are unwilling to take the risk of under-using the monthly pass. They even seem willing to pay a little extra per trip to avoid taking that risk. In the model developed earlier these people would be the ones with the broad probability distribution of expected trips, as shown in Figure 5-3e. Their uncertainty is the factor that makes the distribution so broad. Since these people are risk-averse, they desire to put a ceiling on their cost per ride and therefore choose the punch card. The punch card serves a significant market by providing this sizable group of riders with a viable prepayment option.

TABLE 5-9. REASONS FOR BUYING 40-TRIP PUNCH CARD OVER MONTHLY PASS

Response	Percentage
Do not ride often enough to justify having a monthly pass.	28
Afraid that unexpected circumstances will keep me from making full use of the monthly pass, even though I ride almost every day.	50
Combination of 1 and 2 above.	5
On vacation this month.	8
Other reasons (most related to expected number of trips).	9
TOTAL (N=131)	100

There is further evidence, though still not conclusive, that the implementation of the 40-trip punch card may have had a positive impact on DASH ridership. We asked in question 14, "How frequently do you ride the bus now, compared with your riding before the 40-trip ticket was available? (December 1974)." Nineteen percent did not ride before the 40-trip punch card was available, but 62 percent are riding about the same amount now, 5 percent are riding less, and 13 percent are riding more than they were before the 40-trip punch card was introduced. A related question (F5) asked, "If there has been a change in the amount you ride the bus, compared with your riding before the 40-trip ticket was available, please indicate the reason for the change." Responses appear in Table 5-10.

The third and fifth answer categories were provided for the purpose of assessing possible differing effects of introducing the new punch card. We hypothesized that on one hand the card might encourage more riding among former 10-trip cardholders because of the lower cost per ride. On the other hand was the possibility that former passholders would ride less with the new card because of its lack of an expiration date, and its low price compared with the 10-trip card.

While both effects are minor, the former effect appears to be stronger than the latter. Sixteen respondents chose answer number 3, but only 2 respondents chose answer number 5. In addition, 3 respondents indicated that the availability of the new 40-trip card convinced them to start riding.

TABLE 5-10. REASONS FOR CHANGES IN RIDING FREQUENCIES AMONG DASH 40-TRIP CARDHOLDERS

Reason	Number of Respondents
Did not ride before December 1974.	22
Did not ride before December 1974, and the availability of the 40-trip ticket convinced me to start riding.	3
Ride more because the cost per trip is less than the cost per trip with a 10-trip pass.	16
Ride more because _____.	4
Ride less because I now pay for only the rides I use, whereas I felt obliged to use the monthly pass as much as possible.	2
Ride less because _____.	5
Total 40-trip cardholders whose riding frequencies changed.	52

One conception that some transit managers seem to have about passes is that they have the capacity to "hook" passengers for the period of the pass's validity, causing these passengers to ride more often than they would if they had paid on a purely fixed cost per ride basis. If there is a capacity of prepayment for hooking passengers, this capacity, at least in the DASH service, seems to be at least as strong with punch cards as it is with passes. It is important to stress that use of the DASH pass is limited to two trips a day by the physical constraints of the service. A pass that is used in a more conventional application may very well have the capacity to increase the amount of riding of individuals.

The reasons for which DASH users chose 10-trip punch cards were anticipated to be interesting, because these people have made a clear choice for a payment form that is more expensive than the 40-trip card on a cost-per-trip basis. We wanted to determine whether the 40-trip card was felt to require too much money at one time, or whether infrequent users might be apprehensive about holding onto the 40-trip card for a relatively long period of time in order to exhaust it, or for what other reasons people make the seemingly uneconomic choice of the 10-trip over the 40-trip card.

To test the 10-trip cardholders' completeness of information about the comparative prices of the two punch cards, we asked the question (T2), "Both the 10-trip ticket and the 40-trip ticket can be used for an unlimited length of time, but the 40-trip ticket offers a lower cost per trip than the 10-trip ticket. Did you know this when you bought the 10-trip ticket?" Fourteen of the 17 10-trip cardholders said they did know the prices.

We then asked in question T3, "Why did you buy a 10-trip ticket rather than a 40-trip ticket?" Table 5-11 shows the responses. (Only the first two response categories were provided; the rest were write-ins.)

TABLE 5-11. REASONS FOR BUYING A 10-TRIP PUNCH CARD RATHER THAN A 40-TRIP CARD

Response	Number of Respondents
The 40-trip ticket requires too much money at one time.	6
I ride very infrequently. Would take too long to use 40-trip ticket.	2
Going to get a monthly next month. Too late in month to buy a 40-trip ticket and use it up.	3
Didn't know about the 40-trip ticket.	3
Couldn't get the 40-trip ticket.	1
Wanted to test the system before committing myself to more rides	1
Going to move. Couldn't use up a 40-trip ticket.	1
Total 10-trip punch cardholders	17

The number of respondents to this question is too small to produce any conclusions other than the observation that the 10-trip punch card seems to serve a purpose. The results also point out the need to supply customers with complete information about fare options.

We made the observation that regular monthly passholders sometimes use 40-trip or 10-trip cards during months when they are on vacation for a week or more. This was the apparent reason that three of the respondents to this last question bought 10-trip cards. One man wrote in his comments that he bought a

40-trip card for this purpose, and then kept buying 40-trip cards until he came back in phase with the start of a calendar month or until he took another vacation.

5.2.6 Distribution and Sales

Aside from the minimal problem of supplying price information to all new customers, distribution and sales procedures on DASH services appear to be quite satisfactory. Almost all DASH runs have "bus captains", regular passengers who receive free rides in return for selling passes and punch cards and monitoring the service. Sixty-five percent of DASH passengers buy their passes and punch cards from the bus captains, and most respondents like this arrangement because of the convenience and because they have the option to pay by check if they wish. (In fact most bus captains prefer to handle checks rather than cash.) Twenty percent of respondents said they order tickets by mail from SEMTA, and on the one run where distribution is done solely by mail, there seems to be general satisfaction with this method.

5.2.7 Hypothetical Situations: Reducing the Number of Prepayment Options to One

Finally, we look at how respondents react to questions asking whether they would continue to ride DASH if payment option were reduced to one of the present four. (Questions 12a to 12d.) Table 5-12 assembles the answers to each of the four questions, with each row corresponding to the payment method the respondent used on the day of the survey.

Willingness to continue riding DASH if a given payment option became the exclusive method available is highly related to the respondent's present preference among the four options. Table 5-12 shows this relationship. From it we can estimate the potential viability of each payment method in the absence of all the others. The cash option could be dropped at little loss in ridership. However, this option returns the greatest fare per trip, and for this reason alone, may be cost-effective. Moreover, if the cash option is the entry method by which potential long-term patrons are first introduced to the service, as appears likely to be the case, then it should be retained for its contribution to recruitment of new riders, most of whom will switch to other payment plans if they become regular patrons.

Few of the patrons who used the 10-trip punch card on the survey day said they would refuse to ride if that option were dropped. Most would continue to ride if the 40-trip punch card were retained. This is in marked contrast to the case of respondents who use the monthly pass and the 40-trip punch

TABLE 5-12. DASH RIDER PROJECTIONS OF THEIR USE OF DASH IF PAYMENT WERE RESTRICTED TO ONE OPTION

How Respondent Paid for Trip	Would You Continue to Ride If the Only Payment Method Available Were											
	Cash?			10-Trip Punch Card?			40-Trip Punch Card?			Monthly Pass?		
	Yes	No	NA*	Yes	No	NA*	Yes	No	NA*	Yes	No	NA*
Cash N=7	5	1	1	5	0	2	2	3	2	3	2	2
10-Trip Card N=18	5	12	1	1	17	0	12	4	2	5	11	2
40-Trip Card N=135	12	118	5	60	67	8	130	4	1	69	59	7
Monthly Pass N=65	4	56	5	19	42	4	53	9	3	59	5	1
Total N=225	26	187	12	85	126	14	197	20	8	136	77	2

*Question not answered.

card. There would apparently be a serious loss of ridership if either of these options were terminated.

It must be pointed out that what respondents say they would do in a hypothetical contingency is not necessarily a good prediction of behavior. However, if these responses are credible, and in fact the DASH patrons would respond to a limitation of fare options as they have indicated, then the present fare structure appears sound.

5.2.8 Conclusions from the DASH Survey

The following conclusions can be made about fare prepayment in the SEMTA DASH services:

- DASH users who are relatively certain that they will make more than enough trips to break even on the cost of the pass (versus the 40-trip punch card) will buy the pass.
- DASH users who are uncertain about the number of trips they will make in the future, even though they may usually ride quite often, prefer a non-expiring multiple ride prepayment form like a punch card to a monthly pass.
- The introduction of the 40-trip punch card has expanded the market for DASH slightly.

- The 40-trip punch card would be the most attractive of the four payment methods, if for some reason the options were reduced to one. All four options, however, serve useful purposes.
- DASH users tend to behave in an economic manner with regard to prepayment, generally ignoring the relatively minor convenience differences among the prepayment options.

A note of caution must be made about conclusions emanating from the DASH survey. The sample size is small (225 cases) and the patrons are not typical Detroit transit users but, in general, relatively affluent office workers, engineers, and managers who are riding the bus by choice. (As a group they exhibit demographic similarities to transit commuters in some other cities and especially to users of such other commuter express services as, for instance, the Reston Express Buses in Washington, D.C.). Furthermore, surveys that ask a respondent's estimates about variables such as riding frequency, past behavior, and future behavior under hypothetical circumstances, are subject to inaccuracies and misinterpretations. Because a truly experimental situation did not exist and could not be created within the scope of the study, we felt justified in taking a nonrigorous approach to the DASH survey in order to explore the patterns of DASH use for interesting insights and testable hypotheses.

5.3 THE TULSA ON-BOARD SURVEY

The Metropolitan Tulsa Transit Authority (MTTA) has been providing public transportation in Tulsa OK since 1968. At the present time MTTA's service area approximately covers the city of Tulsa, which had a population of 360,000 in 1970. A total of 83 buses are operated six days a week with an average weekday ridership of 17,000. The system has a flat fare of 25 cents for all trips and requires exact fare from riders paying cash.

Tulsa was selected as a site for an on-board survey for three reasons. First, a 6,500 respondent, system-wide survey was conducted in April 1975. While this survey did not deal with rider motivations in choosing the means of fare payment, it has provided useful background data for a more specific survey. Second, MTTA offers several varieties of fare prepayment which have been well received by the public. In the April survey, approximately half of all riders said they used a punch card to pay their fare. An additional 15 percent reported using a one-day pass.

A third reason for selecting Tulsa is the sale of punch cards to employees by numerous firms, often at a substantial discount. In several

cases mentioned in Section 3, prepayment as an employee benefit has shown a propensity to bring about increased use of transit. To gauge the importance of the convenience afforded by purchasing fare prepayment at the place of work as well as the role of the discount provided by the employer, a supplementary survey of employees of participating firms was conducted. That survey is discussed in Section 5.4, "The Tulsa Employee Survey." The methodologies for both the on-board and employee surveys are discussed in Appendix D. Questionnaire forms and tabulations appear in Appendix E.

5.3.1 General Use of Prepayment in Tulsa

Table 5-13 shows the distribution of payment methods (question 1) among survey respondents on the day of the HRG survey. The punch card was the most popular means of paying for transit among those surveyed. MTTA's punch card costs $5 and is good for 25 rides, representing a 20 percent discount from cash fare. Punch cards may be purchased at MTTA offices and at over 50 retail

TABLE 5-13. PAYMENT METHODS OF TULSA ON-BOARD SURVEY RESPONDENTS

Payment Method Used	Number	Percentage of All Respondents
Punch Card	558	37.6
Cash	505	34.0
Day Pass	258	17.4
Student Punch Card	51	3.4
Senior Permit	36	2.4
Transfer (5¢)	27	1.8
Monthly Pass	20	1.3
Token	8	0.5
Unknown	24	1.6
Total Respondents	1487	100.0

stores and banks. As will be discussed in more detail later, many firms in the downtown area sell punch cards to employees, often at half price.

Day passes were used by 17.4 percent of respondents. MTTA sells these passes on-board and charges 50 cents, twice regular cash fare. The passes are

thus particularly economical for those who are able to adjust their schedules so that they can consolidate their trips into a single day. For commuters the punch card is more economical unless extra rides are taken during the day, in which case a day pass may cost less per ride.

The very limited usage of MTTA's monthly unlimited trip pass is noteworthy. This pass is aimed at riders of express buses from outlying areas to the central business district. Priced at $22, the pass is very rarely economical for non-express riders, who would have to make 88 trips to break even. Since the one-way cost of the express service is 50 cents, even a commuter riding an express bus twice daily would have to do so more than 22 days a month for the pass to be economical. It should be noted that at the time of the survey, it was possible to pay for an express trip with two punches of a punch card plus payment of a dime. This, of course, involves no discount, and exact change is required. (A special punch card for express users was implemented in January 1976, after the survey being reported here was complete).

In the analysis to follow, attention will be focused on users paying with punch cards, cash, and day passes. These three methods together account for 89 percent of the respondents. A series of questions on rider attitudes toward various aspects of prepayment was used to explore the motivations behind the type of payment used.

5.3.2 Choice of Payment Method

The analysis of the DASH service in the preceding subsection demonstrates that the preferred method of fare payment on that service is related to the number of expected transit rides and what appears to be a careful cost calculation on the part of each DASH user. When the same type analysis is applied to the diverse group of riders on Tulsa's conventional fixed-route bus system, the results are different for a number of reasons.

Consider a Tulsa transit user who has planned a day's activities well enough to know how many bus trips (s)he will make on that day. Three basic forms of payment are available to the general rider: punch card, day pass, and cash. Table 5-14 shows the costs of making various numbers of trips by each of these three payment methods. The circled entries in the table indicate the minimum possible cost for each number of rides. For one or two trips a day, the Economic Rider would pay by punch card, thereby earning a 20 percent discount below cash fare. For three or more trips a day, the Economic Rider would buy a day pass. In no case would such a rider pay cash (although for one trip a day, cash is a better choice than the day pass).

TABLE 5-14. COSTS OF DIFFERENT NUMBERS OF TRIPS PER DAY IN TULSA

Payment Method	Number of Trips During One Day					
	1	2	3	4	5	6
	Dollars					
Punch Card*	(.20)	(.40)	.60	.80	1.00	1.20
Day Pass	.50	.50	(.50)	(.50)	(.50)	(.50)
Cash	.25	.50	.75	1.00	1.25	1.50

*If the punch card is purchased from an employer offering a subsidy, the cost to the user would be a fraction (usually half) of that shown in the table.

Table 5-15 shows the distribution of respondents in the Tulsa on-board survey, broken down by payment method used and expected number of trips on the day of the survey. As in the previous table, the circled entries represent the payment methods that would be chosen if all respondents were Economic Riders, concerned only with minimizing their cost per ride. It is evident from Table 5-15 that MTTA riders are for the most part not motivated purely by cost considerations. Of the 249 respondents who estimated that they would make only one trip on the day of the survey (and who use one of the three payment methods in Table 5-15), only 75 (30 percent) paid by the most economical method, the punch card.

TABLE 5-15. ACTUAL USAGE OF PAYMENT METHODS FOR DIFFERENT NUMBERS OF TRIPS

Payment Method	Number of Trips Expected on Day of Survey						Total
	1	2	3	4	5	6+	
	Passengers						
Punch Card	(75)	(388)	7	11	1	2	484
Day Pass	25	106	(27)	(44)	(3)	(7)	212
Cash	149	256	20	15	8	1	449
Total	249	750	54	70	12	10	1145

Similarly only 52 percent of the respondents planning to make exactly two trips that day chose the punch card.

Among those making three trips, the greatest number (27) used the most economical payment method, the day pass, but this was only 50 percent of all

respondents making three trips. Day pass use was relatively high (44 respondents, or 63 percent) among those expecting to make four trips on the survey day. However, 15 of these 4-trip riders were prepared to pay $1 in cash rather than purchase a day pass from the driver on the first trip for 50 cents.

Earlier we saw that DASH users did not always purchase the payment method that minimized their cost per ride, and we investigated some of their reasons for choosing uneconomical payment methods. But for the most part, DASH riders chose the payment form that offered the lowest cost per ride. Just under half (48 percent) of those surveyed in Tulsa chose the cheapest method of payment. Are MTTA riders less economically minded?

The answer is probably that the users' diverse groups which constitute MTTA's ridership have a considerably wider range of trip purposes and constraints (e.g., income level) than is the case with DASH patrons. Those who use transit infrequently and for purposes other than commutation or those with very limited resources may well be concerned with features other than the absolute cost per ride. The primary purpose of this survey was to ascertain whether riders having different trip purposes and different age and income levels are motivated differently in their choice of payment method for transit rides. The remainder of this section on the Tulsa survey addresses these issues.

5.3.3 Method of Payment and Trip Purpose

Table 5-16 is a cross tabulation of fare payment options (question 1) with trip purpose (question 5). The shaded row of the table represents the overall distribution of trip purposes. Comparing each row with the shaded row shows which payment methods were used most frequently for the respective trip purposes. Table 5-17 transposes the rows and columns of Table 5-16 to display the relationship between payment method and trip purpose in another way, showing the trip purpose percentages of riders who use each method of fare payment.

5.3.3.1 Work Trips

The journey to work was the purpose for two-thirds of the trips in the sample (Table 5-17). Just under half of all work trips, 47.6 percent, were paid for by punch card (Table 5-16). Table 5-17 shows that 82.6 percent of the rides paid for by punch cards were work trips. The mean number of trips expected to be taken on the day of the survey by commuters paying for their rides with punch cards (question 3) was 1.9 (80 percent

TABLE 5-16. PAYMENT METHODS USED FOR EACH TRIP PURPOSE IN TULSA

Trip Purpose	Payment Method				Total
	Punch Card	Cash	Day Pass	Other	
	Percent				
Work	47.6	32.4	15.6	4.4	100
School & College	26.5	37.2	11.4	24.9*	100
Shopping	14.8	37.7	36.1	11.4	100
Social & Recreational	7.5	52.5	22.5	17.5**	100
Overall	37.6	34.0	17.4	[illegible]	100

*Primarily student punch cards (for students up to 18 years old).
**Ten percent were senior citizen permits.

TABLE 5-17. TRIP PURPOSES FOR WHICH EACH PAYMENT METHOD WAS USED IN TULSA

Payment Method	Trip Purpose					Total
	Work	School & College	Shopping	Social & Recreational	Other & Unknown	
	Percent					
Punch Card	82.6	12.1	1.6	0.5	3.2	100
Cash	62.6	18.9	4.7	4.2	9.6	100
Day Pass	60.5	11.6	8.9	3.6	15.4	100
Overall	66.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

said 2 trips). They anticipated making an average of 9.1 trips per week (60 percent estimated 10 trips in question 4). Thus commuters who use punch cards tend to be very regular riders of transit.

The reason given most frequently (42.1 percent of the time) by commuters for using punch cards was convenience (question 19). The ability to board without having to be concerned with exact change was shown to be a major factor. Two-thirds of this group of riders expressed considerable dislike for carrying the proper coins to pay the exact fare (question 7). The ability to prepay for transit rides in and of itself was liked by two-thirds of this rider group (question 10). The front-end cost of punch card purchase, therefore, did not appear to be particularly

unattractive to many commuters. The inconvenience of waiting while the card is punched was considered unimportant by nearly all users of punch cards (question 11).

Cost saving was the reason given by 31.5 percent of those commuters choosing to pay transit fares with punch cards. An additional 23.8 percent gave both cost savings and convenience. Fully 92.4 percent of this group liked the idea of a discount for multiple rides "very much". The fact that punch cards do not expire (as passes do) was also important (question 12). Over 90 percent expressed positive feelings toward the absence of a time expiration.

The second most common means of paying for work trips was the regular cash fare. Table 5-16 shows that one-third of all work trips were paid for by cash. These riders tended to use transit less frequently than those paying by punch card. On average they expected to make 1.7 trips on the survey day and 7.3 trips that week. The great majority of this group felt positively towards the fare discounts available through prepayment (question 6) and the ability to ride all day on a single pass (question 8). Sixty percent, however, gave the reason for choosing to pay cash as "convenience". But the inconvenience of waiting while a punch card is punched was considered unimportant, and few had strong negative feelings about going to an outlet to buy a punch card (question 9).

About one-third of the cash-paying commuters expressed a dislike for the need to carry the proper coins to pay exact fare. Presumably, while many commuters who choose to pay cash do not dislike the other options available, they feel that the inconvenience of coin handling is not sufficient to induce them to purchase a punch card. The rejection of the day pass could be in part a result of an alternate mode of travel being used on the trip home.

Unlimited-trip day passes were the means of payment used by 16 percent of the respondents who were on work trips. Consistent with the foregoing analysis of the DASH system, these riders appear to have chosen the day pass because they make sufficient trips to render it economical. Compared with the 1.9 average trips per day by punch card users, day pass users estimated that they would make an average of 2.5 trips.*

*But in the case of employees purchasing punch cards for half price from their employers, more than five rides would have to be taken per day for the day pass to be more economical.

It is interesting that the reason given by two-thirds of the commuters using day passes for choosing that means of payment was not cost, but convenience. It would thus seem that the convenience of using the day pass, even though exact change must be used to purchase the pass each day, is deemed to exceed that of punch cards by this group of riders. Less than half expressed positive feelings toward going to an outlet for the purpose of purchasing a punch card, and only 28 percent disliked the need for exact change.

To summarize, commuters who are frequent users of MTTA service tend to prefer punch cards because they consider them convenient and economical. Such commuters do not appear to take many rides other than work trips, but it is suggested that they ride nearly every workday. Less frequent riders often prefer to pay cash because they perceive it to be easier to have exact change when necessary than to buy a punch card; the discount available through punch card use does not appear to be a great incentive to this group. Day passes are largely used on work trips by those who intend to make more than two trips on that particular day. In general, such riders do not ride transit every day. (However, a commuter could maximize economy by using a punch card on days when (s)he expected to make only one or two trips, and purchasing a daily pass on those days when (s)he expected to make three or more trips.)

5.3.3.2 Trips to School and College

Outside of the journey to work, the most frequent trip purpose cited in the Tulsa on-board survey was traveling to school. Table 5-16 shows that the method most often used to pay for the ride to school was cash. The reason for their choice of payment method given by two-thirds of those paying cash on school trips was convenience. Almost half of these riders expressed indifference toward the ability to prepay for transit; approximately the same fraction also felt indifferent about the nonexpiring feature of punch cards.

Three-quarters of those paying cash on school trips said they liked day passes "very much." Since 90 percent of the cash-paying students expected to ride once or twice on the day of the survey, there was little incentive for them to buy day passes.

Over 80 percent of the cash-paying students either did not like having to pay with exact change or were indifferent. Citing convenience as the most important reason for choosing to pay cash therefore probably implies that the alternative, punch cards, were not thought to be

particularly convenient. The prospect of going to an outlet to purchase a punch card brought mixed reactions. The largest share of this group was indifferent towards doing so, and an equal share felt negatively as felt positively.

Punch cards were, however, used by a quarter of all those surveyed who were journeying to school (Table 5-16).* This group contains more frequent users of transit, with over two-thirds planning to ride twice on the survey day and half expecting to ride 10 or more times during the week of the survey. The reason given most frequently by this group for their choice was cost savings. The nonexpiring feature of punch cards was viewed favorably by three-quarters of this group, and only one-fifth disliked going to an outlet to purchase a punch card.

Day passes were used by 11.4 percent of those surveyed who were on school trips (Table 5-16). Three-quarters of the students using day passes gave convenience as their reason for choosing this method. One-third reported disliking prepayment of transit fares, and only one-fifth disliked having to provide exact change. This group expected to take an average of 2.3 trips on the day of the survey. The expected number of trips for the week varied greatly, averaging just under eight.

In conclusion, users of MTTA service for trips to school or college appear to vary considerably in their preference of how to pay for bus rides. As was the case with commuters, the choice was highly related to the number of expected trips. Punch card users were the most frequent weekly patrons of transit, but those boarding with day passes tended to make the most trips in a single day. Cash payers used the system least.

Only punch card users cited cost as the greatest motivating factor in their choice of payment method. Aside from the need to go to an outlet to purchase the card (there are over 50 such outlets), it is not likely this payment method is any less convenient to use than the two alternatives. It may well be that the front-end cost of punch cards was an important factor in the choice of day passes or cash over punch cards. To a person with limited resources, allocating up to five dollars to transit at one time may be perceived to be quite inconvenient.

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*It is suspected that a number of students indicated using punch cards when they meant student punch cards. Student punch cards cost 15 cents per ride (three dollars for 20 rides). Combining the two forms of punch cards, 48 percent of the trips made by students are represented.

5.3.3.3 Shopping Trips

Only 4.2 percent of the respondents were making shopping trips (Table 5-17). Table 5-16 shows that on shopping trips cash and day passes were used in approximately equal percentages, and that punch cards were used with relative infrequency. Those paying by cash expected to take an average of 2.3 trips on the survey day but only 3.7 during the entire week. Since 95 percent of these riders expressed favorable attitudes toward day passes, it is not entirely clear why more did not choose to purchase them. Quite likely, many of these shoppers use the free tokens distributed by many merchants for the trip home (the survey was conducted during the morning). Three-quarters of those on shopping trips liked the availability of tokens (question 13).

Shoppers using day passes anticipated making an average of 3.5 rides on the day of the survey, and 6.2 during the week. For these riders the day pass is undoubtedly the least expensive means of paying for transit. For their reasons in choosing this method of payment, equal numbers of shoppers using day passes cited cost and convenience. Half felt that going to an outlet to purchase a punch card was undesirable, and few expressed strong positive feelings toward the discount available through punch cards.

The limited number of shoppers using punch cards turned out to be relatively infrequent users of bus service. On the average they expected to take only two trips on the survey day and four all week. Two-thirds gave convenience as their reason for using this means of payment. It is possible that many of this group were using punch cards purchased by a more frequent user of transit within the same household.

The response of shoppers riding transit in Tulsa underlines the value of a day pass to such users. Most appear to use transit service two days a week and to take multiple rides on those days. None of the alternatives available could offer a cost per ride close to the 14 cents (50 ÷ 3.5) the average day pass user incurred. Cash fare is perhaps the logical choice for someone expecting to make only two trips on a given day if they intend to patronize a store distributing tokens.

5.3.4 Method of Payment and Rider Characteristics

Having examined the motivations of users of the alternative methods of payment for various trip purposes, we now turn to characteristics of the users themselves. The purpose here is to explore the extent to which

there is a generalized response to payment alternatives across age groups and income levels.

5.3.4.1 Age of the Rider

Table 5-18 depicts the fare payment options used by riders belonging to various age brackets. Comparing each row with the shaded row (the overall distribution of payment methods used) reveals which age groups were overrepresented among the users of each payment method. In Table 5-19 the shaded row is the age distribution of all riders surveyed. Comparison of each row with this row indicates which of the three payment methods was used most by each age group.

TABLE 5-18. PAYMENT METHODS USED BY AGE GROUP IN TULSA

Rider Age (yrs.)	Trips Paid for by Each Payment Method				Total
	Punch Card	Cash	Day Pass	Other	
	Percent				
0-16	35.0	32.0	7.0	26.0*	100
17-25	31.5	41.6	18.7	8.2	100
26-42	50.6	34.5	11.8	3.1	100
43-61	49.2	28.3	19.0	3.5	100
62+	21.1	23.2	25.3	30.4**	100

*Primarily student punch cards
**Senior citizen permits account for 26.3 percent

Members of the different age groups vary in their motivations for selecting payment methods. There was an overrepresentation of the under 16 and 17-25 year age brackets among those indicating indifference toward the discounts available through the purchase of punch cards. These age groups were also less positive toward prepayment in general than were the other age groups. The younger age brackets consistently gave convenience as a reason for their choice of payment method. It appeared that the younger passengers were not particularly interested in (or able to derive) the economic benefits of fare prepayment.

TABLE 5-19. AGE GROUPS USING EACH PAYMENT METHOD IN TULSA

Payment Method	Trips Taken by Each Age Group (Yrs.)					Total
	0-16	17-25	26-42	43-61	62+	
	Percent					
Punch Card	6.8	25.0	34.4	29.9	3.9	100
Cash	7.5	39.2	27.8	20.4	5.1	100
Daily Pass	3.4	36.7	19.8	28.5	11.6	100

The responses of the 26-to-42 and 43-to-61 year old age groups were for the most par very similar to each other. The former group used cash more and the latter used day passes with greater frequency. For both groups the punch card was the payment method used most often. This, of course, is to be expected since punch cards were shown to be used most heavily by commuters, and these groups include a large share of work-aged respondents.

The oldest group of riders, those 62 years of age or more, were the most frequent users of day passes. Approximately equal numbers of senior citizens boarded with day passes as with senior permits.* For this age group and the one including those 26-61 years of age, motivations for choosing a particular method varied more with the method chosen than was the case with the younger groups.**

5.3.4.2 Income of the Rider

Continuing the convention used in previous sections, Tables 5-20 and 5-21 present the relation between user income level (question 18) and payment method used. It is immediately evident that the higher the income level, the greater the proportion of respondents using punch cards to pay transit fares. The reverse is essentially true with day passes. Furthermore, there is a clear trend for cash fare riders to belong to the lower income levels.

*Senior permits in Tulsa are certified identification cards. Display of the card and payment of a dime are required for boarding. The permit may be used between 9 a.m. and 3 p.m.

**The motivations associated with each payment method were summarized in the previous section entitled "Method of Payment and Trip Purpose."

TABLE 5-20. PAYMENT METHODS USED BY INCOME LEVEL IN TULSA

Rider Income ($)	Trips Paid for By Each Payment Method				Total
	Punch Card	Cash	Day Pass	Other*	
	Percent				
Below 4,000	17.9	37.9	35.7	8.5	100
4,000 to 6,999	29.7	32.9	22.0	9.1	100
7,000 to 9,999	34.7	40.8	12.2	12.3	100
10,000 to 14,999	55.5	28.6	8.2	7.7	100
15,000 to 24,999	60.2	30.7	[illegible]	4.3	100
25,000+	62.2	23.2	9.8	4.8	100
Overall	37.6	[illegible]	[illegible]	[illegible]	[illegible]

*The higher values for "other" in this table are primarily due to missing data.

TABLE 5-21. INCOME LEVELS USING EACH PAYMENT METHOD IN TULSA

Payment Method	Trips Taken By Each Income Group ($)						Total
	Below 4,000	4,000-6,999	7,000-9,999	10,000-14,999	15,000-24,000	25,000 +	
	Percent						
Punch Card	9.1	14.1	7.7	23.1	34.4	11.6	100
Cash	23.9	23.1	11.3	14.6	21.7	5.4	100
Day Pass	46.2	26.6	7.0	8.7	6.9	4.6	100
Overall	21.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

On the basis of income there appear to be two general groups of riders. Notice that the shaded row in Table 5-21 suggests a bimodal, or double-peaked, distribution of income levels among users of MTTA service within the survey sample. The two lowest income brackets contain 21.4 and 20.0 percent of the survey respondents, and the $15,000 to $24,999 per year groups accounts for 24.0 percent. Table 5-20 shows that over 60 percent of the riders in the latter group used punch cards. The former two brackets

were strongly overrepresented among daily pass users and less so among payers of cash fare.

With such clear differences in choice of payment method, it is not surprising that the motivations for using that method varied considerably as well. The idea of prepaying transit fares was liked least often by those with lower incomes (0-$9,999 per year). This group expressed less interest in the discounts available through punch card purchase than did the sample as a whole. Lower income riders also disliked going to an outlet to purchase a punch card. Riders in the low income group did express strong positive feelings toward the ability to ride all day on a single pass. The reason given by over two-thirds of these riders for using a day pass was not cost, but convenience. Since lower income riders using day passes expected to ride an average of 2.7 rides on the day of the survey, however, their cost per ride on average was slightly less than it would have been with a punch card discounted at 20 percent. The initial outlay is far less, and that possibly contributed to the perception of the day pass as being more convenient.

Riders belonging to the second general class of frequent riders, those with incomes of $15,000-24,999 per year, expressed a dislike for the concept of prepayment only about six percent of the time. To them, the ability to ride all day on a single pass was not nearly as attractive as to the lower income riders. Two features of punch cards, the discount and the lack of expiration, were especially well liked.

Since 86 percent of the riders of the high income group were on work trips (making an average of 1.9 trips on the survey day), punch cards allow a cost per ride that is the lowest possible for much of the group. Nonetheless, convenience was the reason most often given for using punch cards.

5.3.5 Conclusions from the Tulsa On-Board Survey

The responses obtained in this survey of Tulsa's MTTA service are consistent with those of the DASH survey discussed earlier. Specifically, the choice of payment method is often closely related to the number of trips the user expects to take. It is clear, however, that the reasons the survey respondents gave for using one method of payment or another went beyond the expected cost per ride. Just under half of those surveyed in Tulsa chose the most economical payment method. There were distinct preference patterns which served to distinguish punch card users, those preferring day passes,

and cash fare riders. Punch cards are used more than the other prepayment forms for work trips, by persons in the 26-61 age group, and by those in higher income brackets. Day passes are used more than other prepayment methods for shopping, by persons in the 62 and older age group, and by those in low income brackets. The use of cash is more evenly distributed among trip purposes and user characteristics, but cash payment is preferred over prepayment for social and recreational trips and by younger passengers.

Indeed, the response toward an alternative means of paying for a transit ride has been shown to be intimately tied to trip purpose and characteristics of the user. The survey showed that convenience in fare payment is at least as important to the majority of riders as are minor differences in cost per ride. The problem, of course, is defining convenience. Judging by the responses obtained, its meaning is quite variable among different groups of riders. Reducing the scale all the way to the individual, it may be that convenience is a set of psychological variables, the importance of each varying with the particular person.

Because different riders seem to have different perceptions of what constitutes convenience, it appears advisable for transit operators to offer a simple, carefully balanced set of prepayment plans. This approach offers promise as a means of attracting new riders while making the service appealing to established patrons. In this context MTTA appears to be a good example of a transit system with a well-balanced prepayment program. The set of plans offered does not favor any one group of riders, but contains options attractive to a wide range of riders. The fact that two thirds of Tulsa transit riders pay their fares by means other than cash is an indication that fare prepayment has been an effective feature of MTTA's marketing strategy.

5.4 THE TULSA EMPLOYEE SURVEY

The MTTA cooperates with Tulsa employers in an innovative program that centers around the authority's punch card. Approximately 15 participating firms purchase punch cards from MTTA at the regular price of $5.00 each for resale to their employees. About half of these firms provide their employees with an additional incentive to use transit by subsidizing as much as half the cost of each punch card. Some firms limit the number of cards that can be purchased by any one employee to two per month; others have no limitations.

Most of the companies have elected to participate in the program primarily because they hope to reduce company expenditures on parking facilities as employees switch from their cars to buses.

The MTTA program offered an excellent opportunity to explore the effects of selling fare prepayment at the rider's place of work. The employer subsidies of the program deserve particularly close examination. Specifically, our objectives in this survey were (1) to determine whether employer subsidies and sale of prepayment at the place of work can increase use of prepayment; and (2) to determine whether these actions can increase transit use.

Five firms were selected for their variety in terms of size, nature of business, and practices in the sale of punch cards to employees. Both users and nonusers of transit were surveyed in the five firms. A discussion of the sample appears in Appendix D, and a copy of the questionnaire with tabulated results is presented in Appendix E.

5.4.1 Employee Familiarity with the Program

Four of the companies involved in the survey subsidize 50 percent of the cost of each punch card. The fifth company offers no subsidy. To assess the respondents' familiarity with the extent of their employers' participation in the program, we asked the question (question P), "Does your employer sell passes at a lower price than would exist elsewhere?" Among the four companies subsidizing the cards, approximately 92 percent of the respondents knew that their employers sold the cards at a discount. Less than one percent erroneously believed that no discount was offered, and seven percent said they did not know. On the other hand, 44 percent of the employees of the fifth firm incorrectly thought that their employer sold punch cards at a discount. Only 26 percent correctly stated that the firm offers no discount, while the remainder indicated they did not know. (This firm is a large aircraft maintenance facility).

Transit users made up 42.7 percent of the total respondents in this survey, and not surprisingly, their answers on the discount question were generally more accurate than those of the other respondents. An exception was noted, however, among the employees in the firm that offers no punch card subsidy. In this case most of the erroneous responses came from the transit commuters rather than the non-transit commuters. Some of these respondents may have interpreted the question incorrectly and compared their card's cost with the cash fare rather than with the cost of the

equally-priced punch cards available for general distribution in stores and banks. The MTTA punch card offers a 20 percent discount below cash fare on a cost-per-trip basis.

Because so many of the employees in the firm that offers no punch card subsidy thought the card was being offered at a discount, we were not able to separate the effects of selling the card at places of work from the effects of the subsidies. Our control group therefore did not function as a control because of false perceptions of the nature of their employer's participation in the punch card program.

5.4.2 Impact of the Program

Respondents who presently ride MTTA buses on the journey to work were asked whether they used transit before their employers began selling punch cards (question D). The response was significant. Just under two-thirds indicated that they had not ridden transit prior to the initiation of the employer punch card distribution program. Of the remaining third that had ridden previously, 30 percent said they now ride more frequently than they did before the program began (question E).

Of the respondents who began riding after the initiation of the employer distribution program, 98 percent said they use punch cards purchased at work to pay for their transit rides (question C). This level of positive response indicates that the program may have been instrumental in attracting these commuters to transit. Comments in response to the open-ended question O, "What is the main reason that you make the journey to and from work in your present manner?," tend to support this conclusion. Low cost was cited as the reason for using punch cards by 45 percent of the people who started riding after their employers began selling the cards (question F). Recall that among all commuters using punch cards on the day of the on-board survey, only 31.5 percent gave cost as a reason for selecting this method of payment. Evidently, lowering the cost through subsidies made cost relatively more important than other factors (such as convenience) in influencing these respondents' choice of payment method.

Very few of the employees who purchase punch cards at work are absolutely dependent on transit for their rides to work. Automobiles are available to 83 percent of them (question I). The cost differential, however, between driving their automobiles and the lowered cost of a partially subsidized punch card, appears to be significant in influencing people to switch from automobiles to transit.

We have further evidence that the distribution and subsidy of punch cards by employers has increased the market penetration of transit in Tulsa. Table 5-22 shows the walking times to bus stops for employees who buy punch cards at work (question M). Almost three quarters of those who rode transit prior to the employer distribution programs live within five minutes of a bus stop. The new riders, however, tend to live significantly farther from bus stops than the already-established riders.

TABLE 5-22. TRANSIT USE AND WALKING TIME TO A BUS STOP IN TULSA

Used Transit Before Program Began?	Walking Time to A Bus Stop in Tulsa				Total
	Less Than 5	5-10	More Than 10	Do Not Know	
	Percent				
No	59.1	24.7	12.6	3.6	100
Yes	73.2	16.7	8.0	2.1	100

Consistent with the responses just reported, the importance of cost as a factor influencing people to use transit seems to increase as the walking time to bus stops increases. Table 5-23 shows this relationship for employees using transit at the time of the survey. The employer subsidies appear to be an effective means of increasing the market penetration of MTTA service.

TABLE 5-23. WALKING TIME TO A BUS STOP AND REASON FOR USING TRANSIT IN TULSA

Walking Time to a Bus Stop (Min.)	Reason for Using Public Transit				Total
	Cost	Convenience	Other	Cost and Convenience	
	Percent				
Less than 5	32.7	19.0	5.0	43.3	100
5-10	45.0	15.0	3.7	36.3	100
More than 10	72.5	22.5	2.5	2.5	100

5.4.3 Conclusions from the Tulsa Employee Survey

The Tulsa on-board survey results presented in the previous section suggested that punch cards are the means of fare payment most used by commuters who ride transit. While their reasons for doing so were mixed, the greatest share indicated that the convenience of using punch cards was the chief motivating factor. The Tulsa employee survey discussed in this section focuses on a subgroup of Tulsa commuters. The vast majority of these commuters can buy punch cards from their employers at half price. In contrast with the larger group of commuters, the participants in company distribution programs cited cost savings as more important than convenience in their decision to use punch cards.

Most people who purchase punch cards from their employers in Tulsa did not use transit before their employers began selling cards. The vast majority of these people have automobiles available, and many live farther from bus stops than those who had been riding transit prior to the start of the sales programs. The low cost per ride resulting from employer subsidization of prepayment was given to be the major reason for participation in the program. The ultimate effect of the employer sales and subsidy program has been an increase in transit ridership.

5.5 THE UNIVERSITY OF PITTSBURGH EMPLOYEE SURVEY

The Tulsa employee survey showed that a company-subsidized discount in the sale of punch cards is the major inducement for employees at those companies to ride transit. To provide a comparative analysis of a system in which employers offer convenient distribution of prepayment with provisional discounts, we turned to Pittsburgh.

The Port Authority of Allegheny County (PAT), which serves the City of Pittsburgh, sells weekly permits ($2.60), monthly permits ($10.00), and annual permits ($100) to the general public through a wide distribution network. All permits are good for unlimited use during the designated time period and allow the passenger to subtract 30 cents from the cash fare. Base fare is 40 cents, meaning that the minimum cash drop for each trip is 10 cents with a permit. The system has five zones, with 10 cent zone fares between most zones. In 1975 PAT sold over 1600 annual permits and nearly 216,000 monthly permits.

In addition to counter sales of permits, PAT has a program whereby participating employers distribute monthly permits to employees and deduct the cost from employees' paychecks. PAT provides an additional incentive

for employees to participate in this program by offering a free permit in the twelth month if a person buys permits through the payroll deduction plan for eleven months. In effect this is a provisional discount of 8.3 percent, contingent on a fairly high level of continuing participation.

The University of Pittsburgh was the first and is currently the largest employer participating in PAT's payroll deduction program. Approximately 500 of the 6000 University employees are in the program. A survey directed at all employees was conducted during the first two weeks of January 1976. A discussion of the survey methodology appears in Appendix D, and the questionnaire and tabulated results are in Appendix E.

5.5.1 Employee Reception of the Program

Of the 2,017 University of Pittsburgh employees returning completed questionnaires, 29.3 percent said they use public transit for their journey to work (question A). Among the employees riding transit to work, 48.7 percent reported using monthly permits to pay their fares (question B). Another 2.2 percent said they use annual permits.

Permit users were asked whether they obtained their permits through payroll deduction (question C). Just over 61 percent replied that they did. The other third presumably purchase their permits at one of PAT's sales outlets, of which there are approximately 100 throughout Pittsburgh. Between these two groups the reasons given for paying transit fares with permits were quite different. In their replies to question F, "Why do you pay for public transit the way you do" those participating on the payroll deduction program cited convenience as the primary reason 58 percent of the time. Another 34 percent cited convenience along with cost, so that a total of 92 percent of payroll deduction participants considered convenience to be an important motivating factor in permit use.

Among those employees of the University of Pittsburgh who indicated that they purchase permits through payroll deduction (9.1 percent of the sample, or 184 employees), 22 percent did not use transit before the program was offered (question D). Of those who did ride previously, 22 percent reported using transit more since joining the payroll deduction program (question E). These figures indicate that payroll deduction has probably made a contribution, albeit fairly minor, toward increased use of transit by participating employees.

Of those purchasing permits elsewhere, only 34 percent said convenience was the reason they use this method of payment. Twelve percent more cited convenience and cost for a total of 46 percent mentioning

convenience as a reason for using permits. Since this group of riders had different reasons for purchasing permits than did those who take advantage of the payroll deduction offering, we looked for differences between the groups with respect to their use of transit. Both groups made an average of 7.2 non-work trips a month on PAT buses (question L). It seems reasonable, therefore, to conclude that the two groups use transit with similar regularity. The distance from home to the nearest bus stop (question M), a proxy for convenience of using transit, was also similar for the two groups. From the data available, therefore, we were not able to detect any significant differences between the group of permit users who are in the payroll deduction program and the users who buy their permits at sales outlets.

5.5.2 Conclusions from the University of Pittsburgh Employee Survey

The payroll deduction program is used by about two-thirds of the transit riders in the sample who use permits, the only form of prepayment available through payroll deduction. The other one-third that uses permits has chosen not to participate in the program. There are several factors that may have affected these employees' decisions. First, the permits have a time expiration. Those not using payroll deduction may have variable enough schedules to cause uncertainty about the economy of using a permit in some months. (Recall discussion of the DASH survey.) This is particularly likely to be the case at a university, where there are a number of semester breaks and vacations, as well as a higher proportion of part-time jobs, including ones requiring fewer than 5 days attendance each week.

A second possible reason for some riders' rejection of payroll deduction in this particular application is that price reductions are realized only after eleven consecutive months of participation. Recall that the participants in Tulsa's employer sales program cited cost saving as their primary motivation for purchasing punch cards at work. While that program is less convenient (employees must go to a counter to purchase the punch cards) than payroll deduction, its economic incentives are substantially greater.

We have observed thoughout our discussions of the user surveys that different riders within a group, however their differences are defined (trip purpose, income, etc.), frequently appear to have different reasons for their choice of prepayment method. Some riders appear to be more cost-conscious than others; some are more concerned with convenience. A

prepayment plan that offers one and not the other will logically appeal to a smaller subgroup of all riders.

5.6 SUMMARY AND CONCLUSIONS: USER SURVEYS

Four surveys were conducted to investigate transit user attitudes toward fare prepayment in different applications. An on-board survey of commuters on SEMTA's specialized DASH express services in the metropolitan Detroit region found that the choice among alternate prepayment options is largely an economic one. Most DASH passengers seem to estimate carefully the number of trips they will be making in the coming month before choosing either the duration-limited pass or a slightly more expensive, trip-limited punch card. When their future trip-making is uncertain, these passengers tend to be risk-averse, and hence choose the punch card in order to put a ceiling on their cost per trip. The responses obtained in a survey of riders in Tulsa's bus system (MTTA) indicated that the more affluent commuters, like most SEMTA DASH express bus users, tend to make their choices among available payment methods on the basis of expected cost per trip. A 25-trip punch card, the most economical payment method for transit usage of fewer than 3 trips per day, was the predominant choice among Tulsa commuters.

Economic considerations do not hold, however, among all transit users, as other findings from the Tulsa on-board survey show. Low income riders in Tulsa tend to prefer the 25-cent cash fare or the 50-cent day pass over the discounted punch cards for the "convenience," they say. The $5.00 front-end cost of MTTA's punch card, though seemingly not very great, may be a deterrent to its use by people with limited resources, even though the cards would save them money in the long run. The payment preferences of the young and the old tend to be aligned with those of the low income groups, primarily because a large share of these age groups have limited incomes.

Employee-sponsored programs to distribute (and sometimes subsidize) transit prepayment were studied by conducting surveys in Tulsa and Pittsburgh. Non-participants as well as participants in the programs were questioned in an attempt to explain why some people are more attracted to the plan than others.

The Tulsa and Pittsburgh (PAT) transit systems differ in many ways, including their basic fare structures. MTTA's flat fare system is more conducive to simple, convenient prepayment plans than is PAT's zone system.

Approximately 40 percent of MTTA's passengers use a punch card to board. PAT's permit, which is one of the few mechanism for offering equitable prepayment for unlimited trips in a zoned fare structure, is disliked by some passengers because of the need to drop coins in the farebox as well as display the permit. Nevertheless, the permits offer a cost savings if used frequently enough, which helps to explain the sale of 216,000 monthly permits and 1,600 annual permits during 1975 in Pittsburgh.

PAT offers an incentive for people to participate in employer-administered payroll deduction program by providing a permit free in the twelfth month after the person stays in the program for eleven consecutive months. This feature plus the convenience of purchase by payroll deduction have helped to attract on the order of a hundred new transit users from among the 6,000 University of Pittsburgh employees and have probably caused an equal number of University transit users to ride more than they did previously.

In Tulsa the results are, as expected, more dramatic, since many of the firms in the punch card distribution program pay half the cost of the punch cards. Judging from survey results from five companies in Tulsa, we estimate that one-fourth of a company's employees might switch to transit when the employer offers a 50 percent subsidy of a transit prepayment plan.

The message to transit operators is clear. By involving employers in the transit marketing process, at least in distributing prepayment instruments, and especially in subsidizing them, a transit operator may realize significant ridership increases. The employers may realize reduced expenditures on parking provisions, a less congested, more attractive city in which to base their facilities, and a favorable public image.

6. SUMMARY AND CONCLUSIONS

Prepayment of transit fares in the United States dates back more than a hundred years, and most forms of prepayment currently in widespread use are identical to, or minor variations of, forms with long histories. Prepayment in the form of the weekly pass was much more prevalent in the 1930's, in an era of mostly private entrepreneurs in transit, than it is today.

With the long decline in transit ridership which became most dramatic after World War II, transit operators were forced to reduce services, raise fares, and trim programs which discounted or seemed to discount fares to riders. Studies of weekly passes had shown that their average usage was well above the assumed number of trips used to determine their price. Riders were taking advantage of their weekly passes to obtain substantial discounts on their transit fares. Milwaukee retains its weekly pass still, and finds the basic characteristics of its usage identical to those described in the 1930's. Unlike Milwaukee, most operators discontinued their weekly passes, feeling that they could not tolerate giving effective discounts in the generally declining state of the industry.

The 1960's and 1970's have seen a number of developments which have rekindled interest in transit fare prepayment. As moribund private transit operations were transformed into public systems and as major new subsidy funds became available from Federal, state, and local sources, interest in marketing transit services was renewed. Introduction of exact-fare policies for reasons of security and operating speed sparked usage of prepayment as an option for riders who may find it difficult always to have exact change in coins. Most recently, requirements for reduced or free fares for elderly, handicapped, and some other users have added to the list of prepayment mechanisms in use, with special tickets, identification cards or permits, and the like provided for these classes of riders. A variety of special prepayment mechanisms for school-age children, often developed by agreement with schools, have remained in use. Some operators have used special incentive prepayment devices to encourage off-peak ridership, especially on weekends.

Many operations have introduced new commuter or express services, some priced at levels above $1.00, and have provided prepayment plans for these services as a convenience to the regular rider and probably also in some cases because paper currency is difficult to use in transit fareboxes. Finally,

recent years have seen spectacular growth in general prepayment options, notably varieties of the monthly pass, as marketing tools. The intent is to increase transit ridership and to induce non-regular users to commit to using transit because they have made a relatively major investment in a pass, with which marginal rides are free and highly convenient. Sales of these passes via payroll deduction and use of various prepayment forms as employee benefits are recent developments with interesting results.

In parallel with the revitalization of prepayment as a part of the general increase in emphasis on public transit, new construction of urban rail transit worldwide over the last ten years has generally been accompanied by implementation of automatic fare collection (AFC) technology. Zone-fare bus operations in Europe have also broadly adopted AFC and extensive prepayment. In both cases, significant cost savings in collection of complex distance-dependent fares has been the major goal of such implementation. Much interest in the United States currently centers on possibilities for credit payment of transit fares, adapting and extending AFC technology.

Currently, over 90 percent of U.S. transit systems have prepayment in some form, most offering two or more forms, and sometimes several different plans within a given form (e.g., several pass plans). Slightly over half of all plans are available only to special rider groups, put in place for explicit or implicit reasons of social policy. About one third of plans are distributed by third-party organizations as well as or instead of the transit operator.

Most current plans are discounted either explicitly or, in the case of unlimited-ride instruments like passes, potentially. The highest discounts are available only to special groups, but a majority of general public plans show some level of discount.

Most optional plans in use today are used by only small percentages of boarding passengers, but for each type of plan there are a few examples of systems where prepaid riders constitute 20 percent or more of daily ridership. The highest usage is found for heavily discounted long-term passes, mostly found in college towns.

Transit operators estimated that prepayment contributed to increased ridership in 43 percent of all cases and contributed to decreases in none. In the remaining cases they estimated no change (30 percent) or said they could not judge the effect (27 percent). The operators also reported that prepayment usually has had no observable effect on revenues, but that revenue increases,

where they occur, outnumber decreases by three to one. Passes are thought to have the most significant positive effect on ridership and revenue, followed by punch cards, and then tickets and tokens. Since the primary use of permits is to allow special groups of riders to pay reduced fares, the operators said that permits generally increased ridership but had mixed effects on revenue.

Most operators reported little significant impact on their operating costs from prepayment plans, noting relatively small printing, distribution, and record-keeping costs. A number of systems with long-term plans and/or high usage rates reported decreased costs in administration or cash handling. Distribution of prepayment instruments by commission counter sales at banks and stores is widespread among larger systems, including a few cases where passes may be purchased with major credit cards.

Efforts to correlate measures of prepayment effectiveness with urbanized area characteristics were generally fruitless, except to reinforce operators' judgment that commuter, subscription, and similar special services are the most likely markets for prepayment, along with the special case of college towns.

Two general reasons have been cited by passengers to account for their methods of paying for transit: 1) cost and 2) convenience. The meaning of "cost" is relatively straightforward; the transit user who is concerned about cost usually computes the cost per trip for each of several payment alternatives. Convenience is a more elusive attribute. Individual user perceptions of convenience vary so much that every payment form, including cash, is considered convenient by some.

Commuters in two different surveys (one in Detroit MI, the other in Tulsa OK) made their choice of payment method on cost considerations most of the time. Commuters are likely to have the most routinized travel patterns of any transit passengers; their ability to predict the number of rides they will make enables them to select the payment method that is most economical. They are also usually able to handle the lump sum payment more easily. Many of the Detroit commuters, however, exhibited risk-averse behavior if they were at all uncertain about the number of trips they would make in the coming month. These people would minimize their maximum possible cost per trip by buying a 40-trip punch card rather than the slightly less expensive but duration-limited monthly pass. For many of them the monthly pass probably would have been more economical, but avoiding the risk of under-utilizing the monthly pass was apparently more important.

A pass is clearly uneconomical for a person who takes fewer than a certain (breakeven) number of trips during the period of the pass's validity.

Few people in this category buy passes. Furthermore, people who use transit for less routine purposes than going to work are generally less willing than commuters to buy multiple-trip prepayment instruments (such as punch cards), even when these are offered at a discount. Tulsa passengers making non-work oriented trips tended to prefer cash or a day pass because of the "convenience". Low income riders, the aged, and the young also generally preferred cash or the day pass over the punch card.

The difficulty of defining convenience is evident from the responses of Tulsa passengers in the survey. While many of the infrequent riders mentioned above liked the convenience of paying with cash or buying a day pass from the driver, the punch card users said they liked the convenience of not having to carry exact change. Permits embody all types of inconvenience mentioned here; the purchaser must go to an outlet to buy them and usually must pay the cash drop in exact change. Like passes, they involve the risk that they will be under-utilized and thus cost the purchaser more per trip than (s)he would have paid in cash fares. Nevertheless permits are economical, and thus popular, for people who can expect a certain minimum use of transit during the period of validity. They are also one of the most equitable forms of prepayment in zoned-fare systems.

Day passes are found in only a few applications. A major conclusion of this research is that the potential of day passes has largely been untapped. In Sacramento CA, 42 percent of the passengers board with day passes; and in Tulsa OK, 17 percent use them. The advantages of day passes listed below are based on results of the on-board survey effort in Tulsa.

Day passes, priced at twice the regular fare:

- can be sold by the driver, even in exact fare systems, and therefore do not require the passenger to make a special trip to a prepayment outlet;
- encourage trip-making during off-peak periods; when transit capacity is unconstrained;
- enable people to consolidate many trips into a single day at a low price. For this reason they offer a solution to the front-end cost problem inherent in most prepayment plans. (Low-income people sometimes have difficulty taking advantage of bulk discounts available with tickets or punch cards, because of the prohibitively high purchase cost of some of these devices. Day passes, however, have shown to be popular among low-income transit users).

- offer a convenient means for commuters to pay for round trips.

Response to employer-sponsored programs for distributing prepayment has been quite good and marks these programs as another area with much potential. Payroll deduction plans are an excellent way of attracting people to transit and keeping them in the habit of using it. Moreover, merely the sale of transit passes and other prepayment instruments at a place of work can increase transit's visibility and encourage more people to ride. Probably the biggest public response is induced by employer subsidies of prepayment plans.

Since prepayment's purpose in the minds of many transit operators is to attract new riders and encourage old ones to ride more often, this final set of conclusions relates to the fruitful application of prepayment principles in a marketing context.

More attention needs to be given by transit operators to balancing their prepayment offerings. Sometimes prepayment plans duplicate each other, confuse the passengers, and lead to more administrative costs and troubles than they are worth. Some plans were started years ago, have ceased to serve the purposes for which they were designed, but are retained without any solid justifications.

Operators do not usually go through the formal process of setting up objectives for prepayment plans, carefully considering the optimum strategy for meeting those objectives, and then measuring the results. The common approach rather, is to "try it and see what happens". Since prepayment plans are relatively easy and inexpensive to put in place (but perhaps more difficult to remove), this approach has been satisfactory, but it has usually led to a lack of quantitative information about prepayment that might be used to direct future implementation of such plans.

In most transit systems two or three basic prepayment options will cover the spectrum of needs if the plans are properly priced relative to one another. The number of possible combinations is endless, and no one combination can be recommended for general applicability. We can only offer the following general guidelines for establishing a balanced set of prepayment plans:

- A relatively low-priced, short duration option should be made available particularly to meet the needs of low-income riders, for whom a large purchase price would be a deterrent. (A day pass or a 10-ride punch card would be good choices).
- Use of weekly and monthly passes is limited to a select group of frequent transit riders, typically commuters. If it is

desired to include passes in a set of prepayment plans that everyone can use practically, passes should be complemented by a multiple-trip format like a punch card. A non-expiring punch card by itself, however, can serve both frequent and infrequent riders.

- Discounts of no more than 20 percent on punch cards or other multiple-trip formats are sufficient to attract a significant percentage of passengers to these forms, given an adequate distribution system.
- Permits are an equitable form of prepayment in zoned systems. A permit is likely to attract more users if it is designed to function as a pass for the base fare, with cash drops required only for additional zones. A permit that functions as a pass in off-peak hours can be used to encourage shifts from peak to off-peak traveling.

The task of considering alternate prepayment forms does not end when an appropriate combination has been selected. A continuing review process is needed to assure that the transit system's prepayment programs meet the needs of its passengers. Fare prepayment is a flexible part of transit operation and one that is conducive to marketing innovations.

APPENDIX A

SAMPLING PROCEDURES FOR SURVEYS OF TRANSIT OPERATORS AND TABULATION OF POSTCARD SURVEY RESULTS

The telephone survey was the basis for estimates of usage of the various types of plans as well as the summary of transit operators' experiences with fare prepayment. It is, therefore, worthwhile to elaborate on the method used to obtain the sample of operators called.

Postcards were initially sent to all U.S. public and private operators listed in the APTA and Bus Ride directories [1, 9]. The objectives of the postcard survey were 1) to determine the number of agencies using each type of plan and 2) to form the basis for selection of a smaller sample to be used in more in-depth telephone interview. A total of 555 postcards were mailed, representing an estimated 75 to 80 percent of the nation's operators in cities of over 10,000 population. The 319 responding operators account for 59.3 percent of those receiving postcards.

Postcard recipients were asked to do three things: indicate "yes" or "no" to a series of ten questions on prepayment, circle all modes of transit they operate, and check a special box if they were aware of prepayment plans in their system's history. The postcard questionnaire is reproduced in Figure A-1, and totals from the respondents are tabulated in Table A-1. The "transit modes operated" sum to more than the total number of respondents, since a given transit system may operate more than one mode.

Following the postcard survey, a telephone survey was conducted to obtain a more detailed picture of prepayment use among transit operators. A total of 146 operators were contacted. In determining which systems should be included in the sample to be telephoned, several decision rules were applied:

1) No more than one third of the operators indicating use of only tickets or only tokens were included,
2) All responding operators serving cities of 250,000 population or greater were included,
3) One half of the responding operators serving cities between 100,000 and 250,000 population were included,
4) One fourth of the responding operators serving cities of less than 100,000 population were included,
5) One fourth of the responding operators having no form of prepayment were included, and

6) One tenth of all operators not responding to the postcard survey were included.

Please check "yes" or "no" box for each statement.

Check here if you know of prepayment plans in your system's history ..... ☐

yes no IN OUR TRANSIT SYSTEM, PATRONS MAY PURCHASE:

- ☐ ☐ 1. Tickets
- ☐ ☐ 2. Tokens
- ☐ ☐ 3. Punch cards (multiple rides)
- ☐ ☐ 4. Passes (no further fare with use)
- ☐ ☐ 5. Permits (discounted fare with use)
- ☐ ☐ 6. Stored-fare cards (magnetic encoding)
- ☐ ☐ 7. PATRONS PAY FOR SERVICE VIA A CREDIT CARD
- ☐ ☐ 8. OTHER PREPAYMENT PLANS ARE AVAILABLE (describe _____)
- ☐ ☐ 9. Prepayment is available to all patrons (limitations _____)
- ☐ ☐ 10. Prepayment is possible for all services (limitations _____)

COMMENTS:

PLEASE CIRCLE ALL TYPES OF TRANSIT THAT YOU OPERATE:
Commuter Rail, Rail Rapid, Line Bus, Trolley, Demand Responsive, Taxi, Jitney, Vanpool, Subscription/Express Bus

Figure A-1. Postcard Questionnaire Sent to U.S. Transit Operators

Within each size group the members were not determined randomly. Rather, the returned postcards were analyzed and systems were selected on the basis of plan combinations present. Systems known to have interesting approaches to prepayment were included, and public operators were included more frequently than private. The resulting 146-system sample includes 112 operators who indicated on the postcard survey use of some form of fare prepayment, 8 operators who indicated that they did not have prepayment, and 26 operators who failed to respond to the postcard survey.

The 112 operators who reported use of prepayment on the postcard survey and who were later telephoned occasionally interpreted some of the prepayment classes differently than we have defined them. For example, some operators refer to their punch cards as "punch tickets" and therefore indicated use of tickets rather than punch cards. Such differences in interpretation were clarified when we talked with the operators on the telephone. The data recorded during the telephone interviews consistently conforms to our definitions of the various prepayment types.

The postcard sample is more representative of all transit operators in the country than the telephone survey sample, since we intentionally chose to call large operators and operators who have the most interesting plans. The group of operators who did not respond to the postcard survey were

TABLE A-1. POSTCARD SURVEY RESULTS
U.S. TRANSIT OPERATORS

Total Respondents	319		
Types of Fare Prepayment Offered	Yes	No	% Yes
Tickets	179	137	57
Tokens	87	229	28
Punch Cards	87	229	28
Passes	104	212	33
Permits	69	247	22
Magnetic Stored Fare	3	313	1
Credit Card	3	313	1
Other	22	294	7
Is Prepayment Available to all Patrons?	158	82	66
Is Prepayment Possible for all Services?	210	9	96
Transit Modes Operated	Number of Operators		% of Total
Commuter Rail	8		3
Rail Rapid	11		3
Line Bus	279		88
Trolley	9		3
Demand Responsive	27		9
Taxi	5		2
Jitney	1		
Vanpool	2		1
Subscription Express Bus	68		22
Knowledge of Prepayment Plans in System's History	58		

hypothesized to have less use of prepayment than the ones who did respond. Some of these were called to determine whether this hypothesis could be accepted.

By examining the differences that exist between the various samples, we developed estimates of the percentage of U.S. transit operators that use

each prepayment type. The calculation of this estimate will be more easily understood from Table A-2. The entries in column A of Table A-2 are the percentages of operators who reported having each of the prepayment plans. The percentages do not sum to 100 percent in this and other columns, because operators often have more than one prepayment plan. Column B shows the postcard responses among those responding operators who were also

TABLE A-2. ADJUSTMENTS APPLIED TO OBTAIN AN OVERALL ESTIMATE OF PREPAYMENT PLAN USE

Plan Type	Postcard Respondents N=319 A	Postcard N=112 B	Telephone N=112 C	Postcard Non-Respondents N=26 D	Correction Factor For Postcard Misinterp. C÷B= E	Adjustment For Telephone Sample Bias AxE= F	Adjustment For Non-Responses 0.6(F) +0.4(D)= G
	Percent					Percent	
Tickets	56.1	47.8	43.5	42.9	0.91	51.1	48
Tokens	27.3	33.0	33.0	25.0	1.00	27.3	26
Passes	32.6	43.5	53.9	42.9	1.24	40.4	41
Permits	21.6	30.4	37.4	39.3	1.23	26.6	32
Punch Cards	27.3	26.1	40.0	25.0	1.53	41.8	35
No Prepayment	13.6	8.7	4.3	7.1	0.49	6.7	7

telephoned. The differences between columns A and B reflect the decision to choose operators for telephone interviews on the basis of interesting prepayment plans. Column C shows the corrected percentages of responding operators with each prepayment type, according to our definitions of the various types. Column D shows the percentages of non-responding operators who have various prepayment plans, according to the telephone interviews with 26 non-respondents. Column E shows correction factors, computed by dividing the entries in column C by those in column B. The correction factors are multiplied by the corresponding entries in column A to produce estimates of the true percentages of responding operators having each plan (column F). Column G is a weighted average of the corrected percentages among responding operators (column F) and the percentages determined from the sample of non-responding operators who were telephoned (column D). The .6/.4 weighting scheme is based on the 60 percent response rate to the postcard survey. The final estimates

In column G are thought to be a slightly better indication of the incidence of transit prepayment plans in the U.S. than the raw percentages resulting from the postcard survey alone.

APPENDIX B
TRANSIT OPERATORS SURVEYED

B.1 CITIES IN THE TELEPHONE SAMPLE OF U.S. TRANSIT OPERATORS

Table B-1 lists the 146 operators who were interviewed by telephone in September and October of 1975. Operators are listed in rank order according to the population of their service areas. Each system is identified by the major city in which it operates, although some multi-jurisdiction systems are identified by the cities in which their transit offices are located. Systems serving the New York City and Chicago metropolitan areas are grouped respectively under those titles rather than under the cities in which their operators are based.

How To Read The Columns

"SVC. AREA POP." is the service area population as reported by the respondent. The figures were recorded during the telephone interviews and verified later by a mailing to all respondents. In some cases the population reflects a single city, while in others the service area is a complete SMSA or larger.

"NO. VEH." is the reported number of vehicles owned or leased by the transit operator, as of July 1975. Figures for multi-modal systems generally include all vehicles, rather than buses alone. The same verification procedure was followed as above.

"AVG. DAILY RIDERS" is the average daily ridership reported by the operator. It is an estimate reflecting average weekday (not including weekends) ridership in the month prior to July 1975.

"RECENT GROWTH" refers to a one-year period prior to the telephone interview. Respondents were asked whether vehicles, route-miles, and ridership had changed over the past twelve months. The answers, "increased", "stayed the same", and "decreased" in each instance are non-numerical; changes are substantial in some cases and very slight in others. The following symbols are used for these changes in Table B-1: "+" for increased, "s" for stayed the same, and "-" for decreased. "SYS" represents a combination of vehicle and route-mile changes, while "RIDER" indicates a change in system ridership.

"PREPAYMENT" indicates the actual formats available in each system. Numbers reflect how many plans are available within each format, corresponding to the column label. (For Los Angeles, the "3" under "passes" means there are three different pass plans available to patrons). Parentheses indicate that at least one of the enclosed plans is used by 20 percent, or more, of the ridership.

The data on prepayment is current as of July 1975 and subject to widespread changes, since many transit operators are currently experimenting with different prepayment methods.

Numbers in brackets, [ ], identify notes at the end of Table B-1.

It should be emphasized that all data in the table was supplied to us by individual transit operators. Particularly in large metropolitan areas it is difficult to judge the extent of coverage of a transit system over the population. In our attempts to cross-check the population figures with published data on urban area sizes, we found significant differences in some cases but have generally left the numbers as quoted to us by the survey respondents.

TABLE B-1. SELECTED TRANSIT SYSTEMS
Rank Order by Population Served

CITY (OPERATOR)	SVC. AREA POP.	NO. VEH.	AVG. DAILY RIDERS	RECENT GROWTH		PREPAYMENT					
				SYS	RIDER	tickets	tokens	passes	permits	punch cards	other
New York Metropolitan Area											
Metro Transp Auth, bus [1]	12,076,000	4500	2,463,000	s	-		1	2			
Metro Transp Auth, subway*	12,076,000	6700	3,600,000	s	-		(1)				
Long Island Railroad NY*	7,030,000	1105	250,000	s	s	1	(2)			(1)	
Staten Is. Rapid Transit NY*	350,000	52	18,000	s	+	(1)		(1)			
Brooklyn NY (Pioneer Bus)	800,000	65	8,000	s	+			1	1		
Port Authority NY* [2]	1,000,000	299	145,000	s	+	no prepayment					
Atlantic City NJ (Lincoln)	[3]	86	5,500	s	-	(3)					
Bergenfield NJ (Rockland)	[3]	160	28,500	s	s	4			1		
Clifton NJ	[3]	7	3,600	s	s	2					
Garfield NJ	[3]	15	3,000	-	-	2					
Los Angeles CA (SCRTD)	10,000,000	2212	650,000	+	+	1		3	2		
Detroit MI (SEMTA) [4]	4,736,000	225	24,000	s	+	(1)		2	2	1	
Chicago Metropolitan Area											
Chicago IL (CTA)	4,000,000	3500	1,900,000	+	-		1		2		
Illinois Central Gulf RR*	[5]	161	30,000	+	-						(1)
Hammond IN	[6]	14	420	s	s	(2)					
Washington DC (WMATA)	3,000,000	2030	400,000	+	+	1	1				
Boston MA (MBTA)	2,760,000	1838	475,000	s	-		1	3	1	1	
San Francisco CA (BART)* [7]	2,348,000	274	124,000	+	+						(1)
Baltimore MD	2,300,000	1021	390,000	-	s	1	2	1	1		
Philadelphia PA (SEPTA) [8]	2,000,000	2400	800,000	s	+	1	1	1			
St. Paul MN (MTC)	2,000,000	1000	210,000	+	+		1			3	
Cleveland OH (RTA)	1,750,000	1154	356,000	+	-	1		1	2		
Santa Ana CA (OCTD)	1,670,000	244	30,000	+	+	1		(4)			
Pittsburgh PA (PAT)	1,600,000	1073	385,000	+	+	2		1	3		
Oakland CA (ACT)	1,600,000	807	205,000	-	-	(1)	1				
Denver CO (RTD)	1,500,000	485	100,000	+	+	(3)			3		
St. Louis MO (Bi-State)	1,500,000	858	200,000	+	+			1	1	1	
Miami FL (Dade County)	1,450,000	516	195,204	-	+				2		
Seattle WA	1,400,000	625	140,000	+	+	2		4	1		
Kansas City MO	1,300,000	304	74,000	+	+				1	1	
Houston TX	1,232,000	375	90,000	+	+				3		
Buffalo NY	1,148,000	523	65,000	+	+	1	(1)	(2)	1		
San Jose CA	1,100,000	236	40,000	+	+			2	1	(2)	
Columbus OH	1,051,000	275	35,000	+	s	(1)			1		
Milwaukee WI (MTS)	1,000,000	523	150,000	+	-	2		(2)			
San Diego CA	900,000	349	125,000	+	+			3	1		
Portland OR	900,000	422	104,000	+	+	1		(2)			
Dallas TX	888,000	449	100,000	+	+			1	1	1	
Camden NJ (PATCO)*	850,000	75	40,000	s	+						(1)

*Commuter rail or rail rapid service only, no buses.

LEGEND: "+" indicates an increase from 1974 to 1975, "-" means a decrease, "s" means it stayed the same, and "()" indicates use by 20 percent or more of the riders for at least one of the enclosed plans.

TABLE B-1. (Continued)

CITY (OPERATOR)	SVC. AREA POP.	NO. VEH.	AVG. DAILY RIDERS	RECENT GROWTH		PREPAYMENT					
				SYS	RIDER	tickets	tokens	passes	permits	punch cards	other
Memphis TN	850,000	300	55,000	s	-	no prepayment					
Phoenix AZ	784,000	125	23,000	+	+			2		1	
Louisville KY	770,000	235	40,000	+	+	1	1				
Cincinnati OH	750,000	421	105,000	+	+			1	1		
Salt Lake City UT	750,000	180	31,000	+	+		1	4			
San Antonio TX	750,000	263	65,000	+	+	1			1	1	1
Birmingham AL	725,000	185	34,500	+	+	1	1			2	
Albany NY	720,000	205	42,000	s	s		1	2	1		
San Francisco CA (Muni)	716,000	1084	553,000	+	+	1	1	2		1	
Rochester NY	690,000	246	50,000	s	-		1	1	1	1	
Sacramento CA	634,000	201	50,000	+	+		2	(2)			
New Orleans LA	600,000	510	300,000	+	-		1		1		
Jacksonville FL	560,000	220	45,000	+	-	1		1	1		
Wilmington DE (DAST) [9]	550,000	40	650	+	+						(1)
Omaha NB	545,000	165	34,000	+	+	1			1	(1)	
Providence RI	513,000	186	58,000	s	+		2				
Fort Worth TX	500,000	121	18,000	+	s		1	1	1	3	
Nashville TN	500,000	135	25,000	+	+			1	1	1	
Tucson AZ	450,000	96	21,600	+	+			(3)			
Holyoke MA	450,000	103	[10]	+	-	2	1				
Oklahoma City OK	400,000	60	4,500	s	s	2		1	1		
Grand Rapids MI	400,000	63	8,000	+	+	(2)				1	
Albuquerque NM	399,000	67	11,684	+	+		1	2	1	1	
Harrisburg PA	372,000	57	16,000	+	+			1		(1)	
Wilmington DE (DART) [11]	371,000	94	25,000	+	+	(3)	(1)				
Fresno CA	363,000	60	16,000	+	+		1	(2)			
Akron OH	363,000	72	12,000	+	+					1	
Tulsa OK	360,000	115	17,000	+	+			2	1	(2)	
El Paso TX	360,000	41	20,000	-	s	no prepayment					
Flint MI	330,000	47	10,000	+	+		1				
Charlotte NC	305,000	120	21,000	+	-	(2)		1			
Baton Rouge LA	300,000	60	11,400	+	+			(2)			
Austin TX	300,000	55	20,200	s	+			2		1	
North Andover MA	300,000	62	6,400	+	+	(1)		(1)		1	
Chattanooga TN	280,000	95	11,500	+	+	2	1		1		
Wichita KS	280,000	46	8,000	+	+		1			(1)	
Hampton VA	277,000	99	23,000	+	s				1	(1)	
St. Petersburg FL	260,000	78	26,000	s	+		1	(2)			
San Bernardino CA	250,000	42	10,500	+	+	1		(2)	(1)		
Richmond VA	250,000	219	68,000	+	+	1		1	2		
Fort Wayne IN	240,000	80	11,000	s	s			2	1	1	
Scranton PA	225,000	40	10,500	+	+	1					
Kingston PA	225,000	52	17,500	s	s		1	1			

LEGEND: "+" indicates an increase from 1974 to 1975, "-" means a decrease, "s" means it stayed the same, and "()" indicates use by 20 percent or more of the riders for at least one of the enclosed plans.

TABLE B-1. (Continued)

CITY (OPERATOR)	SVC. AREA POP.	NO. VEH.	AVG. DAILY RIDERS	RECENT GROWTH SYS	RECENT GROWTH RIDER	PREPAYMENT tickets	PREPAYMENT tokens	PREPAYMENT passes	PREPAYMENT permits	PREPAYMENT punch cards	PREPAYMENT other
Ventura CA	223,000	32	6,000	+	+	2		1		2	
Spokane WA	215,000	90	18,000	s	+		1		(1)		
Montebello CA	200,000	26	8,000	s	s					1	
Lancaster PA	200,000	36	4,800	-	s	1		1			
Tacoma WA	200,000	116	21,000	s	-	1		1	(2)		
Charleston WV	200,000	70	16,000	+	+	1				1	
Mobile AL	190,000	40	8,000	s	-					1	
Portsmouth VA	170,000	47	5,600	s	s	2					
Ann Arbor MI	169,000	78	8,300	+	+		1	(2)			
Savannah GA	163,000	60	18,000	s	+		1			1	
Maple Heights OH	162,000	48	3,700	-	+			1	1		
Kalamazoo MI	152,000	49	5,071	+	+		1			(2)	
Winston-Salem NC	150,000	64	12,000	s	+	1		1	1	1	
Portland ME	150,000	71	12,000	+	+	1		1		2	
Rockford IL	147,000	42	9,800	+	+			1		(2)	
New Haven CT	137,000	9	1,100	s	-				1		
Springfield MO	125,000	63	4,500	-	-	(2)	1				
Canton OH	115,000	67	7,000	+	+	no prepayment					
Elmira NY	115,000	14	850	s	s	(1)				(1)	
Springfield IL	113,000	45	10,500	+	+		1			(1)	
Santa Cruz CA	110,000	30	6,000	+	+			3	1	1	
Monterey CA	105,000	14	2,300	+	+			1		(1)	
Huntsville AL	100,000	6	500	s	-			(3)			
Minneapolis MN	100,000	13	1,430	+	+		(1)				
Sioux City IA	100,000	30	4,995	+	+			1		3	
Champaign IL	100,000	15	4,000	s	+		1	1			
Manchester NH	99,000	29	5,000	-	+				1	2	
Decatur IL	91,000	23	4,000	+	+	1			2		
Altoona PA	90,000	34	5,600	s	s	(2)					
Melbourne FL	90,000	6	450	s	+	2		1	1		
Kenosha WI	88,000	30	3,500	+	+	(1)			(1)		
Fargo ND [12]	85,000	21	760	s	s					(1)	
Lafayette LA	85,000	20	2,700	+	+				1		
Johnstown PA	84,000	3[illegible]	6,500	s	-			(1)			
Boulder CO	80,000	22	5,600	s	+	1	1	1	1		
Derby CT (Valley Transit)	76,000	8	500	+	s						(1)
Billings MT	75,000	11	2,200	+	+	(1)		5	1		
Bay City MI	74,000	8	1,150	+	+	1		1		2	
Albany GA	72,000	8	750	s	+	no prepayment					
Galveston TX	65,000	121	18,000	s	s		(1)	1	1		
Lawrence KS	65,000	12	8,300	s	+			(1)			
La Crosse WI	60,000	25	2,900	+	s		(1)	1			
Olean NY	60,000	7	243	s	s	(1)					

LEGEND: "+" indicates an increase from 1974 to 1975, "-" means a decrease, "s" means it stayed the same, and "()" indicates use by 20 percent or more of the riders for at least one of the enclosed plans.

TABLE B-1. (Continued)

CITY (OPERATOR)	SVC. AREA POP.	NO. VEH.	AVG. DAILY RIDERS	RECENT GROWTH SYS	RECENT GROWTH RIDER	PREPAYMENT tickets	PREPAYMENT tokens	PREPAYMENT passes	PREPAYMENT permits	PREPAYMENT punch cards	PREPAYMENT other
Whittier CA [13]	60,000	58	2,400	s	-						(1)
Kent OH	58,000	30	22,000	s	+	1		(1)			
Alexandria LA	55,000	18	2,700	s	-				1		
Rochester MN	53,000	20	3,400	s	+			1		(2)	
St. Cloud MN	52,000	11	1,700	s	+		(1)	1	1		
Wausau WI	50,000	22	2,800	s	+	1	(1)				
Jackson TN	46,000	12	2,100	s	+	1					
Jackson MI	45,000	10	1,450	s	s			1	(2)		
Chapel Hill NC	45,000	35	12,500	+	+		1	(2)		1	
Burlington IA	40,000	12	1,400	+	+			5		1	
Lowell MA (Marinel Trans.)	40,000	9	291	s	s	no prepayment					
Fond Du Lac WI	36,000	11	1,000	s	+		(1)	1	1	1	
New London CT	35,000	2	141	s	+	no prepayment					
Annapolis MD	33,000	4	2,800	s	-					2	
Torrington CT	32,000	3	[14]	+	s			1		2	
W. Memphis AK (Bridge Transit)	30,000	6	120	s	-	1					
Westport CT	28,000	9	2,000	s	+			(1)		1	
Staunton VA	27,000	16	2,000	s	s					(1)	
Davis CA	25,000	17	2,000	+	+			(1)		(1)	
Middletown NY [15]	23,000	15	750	s	s	(1)					
Charlottesville VA	15,000	17	12,000	+	+			(3)			
Babylon NY	8,000	12	1,200	s	+	no prepayment					

Notes to Table B-1:

[1] Metropolitan Transportation Authority of New York operates the Metropolitan Suburban Bus Authority, New York City Transit Authority, the Long Island Railroad Company, the Staten Island Rapid Transit Operating Authority, and the Erie-Lackawanna and Penn Central commuter trains in addition to the subways. The bus operating statistics are listed separately from the subway and rail components.

[2] PATH figures exclude suburban counties served by commuter railroads.

[3] These operations are based in New Jersey cities with a large component of the ridership being commuter traffic into New York City, but also carry local traffic in the home city or county. Service area population was not calculated.

[4] SEMTA serves suburban area around Detroit. It does not include Detroit DOT service in the city.

[5] Single commuter rail line into Chicago. Service area population not calculated.

[6] Commuter buses into the Chicago area from neighboring Hammond. Service area population not calculated.

[7] 274 cars in BART revenue service, of a 450-car total fleet.

Notes (Concluded):

[8] Excludes commuter rail and suburban lines. Total SEPTA service area is 4 million.

[9] Demand Responsive Transportation for seniors and handicapped throughout the State of Delaware.

[10] Figure unavailable.

[11] Delaware Authority for Regional Transportation offers conventional transit in the Wilmington metropolitan area.

[12] Figures reflect demand-responsive and non-school bus service only. The operator also runs 20 school buses and 50 taxicabs.

[13] Commuter subscription service in Los Angeles Metropolitan area.

[14] Figure unavailable.

[15] Figures apply to operations within the city limits, only.

B.2 OPERATORS STRATIFIED BY PREPAYMENT FORMAT

Table B-2 lists the responding operators who offer each prepayment format (tickets, tokens, etc.), current as of July 1975. Tickets and punch cards are subdivided by the number of trips sold in a unit: 1-to-9 rides, 10-to-19 rides, or 20-plus rides. Passes are categorized as: one-day, 2-to-7 days, monthly and bi-monthly, 2-to-11 months, annual, or unlimited duration. Permits are listed by availability to the general public, students, or senior citizens and handicapped.

Within each format class the systems are listed in alphabetical order, first by state, then by city within states. Where operators offer multiple plans using the same format (i.e. both regular and student 10-ride punch cards), the number of such plans is indicated in brackets following the particular city (operator).

TABLE B-2.
OPERATORS STRATIFIED BY PREPAYMENT FORMAT
City (Operator) [Number of Plans in Class]

TICKETS, 1-to-9 rides**

San Bernardino CA
San Francisco CA (Muni)
Ventura CA [2]
Denver CO (RTD)
Jacksonville FL
Decatur IL
Portland ME
Holyoke MA
Bay City MI
Detroit MI (SEMTA)
Grand Rapids MI
Omaha NB
Atlantic City NJ [2] (Linc)
Clifton NJ [2]
Garfield NJ
Buffalo NY
Long Is. Railroad NY*
Middletown NY
Staten Island NY*
Olean NY
Charlotte NC [2]
Winston-Salem NC
Cleveland OH
Columbus OH
Altoona PA
Lancaster PA
Philadelphia PA
Tacoma WA
Charleston WV
Kenosha WI

TICKETS, 10-19 rides***

W. Memphis AR
Birmingham AL
Los Angeles CA
Santa Ana CA
Denver CO (RTD)
Washington DC
Wilmington DE
Melbourne FL [2]
Hammond IN
Louisville KY
Holyoke MA
Grand Rapids MI

TICKETS, 10-19 rides* continued**

Springfield MO
Billings MT
Atlantic City NJ (Lincoln)
Bergenfield NJ
Garfield NJ
Elmira NY
Kent OH
Oklahoma City OK [2]
Portland OR
Altoona PA
Pittsburgh PA
Scranton PA
Chattanooga TN
Jackson TN
Portsmouth VA [2]
Richmond VA
Milwaukee WI [2]
Wausau WI

TICKETS, 20-plus rides***

Oakland CA (ACT)
Boulder CO
Denver CO (RTD)
Wilmington DE [2]
Hammond IN
Baltimore MD
North Andover MA
Springfield MO
Bergenfield NJ [3]
Pittsburgh PA
Chattanooga TN
San Antonio TX
Seattle WA [2]

TOKENS

Birmingham AL
Fresno CA
Oakland CA (ACT)
Sacramento CA [2]
San Francisco CA (Muni)
Boulder CO
Wilmington DE (DART)

TOKENS, continued

Washington DC
St. Petersburg FL
Savannah GA
Champaign IL
Chicago IL (CTA)
Springfield IL
Wichita KS
Louisville KY
New Orleans LA
Baltimore MD [2]
Boston MA
Holyoke MA
Ann Arbor MI
Flint MI
Kalamazoo MI
Minneapolis MN
St. Paul MN (MTC)
St. Cloud MN
Springfield MO
Chapel Hill NC
Albuquerque NM
Albany NY
Buffalo NY
Long Is. Railroad NY [2]*
New York NY (MTA)****
Rochester NY
Philadelphia PA
Kingston PA
Providence RI [2]
Chattanooga TN
Ft. Worth TX
Galveston TX
Salt Lake City UT
Spokane WA
Fond Du Lac WI
LaCrosse WI
Wausau WI

ONE-DAY PASS

Sacramento CA
Santa Cruz CA
Ventura CA
Boulder CO
Melbourne FL

*Systems with rail, only
**Sold singly, bulk less than 10, or bulk to customer-specified numbers
***Sold in books or strips
****Applies to MTA buses and subways.

TABLE B-2. (Continued)

DAY PASS, continued	MONTHLY PASS, continued	UNLIMITED PASS, continued
Champaign IL Baltimore MD Bay City MI New York NY (MTA) [2]**** Tulsa OK Portland OR Charlottesville VA Seattle WA Tacoma WA Fond Du Lac WI	Billings MT Albuquerque NM Albany NY Brooklyn NY Buffalo NY Rochester NY Staten Island NY* Winston-Salem NC Cincinnati OH Oklahoma City OK Tulsa OK Portland OR Kingstown PA Dallas TX Ft. Worth TX Salt Lake City UT [4] Seattle WA	Tucson AZ Monterrey CA San Bernardino CA Torrington CT Rockford IL Baton Rouge LA St. Cloud MN Billings MT Harrisburg PA Johnstown PA Lancaster PA Philadelphia PA Nashville TN
2-6 DAY PASS	2-11 MONTH PASS	PERMIT, general public
Huntsville AL Fort Wayne IN Maple Heights OH Pittsburgh PA	Huntsville AL [2] Davis CA Lawrence KS Baton Rough LA Detroit MI (SEMTA)* Rochester MN Billings MT [2] Chapel Hill NC Albuquerque NM Albany NY Buffalo NY Kent OH Charlottesville VA Seattle WA LaCrosse WI	Denver CO (RTD) Pittsburgh PA [3] Houston TX** Seattle WA
WEEKLY/BI-WEEK PASS	ANNUAL PASS	STUDENT PERMIT (K-12)
Jacksonville FL St. Petersburg FL Fort Wayne IN Burlington IA [2] Jackson MI St. Louis MO Charlotte NC Cleveland OH Richmond VA Milwaukee WI [2]	Westport CT Burlington IA Sioux City IA North Andover MA Billings MT Chapel Hill NC Charlottesville VA Seattle WA	Los Angeles CA (SCRTD) San Bernardino CA Denver CO (RTD) New Haven CT Melbourne FL Miami FL (Dade County) Chicago IL (CTA) Decatur IL Baltimore MD Jackson MI Winston-Salem NC Cleveland OH Houston TX Richmond VA Spokane WA Tacoma WA
MONTHLY PASS	UNLIMITED PASS	SENIOR AND/OR HANDICAPPED PERMIT
Phoenix AZ Tucson AZ [2] Fresno CA [2] Los Angeles CA (SCRTD) [3] Sacramento CA San Bernardino CA San Diego CA [3] San Francisco CA (Muni) [2] San Jose CA [2] Santa Ana CA [4] Santa Cruz CA [2] St. Petersburg FL Burlington IA [2] Portland ME Boston MA [3] Ann Arbor MI [2] Detroit MI (SEMTA)	Phoenix AZ	Los Angeles CA (SCRTD) San Diego CA San Jose CA Santa Cruz CA Boulder CO Denver CO (RTD) Jacksonville FL

*Systems with rail, only
**Permit plan limited to employees of one firm
****Applies to MTD buses and subways.

TABLE B-2. (Concluded)

SENIOR AND/OR HANDICAP PERMIT, continued	PUNCH CARD 10-19 rides, continued	PUNCH CARD 20 plus rides, continued
Miami FL (Dade County)	Montebello CA	Tulsa OK [2]
Chicago IL (CTA)	San Francisco CA (Muni)	Harrisburg PA
Ft. Wayne IN	Santa Cruz CA	Nashville TN
Alexandria LA	Ventura CA [2]	Austin TX
Lafayette LA	Torrington CT [2]	Fort Worth TX [2]
New Orleans LA	Westport CT	Galveston TX
Detroit MI (SEMTA) [2]	Rockford IL [2]	San Antonio TX
Jackson MI	Ft. Wayne IN	Charleston WV
St. Cloud MN	Sioux City IA [3]	
Kansas City MO	Portland ME [2]	MAGNETIC STORED FARE
St. Louis MO	Annapolis MD [2]	
Billings MT	North Andover MA	San Francisco CA (BART)**
Omaha NB	Detroit MI (SEMTA)	Chicago IL (Illinois Central Gulf RR)**
Manchester NH	Grand Rapids MI	Camden NJ (PATCO)**
Bergenfield NJ	St. Paul MN (MTC) [2]	
Albuquerque NM	Rochester MN [2]	CREDIT CARD
Albany NY	Kansas City MO	
Brooklyn NY (Pioneer Bus)	St. Louis MO	Derby CT (VAlley Transit)
Buffalo NY	Omaha NB	
Rochester NY	Manchester NH [2]	OTHER
Cincinnati OH	Elmira NY	
Cleveland OH	Rochester NY	Whittier CA (roster on subscription buses)
Columbus OH	Winston-Salem NC	Wilmington DE (DAST) (monthly billing to participating agencies)
Maple Heights OH	Akron OH	San Antonio TX (roster on club car)
Oklahoma City OK	Dallas TX*	
Tulsa OK	Ft. Worth TX	
Chattanooga TN	Staurton VA	
Nashville TN	Fond Du Lac WI	
Dallas TX		
Ft. Worth TX	PUNCH CARD, 20 plus rides	
Galveston TX		
Houston TX	Birmingham AL	
San Antonio TX	Mobile AL	
Hampton VA	Phoenix AZ	
Richmond VA	Monterrey CA	
Tacoma WA	San Jose CA [2]	
Kenosha WI	Savannah GA	
	Springfield IL	
PUNCH CARD, 1-to-9 rides	Wichita KS	
	Boston MA (MBTA)	
Burlington IA	Bay City MI	
Bay City MI	Kalamazoo MI [2]	
	St. Paul MN (MTC)	
PUNCH CARD, 10-19 rides	Albuquerque NM	
	Long Island RR NY	
Birmingham AL	Chapel Hill NC	
Davis CA	Fargo ND	

*Punch card for 10 base fares @ 35¢ and 30 zone charges @5¢
**Systems with rail, only.

APPENDIX C

TABULATION OF RESPONSES IN TELEPHONE INTERVIEWS
WITH TRANSIT OPERATORS

Operators were first queried about transit system characteristics and then were asked a series of questions about each prepayment plan available. For each transit system, one system data form was completed by the interviewer plus a plan data form for each available (or discontinued) plan. The questions are reprinted below, with the response categories, number of responses in each category (No.), and percent of the total responses (%). Non-categorical variables are described in brackets, as in question S1. Additional areas for comments were available with each question. Missing data on specific question causes the totals to vary and percentages to total less than 100.

System Data (For Each Transit System; Total=146)

S1. What is the geographical description of the area your system serves? [un-coded; interviewer records description]

S2. What is its area? [actual square mile figure]

S3. What was the 1970 Census population? [actual figure, in thousands]

S4. What type of vehicle is used?

	No.	%		No.	%
Bus	128	87.7	Bus & Trolley	3	2.1
Rail	6	4.1	Bus & Rail & Trolley	3	2.1
Bus & Rail	3	2.1	Other [describe]	3	2.1

S5. Is there a Dial-A-Ride component?

	No.	%
Fixed-route only	120	82.2
Dial-A-Ride	2	1.4
Combined	19	13.0

S6. Is there subscription service for work or school trips?

	No.	%		No.	%
No	93	63.7	Yes, work	16	11.0
Yes, school	24	16.4	Yes, school & work	13	9

S7. What days does the system operate?

	No.	%
Every day	83	56.8
No Sundays	51	34.9
No Saturdays & Sundays	11	7.5

S8. How many hours does the service operate on a normal workday: Monday through Friday?

	No.	%
Less than 12	10	6.8
12-to-16	60	41.1
Greater than 16	74	50.7

S9. Saturday hours (if applicable).

	No.	%
Less than 12	17	11.6
12-to-16	53	36.3
Greater than 16	63	43.2

S10. Sunday hours (if applicable).

	No.	%
Less than 12	19	13.0
12-to-16	9	6.2
Greater than 16	51	34.9

S11. What was the average weekday passenger count in the most recent year for which you have data? [actual number of average daily riders]

S12. How many vehicles does the system currently own? [actual number]

S13. Is this more or fewer than at this time last year?

	No.	%
Greater than 10% increase	40	27.4
Up to 10% increase	24	16.4
Same as last year	70	47.9
Up to 10% decrease	8	5.5
Greater than 10% decrease	1	0.7

S14. Have total route miles of the system increased or decreased over the past year?

	No.	%
Increased	69	47.3
Stayed the same	71	48.6
Decreased	3	2.1

S15. Has total system ridership increased, decreased or stayed the same over the past year?

	No.	%
Greater than 10% increase	43	29.5
Up to 10% increase	48	32.9
Same as last year	29	19.9
Up to 10% decrease	16	11.0
Greater than 10% decrease	8	5.5

S16. Do you have exact change fare payment?

	No.	%
No	41	28.1
Yes	93	63.7

S17. How many different prepayment plans are available in your system?

	No.	%		No.	%
0:	8	5.5	4:	25	17.1
1:	21	14.4	5:	10	6.8
2:	42	28.8	6:	5	3.4
3:	36	24.7	7:	1	0.7

Plan Data (For Each Prepayment Plan; Total=408)

P1. What is the physical format of the thing purchased?

	No.	%		No.	%
Ticket	79	19.4	Punch Card	73	17.9
Token	54	13.2	Magnetically Stored Fare	3	0.7
Flash Pass (free ride)	114	27.9	Credit Card	1	0.2
Permit (discount fare)	65	15.9	Other [describe]	5	1.2

P2. What does the prepayment buy?

	No.	%
Free boarding	322	78.9
Discounted Fare	66	16.2
Entry to otherwise unavailable service	5	1.2

P3. Is cost per trip less than comparable cash fare?

	No.	%		No.	%
No	66	16.2	Yes, greater than 50% discount	39	9.6
Yes, less than 15% discount	39	9.6	Yes, free to customer	39	9.6
Yes, 16-30% discount	41	10.0	Depends on use	86	21.1
Yes, 31-50% discount	67	16.4	Required for service, no comparable fare	15	3.7

P4. Does purchaser buy a fixed number of trips?

	No.	%		No.	%
1-4	33	8.1	Greater than 19	47	11.5
5-9	10	2.5	No fixed number	220	53.9
10-19	87	21.3			

P5. Is the privilege time-limited? (i.e. does it expire)?

	No.	%		No.	%
Less than 24 hours	16	3.9	2 or 3 months	10	2.5
1-to-6 days	6	1.5	4 months to 1 year	37	9.1
7-to-13 days	17	4.2	unlimited	247	60.5
14 days to 1 month	63	15.4			

P6. Does the plan encourage transfers between different modes or lines?

	No.	%
No	194	47.5
Yes	88	21.6
Not applicable [why?]	110	27.0

P7. Is privilege limited to certain times of the day?

	No.	%		No.	%
Not limited	319	57.1	Evening	1	0.2
Off-peak only	38	9.3	Peak only	35	8.6

P8. Is plan eligibility age-limited?

	No.	%		No.	%
Elem & Sec School	78	19.1	Senior Citizens	51	12.5
No	233	57.1	Senior & Handicapped	34	8.3

P9. Is plan limited to certain classes (other than by age)?

	No.	%
No class limits	297	72.8
Handicapped	11	2.7
Handicap & Senior Citizens	34	8.3
College or university students/staff	13	3.2
Employees of participating employers	9	2.2
Clients of participating agencies	14	3.4
Other [describe]	12	2.9

P10. Is plan limited to certain area(s) of system's service area?

	No.	%
No	353	86.5
Yes	41	10.0

P11. Is privilege limited to certain day(s) of week?

	No.	%		No.	%
None	330	80.9	Weekdays only	59	14.5
Weekends	4	1.0	Sunday only	2	0.5

P12. Is privilege limited to certain services or unlimited?

	No.	%		No.	%
Unlimited	335	82.1	Work trips	10	2.5
School trips	40	9.8	Other [describe]	8	2.0

P13. Is plan transferable or personally limited?

	No.	%
Transferable	196	48.0
Limited to person	191	46.8
Limited to family	6	1.5

P14. Is (pass, token, ticket...) purchased on vehicle?

	No.	%
No	314	77.0
Yes	78	19.1

P15. Is (pass, token, ticket...) purchased at a booth or counter?

	No.	%		No.	%
1 counter	116	28.4	More than 5 locations	157	38.5
2-to-5 locations	55	13.5	No booth or counters	62	15.2

P16. Is (plan) sold by mail?

	No.	%
No	280	68.6
Yes	112	27.5

P17. Is (pass, tokens...) sold in vending machines?

	No.	%
No	392	96.1
Yes	3	0.7

P18. Is (plan) available through payroll deduction?

	No.	%
No	379	92.9
Yes	12	2.9

P19. Can plan be paid for by a third party directly to transit authority?

	No.	%		No.	%
No	249	61.0	Yes, stores	14	3.4
Yes, employer	29	7.1	Yes, school district	32	7.8
Yes, social welfare agency	42	10.3	Other [describe]	27	6.6

P20. Was this plan in effect July 1, 1975?

	No.	%
No	35	8.6
Yes	360	88.2

P21. In what month and year did this plan start? [__19__]

P22. (For now-defunct plans). What month and year was this plan terminated?

[__19__]

P23. Do you feel that total system ridership was affected by the implementation of this plan?

	No.	%		No.	%
Don't know	98	24.0	No change	129	31.6
Decreased	0	0.0	Increased	177	43.4

P24. Is there data available that would support question 23?

	No.	%
No	266	65.2
Yes	50	12.3

P25. Do you feel that there was a change in system operating revenue as a result of this plan?

	No.	%		No.	%
Don't know	98	24.0	No change	154	37.7
Decreased	36	8.8	Increased	104	25.5

P26. Is there data available that would support question 25?

	No.	%
No	256	62.7
Yes	40	9.8

P27. How did this plan affect management's total administrative costs of fare collection?

	No.	%		No.	%
No information	61	15.0	Increased	92	22.5
Decreased	11	2.7	Initial increase followed by a decrease	2	0.5
No change	227	55.6			

P28. Was staff added to administer the program?

	No.	%		No.	%
No	366	89.7	Three to five	1	0.2
One or two	21	5.1	More than five	6	1.5

P29. Has the plan generated noticeable savings in the cost of coin handling and counting?

	No.	%
No	358	87.7
Yes	34	8.3

P30. (Pass or permit plans only:) Do you have an estimate of how many persons are (pass/permit) holders at any given time? [actual number]

P31. What percentage of boarding passengers use a (pass, permit, ticket...) to board?

	No.	%		No.	%
Under 10%	171	41.9	More than 40%	49	12.0
11-to-20%	48	11.8	Don't know	81	19.9
21-to-40%	38	9.3			

P32. Why was this plan established? [interviewer records reasons]

	No.	%
Improve service	64	40.3
Convenience	25	15.7
Increase ridership	17	10.7
Reduce costs	2	1.3
Convenience and increase ridership	8	5.0
Get riders to commit to transit	3	1.9
Legislative requirement	7	4.4
Introduce service	5	3.1
Miscellaneous reasons	28	17.6

APPENDIX D
METHODOLOGIES FOR SURVEYS OF TRANSIT USERS

D.1 SEMTA DASH ON-BOARD SURVEY

The SEMTA DASH survey was designed to ask some very specific questions related to the decisions made in choosing one form of prepayment over another. The respondents to this survey first answered a general set of questions about their trips on DASH and then branched to one of four differently colored pages to answer questions specific to the payment method they used (see questionnaire in Appendix E).

SEMTA has DASH express routes from 10 different suburbs and outlying cities to work locations in and around Detroit. On one of these, between Dearborn and downtown Detroit, only punch cards or cash can be used to pay for rides. On the other routes passengers have a choice among a monthly pass, a 40-trip punch card, a 10-trip punch card, or cash. We surveyed only passengers on these latter nine routes, which are covered by 13 different buses (two of the routes have two buses, and another route has three buses).

We were very fortunate to have the assistance of the DASH "bus captains", regular passengers who sell passes and punch cards and generally monitor service. The bus captains know most of the passengers fairly well and were a tremendous help in distributing and collecting the questionnaires on the buses. (One of the 13 buses does not have a bus captain, so passengers must purchase their punch cards and tickets by mail. A special surveyor covered this bus). Most of the questionnaires were completed on the afternoon of October 16, 1975, and the bus captains made an effort to cover all remaining regular riders on subsequent days if they did not ride on that afternoon. Out of the daily estimated round-trip ridership of 250 passengers for the nine routes surveyed, 225 questionnaires were completed and returned, for a response rate of approximately 90 percent.

D.2 TULSA ON-BOARD SURVEY

In designing this survey we sought to relate means of fare payment to trip purpose, importance of discounts, importance of convenience, and characteristics of the transit user. Motivations for the choice of prepayment have been explored through a series of questions that use a

five-point scale to ascertain the likes and dislikes of respondents with respect to various features related to prepayment. The questionnaire is reproduced in Appendix E.

The survey was conducted on a single day (December 17, 1975) from 6 a.m. to 1 p.m. The advantage of the half-day survey is that the same commuter is not surveyed twice. To further avoid multiple responses by the same individual, passengers who indicated that they had previously completed a survey form were not given another. (A trained surveyor on each bus distributed and collected questionnaires and assisted passengers who had difficulty with the forms).

In an effort to draw a sample which is representative of the population served by MTTA, 25 routes (of the 38 total) were surveyed. The routes were selected by applying two criteria. First, express routes primarily serving downtown-bound white collar workers were to be sampled in approximately equal numbers with non-express routes. (During peak hours a large portion of the passengers on the non-express routes are commuters, but a considerable number of students and persons with other trip purposes ride as well).

A second criterion in selecting routes to be surveyed was to obtain a sample containing riders from neighborhoods which are maximally different. The underlying objective in this sampling procedure was to determine whether there is a generalized user response to fare prepayment among riders representing different age groups and income levels as well as having different trip purposes.

The total number of respondents in the Tulsa on-board survey was 1,487. This represents an estimated 17 percent of all users of the MTTA system during the hours of the survey. The response rate was very good. According to surveyor's records of the number of persons refusing the forms, over 90 percent of all riders on the selected buses filled out forms.

D.3 TULSA EMPLOYEE SURVEY

The principal purpose of surveying employees in the Tulsa area was to determine whether selling transit prepayment instruments at the place of work and subsidizing them by the employer stimulates transit usage.

Approximately fifteen firms purchase punch cards for resale to their employees. Most of these firms subsidize the cards and sell them at a discount, typically half price. Some of the firms discounting the punch cards limit the number which can be purchased by an employee to two per month, but most have no such limitations.

Five firms were selected for the employee survey. The firms were selected so as to include one which offers no discount, which it was hoped would serve as a control, allowing us to compare the effects of convenience and cost saving. The firms selected include a major airline company (maintenance facility), a small engineering firm, a large bank, an electric utility company, and a construction company home office.

Even in firms subsidizing the purchase of punch cards, not every employee chooses to ride transit. To gain insight into the motivations of those who have decided not to take advantage of discounted transit service, we asked employers to distribute the forms in equal shares to users and nonusers of transit. Such distribution was relatively simple, because most of the firms maintain records of punch card purchasers. One firm requested that all employees be surveyed to ease distribution, so this was done.

In all, 2,200 survey forms were distributed to the five firms. Of these 999 were returned for a response rate of 45.4 percent. We were quite successful in obtaining equal samples of users and nonusers of transit, with 42.7 reporting that they are regular bus riders. Since the survey had to apply to transit users as well as nonusers, some of the questions on the questionnaire were to be directed at certain respondents only. Directions after each question tell the respondent which question is to be answered next. (See questionnaire in Appendix E.)

D.4 UNIVERSITY OF PITTSBURGH EMPLOYEE SURVEY

This survey investigates user response to an employer-sponsored program that offers great convenience in the purchase of prepayment but no discount. Our purpose was to compare the responses in this survey with those in the Tulsa employee survey, where the convenience of purchasing prepayment was slightly less and a sizable discount was present. In many respects such a comparison involves contrasting unlike systems. Port Authority of Allegheny County (PAT) serves five and one-half times as many people as MTTA. Because of the need for multiple zones in a system the size of PAT, there is a greater degree of complexity in the fare structure than is the case in smaller systems. To reduce interpretive biases as much as possible, the survey forms used in Tulsa and Pittsburgh were designed with identical formats.

In Pittsburgh nine employers offer PAT permits through payroll deduction. The University of Pittsburgh is the largest participating employer, having 6,000 employees. Of these, 500 (8.3 percent) purchase PAT permits through payroll deduction. In selecting the University as the preferred survey site, we were confident about obtaining a meaningfully sized sample of payroll deduction participants. For expedience, University staff recommended a campus-wide mailing to all 6,000 employees, rather than a selective mailing to all payroll deduction program participants and a representative sample of other employees.

Of the 6,000 survey forms distributed through the University's mail system, 2,017 were returned for a 33 percent response rate. Within our sample 29.3 percent, or 588, use public transit, and 9.1 percent (184 employees) of the sample participate in the payroll deduction program.

APPENDIX E

QUESTIONNAIRE FORMS AND TABULATIONS OF RESPONSES

The Huron River Group, Inc. 209 E. Washington Ann Arbor, MI 48108

STUDY OF PREPAID TRANSIT FARES

Please check the boxes beside the appropriate answers and return completed form to your bus captain before getting off the bus.

	Ans.	N	%
1. About how long have you been using the DASH commuter bus?	1	3	1.3
1 ☐ Never rode before today	2	10	4.5
2 ☐ Less than 1 month	3	32	14.3
3 ☐ 1 to six months	4	19	8.5
4 ☐ 6 to 12 months	5	48	21.4
5 ☐ More than a year	6	112	50
6 ☐ Ever since it began (approximately 2 years)			
2. How did you pay for this trip?	2	7	3
1 ☐ One-way cash fare	2	18	8
2 ☐ 10-trip ticket	3	135	60
3 ☐ 40-trip ticket	4	65	29
4 ☐ Monthly pass			
3. In the past 20 working days, how many one-way trips would you estimate you have made on the DASH service? (Both ways every day would be 40 one-way trips.) ☐	3	Mean= 29.6 Std dev=12.4	
4. How many DASH trips do you expect to make in the next 20 working days? ☐	4	Mean= 32.3 Std dev=10.4	
5. If you ride DASH less than every day that you go to work, how do you go to or from work on trips when you don't use DASH?	5	1	114	54
1 ☐ Drive my car		2	21	10
2 ☐ Passenger in someone else's car		3	2	1
3 ☐ Car pool		4	48	23
4 ☐ Ride DASH every day		5	2	2.4
5 ☐ Other public transportation		6	20	10
6 ☐ Other: _____				
6. Which category below best describes your household's annual income before taxes? (Your answer will be strictly confidential. You are not identified on this form.)	6	1	2	1
1 ☐ Less than $5,000		2	11	5
2 ☐ $5,001-$10,000		3	33	16
3 ☐ $10,001-$15,000		4	53	26
4 ☐ $15,001-$20,000		5	57	28
5 ☐ $20,001-$25,000		6	27	13
6 ☐ $25,000-$30,000		7	20	10
7 ☐ More than $30,000				
7. How many cars are registered to members of your household?	7	1	5	2
1 ☐ None		2	53	24
2 ☐ One		3	127	56
3 ☐ Two		4	39	17
4 ☐ Three or more				
8. Do you have a valid driver's license?	8	1	221	97
1 ☐ Yes		2	5	3
2 ☐ No				
9. If you use alternate transportation for some of your trips to work, what is the reason?	9	1	45	23
1 ☐ Work late		2	1	.5
2 ☐ Travel out of town		3	5	3
3 ☐ Enjoy driving to work occasionally		4	6	3
4 ☐ Need car during the day for work		5	49	25
5 ☐ Need car during the day or after work for personal errands, lunch		6	9	5
6 ☐ Car pool available		7	25	13
7 ☐ Social/recreational		8	56	29
8 ☐ Other:				

Figure E-1. SEMTA DASH Survey

10. How do you usually spend your time on the bus?

Ans.	N	%
12:1	37	16
2	42	19
3	3	1
4	13	6
5	12	5
6	0	0
7	128	52

1 ☐ Read for personal pleasure or enrichment
2 ☐ Sleep
3 ☐ Do office-related work
4 ☐ Look at the scenery
5 ☐ Talk with other passengers
6 ☐ Play chess
7 ☐ Other: Combinations of 1 through 5

11. Are you familiar with the prices of the following fare payment mechanisms?

			Ans.	N	%
11a	Monthly pass for unlimited use within the designated calender month?	1 ☐ Yes 2 ☐ No	11a:1		93
			2		7
11b	40-Trip Ticket for 40 one-way trips and no expiration date?	1 ☐ Yes 2 ☐ No	11b:1		95
			2		5
11c	10-Trip Ticket for 10 one-way trips and no expiration date?	1 ☐ Yes 2 ☐ No	11c:1		90
			2		10
11d	One-Way Cash Fare good for one trip at a time?	1 ☐ Yes 2 ☐ No	11d:1		80
			2		20

12a. Would you continue to ride the bus if you could only buy the monthly pass to pay your fare? (at its present price.)

Ans.	N	%
12a:1		64
2		36

1 ☐ Yes
2 ☐ No

12b. Would you continue to ride the bus if you could only buy the 40-trip ticket to pay your fare? (at its present price.)

Ans.	N	%
12b:1		90.5
2		9.5

1 ☐ Yes
2 ☐ No

12c. Would you continue to ride the bus if you could only buy the 10-trip ticket to pay your fare? (at its present price.)

Ans.	N	%
12c:1		48
2		52

1 ☐ Yes
2 ☐ No

12d. Would you continue to ride the bus if you could only pay the one-way fare? (at its present price.)

Ans.	N	%
12d:1		13
2		87

1 ☐ Yes
2 ☐ No

13. How do you buy your pass/ticket?

Ans.	N	%
13:1	146	65
2	44	20
3	3	1
4	3	1
5	22	10
6	6	3

1 ☐ From the bus captain
2 ☐ Mail order from SEMTA
3 ☐ From the driver
4 ☐ From another passenger

Answers 1 & 3 above
Other

Figure E-1 (Continued)

	Ans.	N	%
14. Why do you prefer to buy passes/tickets this way?	14:		
_____			
_____			
15. Can you suggest any improvements in the way passes/tickets are sold: _____	15:		
_____			
_____			
16. Prior to December, 1974 40-trip tickets were not sold for DASH service. How did you pay for the service before that date?	16: 1	106	48
	2	44	20
	3	4	2
	4	45	20
Answers 1 & 2 above	5	22	5

1 ☐ Monthly pass
2 ☐ 10-trip ticket
3 ☐ One-way fare
4 ☐ Did not ride prior to December, 1974

If you boarded the bus today by:

Monthly pass - Please turn to the Pink page for more questions.
40-trip ticket - Please turn to the Blue page for more questions.
10-trip ticket - Please turn to the Green page for more questions.
One-way fare - Please turn to the Yellow page for more questions.

Use this space for any comments you did not have enough space to write above: 17:

Figure E-1 (Continued)

Please answer the questions on this page if you use a

MONTHLY PASS

M1. Why did you buy a monthly pass rather than a 40-trip ticket?

1 ☐ Lower cost per trip with the monthly pass, for the number of times I ride
2 ☐ Can board the bus faster, since the monthly pass does not have to be punched
3 ☐ To force myself to use the bus as much as possible
4 ☐ Other: _____

4 Answers 1 & 2 above
5 Answers 1 & 3 above
6 Answers 1, 2 & 3 above

Ans.	N	%
M1:1	54	83
2	0	0
3	0	0
4	9	14
5	1	
6	1	

M2. Why did you buy a monthly pass rather than a 10-trip ticket?

1 ☐ Lower cost per trip with the monthly pass, for the number of times I ride
2 ☐ Can board the bus faster, since the monthly pass does not have to be punched
3 ☐ To force myself to use the bus as much as possible
4 ☐ Other: _____

4 Answers 1 & 2 above

M2:1	59	92
2	0	0
3	0	0
4	5	8

M3. Why did you buy a monthly pass rather than pay the one-way fare?

1 ☐ Lower cost per trip with the monthly pass, for the number of times I ride
2 ☐ Do not have to pay each time I board with the monthly pass
3 ☐ Other: _____

M3:1	60	94
2	0	0
3	4	6

STOP - You need answer no more questions. Please return this questionnaire to the bus captain. Thank you for your cooperation and time.

Figure E-1 (Continued)

Please answer the questions on this page, if you use a

40-TRIP TICKET

	Ans.	N	%
F1. Why did you buy a 40-trip ticket rather than a monthly pass?	F1:1	37	28
	2	66	50
	3	6	5
	4	22	17

1 ☐ Do not ride often enough to justify having a monthly pass
2 ☐ Afraid that unexpected circumstances will keep me from making full use of the monthly pass, even though I ride almost every day.
3 ☐ Other: _____

3 Answers 1 & 2 above

4 Other Reasons

F2. Why did you b y a 40-trip ticket rather than a 10-trip ticket?	F2:1	89	67
	2	9	7
	3	30	23
	4	5	4

1 ☐ Lower cost per ride with the 40-trip ticket
2 ☐ Do not have to buy the 40-trip ticket as frequently as the 10-trip ticket
3 ☐ Other: _____

3 Answers 1 & 2 above

4 Other Reasons

F3. Why did you buy a 40-trip ticket rather than pay the one-way fare?	F3:1	101	76
	2	6	5
	3	23	17
	4	4	3

1 ☐ Lower cost per ride with the 40-trip ticket
2 ☐ Do not have to pay each time I board with the 40-trip ticket
3 ☐ Other: _____

3 Answers 1 & 2 above

4 Other Reasons

F4. How frequently do you ride the bus now, compared with your riding before the 40-trip ticket was available? (December 1974)	F4:1	26	19
	2	18	13
	3	83	62
	4	7	5

1 ☐ Did not ride before the 40-trip ticket was available
2 ☐ Ride more than I did before the 40-trip ticket was available
3 ☐ Ride about the same
4 ☐ Ride less

F5. If there has been a change in the amount you ride the bus, compared with your riding before the 40-trip ticket was available, please indicate the reason for the change.	F5:1	22	22
	2	3	3
	3	16	16
	4	4	4
	5	2	2
	6	5	5
	7	47	47

1 ☐ Did not ride before December 1974
2 ☐ Did not ride before December 1974, and the availability of the 40-trip ticket convinced me to start riding
3 ☐ Ride more because the cost per trip is less than the cost per trip with a 10-trip pass
4 ☐ Ride more because _____
5 ☐ Ride less because I now pay for only the rides I use, whereas I felt obliged to use the monthly pass as much as possible
6 ☐ Ride less because _____
7 ☐ Ride about the same

STOP - You need answer no more questions. Thank you for your cooperation

Figure E-1 (Continued)

Please answer the questions on this page, if you use a

10-TRIP TICKET

		Ans.	N	%
T1.	Why did you buy a 10-trip ticket rather than a monthly pass?	T1:1	6	35
		2	2	12
	1 ☐ Do not ride often enough to justify having a monthly pass	3	2	12
	2 ☐ Too late to buy a monthly pass this month. Will buy one next month	4	7	41
	3 ☐ The monthly pass requires too much money at one time			
	4 ☐ Other: _____			
	_____			
T2.	Both the 10-trip ticket and the 40-trip ticket can be used for an unlimited length of time, but the 40-trip ticket offers a lower cost per trip than the 10-trip ticket. Did you know this when you bought the 10-trip ticket?	T2:1	14	78
		2	3	3
	1 ☐ Yes 2 ☐ No			
T3.	Why did you buy a 10-trip ticket rather than a 40-trip ticket?	T3:1	6	35
		2	2	12
	1 ☐ The 40-trip ticket requires too much money at one time	3	9	53
	2 ☐ I ride very infrequently. Would take too long to use 40-trip ticket			
	3 ☐ Other: _____			
	_____			
T4.	Why did you buy a 10-trip ticket rather than pay the one-way fare?	T4:1	12	71
		2	2	12
	1 ☐ Lower cost per ride with the 10-trip ticket	3	3	17
	2 ☐ Do not have to pay each time I board with the 10-trip ticket			
	3 ☐ Other: _____			
	_____			

STOP - You need answer no more questions. Please return this questionnaire to your bus captain. Thank you for your cooperation and time.

Figure E-1 (Continued)

Please answer the questions on this page, if you pay the

ONE-WAY FARE

		Ans.	N
C1.	Why did you pay the one-way fare rather than buy a monthly pass?	C1:1	1
		2	3
1 ☐	Wanted to try the service before committing myself	3	1
2 ☐	Do not ride often enough to justify having a monthly pass	4	1
3 ☐	This is my first ride	5	0
4 ☐	Too late to buy a monthly pass for this month	6	1
5 ☐	The monthly pass requires too much month at one time		
6 ☐	Other:		
	_____		
	_____		
C2.	Why did you pay the one-way fare rather than buy a 40-trip ticket?	C2:1	2
		2	2
1 ☐	Wanted to try the service before committing myself	3	1
2 ☐	Do not ride often enough to justify having a 40-trip ticket	4	0
3 ☐	This is my first ride	5	2
4 ☐	The 40-trip ticket requires too much money at one time		
5 ☐	Other:		
	_____		
	_____		
C3.	Why did you pay the one-way fare rather than buy a 10-trip ticket?	C3:1	2
		2	1
1 ☐	Wanted to try the service before committing myself	3	0
2 ☐	Do not ride often enough to justify having a 10-trip ticket	4	2
3 ☐	This is my first ride	5	1
4 ☐	The 10-trip ticket requires too much money at one time		
5 ☐	Other:		
	_____		
	_____		
C4.	If you decided to buy one of the other types of tickets, which would you choose?	C4:1	0
		2	3
1 ☐	Would always pay the one-way fare	3	3
2 ☐	10-trip ticket	4	0
3 ☐	40-trip ticket		
4 ☐	Monthly pass		

STOP - You need answer no more questions. Please return this questionnaire to your bus captain. Thank you for your cooperation and time.

Figure E-1 (Concluded)

Dear MTTA Passenger,

The U.S. Department of Transportation is sponsoring a study having to do with alternative methods of paying transit fares. Please check the boxes beside the appropriate answers and return the completed form to the person who gave it to you before you leave the bus. All answers will be kept entirely confidential and used for statistical analysis only. Your name is not requested.

Thank you for your cooperation.

PLEASE DO NOT WRITE IN THIS SPACE

1. How did you pay your fare for this trip?

[1] Punch Pass [2] Cash [3] Student Fare [4] Token
[5] Transfer [6] Senior Citizen Fare [7] Daily Rider Fare
[8] Monthly Pass [9] Other:_____ 1:__

2. Do you sometimes use a different method of payment than you used today?

[2] No [3] Yes → If so, what alternate method of payment do you sometimes use? 2:__

[1] Punch Pass [2] Cash [3] Student Fare
[4] Token [5] Transfer [6] Senior Citizen Fare
[7] Daily Rider Fare [8] Monthly Pass
[9] Other:_____ 3:__

3. How many one-way trips do you plan to take today? [ ] (Please write the number of rides in the box) 4-5:__

4. How many one-way trips do you plan to take this week? (Monday through Saturday)

[ ] (Please write the number of rides in the box) 6-7:__

5. What is the primary purpose for this trip on MTTA? (Please check only one box).

[1] Work [2] School [3] College [4] Shop
[5] Social, Recreational [6] Other:_____ 8:__

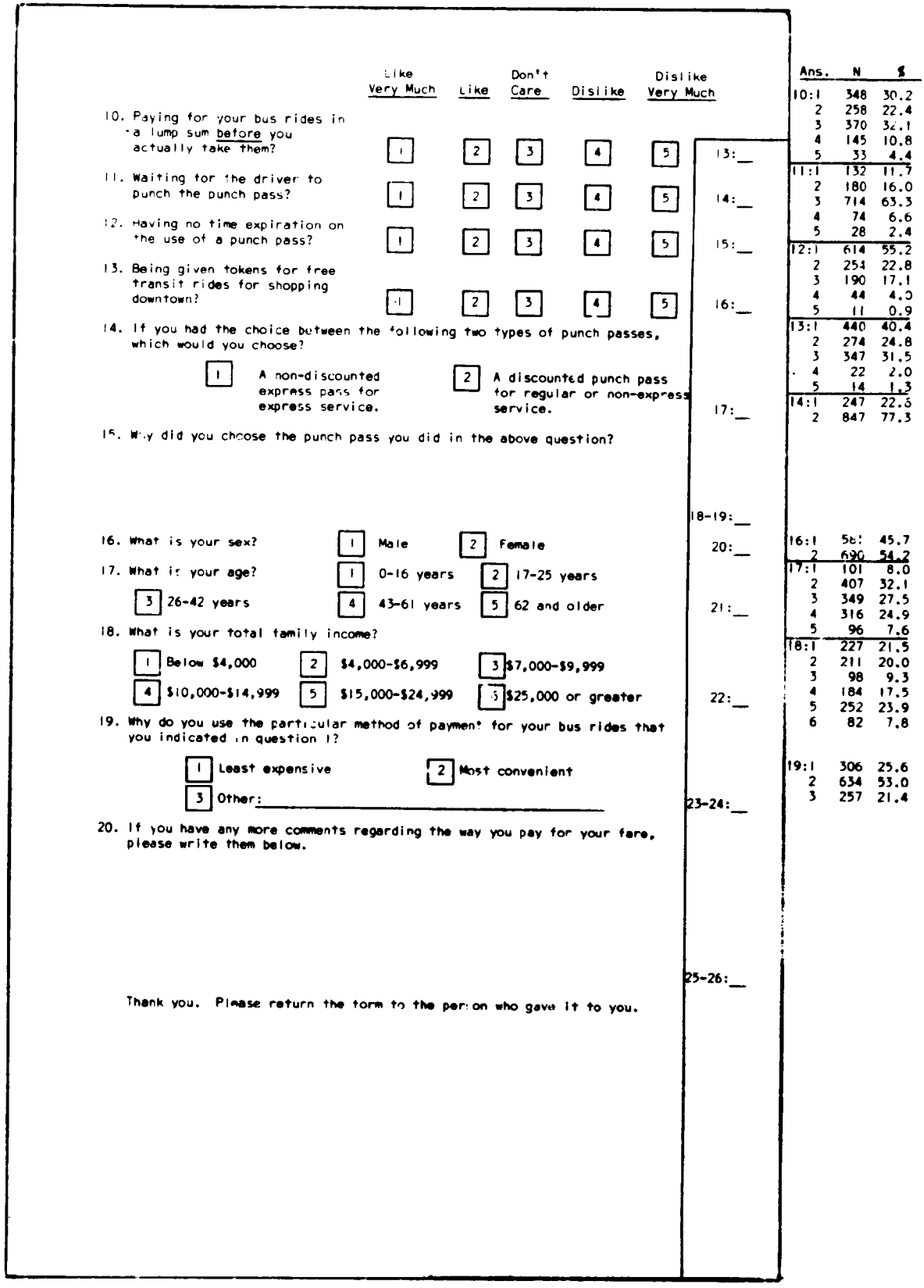
Below are several features that have to do with the way you pay your fare. Please check the appropriate box to indicate the degree of importance of each feature to you.

How much do you like:	Like Very Much	Like	Don't Care	Dislike	Dislike Very Much	
6. Receiving a 20 percent discount on bus rides with a punch pass?	[1]	[2]	[3]	[4]	[5]	9:__
7. Carrying the proper coins to pay the exact fare?	[1]	[2]	[3]	[4]	[5]	10:__
8. Being able to ride all day on a single daily pass, regardless of how many trips are taken?	[1]	[2]	[3]	[4]	[5]	11:__
9. Going to one of the outlets that sells passes for the purpose of buying a pass?	[1]	[2]	[3]	[4]	[5]	12:__

OVER PLEASE

Ans.	N	%
1:1	559	38.0
2	506	34.4
3	51	3.5
4	7	0.5
5	26	1.8
6	35	2.4
7	258	17.6
8	21	1.4
9	7	0.5
2:2	747	52.1
3	686	47.9
2:1	146	10.3
2	262	18.4
3	13	0.9
4	43	3.0
5	51	3.6
6	14	1.0
7	130	9.2
8	5	0.4
9	758	53.3
3:Mean= 2.02 Std dev= 0.92		
4:Mean= 8.14 Std dev= 4.14		
5:1	968	66.8
2	204	14.1
3	48	3.3
4	62	4.3
5	41	2.8
6		5.7
6:1	873	70.1
2	215	17.3
3	136	10.9
4	12	1.0
5	9	0.6
7:1	203	16.6
2	202	16.5
3	301	24.6
4	286	23.4
5	232	18.9
8:1	736	58.5
2	193	15.3
3	279	22.2
4	22	1.7
5	29	2.3
9:1	299	25.4
2	255	21.7
3	397	33.7
4	166	14.1
5	61	5.1

Figure E-2. Tulsa On-Board Survey



	Like Very Much	Like	Don't Care	Dislike	Dislike Very Much	
10. Paying for your bus rides in a lump sum before you actually take them?	1	2	3	4	5	13:__
11. Waiting for the driver to punch the punch pass?	1	2	3	4	5	14:__
12. Having no time expiration on the use of a punch pass?	1	2	3	4	5	15:__
13. Being given tokens for free transit rides for shopping downtown?	1	2	3	4	5	16:__

14. If you had the choice between the following two types of punch passes, which would you choose?

[1] A non-discounted express pass for express service.

[2] A discounted punch pass for regular or non-express service. 17:__

15. Why did you choose the punch pass you did in the above question?

18-19:__

16. What is your sex? [1] Male [2] Female 20:__

17. What is your age?

[1] 0-16 years [2] 17-25 years [3] 26-42 years [4] 43-61 years [5] 62 and older 21:__

18. What is your total family income?

[1] Below $4,000 [2] $4,000-$6,999 [3] $7,000-$9,999

[4] $10,000-$14,999 [5] $15,000-$24,999 [6] $25,000 or greater 22:__

19. Why do you use the particular method of payment for your bus rides that you indicated in question 1?

[1] Least expensive [2] Most convenient

[3] Other:_____ 23-24:__

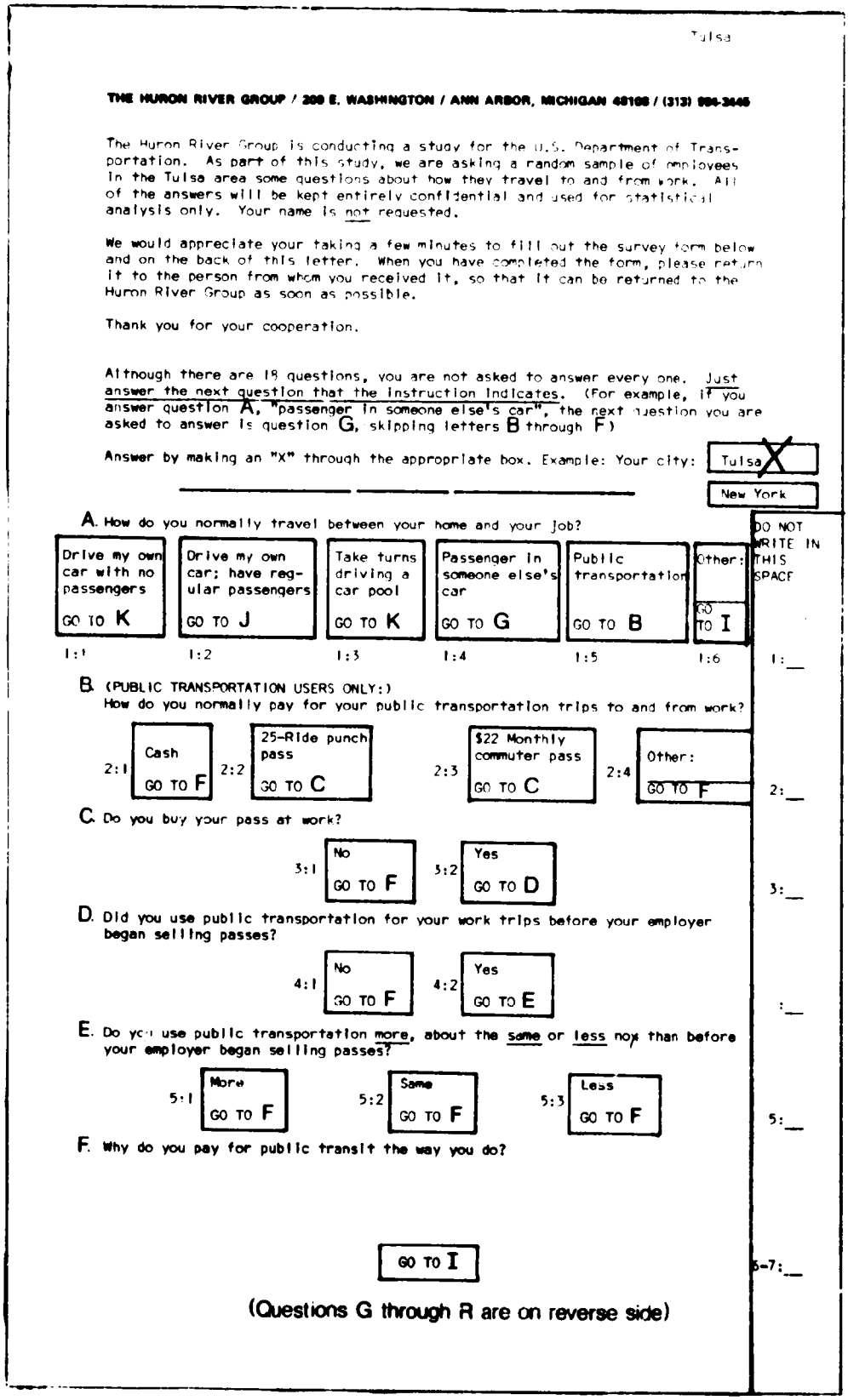
20. If you have any more comments regarding the way you pay for your fare, please write them below.

25-26:__

Thank you. Please return the form to the person who gave it to you.

Ans.	N	%
10:1	348	30.2
2	258	22.4
3	370	32.1
4	145	10.8
5	33	4.4
11:1	132	11.7
2	180	16.0
3	714	63.3
4	74	6.6
5	28	2.4
12:1	614	55.2
2	254	22.8
3	190	17.1
4	44	4.0
5	11	0.9
13:1	440	40.4
2	274	24.8
3	347	31.5
4	22	2.0
5	14	1.3
14:1	247	22.6
2	847	77.3
16:1	581	45.7
2	690	54.2
17:1	101	8.0
2	407	32.1
3	349	27.5
4	316	24.9
5	96	7.6
18:1	227	21.5
2	211	20.0
3	98	9.3
4	184	17.5
5	252	23.9
6	82	7.8
19:1	306	25.6
2	634	53.0
3	257	21.4

Figure E-2 (Concluded)



Tulsa

THE HURON RIVER GROUP / 209 E. WASHINGTON / ANN ARBOR, MICHIGAN 48108 / (313) 994-3440

The Huron River Group is conducting a study for the U.S. Department of Transportation. As part of this study, we are asking a random sample of employees in the Tulsa area some questions about how they travel to and from work. All of the answers will be kept entirely confidential and used for statistical analysis only. Your name is not requested.

We would appreciate your taking a few minutes to fill out the survey form below and on the back of this letter. When you have completed the form, please return it to the person from whom you received it, so that it can be returned to the Huron River Group as soon as possible.

Thank you for your cooperation.

Although there are 18 questions, you are not asked to answer every one. Just answer the next question that the instruction indicates. (For example, if you answer question A, "passenger in someone else's car", the next question you are asked to answer is question G, skipping letters B through F)

Answer by making an "X" through the appropriate box. Example: Your city: Tulsa X / New York

A. How do you normally travel between your home and your job?

Drive my own car with no passengers	Drive my own car; have regular passengers	Take turns driving a car pool	Passenger in someone else's car	Public transportation	Other:
GO TO K	GO TO J	GO TO K	GO TO G	GO TO B	GO TO I
1:1	1:2	1:3	1:4	1:5	1:6

B. (PUBLIC TRANSPORTATION USERS ONLY:)
How do you normally pay for your public transportation trips to and from work?

Cash	25-Ride punch pass	$22 Monthly commuter pass	Other:
GO TO F	GO TO C	GO TO C	GO TO F
2:1	2:2	2:3	2:4

C. Do you buy your pass at work?

No	Yes
GO TO F	GO TO D
3:1	3:2

D. Did you use public transportation for your work trips before your employer began selling passes?

No	Yes
GO TO F	GO TO E
4:1	4:2

E. Do you use public transportation more, about the same or less now than before your employer began selling passes?

More	Same	Less
GO TO F	GO TO F	GO TO F
5:1	5:2	5:3

F. Why do you pay for public transit the way you do?

GO TO I

(Questions G through R are on reverse side)

DO NOT WRITE IN THIS SPACE

1:__
2:__
3:__
:__
5:__
6-7:__

Ans.	N	%
A:1	371	37.2
2	64	6.4
3	57	5.7
4	52	5.2
5	426	42.7
6	28	2.8
B:1	9	2.1
2	413	97.2
3	2	0.5
4	2	0.2
C:1	3	0.7
2	410	99.3
D:1	188	64.0
2	106	36.0
E:1	53	35.2
2	95	63.5
3	2	1.3

Figure E-3. Tulsa Employee Survey

G. (Answer only if you are regularly a passenger in some else's car on your trip to and from work). Do you pay the driver of the car?

8:1 No GO TO I 8:2 Yes GO TO H 8:__

H. How much do you pay the driver every month?

$_____ GO TO I 9-10:__ (MD=99)

I. Is there a car normally available for your work trip?

11:1 No GO TO L 11:2 Yes GO TO L 11:__

J. (Answer only if you normally drive to work and bring a regular passenger or passengers with you). Do you receive payment from your passenger or passengers?

No GO TO K Yes → How much do you receive each month $_____ GO TO K 12-13:__ (MD=99)

K. About how much do you pay for parking each month?

$_____./month GO TO L 14-15:__ (MD=99)

L. Do you ever use public transportation for trips other than to and from work?

No ↓ Yes → About how many trips a month?_____ 16-17:__ (MD=99)

Please answer questions M through R

M. How long does it (or would it) take you to walk from your home to the nearest public transportation stop?

Less than 5 minutes 18:1 5 to 10 minutes 18:2 More than 10 minutes 18:3 Don't know 18:4 18:__

N. How long does (or would) it take you to walk to your work place from the nearest public transportation stop?

Less than 5 minutes 19:1 5 to 10 minutes 19:2 More than 10 minutes 19:3 Don't know 19:4 19:__

O. What is the main reason that you make the journey to and from work in your present manner?

20:__

P. Does your employer sell passes at a lower price than would exist elsewhere?

21:1 No 21:2 Yes 21:3 Don't know 21:__

Q. Your sex: 22:1 Male 22:2 Female 22:__

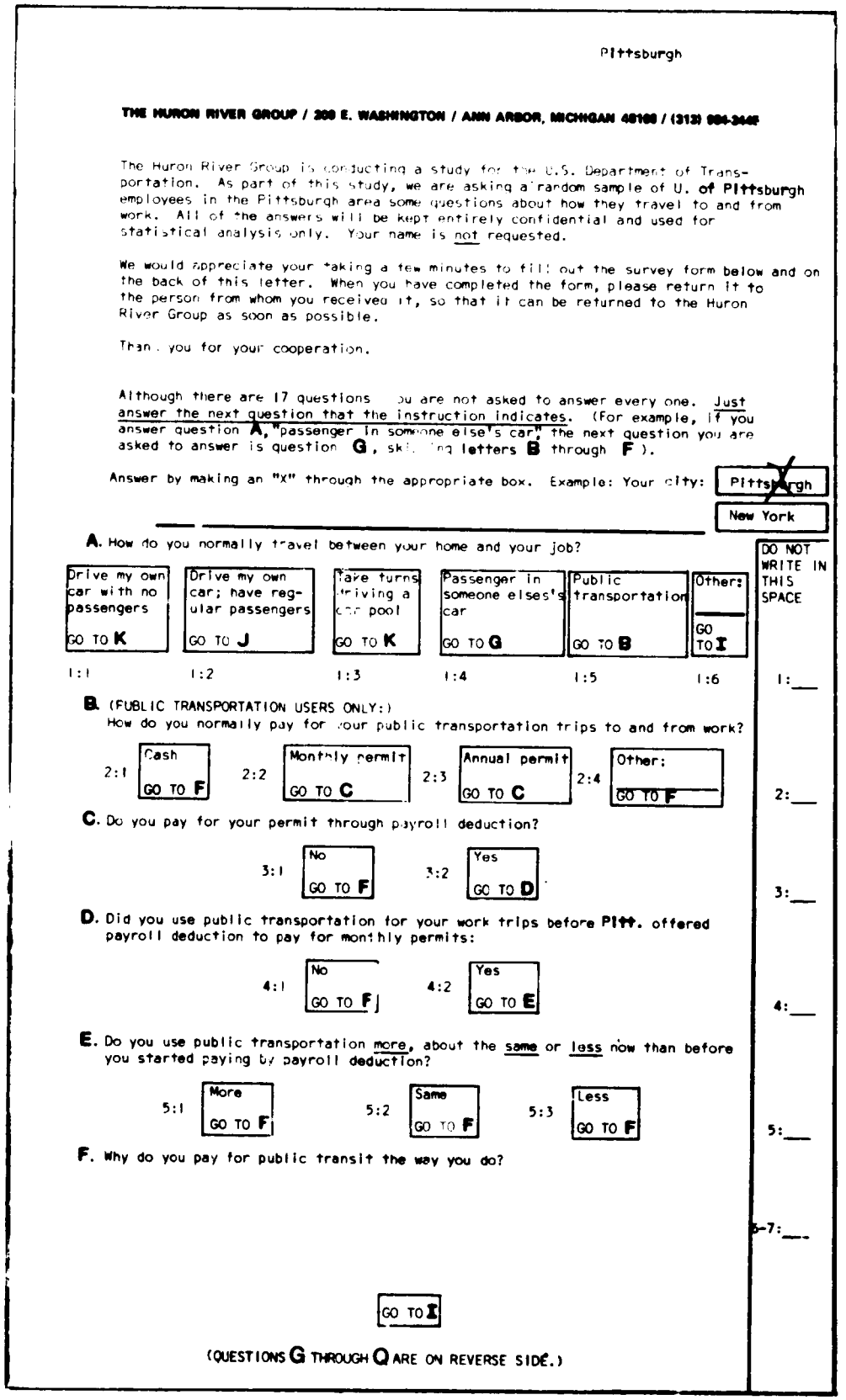
R. Your age: Younger than 20 23:1 20-29 23:2 30-39 23:3 40-49 23:4 50-59 23:5 60 or older 23:6 23:__

We would appreciate any further comments you may care to provide concerning your present commuting arrangements, with particular reference to your use, or potential use, of public transportation, and particularly your thoughts regarding the availability of passes at your place of work. Please write any additional comments on a separate sheet and attach to this questionnaire. 24:__

Please return this questionnaire to the person from who you received it as soon as possible. Thank you very much for your assistance.

Ans.	N	%
G:1	24	48.0
2	26	52.0
H:Mean= 11.04 Std dev= 5.95		
I:1	56	16.6
2	281	83.4
J:Mean= 12.07 Std dev= 6.47		
K:Mean= 13.62 Std dev= 8.61		
L:Mean= 3.78 Std dev= 3.91		
M:1	477	49.1
2	239	24.6
3	169	17.4
4	86	8.9
N:1	788	81.5
2	65	6.7
3	39	4.1
4	75	7.7
P:1	39	4.1
2	824	85.5
3	101	10.4
Q:1	515	52.5
2	467	47.5
R:1	16	1.6
2	360	36.4
3	268	27.1
4	170	17.2
5	153	15.4
6	21	2.2

Figure E-3 (Concluded)



Pittsburgh

THE HURON RIVER GROUP / 209 E. WASHINGTON / ANN ARBOR, MICHIGAN 48108 / (313) 994-3465

The Huron River Group is conducting a study for the U.S. Department of Transportation. As part of this study, we are asking a random sample of U. of Pittsburgh employees in the Pittsburgh area some questions about how they travel to and from work. All of the answers will be kept entirely confidential and used for statistical analysis only. Your name is not requested.

We would appreciate your taking a few minutes to fill out the survey form below and on the back of this letter. When you have completed the form, please return it to the person from whom you received it, so that it can be returned to the Huron River Group as soon as possible.

Thank you for your cooperation.

Although there are 17 questions you are not asked to answer every one. Just answer the next question that the instruction indicates. (For example, if you answer question **A**, "passenger in someone else's car" the next question you are asked to answer is question **G**, skipping letters **B** through **F**).

Answer by making an "X" through the appropriate box. Example: Your city: [X] Pittsburgh [ ] New York

A. How do you normally travel between your home and your job?

1:1	1:2	1:3	1:4	1:5	1:6
Drive my own car with no passengers GO TO **K**	Drive my own car; have regular passengers GO TO **J**	Take turns driving a car pool GO TO **K**	Passenger in someone elses's car GO TO **G**	Public transportation GO TO **B**	Other: GO TO **I**

B. (PUBLIC TRANSPORTATION USERS ONLY:)
How do you normally pay for your public transportation trips to and from work?

2:1	2:2	2:3	2:4
Cash GO TO **F**	Monthly permit GO TO **C**	Annual permit GO TO **C**	Other: GO TO **F**

C. Do you pay for your permit through payroll deduction?

3:1	3:2
No GO TO **F**	Yes GO TO **D**

D. Did you use public transportation for your work trips before Pitt. offered payroll deduction to pay for monthly permits:

4:1	4:2
No GO TO **F**	Yes GO TO **E**

E. Do you use public transportation more, about the same or less now than before you started paying by payroll deduction?

5:1	5:2	5:3
More GO TO **F**	Same GO TO **F**	Less GO TO **F**

F. Why do you pay for public transit the way you do?

GO TO **I**

(QUESTIONS **G** THROUGH **Q** ARE ON REVERSE SIDE.)

DO NOT WRITE IN THIS SPACE

1:___
2:___
3:___
4:___
5:___
6-7:___

Ans.	N	%
A:1	734	36.5
2	209	10.4
3	64	3.2
4	131	6.5
5	589	29.3
6	283	14.1
B:1	258	45.7
2	286	48.7
3	13	2.2
4	20	3.4
C:1	116	38.7
2	184	61.3
D:1	41	21.8
2	147	78.2
E:1	34	22
2	120	77
3	1	1

Figure E-4. University of Pittsburgh Employee Survey

G. (Answer only if you are regularly a passenger in some else's car on your trip to and from work.) Do you pay the driver of the car?

8:1 No → GO TO **I** 8:2 Yes → GO TO **H** 8:___

H. How much do you pay the driver every month?

$_____ GO TO **I** 9-10:___ (MD=99)

I. Is there a car normally available for your work trip?

11:1 No → GO TO **L** 11:2 Yes → GO TO **L** 11:___

J. (Answer only if you normally drive to work and bring a regular passenger or passengers with you). Do you receive payment from your passenger or passengers?

No → GO TO **K** Yes → How much do you receive each month $_____ GO TO **K** 12-13:___ (MD=99)

K. About how much do you pay for parking each month?

$_____ month GO TO **L** 14-15:___ (MD=99)

L. Do you ever use public transportation for trips other than to and from work?

No Yes → About how many trips a month?_____ 16-17:___ (MD=99)

Please answer questions M through Q

M. How long does it (or would it) take you to walk from your home to the nearest public transportation stop?

Less than 5 minutes 18:1 | 5 to 10 minutes 18:2 | More than 10 minutes 18:3 | Don't know 18:4 | 18:___

N. How long does (or would) it take you to walk to your work place from the nearest public transportation stop?

Less than 5 minutes 19:1 | 5 to 10 minutes 19:2 | More than 10 minutes 19:3 | Don't know 19:4 | 19:___

O. What is the main reason that you make the journey to and from work in your present manner?

20:___

P. Your sex: Male 21:1 Female 21:2 21:___

Q. Your age: Younger than 20 22:1 | 20-29 22:2 | 30-39 22:3 | 40-49 22:4 | 50-59 22:5 | 60 or older 22:6 | 22:___

We would appreciate any further comments you may care to provide concerning your present commuting arrangements, with particular reference to your use, or potential use, of public transportation, and particularly your thoughts regarding the payroll deduction plan referred to in the questionnaire. Please write any additional comments on a separate sheet and attach to this questionnaire. 23:___

Please return this questionnaire to the person from whom you received it as soon as possible. Thank you very much for your assistance.

Ans.	N	%
G:1	79	59.3
2	54	40.7
H: Mean= 16.98		
Std dev= 10.34		
I:1	352	40.8
2	510	59.2
J: Mean= 19.55		
Std dev= 11.56		
K: Mean= 15.95		
Std dev= 7.79		
L: Mean= 5.37		
Std dev= 7.17		
M:1	1142	57.8
2	434	22.0
3	373	18.9
4	26	1.3
N:1	1332	67.5
2	405	20.5
3	201	10.2
4	36	1.8
P:1	957	48.2
2	1028	51.8
Q:1	53	2.7
2	797	40.2
3	488	24.6
4	315	15.9
5	254	12.8
6	75	3.8

Figure E-4 (Concluded)

APPENDIX F
REPORT OF INVENTIONS

After a diligent review of the work performed under this contract, no innovation, discovery, improvement, and/or invention was made; nor were any of the above intended to be made. The purpose of the study was the examination of the overall ridership and revenue impacts of ongoing and completed fare prepayment programs, so that the invention or development of new devices for fare collection was not expected.

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