Report No. UMTA-74-6-1

THE EFFECT OF FARE REDUCTIONS ON PUBLIC TRANSIT RIDERSHIP

John R. Caruolo

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PROJECT REPORT

Prepared for

DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION

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16. Abstract

The study was undertaken to determine the effects of various reduced fare programs on transit ridership. A listing of all reduced fare programs in North America is provided. The concept of fare elasticity was defined and determined for the various programs. Empirical evidence was obtained and analyzed from senior citizen programs, reduced base fare programs, free fare programs and promotional programs. It was found that reduced fare programs produce significant ridership increases. Senior citizen transit demand was found to be more elastic than overall ridership demand. Off-peak travel is more elastic than peak hour travel. Even with these significant ridership increases, reduced fare programs result in a revenue loss. These programs have been successful in achieving their particular social and environmental objectives.

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CHAPTER I

INTRODUCTION

In recent years, a growing number of transit systems in the United States have experimented with fare reductions or the elimination of fares completely. These programs have resulted in fares insufficient to support the operating costs of the system and have necessitated subsidies in some form. There are three basic types of reduced fare programs that will be examined in this report: 1) An across the board fare reduction applied to the base fare for all riders in the system. This reduction in fares must be applied over a significant period in time. The reduction may apply over a 24 hour period or may be in effect only during the off-peak hours of the day. A listing of reduced base fare programs in North America is given in Table 1.1. This listing is not complete as revisions and additions to the list occur periodically; 2) A fare reduction offered to a special population group of the total ridership. This report will examine senior citizen fare reduction programs which have been instituted in every part of the North American continent. Other special population groups that are offered special fares include students, the handicapped, the blind, policemen and uniformed government employees. Senior citizen programs may also be restricted to the off-peak hours of the day. A table listing the current senior citizen programs in North America is included in the appendix of this report. A listing of special reduced fares and procedures for the blind, handicapped, unemployed, and welfare recipients is also available in the appendix; and 3) A fare reduction limited to a certain route or routes in a transit system. These programs usually deal with downtown shuttle bus loops.

The ultimate reduction in transit fares leads to a free or no fare transit system. There have been numerous free fare experiments conducted in the United States in recent years. This report will discuss free fare programs in the context of a type of reduced fare program.

PURPOSE OF THE STUDY

The purpose of this report is to investigate the effects of reduced fare programs on transit ridership. The report will identify all such programs in the United States and Canada. Information about each program will be provided. The report will then determine whether the fare reductions have satisfied their particular objectives. Empirical results from fare reduction programs will be analyzed to determine whether fare reductions have produced significant ridership increases and whether the increases in ridership economically justify the fare decrease.

The report will attempt to quantify fare reduction effects on transit demand. These results will assist local transit planners in the prediction of system changes resulting from the implementation of a reduced fare program. Any such guide lines must be examined and modified when applied to a particular local transit setting.

Table 1-1

Reduced Base Fare Programs in North America

Area	Fare Reduction	Funded	Comments
Atlanta	From 40¢ to 15¢ Transfers from 5¢ to free	1% Sales Tax	Service improvements also implemented. Program began 3-1-72
Boston	10¢ (from 25¢) 3 rapid transit lines 10-1 Mon. to Friday	General City Revenue	Begun April 1973, still in progress.
Boston	Fare and Service changes on rail and bus lines	UMTA Demonstration Grant	Done in 1962-1963.
Cincinnati	Bus fare cut from 55¢ to 25¢	0.3% addition to city payroll tax	April 1, 1973.
Denver	From 40¢ to 35¢	General Revenue	Also implemented service improvements simultaneously. Began April 15, 1971.
Evanston, Illinois	Bus fare from 40¢ to 25¢	General Revenue	Began 9-72. Ridership increased by 2000 per day.
Haddonfield, NJ Dial-a-Ride	From 60¢ to 30¢	UTMA Demonstration Project	Implementation date 10-20-73.
Kansas City	From 50¢ to 40¢	1/2¢ sales tax	Implemented in 10-71.
Louisville	50¢ to 25¢ in the off-peak hours	Federal revenue sharing funds provided by the city.	July, 1973.

Table 1-1

Reduced Base Fare Programs in North America

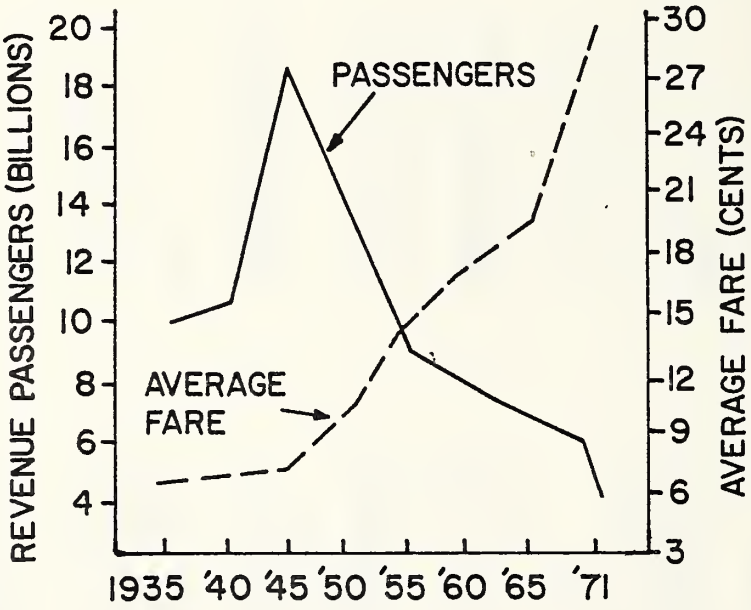
Area	Fare	Funded	Comments
New Castle, Pennsylvania	25¢ to 15¢ during off-peak hours	UMTA Demonstration Grant	For 23 days in 1966.
New York City	Half-fare Sunday program	None	Program extended from 4 Sundays in Dec. 1973 to June 30, 1974.
St. Louis	45¢ to 25¢	1/2% sales tax	November, 1973.
San Diego	Base Fare from 40¢ to 25¢	California State Sales Tax	Service improvements. Implemented 9-1972. Zone fares eliminated.
San Francisco	Unlimited Sunday use for 50¢	None	None
Santa Cruz	25¢ to 10¢ on week-ends	Self-sufficient	150% increase in ridership (week-end).
Seattle	Base fare 25¢ to 20¢	None	Done in 1-1973. A 10% increase in ridership on suburban lines.
Toronto	Zone fares to base fare	None	Savings from 15¢ to 25¢ a ride.
Tulsa	30¢ to 25¢	General Revenue	Began March 20, 1973. Service improvements simultaneously implemented.

OBJECTIVES OF FARE REDUCTION PROGRAMS

Since the end of World War II there has been a steady and dramatic decline in the demand for transit service. Since the 1940's, ridership has dropped by over 65%.(1) During this same period, transit fares have increased by over 360% from an average fare of 6.68¢ to 31.32¢.(2) This corresponding increase in fares with the decrease in ridership in the United States can be seen from Figure 1.1.

Figure 1.1

Transit Trends (3)



In recent years, a growing number of transit systems have experimented with fare reductions as a device to increase the demand for transit service. The theory is that the lower the price, the higher the demand will be. From this economic theory, social and environmental objectives develop.

The basic objective of all fare reduction programs is to increase transit usage. This increase in ridership may be composed of former auto travelers diverted to transit and former transit users making additional trips. The objective of many programs is to divert a significant number of riders from the auto to transit for traffic congestion, energy conservation, and environmental reasons. Such a diverson would relieve traffic congestion in downtown areas. A more efficient use of existing transportation facilities would also result. A diversion from car to transit would yield a

savings in fuel resources. A standard auto with two passengers consumes four times as much energy per passenger mile as does a highway bus with twenty-two passengers.(4) A major benefit of a diversion from car to transit is the reduction in air pollution. A Charles River Associates report calculated the reduction in air pollution obtained from such a diversion given a free fare transit system in Boston.(5) The report predicted a 4% reduction in pollution over the entire urban area which is a significant amount where existing pollution levels hover not far below hazard levels. The major objective of the Seattle, Washington free transit zone in the central business district (CBD) is the reduction of pollution levels by a diversion form auto to transit. The federal requirements for air quality standards in the Seattle Metropolitan area were the prime determinant in the implementation of the program.

Another objective of reduced fare programs is the stimulation of downtown areas by the increased transit travel to such areas. Reduced fares will encourage shoppers to the downtown areas therefore increasing business activity. This objective presupposes an existing high quality transit service to the CBD. Lowering the transit fares would increase the mobility and economic activity of the daytime CBD working population. This objective has resulted in numerous free CBD bus loops across the United States.

The result of the awareness of the economic and social needs of special groups have resulted in numerous reduced fare programs. Reduced fare programs are seen as a means of increasing the mobility of the poor, the elderly, the handicapped-all non-driver groups that are transit dependent. By reducing the cost of transportation, these groups are granted access to a greater number of social and economic opportunities. Two objectives of the New York City senior citizen reduced fare plan are increased economic well being and reduction of social isolation of the city's elderly.(6)

Another objective of some reduced fare programs is to provide transit as a public service to the populace. The proponents of this view argue that Transit should be provided as a public service or utility, just as are police or fire protection. The city of Commerce, California has cited this objective as reasoning for their free public transit system.

CHAPTER 2

LITERATURE REVIEW

In the course of this study, an extensive literature search was completed. The findings of this literature review are given in the bibliography. All pertinent references were investigated that dealt with reduced fare programs or free fare programs. The results of this search are summarized in this chapter. The current methodology for measuring demand changes due to fare variations will be given. The chapter will also examine various survey findings on the effect of fare reductions on modal split. Various mathematical models will be examined which attempt to explain the amount of transit usage at several fare levels. The chapter will also discuss the data collection procedure used in obtaining empirical evidence about fare reductions across the United States.

The relationship between the price and the usage of a system is known as the demand function. The exact shape of this demand function is unknown, although it is known that the demand for transit is inversely proportional to the price of that service. It is useful that the planner know the exact shap of this curve to predict the effects of policy changes such as fare reductions on transit ridership.

TRANSIT FARE ELASTICITIES

The most convenient and familiar measure of the relationships between transportation system characteristics and demand are elasticities. The direct price elasticity is a measure of the sensitivity of the demand for transit service. It is useful to distinguish cross-elasticities from direct elasticities. A cross-elasticity relates a change in traffic on one mode to a change in a system characteristic of a competing mode. These cross-elasticities can summarize the degree of diversion to other modes caused by a change in transit fares. A direct fare elasticity for transit represents the sensitivity of ridership changes to the in-vehicle money price (out-of-pocket costs) of that transit service.

This report will discuss two types of demand elasticities. The arc elasticity of demand is calculated as the ratio of the percentage change in travel divided by the percentage change in price when the base of the percentages is the average of the before and after values. Equation One states the arc elasticity mathematically;

$$N_{arc} = \frac{\log q_1 - \log q_2}{\log x_1 - \log x_2} \qquad \text{(Equation 1)}$$

N_{arc} = arc elasticity

q_1 = demand (ridership) before fare change

x_1 = price (fare) before fare change

q_2 = demand (ridership) after fare change

x_2 = price (fare) after fare change

Another type of elasticity, the shrinkage ratio or loss ratio, is the measure most familiar to transit operators. The shrinkage ratio is the percent change in ridership resulting from a one percent change in the price. This ratio is calculated by relating the changes in both the ridership and the fare to their values before the change. Stated mathematically;

$$N_{sr} = \frac{q}{x} \cdot \frac{x_1}{q_1} \qquad \text{(Equation 2)}$$

N_{sr} = shrinkage ratio

q = demand change

x = price change

q_1 = demand before change

x_1 = price before change

The sign of price elasticities is negative due to the shape of the demand curve. The distinction between the arc elasticity and shrinkage ratio is important. Only when the percentage price change is small, will the two measures give the same value. A large reduction will result in two different values. This is illustrated in the following calculations dealing with a fare reduction in Boston, Massachusetts.

A fare reduction of the off-peak bus fare from 25¢ to 10¢ resulted in an overall off-peak passenger increase of 79%. (1)

$$N_{arc} = \frac{\log q_1 - \log q_2}{\log x_1 - \log x_2} = \frac{\log 5696 - \log 10,196}{\log .25 - \log .10}$$

$$= \frac{-0.2531}{+0.3979} = \underline{-0.64}$$

$$N_{sr} = \frac{q}{x} \cdot \frac{x_1}{q_1} = \frac{-4500}{10,169} \cdot \frac{.25}{.15} = \frac{-0.79}{+0.60}$$

$$= \underline{-1.32}$$

The large difference between values results from the fact that the fare change was a rather large one (60% of the base fare). For arc elasticities, a value of -1.0 represents approximately the dividing value between gaining and losing revenue by reducing fares. This is not necessarily true of the shrinkage ratio. When the elasticity is less than -1.0 (from 0 to -1.0) demand is considered inelastic and price reductions lead to revenue losses. An elasticity greater than -1.0 (from -1.0 to $-\infty$) represents that the demand is elastic and revenue gains will result from fare reductions. In the preceding example, revenue fell by 36% which is reflected in the arc elasticity. The shrinkage ratio of -1.32 gives the impression that the demand was elastic which it was not. The usefulness with elasticity arises from the fact that it is a dimensionless number. Thus, a comparison can be made between the effects of service improvements and the effects of a fare reduction even though one is comparing minutes with dollars.

A major problem in deriving fare elasticies is the many factors which change in time that bias ridership measures before and after the fare change. Such factors may include weather, seasonal variation, or supply of the transit service. A particular problem arises when service improvements occur simultaneously with a fare change. In these cases it is usually impossible to isolate the effect of the fare change on transit ridership.

The consulting firm of Simpson and Curtin made one of the first attempts to determine the exact shape of the demand curve with respect to price. They collected evidence of ridership losses associated with fare increases from the late 1940's to late 1960's. They calculated a short-run (3 months) shrinkage ratio from 77 urban bus changes in the United States. After eliminating the secular trend by comparison with ridership during the same period in the preceeding year, they arrived at a mean shrinkage ratio of -0.36 with a standard deviation of -0.09.(2) The transit industry has adopted the "Simpson and Curtin formula" which states that a 1% fare increase will result in a 1/3 of a percent (.33) decrease in ridership. The formula shows transit demand to be inelastic to price. The acceptance of the -0.33 figure has been for fare decreases as well as fare increases. The procedure of predicting increases in ridership due to fare decreases using this formula is invalid. The relationship was determined from data derived from fare increases, not fare reductions. In absence of a relationship using fare reductions as its data base, this relationship must be used for predicting ridership changes, although the figure is usually modified to fit local conditions. Another disadvantage with this model is that it involves extrapolation outside its data range for zero fare level or free transit.

Curtin himself has recommended using an elasticity factor of-.20 in planning estimates, arguing that this number better represents more recent fare changes. In thirteen large citits in which fare changes have occurred since 1952, only two had shrinkage ratios greater than -0.30.

The New York City experience with fare increases tends to reinforce the Simpson and Curtin formula. The analysis of fare increases from 1948 to 1970 show subway shrinkage ratios between -0.1 and -0.2 and surface line shrinkage ratios between -0.13 and -0.34.(3) This suggests that bus travel is more elastic than subway travel. The reason for this may be that on the surface a rider has a greater choice of alternate modes at a comparable price. The New York City data show a greater elasticity for week-

end travel than for weekday travel. The data confirmed that off-peak hour travel was more elastic than peak hour travel. Off-peak hour trips are more responsive to price changes because the purpose of travel is more discretionary than for peak hour trips. The New York data suggests that transit ridership is inelastic to changes in transit fares.

There have been various attempts to derive elasticities by regression models. These models estimate transit patronage as a function of certain transit operation characteristics. One of the earlist works was done by Walter Rainville for the American Transit Association in 1948. Taking data on ridership, gross revenue, and vehicle mileage for a city with various socio-economic variables for each year from 1920 to 1946, Rainville attempted to determine a method for analyzing the effect of proposed fare changes. (4) Using multiple regression, the analysis tried to determine bank debit per capita, average fare, and automobiles per capita. The models developed were reasonably accurate for one year forcasts. The ATA recommended that its members attempt to use the models but little work was tried due to a lack of computer facilities in transit systems back in the late 1940's.

Another study was attempted by Carstens in 1968 for small urban areas in Iowa. (5) Time series data from 13 transit operations in Iowa between 1955 and 1965 were analyzed and a regression equation developed relating number of transit rides per capita to quality of service, average fare, size of city and non-employed residents. The model was highly sensitive to level of service and was able to account for 97% of the total variance in ridership. It was found that an increase in fare leads to a decrease in ridership but the amount of decrease depends largely upon the level of service. The elasticity at high levels of service ranged from -0.3 to -0.4 while at low levels of service the range of elasticity was from -0.8 to -1.0. The data indicates that only for transit systems with low levels of service will fare reductions be elastic. For systems with high levels of service, price elasticities seem inelastic.

A fare reduction in Iowa City in late 1966 tends to justify Carsten's conclusions. When the average fare was reduced from 19.3¢ to 10¢ ridership more than doubled, raising passenger revenue by 25%. (6) This increase did not occur until one year after the reduction indicating a substantial time lag before the the effects of such a program can be measured. Discounting the effects of additional service, the shrinkage ratio of this reduction is -2.04.

The most recent work with regression models has been done by Michael Kemp of the Urban Institute. Kemp has set up several models of ridership on the Metropolitan Atlanta Ripid Transit Authority (MARTA) system to estimate the effects of their recent fare and service changes. (7) The models use monthly time series operating data from March 1970 through March 1973. The variation in ridership was accounted for by a small number of variables. The model, estimated by standard linear regression techniques, used revenue passengers as the dependent variable and base fare, total service miles, number of working and non-working days per month and a dummy variable as the independent variables. The dummy variable was used to explain seasonal variations. The models were very successful in predicting the month to month variations in passenger volumes on the system. The results of the models will be discussed when the Atlanta fare change is exam-

ined in Chapter 4. Kemp used the same procedure to analyse the San Diego and Cincinatti fare cuts.

A cross-sectional model was used by Charles River Associates (CRA) in their theoretical analysis concerning the costs and benefits of free transit. The model was calibrated using 1963/1964 home interview survey data from metropolitan Boston.(8) Both travel time and travel money were included in the analysis and both were disaggregated into "in-vehicle" and "access" components. The calibrated model was used to forecast the demand reaction to free transit. Elasticities for both travel time and travel price were calculated. The use of the model to forcast reaction to free transit involves an extrapolation far outside the range of calibration data. There is valid reason to doubt the meaningfulness of the elasticities derived, outside the range of data. The CRA study does represent the best attempt that can be made by desk research alone to estimate the effects of free transit. Also, there is an unusual consistency between the analytical results presented by CRA and bits and pieces of factual free transit evidence that have accumulated over the years. The model does have a disadvantage in its consideration of all modes of transit as a single mode. Table 2.1 shows the elasticities with respect to travel cost and Table 2.2 shows the elasticities with respect to travel time.

Table 2.1 illustrates the insensitivity of trips with respect to prices by showing small elasticities especially, for transit trips. The transit line haul cost represents the fare on the predominant transit mode and access cost largely represents feeder bus fare. For shoppping trips total elasticity is -0.32 while for work trips the elasticity drops to -0.19. These are very low elasticities. For auto trips, travel is more sensitive to price than transit trips. This is especially true for auto shopping trips that exhibit an elasticity of -.88 for auto line costs (operating cost of auto exclusive of owership costs) but demand is still inelastic. Work trips are relatively insensitive to prices. The cross-elasticities in the table are all either zero or very low. The only non-zero cost cross-elasticity is for auto trips with respect to fares. This shows the problems in diverting motorists. A similiar table of elasticities with respect to travel time offers an interesting result. These large elasticities indicate that travel demand is very sensitive to reductions in travel time. The total elasticity for transit work trips is +0.742 (versus -0.19 for prices) and for transit shop trips to +0.593 (versus -0.323 for prices).

The results suggest that ridership is more sensitive to changes in travel time than to changes in fares. The results indicate that fare reductions will not stimulate great increases in ridership and will ultimately lead to greater losses in revenue. The low elasticities dc indicate that an increases in fare should cause only a small decrease in ridership and an ultimate increase in revenues. Overall, the study concluded that free transit could achieve many of the social benefits attributed to it but at a very high cost. For a small fraction of the cost of free transit, service could be improved and it would achieve many of the same benefits. These service improvements could be financed out of the fare box.

Demand elasticities can also be derived from modal choice models. These models assume a given a given volume of trip making regardless of trip price. These models have a disadvantage in assuming that say the

Table 2-1

Elasticities of Passenger Travel Demand With Respect To The Components Of Travel Cost[1]

Auto Trips

Trip Purpose	Direct Elasticities: Auto-Line Haul	Direct Elasticities: Auto out of pocket	Cross Elasticities: Transit Line Haul	Cross Elasticities: Transit Access[2]
Work	-.494	-.071	-.138	0
Shopping	-.878	-1.65	0	0

Transit Trips

Trip Purpose	Direct Elasticities: Transit Line Haul	Direct Elasticities: Transit Access	Cross Elasticities: Auto Line Haul	Cross Elasticities: Auto out of pocket
Work	-.09	-.100	0	0
Shopping	-.323[3]		0	0

[1]All Elasticities have been computed at the means of the variables.

[2]Access prices represent the total price minus the line-haul component price.

[3]The sample was unsuitable for estimating disaggregated values.

Table 2-2

Elasticities of Passenger Travel Demand With Respect To The Component of Travel Time[1]

Auto Trips

	Direct Elasticities		Cross Elasticities	
Trip Purpose	Auto In-Vehicle	Auto Out-of-Vehicle	Transit Line-Haul	Transit Access
Work	-.82	-1.437	0	.373
Shopping	-1.02	-1.440	.0950	0

Transit Trips

	Direct Elasticities		Cross Elasticities	
Trip Purpose	Transit Line-Haul	Transit Access	Auto In-Vehicle	Auto Out-of-Vehicle
Work	-.39	-.709	0	0
Shopping	-.593[2]		0	0

[1]These elasticities have been computed at the means of the variables.

[2]The available shopping transit trip sample was unsuitable for estimating elasticities for the disaggregated time components.

demand reaction to a 10¢ fare increase will be identical to the demand reaction if the price of auto travel was reduced by that amount. This assumption is questionable.

A study undertaken by Leon Moses and Harold F. Williamson, Jr. developed a modal choice model to determine the kinds of price changes needed to induce automobile commuters to shift to public transportation. Using 1956 data from a commuter survey in Cook County, Illinois, diversion prices were developed for alternative modes. The results suggest a 13% diversion from car to transit if public transportation were free. (9) To accomplish a 50% diversion from car to transit, auto commuters would have to be paid 50¢ per trip. The study concluded that price reductions greater than present fares would be required on each of the modes of public transportation to divert 1/3 of the auto commuters to transit.

Another study done with the Cook County data was done by S. L. Warner. He focused on the binary choice between the auto and transit for the downtown work journey trips. The implied transit fare elasticity was -0.8 and the cross-elasticity of auto usage with respect to transit fare roughly +0.2. (10) This direct elasticity for work trips is numerically high.

Various public surveys have attempted to predict transit usage for a free transit or reduced transit situation. Most surveys indicate that speed or other transit service parameters appear to be more important as a demand factor than fares. A survey conducted by Southeastern Pennsylvania Transportation Authority (SEPTA) indicated 23.5% diversion from auto to car with a 50% reduction in fares. (11) Free transit would divert 66.7% of all motorists to transit. These results are significantly different than most other studies. Whether 67% of all motorists would actually divert to transit is questionable considering that these users have never been exposed to such a system. Over crowding, especially during the peak hours, may reduce this percentage.

A survey undertaken in Denver, Colorado, attempted to ascertain the feasibility of a free bus service in a street corridor. Approximately 34% of all motorist replying to the survey, indicated that they would use transit if it were free. (12) An analysis was undertaken to determine the total transportation costs for a free bus service and the present service for a street corridor. It was found that the total costs were less under a free bus system than under the present system, but the margin of advantage was small. The additional environmental, social, and economic (parking) benefits not analyzed were cited in arriving at the conclusion that free bus service would be beneficial.

A survey of London commuters in 1965 attempted to answer the question of low fares in London. When asked if they would use transit if it were free, 51% responded favorably. (13) Asked if they would use transit if the fare was reduced to 12¢, 44% indicated that they would switch to transit. The additional 7% that would switch with free transit indicates that auto travel is inelastic to fare reductions below a certain level.

The preceeding discussion has indicated that demand for public transport is inelastic to price. Direct price elasticities are usually less than one and cross-elasticities are even smaller. This means that reduced fares can-

not generate significant increases in ridership and ultimately result in revenue loss. It would seem that fare increases can increase revenue at the expense of a small decrease in ridership. These conclusions will be analyzed by empirical evidence in the following chapters.

DATA COLLECTION

In the attempt to obtain empirical data for the analysis of reduced fare programs, various transit systems across the United States were contacted. Information regarding their particular reduced fare program was requested.

Each transit system was contacted by phone and a follow-up letter was sent requesting specific information. A sample letter is included in the appendix. The letter requested not only ridership and fare data but other miscellaneous elements of the program. It was requested that information be sent on the cost of such programs and the source of funding for the programs. Information regarding other improvements made in the system implemented simultaneously was also requested.

Some problems did arise with data in compatibility but the majority of replies consisted of suitable data for analysis. The results of this data collection procedure is given in the following chapters.

CHAPTER 3

SENIOR CITIZEN REDUCED FARE PROGRAMS

Senior citizen reduced fare programs are in existence in every major metropolitan area in the North American continent. Some states are instituting statewide reduced fare programs such as New Jersey and Pennsylvania. There is legislation in the Wisconsin and Ohio state goverments that would initiate a statewide senior citizen program. The Pennsylvania program is financed by funds from the state lottery while the funding for the New Jersey program comes from the state's general fund.

Senior citizen programs are usually restricted during the peak hour. This policy attempts to obtain a better distributin of the total ridership between peak and off-peak hours and to eliminate delays during the peak hours from senior citizen boarding. Most programs have age restrictions but not income restrictions. A listing of free fare senior citizen programs is provided in the appendix, Table A-2.

The costs of such senior citizen programs are large. The greatest cost is the loss of passenger revenue due to the lowering of the fare. The amount of this loss depends on the corresponding ridership increase. In off-peak senior citizen programs, the shifting of riders from peak to off-peak periods may actually reduce operating costs. The costs of various senior citizen programs is given in Table 3.1. The costs in this table are rather large considering that these costs pertain to programs that benefit only a small segment of the riding public.

Table 3-1

Cost of Senior Citizen Programs

City	Population (Million)	Adult Fare	Reduced Fare	Annual Revenue Loss
New York	7.8	35¢	15¢	$14 Million
Chicago	3.6	45¢	20¢	$7.5 Million
Philadelphia	2.0	35¢	Free	$6.2 Million
Cleveland	0.88	50¢	25¢	$1.2 Million
Detroit	1.7	40¢	15¢	$1.5 Million
Honolulu	0.63	25¢	Free	$1.05 Million
San Francisco	0.74	25¢	5¢	$650,000
Vanocuver	0.43	25¢	15¢	$2 Million
Minneapolis	0.98	30¢	Free	$1 Million

The results of senior citizens programs vary considerably from area to area but the evidence suggests that the demand by senior citizens is more elastic to fare reductions than the demand of the rest of the riding public but that the demand is still inelastic and therefore requires some form of subsidy. Table 3.2 shows the elasticities of off-peak senior citizen programs.

Table 3.2

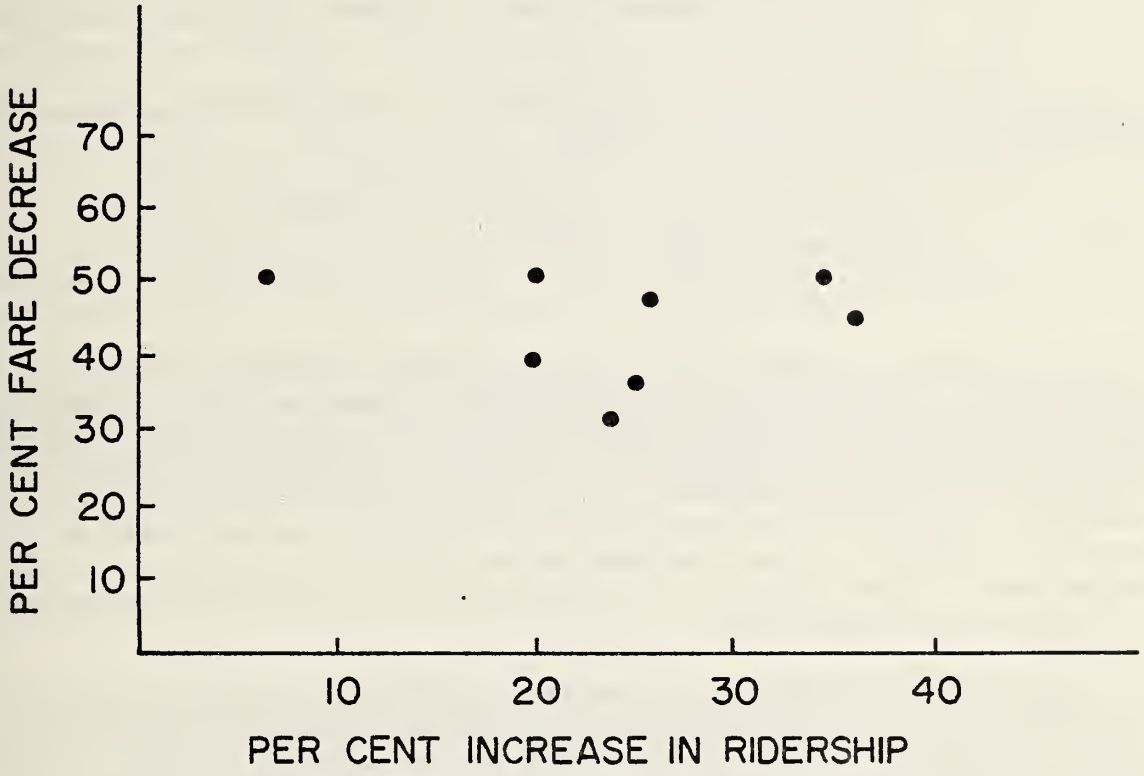
Elasticities of Off-Peak Hour Senior Citizen Programs

City	Percent Fare Reduction	Percent Ridership Increase	Arc Elasticity	Shrinkage Ratio
Baltimore	50.0	8.0	-0.11	-0.16
Los Angeles	33.3	23.9	-0.53	-0.72
Madison	40.0	20.0	-----	-0.50
Miami	50.0	34.5	-0.43	-0.69
New York	50.0	26.7	-0.34	-0.53
Pittsburgh	45.0	34.3	-0.68	-0.76
Minneapolis	100	99.0	-0.30	-----
Philadelphia	100	44.7	-0.16	-----
South Bend, Ind.	50.0	20.0	-----	-0.40
Washington, D.C.	37.5	26.0	-0.48	-0.69

The mean shrinkage ratio is -0.56 with a standard deviation of -0.21. The mean arc elasticity is -0.38 with a standard deviation of -0.21. The following figure illustrates the experience of eight of the senior citizen fare reductions. As can be seen, the results vary considerably from system to system. No equation can satisfactorly explain the experience of these fare changes.

Figure 3.1

Increases In Ridership Due to Senior Citizen Fare Reductions



LOS ANGELES, CALIFORNIA

In June 1961, the Southern California Rapid Transit District instituted an off-peak reduced fare plan for the elderly. Senior citizens 65 years or older making under a certain income were eligible. I.D. cards were required. The average token fare of 22.5¢ was reduced to 15¢. Overall ridership on the system increased by 1.9 million riders or 23.9%. (1). There was a shifting of 862.250 former peak hour riders to the off-peak period. This shifting resulted in a $64,670 revenue loss. There was an increase of 26,000 new full fare Saturday riders. While these riders cannot be explained directly to the reduced fare, it is probable that this increase is due to the increase during the week and therefore can be attributed to the reduced fare. The shrinkage ratio for this program is -0.72, which is a rather high figure.

The cost of this program can be obtained using a methodology developed by Northwestern University. The following relationship expresses the net effect on passenger revenue due to a off-peak senior citizen reduced fare program. (2)

$\Delta r = e \cdot \Delta b (E - e) - \Delta p (E - e)$

where Δr = revenue change
e = off-peak period reduced fare
Δb = number of new riders at the reduced fare
E = average regular fare
Δp = number of riders shifted from peak to off-peak periods by the reduced fare

Using the Northwestern methodology reveals the total annual reduction resulting from the reduced fare plan.

$$r = (1,924,250)\ (\$.15) - (4,801,250)\ (\$.225 - \$.15) - (862,250)\ (\$.225 - \$.15)$$

$$r = \$136,125 \text{ per year}$$

For this program, there was an increase in Sunday riding at full fare, estimated to yield about $5,850 additional revenue per year. If no recognition of the increase in senior citizen trips during the base period was made and the revenue change was estimated on the basis of the reduction in fare multiplied by the total number of base period trips made by senior citizens after implemtation of the program, the loss would be estimated at $569,081 per year. This is a gross overestimate of the loss in revenue yet the revenue loss is often calculated in this fashion by transit companies due to data collection limitations.

In 1962 the reduced fare was increased to 20¢ (base fare 25¢), because transit officials felt the loss occurred with the original reduction was too great. Transit officials believe that the 5¢ reduction has stimulated enough additional riding to eliminate the revenue loss. In 1974, the senior citizen fare was 20¢ and the base fare was 30¢.

NEW YORK CITY

On July 1, 1969, all New York City residents 65 or over and not employed full time were eligible to ride on the buses and subways during the hours of 10 a.m. to 4 p.m. and 7 p.m. to midnight, weekdays, all day Saturday, Sundays, and holidays at a reduced fare of 10¢ (base fare 20¢).(3) This figure is now 15¢ with the advent of the 35¢ fare. This reduction amounted to a 50% drop in the fare for senior citizens. Residents are issued reduced fare cards for identification. In the subways, the senior citizen shows his card and gets one token for 35¢ and a coupon. The coupon is redeemable for a free fare on his return trip only if the person makes both journeys during the same day during the eligible hours. The latest registration figures of 600,000 indicates that 73% of those eligible for the program have registered. The majority of the residents were younger elderly, in the range of 65 to 74 years old. The majority of registrants are female. Registration was lower in the poverty areas than in the rest of the city. White areas experience higher registration than non-white except in Central Harlem

which was among the highest registration of any area in Manhattan. It appears that acceptance of the program was related to social class and ethnic background.

A before and after ridership survey was undertaken by the Polytechnic Institute of New York, Division of Transportation Planning. The survey indicates that ridership increased by 26.7% between 10 a.m and 4 p.m. The largest increase in that ridership occurred during the middle of the day, in the noon to 2 p.m. period. A shift between 10 a.m. and/or after 4 p.m. would more likely be reflected by increases during the 10 a.m. to noon period and 2 p.m. to 4 p.m. period, suggesting that the 26.7% increase represents an overall change. The shrinkage ratio for this reduction is equal to -.45. Study of ridership indicates an average of six trips per week per person. The overall ridership increase was principally a phenomenon of more people riding rather than increased trip making by the same people. The program is considered successful in satisfying its social objectives.

The City of New York, under State law, is required to reimburse the Transit Authority for the full amount of every reduced fare. The City has payed $30 million in the first two years of the program to the Transit Authority. This represents an approximate yearly subsidy of $25 per senior citizen.

CHICAGO

The Chicago Transit Authority (CTA) instituted a reduced fare program on April 20, 1969. The reduced fare was from 40¢ to 20¢ (45¢ is the present base fare) and is available to all residents 65 years or older from 9 a.m. to 3 p.m. A study was undertaken to find the extent of the reduced fare plan on transit ridership. A before and after research program was used to assess the effects of the reduced fare plan. The "before" phase was done in March-April 1969 and the "after" phase during August 1969. For all modes of travel, frequency of trips per person increased by 58%. (4). This increase can be attributed to factors other than the reduced fare, such as weather changes, seasonal variations and sample bias. On CTA trips, the mean frequency of trips per person increased by 99% during the hours when the plan was in effect and 16% during the remaining hours of the day. This indicates that the increase in trips is genuine and not a result of the shifting of trips from peak to off-peak hours. Because of sampling bias, lack of sufficient sample size and other factors, it was not considered possible to make reliable statements of ridership trends from this data. It can be said, however, that whereas overall system usage has decreased over the course of the study, senior citizen ridership has increased, thereby satisfying the social objective of the program.

The city estimates costs of the program in 1971 to be $3,500,00. Since the inception of the program, the State of Illinois has subsidized the program by $7.6 million.

PHILADELPHIA

In July 1973, the Southeastern Pennsylvania Transportation Authority (SEPTA) instituted a free fare program for the elderly in the Philadelphia area. The program, subsidized by the Pennsylvania Lottery, allows senior citizens to ride free during the off-peak hours and pay a nominal fare of 10¢ during peak hours. Base adult fare is 35¢ in the system. From a social viewpoint, SEPTA considers the program to be a great success. In the first month of operation, the program handled an increase of 33% in senior citizen ridership over the previous month.(5) Some suburban Red Arrow bus lines experienced an increase of 75% in senior citizen ridership. During 1972, there were 22.6 million senior citizen trips, while in 1973 ridership for senior citizens amounted to 32.7 million trips. This increase is substantial and, when one realizes that the program was in effect only for one-half of the year 1973, the increase is more impressive. By January 1974, ridership had increased by approximately 2 million senior citizens trips per month since the implementation of the program. Increase in senior citizen ridership has been over 100%.

To finance this program, the lottery will have supplied $6.2 million in capital to SEPTA by June 30, 1974.

MIAMI

On October 1, 1972, the Metropolitan Dade County Transit Authority instituted an off-peak hour reduced fare program for senior citizens. The reduction in fare was 15¢ off the base fare of 30¢. All senior citizens 65 years or older are eligible and may show a Medicare card or a special MTA permit as identification. The program was instituted because of the dependency on transit amongst Dade County's large population of senior citizens. The objectives of the reduced fare program were: 1) To increase the mobility of senior citizens living on fixed and limited incomes, and 2) To increase transit ridership in off-peak hours. A survey was taken after implementation of the plan to ascertain the success of achieving those objectives.

Senior citizen ridership had increased during off-peak hours by 34.5% .(6) This showed that a large percentage of this increase represents a shift to the off-peak hours. It appears that the objectives of the program have been achieved. By virtue of the program, senior citizens are able to travel more often within their limited incomes.

Annual revenue loss, based on 15¢ per passenger, is estimated to be $1,091,553. No cost factor was included for passengers changing their rinding habits from peak to off-peak hours. The operating experience of the system was adversely affected by the reduced fare program. The transition periods between times caused particular problems. Just prior to 10 a.m., Senior citizens would stop buses to ask drivers if the reduced fare period was in effect. This not only slowed service, but resulted in heavy loads just after 10 a.m. until 10:45 a.m. Problems to the boarding process arose with the senior citizens showing their identification and the negotiation be-

tween operator and senior citizen of the exact fare to be charged. This has a negative effect on running time and schedule adherence.

MILWAUKEE

The Milwaukee Transport Corporation initiated a pilot program for reduced transit fares for senior citizens. The program began on May 14, 1973, and continued until the budgeted amount ($50,000) was expended in providing a half fare (a reduction from 50¢ to 25¢) subsidy to persons 65 years and older during the off-peak hours. A survey was also undertaken to evaluate the effectiveness of the program, as to whether senior citizen trip making increased. The survey constituted of three parts which occurred before, during, and after the pilot program.(7)

The survey found that there was little change in ridership due to the reduced fare program. Senior citizen ridership and the total number of transit riders failed to change during the reduced fare period. Even though the total ridership did not change, there was a modest shift from peak period to off-peak period riding by senior citizens. The survey indicated that a small proportion of riders (14%) changed their mode of travel to obtain a reduced fare.

There were many problems with this survey. This time period that the program was surveyed was too short to produce new stabilized ridership patterns. Also, the survey was taken on only certain routes of the city and this introduced a large bias into the data collection. This reduced fare program was continued despite this discouraging report. The Milwaukee and Suburban Transport Corporation has estimated an 8% to 10% increase in senior citizen ridership. This off-peak senior citizen program costs approximately $750,000 per year. The shrinkage ratio for this program is roughly between -0.16 and -0.20.

MADISON

Madison began a program of off-peak hour reduced fares for the elderly in August, 1973. The effect of the reduction from 25¢ to 15¢ has been an increase in ridership by 20%.(8) This corresponds to a shrinkage ratio of -0.50. The intent of the program is to encourage senior citizens to increase their trip making. The reduced off-peak fares will increase the mobility of senior citizens and alter their riding habits so they will use the buses in the off-peak hours. The program is considered a success.

BALTIMORE

The Maryland Department of Transportation implemented a reduced bus fare program for senior citizens of the Baltimore Metropolitan area. The

program provides a 15¢ fare on MTA buses on weekends, holidays and the off-peak hours during the week days (9 a.m. to 4 p.m. and 6 p.m. to 9 a.m.). The current adult basic fare is 30¢. Eligibility is restricted to persons 65 years of age and older that have obtained an identification card. The program was implemented in April, 1972. The program was designed to serve a pressing social need, that of making affordable public transit available to the area's elderly.

During the first year of the program, senior citizen ridership has increased by over 6, 000 rides per week or 8%. (9) The shrinkage ratio of the program is - 0.16 which is very inelastic. The Maryland Department of Transportation feels, although, that the program has been successful in meeting its service objectives.

During the first year, annual revenue losses amounted to $561,400 and since ridership is increasing, this amount will probably exceed $600,000 in the second year of the program.

PITTSBURGH

A reduced transit fare program was implemented in February, 1970 by the Port Authority of Allegheny County. The average cost of a one-way ride was reduced from 34¢ to 19¢ which constitutes a 45% reduction. The program was in effect between 10 a.m. and 3 p.m. and after 7 p.m. on weekdays and all day on weekends and holidays. All Allegheny residents, 65 years or older, are eligible for the program. The program was sought as a means of alleviating some of the mobility problems of the elderly and of providing them with the opportunity for greater participation in the life of the community. An identification card must be obtained. A survey was undertaken after implementation of the reduced fare program.

The average number of round trips increased by 10.5% with off-peak trips increasing 46.5% and peak trips decreasing by 31.8%. This indicates that the impact may depend on other factors affecting transit usage such as elderly retirement, health, etc. To estimate the real impact of the reduction, the usage that would have been expected to occur without any fare reduction must be computed. After computing expected ridership, it was found that the effect of the reduced fare program was a net increase of 1, 157, 000 round trips per year. (10) This figure corresponds to a 21.3% increase in ridership.

Such a ridership increase, clearly indicates a sensitivity of senior citizens to reduced fare change. In determining the elasticity of the fare reduction, a 21.3% increase in ridership underestimates the effect of the reduction, since this figure would be higher if fares would have been reduced in the peak period as well. A more logical figure is represented by the division of off-peak trips experienced during the fare reduction by the number of off-peak trips expected without the fare reduction. This results in a 34.3% increase. The shrinkage ratio is -0.76. The survey found that the elasticity for outside Pittsburgh was larger than the elasticity for Pittsburgh. This result tends to support Carsten's findings that residents of lower service areas are more

responsive to transit fare changes.

The net effect on revenue from the program was an annual loss of $628,900. This figure takes into account not only the loss due directly from the fare lowering but the loss due to the shifting of full fare trips in the peak period to reduced fare trips in the off-peak period. The Port Authority has instituted a free fare program for the elderly in July 1973 which is subsidized by the revenues from the Pennsylvania Lottery.

MINNEAPOLIS

Twin Cities Metro has a free fare program for senior citizens. The program is in effect during the off-peak hours (9:30 a.m. to 3:30 p.m. and 6:30 p.m. to 6:30 a.m.) on weekdays and all day Saturdays and Sundays. The plan was instituted on January 1, 1972.

Twin Cities estimates that senior citizen ridership prior to implementation of the program was 3,528,026. In 1972 and 1973, MTC carried 7,021,225 and 8,445,545 senior citizens respectively.(11) The increase in ridership due to the program in the first year amounted to 99%, nearly doubling ridership. The program is funded by general city revenues.

DETROIT

The program in Detroit is the oldest of any major metropolitan area in the United States. Im May, 1956, Detroit Department of Street Railways (DSR) instituted an off-peak hour reduced fare program for senior citizens. Eligibility for the program is restricted to citizens not gainfully employed and at least 65 years old. An indentification card is required that can also be presented for discounts at downtown theaters. The normal fare is 40¢ and the reduced fare is 15¢.

Although no studies on the program have been undertaken, the DSR does not believe that the reduction has resulted in any increase in riding by the elderly. It is not believed that the savings in cost is a determining factor in the riding habits of senior citizens. This conclusion is evidenced by statistics over the past twenty years. Statistics indicate that the total rate of decline in the system ridership has remained approximately the same both before and after the implementation of the program in 1956. It is estimated that the 15¢ fare for senior citizens costs the DSR about $1.5 million per year. The DSR feels it is a worthwhile social program but should be subsidized outside the DSR.

WASHINGTON, D.C.

A senior citizen reduced fare was put into operation on May 9, 1971. The reduction was 15¢ in the basic fare of 40¢ during the off-peak hours during the weekdays and all day on Sundays and holidays. There is no reduction in fares on Saturdays.

Ridership of senior citizens rose from 47,000 per week to 59,000, an increase of 26%.(12). The shrinkage ratio is -0.69. Even with the ridership increase, there remains a decrease in passenger revenue due to the fare reduction estimated at $250,000 annually.

HONOLULU, HAWAII

In May, 1970, Honolulu instituted a free fare program for all senior citizens over the age of 65. A bus pass is required for indentification. This program also includes children under 6 years of age. The regular adult base fare is 25¢. The City subsidizes the program. The program is in effect during all hours of the day, seven days a week.

The Mayor of Honolulu is very pleased with the results of the program. The City is seeking a Federal D.O.T. grant to try a total no-fare demonstration project. The system is at present averaging 350,000 senior citizen trips per month. This is an increase of 88% in less than 3 years. Over this period, though, the program operational hours increased from off-peak hours to all day. Since 1970, passenger revenue has decreased by $542,000.

In 1970, the system handled 23,693,547 passengers. In 1972, the number of passengers increased to 24,039,215, of which 2,966,020 were senior citizen trips.(13) Therefore, over the two-year period, revenue passengers actually decreased but overall passenger totals increased due to the high number of senior citizen trips.

Elasticity cannot be calculated because senior citizen ridership before the program was implemented is not available.

DES MOINES, IOWA

Instituted in May, 1961, a senior citizen reduced fare plan halved the basic fare of 30¢ to 15¢. In 1973, the senior citizen fare is 35¢ which is a reduction of 10¢ from the adult base fare. Identification cards were required for persons 65 years of age and over that have an income under $6000 annually. The plan is in effect 10 a.m. to 3 p.m. and all hours after 6:30 p.m. for every day of the year.

No surveys have been made to quantify the effects of the program; however, transit officials believe there has been an increase in senior citizen

ridership. This increase in ridership is not believed great enough to offset revenue losses and therefore it produces a revenue loss.

Transit officials argue in favor of the program from an overall service and social viewpoint. They believe peak hour service is speeded up due to absence of elderly people boarding during rush periods. This resulted in faster service during the peak hours, fewer injuries to elderly people, and fewer claims against the transit system due to the decrease of injuries to senior citizens. (14)

Various Programs Across the United States (15)

A review of the listing of senior citizen programs reveal a large number of programs experiencing no significant change in ridership. The monitoring procedures for ridership counts on many of these systems make estimates of senior citizen ridership impossible to obtain.

ALBUQUERQUE, NEW MEXICO

A senior citizen reduction program from 30¢ to 20¢ during all hours of the day has caused a 23% increase in senior citizen patronage. This is a fare elasticity of -0.70.

EUCLID, OHIO

The senior citizen reduced fare program allows all senior citizens to ride at 15¢, a reduction of 10¢ from the base fare. This decrease in fares has caused a 7% increase in ridership. Fare elasticity is -0.18. The program is in effect during all hours of the day.

PROVIDENCE, RHODE ISLAND

The senior citizen program allows all persons over 65 years of age to ride on the transit system for 20¢. The adult base fare is 35¢. A 2% increase in ridership has resulted from the program corresponding to a fare elasticity of -0.05.

SOUTH BEND, INDIANA

A reduced fare program is offered for senior citizens during the off-peak hours on weekdays. A 50% fare reduction (from 30¢ to 15¢ is available to all senior citizens and the program has increased ridership by 20%. Fare elasticity is -0.40.

TORRANCE, CALIFORNIA

About a 30% increase in senior citizen ridership has resulted from a reduced fare program. The reduction, from 35¢ to 10¢, is available to persons 60 years and older during all hours of the day. Far elasticity is -0.42.

CHAPTER 4

REDUCED BASE FARE PROGRAMS

A number of transit systems in the United States are experimenting with reduced base fare programs. These programs reduce the fare far below that which is sufficient to cover operating costs. A number of these programs are implemented as attempt to provide transit as a public service to the community. These programs may be instituted to increase transit ridership, decrease vehicular traffic, or stimulate activity in the CBD.

Because the fare does not cover operating costs, subsidies must be obtained by the transit system. The amount of ridership increase by the program will affect other costs. Existing capacity in the system may be over-taxed and additional rolling stock may have to be purchased. These costs comprised a major portion of the total cost of the Atlanta fare reduction, for example. Ridership increases were so large that service improvements were made and the purchasing of additional buses was made necessary. In off-peak hour programs, such as New Castle, Pa. and Louisville, the increase in ridership can be served during the under utilized off-peak hours, by existing capacity. Table 4.1 lists the costs of reduced base fare programs across the U.S.

Table 4.1

Cost of Reduced Base Fare Programs

City	Population	Adult Fare	Reduced Fare	Cost of Program
Atlanta	497, 421	40¢	15¢	$10 Million/yr
Cincinatti	452, 524	55¢	25¢	$ 6 Million/yr
Evanston	79, 808	40¢	25¢	$ 3 Million/yr
Louisville	361, 958	50¢	25¢ (off-peak hours)	$750, 000/ first 6 months
Tulsa	330, 350	30¢	25¢	$30, 000/ first 3 months

The effect on transit ridership by reduced fare programs varies considerably from system to system. The empirical evidence suggest that al though the demand appears more elastic than the "Simpson and Curtin" formulation, the demand is still inelastic. Such reduced base fare programs will result in a revenue loss. The increases in ridership due to the programs are significant. These conclusions are evidenced by Table 4.2 which show the shrinkage ratios and arc elasticities for various programs.

Table 4.2

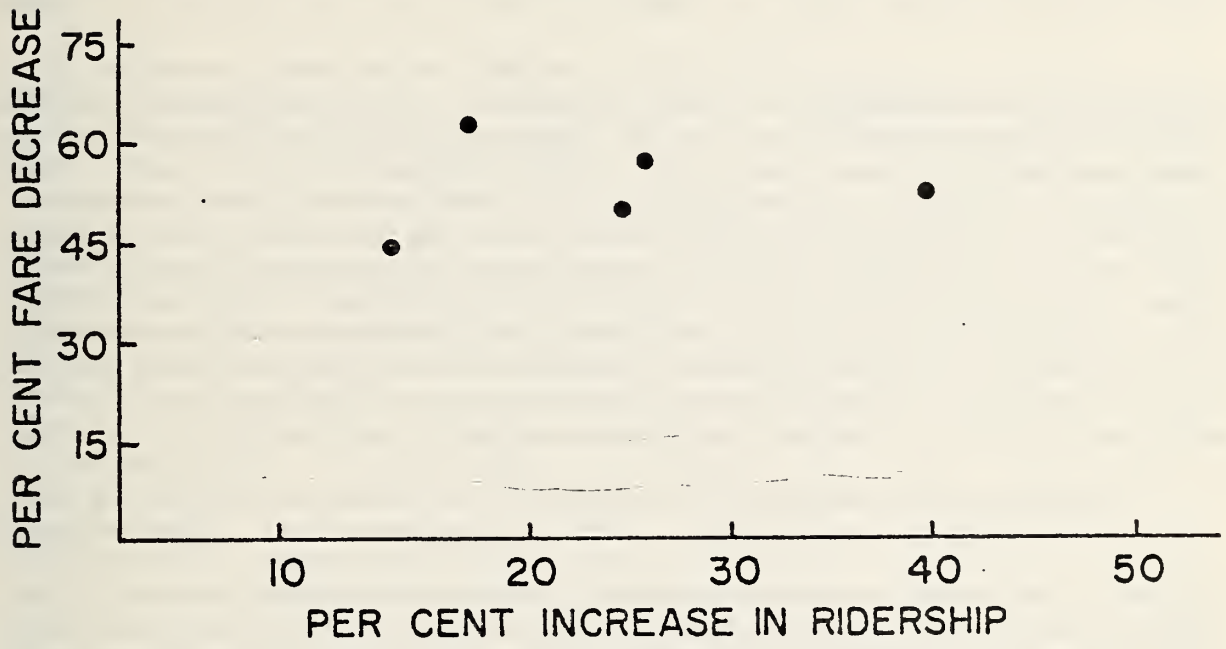
Elasticities of Recent Base Fare Reductions

City	Percent Fare Reduction	Percent Ridership Increase	Arc Elasticity	Shrinkage Ratio
Atlanta	62.5	19.0	-0.18	-0.31
Cincinatti	54.5	40.0	-0.42	-0.73
St. Louis	44.0	15.0	-0.24	-0.34
San Diego	37.5	23.0	-0.42	-----
		Off-Peak Hour Reduction		
Louisville	50.0	25.0	-0.40	-0.50

The mean shrinkage ratio is -0.46 and the mean arc elasticity is -0.32. Both measures have a standard deviation of -0.22. These figures do not include the Louisville program. Figure 4.1 illustrates the experience of these fare changes.

Figure 4.1

Increases in Ridership Due to Reduced Base Fare Programs



ATLANTA

The most ambitious reduced fare program undertaken in the United States was in Atlanta by the Metropolitan Atlanta Rapid Transit Authority (MARTA). On February 17, 1972, MARTA, a public agency, purchased the privately-owned Atlanta Transit System. MARTA then embarked on its short range $1.3 billion transit development program.(1) On March 1, 1972, as part of this development program, the reduced fare plan was implemented. This plan lowered fares from the previous 40¢ base fare with 5¢ transfers to a flat 15¢ fare with free transfers.

The financing of the overall $1.3 billion transit program is obtained from a voter-approved one percent sales and use tax levied in DeKalb and Fulton Counties. Clayton County, which is provided some service by MARTA, rejected the tax plan and subsequently fares in that portion of the system remained unchanged. With its secure income source, MARTA's policy of operation is to maintain low fares. The level of these fares is to offset the regressiveness of the sales tax to the poor by providing relatively "cheap" transit service. It was not MARTA's prime objective to increase ridership with the reduced fare, but to overcome the inequity of the sales tax.

Implementation of reduced fares had immediate and unanticipated effects. Ridership increased during the first week of reduced fare operation by 18.5%. As ridership continued at an increased rate, MARTA was forced

to acquire used buses on emergency basis from other transit systems. These vehicles were reconditioned and put into service immediately to relieve overloads. Over the ensuing months, more service changes were undertaken to provide increased service for this increase in ridership. By February, 1973, these changes amounted to approximately a 30% increase in the annual vehicle miles operated.

The fare reduction undertaken in Atlanta represents a fare cut of 62.5%, which is much larger than the norm. The program also gives the best documented demand reaction to a decrease in fares. Most empirical investigation with price changes have been done with fare increases. The response to this reduced fare program provides excellent answers as to the effect of such programs. To answer the many questions arising from the increase in ridership, MARTA undertook a two-part research effort. Their study consisted of an on-board transit survey and an in-home interview survey to determine characteristics and attitudes of persons riding and not riding the transit system. Results of the November, 1972 on-board survey have been published and will be discussed. Findings from the in-home survey have not as yet been made available to the public.

The survey has attempted to answer several questions relating to transit ridership characteristics. The first question was: "What is the increase in ridership?" How much is due to reduced fare and how much of the increase is due to service changes? How much of the increase is due to new riders, and how much is due to more trips made by old riders? Overall transit ridership increased 30.2%, with 91% of the increase due to new rider trips. On the weekday, ridership increased by 28%. This increase is composed entirely of new transit trips. Ridership increased by 41% on Saturdays and 78.8% on Sundays. Saturday's increase is over one-half due to new riders trips while 63.5% of Sunday's increase is due to increased trip making by old riders. When asked reasons for change to transit, 50% or more of all new riders indicated fare. A small number of new riders indicated service change as their reason for change to transit and the remaining new riders selected "other" as the reason. The large number selecting neither fare nor service change indicates that there is a complex mode choice decision involving an overlap of both fare and service considerations. The relative weights of these two considerations was not obtained from the survey. The magnitude of the "other" response indicates that no definitive conclusion can be drawn from the study. Fare considerations clearly stand out in the survey data but service considerations do not. It is probable that service considerations are present in the decision "other" in the responses. Fare reduction is news worthy and has a large impact on the public and this may be a reason why fare considerations received a high proportion of responses. The study concludes that as a result of increased public awareness of reduced fares and only limited service improvements at the time of the survey, fare was the primary single reason for increased ridership.

The second question was "How much automobile traffic has been diverted to transit? What mode of travel did new riders use before they changed to transit?" Of the weekday new drivers, 41.8% previously made the trip by driving an auto and 21.9% made the trip by auto passenger. This accounts for almost 2/3 of the new rider trips, all of whom made the trip previously by auto. Of the auto trips eliminated (21,642), the highest

percent of these trips occurred during the evening peak hours. Assuming 50% of this evening peak hour volume occurs during the highest one-hour volume period, a four to six lane freeway would have to be provided to handle this traffic. Induced trips accounted for 21.5% (11,151) of the week day new rider trips. On weekends, 1/3 of the new riders drove automobiles and 1/4 previously did not make the trip.

The next question was "What are the characteristics of transit ridership as compared to before MARTA? What are the differences between the old and new riders?" Results of the November 1972 survey were compared with a survey taken in October 1970. The percentage of non-home based trips increased from 5.9% to 14%, showing greater mobility in the off-peak hours. The percentage of non-work trips increased from 29.9% to 39.9%. The number of park-and-ride and kiss-and-ride access trips to the transit service has more than doubled, although MARTA has undertaken no action to encourage this activity. Comparing new and old riders in the 1972 survey, the study indicates that new riders are generally younger and wealthier than old riders and new riders constitute a higher proportion of males and whites. This indicates that transit has been made attractive to a different segment of the population. A much larger percentage of new riders than of old riders have automobiles available to them for their trip but have selected transit by "choice".

The increase in ridership is largely due to new rider trips (91%). Since these new riders have a higher average income than old riders, the reduced fares objective to offset the regressive aspects of the sales and land use tax seems invalid. A more detailed ridership profile would provide a better view of this inconsistency. It would seem that new trips are being made almost exclusively by higher income individuals. While this is making transit acceptable to a different segment of the population, the reduced fare has not stimulated a great increase in old rider trips, a 2.7% increase over trips being made before reduction. This seems logical in that the poor are captive riders and cannot exhibit a great elasticity, whereas middle income riders have a strong elasticity as they have a choice of mode.

The survey's final question was: "Did the fare need to be reduced as much as it was in order to achieve significant increase in transit ridership?" The study revealed that a lesser decrease in fare, to 25¢, would have achieved 80% of the increase in ridership with the decrease in fares to 15¢. Had the objective of the fare reduction been to increase ridership, then the amount of decrease need not have been as large to obtain significant increase in ridership. Even with the smaller reduction, however, an operating deficit would have resulted.

The short range transit improvement program calls for a base fare of 15¢ for seven years and an increase of 5¢ a year until the tenth year. After ten years, the fare will be set equal to one-half the operating costs.

Using survey data which indicates the proportion of new trips due to fare consideration only, 200,877 new trips were attracted by the fare reduction. This is a 19% increase over the ridership predicted at 40¢ fare. The shrinkage ratio is -0.31, still a relatively low value. In regards to the discussion earlier about responses as to the reason for changes to transit

this elasticity may be higher than it should be, if other causes could be isolated. However, it is felt that the "other" category may contain some fare and service considerations and therefore this number seems reasonable based on the available survey data.

Michael Kemp has done an extensive analysis of the Atlanta fare reduction with regression models. The models have estimated an arc elasticity of -0.18, which is very low.(2) Kemp estimates that 8.2 million revenue passengers have been added to the system by the fare reduction which is an increase of over 19%. The models were also used to determine the amount of additional ridership if the fare had been eliminated. At most, an additional 5.1 million revenue passengers, over and above the ridership increase at 15¢, would have been added to the system. The models were less successful in isolating out the effects of service improvements than they were in the fare reduction. A demand elasticity with respect to vehicle miles was calculated at +0.3, a larger figure than to fare change.

SAN DIEGO

Since 1967, when the city took control of the privately-owned transit system, the San Diego Transit Corporation has followed a policy of reducing fares. This policy is to encourage an increase in transit ridership and a decrease in auto pollution. In September, 1972, the largest fare change in the system's history was undertaken. The base fare of 40¢ was reduced to 25¢ and the existing zone fare was abolished. This policy change resulted, in some cases, in a fare reduction from 90¢ to 25¢ per trip. All time restrictions on the senior citizen fare program were abolish The monthly SAVER PASS reduced its price from the existing $36 to $16, depending on zone location, to a flat $10 per month. Major service improvements were also made.

From August 1972 to August 1973, vehicle miles in the system increased by 28%.

The effect of these fare and service changes on transit ridership in the San Diego region has been dramatic. Since the fare was reduced, ridership has increased from 34.7% in September 1972 to 72% in June 1973.(3) The fare reduction is considered successful in achieving its objectives of increasing ridership and decreasing pollution. Also, as a result of these fare and service changes, gross passenger revenue has increased by 19%, over the previous year. The result of these changes has been to show that the demand was elastic.

Michael Kemp of the Urban Institute has estimated that 3.5 million revenue passengers have been added to the 16.2 million passengers who would have taken trips on the system at the 40¢ base fare given the service improvements.(4) This is an increase of 23%. This corresponds to an arc elasticity of -0.42. A shrinkage ratio cannot be calculated because the average fare with the zone system before the reduction is unknown. Kemp has also estimated that the service improvements have increased ridership by over 19% given the fare change. This a demand elasticity with re-

spect to vehicle miles of between +0.7 and +0.8.

The San Diego Transit system deficit is about $7 million per year and this amount is funded by the California state sales tax, local property taxes and contributions from outlying communities served by the system.

CINCINNATI, OHIO

A major fare change was undertaken in Cincinnati, Ohio. The private transit company in Cincinnati had been experiencing a drastic decline in ridership since 1946. Since 1968, ridership had decreased by 47% and in one year from 1972 to 1973, passenger revenue dropped by 29%. In August 1973, the city purchased the transit company and became the Queen City Metro Division of the Southwest Ohio Regional Transit Authority. On April 1, 1973, the city had reduced the base fare of 55¢ to 25¢ and abolished to 10¢ transfer fee. To pay forthe purchase of the system and the additional $6 million subsidy per year due to the fare reduction, the city added an additional 0.3% to the city payroll tax. (5)

By the end of 1973, ridership had increased by approximately 40 per cent of the previous year. The increase in ridership is experienced in both the peak and off-peak periods with substantial increases in both Sunday and Saturday travel. This increase corresponds to a shrinkage ratio of approximately -0.73. From April to December 1973, passenger revenue dropped over $2,946,300 as compared to the same period in 1972, a 40% decrease. Passenger revenue in 1973 had been increased over 1972 by 3% before the fare reduction. An arc elasticity of -0.42 was estimated given the 40% ridership increase and the reduction of 55¢ to 25¢.

BOSTON

A demonstration project was undertaken in October, 1962, to analyze the effects of service improvements and fare reductions on the public use of all available forms to mass transportation. Various transportation companies in the vicinity of Boston were contracted to run the experiments. There were 35 experiments involving new services, frequency and fare changes. The resulting changes in operating costs and ridership were recorded. Of these 35 experiments, only three provide data from which fare elasticity can be measured. Two general conclusions can be made from the study about fare elasticity. (6)

1) Frequency of service is a more important factor than lower fares for increasing passenger volumes and retaining present ridership on public transportation.

2) Off-peak fare reductions by themselves do not generate enough new ridership to offset reductions in revenue.

An off-peak bus fare reduction was instituted in Lowell, Massachusetts. A three-month off-peak hour reduction from 25¢ to 10¢ resulted in a ridership increase of 79%, but a revenue loss of 36% was experienced. The shrinkage ration of -1.32 is misleading because, although the shrinkage ratio is greater than one, there was a loss in revenue. The arc elasticity, a better measure in this case, was -0.64. A similar experiment conducted in 1963-1964 involved both rail and bus in an off-peak fare experiment. A commuter railroad company agreed to identical fares and a common one-way off-peak fare schedule between Boston and the suburbs. The average off-peak fare on the buses was reduced by approximately 30%. The results show a shrinkage ratio of -0.6 and a gross revenue decrease of only 12%. These results ignored the switching between bus and rail and between peak and off-peak traffic.

A market survey of riders in the experiments indicated that the increase in ridership was mainly from auto drivers. The survey indicated that to shift 41% of all auto users to transit, increased service would be needed. Only 20% would shift if lower fares were introduced. The program concluded that a lowered price alone has a slight effect when combined with improvements in service. The greatest impact on ridership can be gained by improved service plus sharp cuts in fares.

DENVER

On April 15, 1971, transit service operation in Denver was taken over by the Denver Metro Transit (DMT). In order to provide a better transit service and to increase ridership, the DMT decided to reduce the bus fares. On May 1, 1971, the basic adult fare of 40¢ was reduced to 35¢ and the fare was reduced further to 25¢ during off-peak hours. Student fares were reduced from 25¢ to 20¢ and senior citizen fares dropped from 40¢ to 25¢ during the off-peak hours. The student fare was extended to cover college as well as high school students. A "before" and "after" survey was undertaken to evaluate the effect of the fare reductions on the transit patronage. The immediate effect of the fare reduction was to halt the 15% passenger decline, by the summer of 1971.(7)

In addition to the fare changes, the DMT had also implemented service improvements in September, 1971. Some 10,000 miles were added to the system weekly. Up until that time, overall ridership had increased 1.6% while fare box revenues declined by 14.8%. This represents a 16.6% increase in ridership when one considers the halting of the 15% passenger decline that had been occurring yearly. Therefore, overall ridership was up by 16.6% over what it would have been if the fares had not been made. It was not possible to calculate an elasticity for each component of the fare changes. In 1972, passenger ridership increased by over 20% from 1971 due to the service changes implemented and the reduced fare.

LOUISVILLE

The bus service in the city of Louisville has been on the decline over the last decade. Periodic increases in fares and reductions in service had caused an annual 18% decline in ridership. (8) It was decided that the single most important need confronting the community was a lower fare. In an effort to stop the deterioration of the transit service, the city of Louisville instituted a reduced fare program in July, 1973. The adult base fare was reduced from 50¢ to 25¢ during the off-peak hours on weekdays and all day Saturdays and Sundays. Student fares were also reduced from 25¢ to 10¢ and the 5¢ transfer charge was eliminated. The city of Louisville and Jefferson County financed this $750,000 experiment with federal revenue sharing funds. A monitoring program was established on the Louisville Transit Company to analyze demand changes.

The adult ridership increased by 25%. This increase is composed of a 7% increase over a similar period in 1972 and the elimination of the steady 18% decline in system usage. The percentage of off-peak riders increased from 55% of all ridership to 67% of all ridership, indicating a better distribution of ridership. This shift has provided capacity during the peak hours where increases in student ridership can be accomodated with the rolling stock available. This increase in ridership corresponds to a shrinkage ratio of -0.50. The arc elasticity is approximately -0.40. Saturday ridership rose by 21%, while Sunday ridership increased by 34%. These increases in weekend trips can be assumed to be composed of "choice" riders. Student ridership has also increased by approximately 20 per cent.

Without a doubt the program has realized significant success. The increase in ridership figures are more impressive when one realizes that there was little or no increase in service on many of the routes throughout the system. However, the increases in ridership did tax the existing capacity of the system to its limit and any further increases in ridership would necessitate the purchase of additional rolling stock.

KANSAS CITY

A fare reduction in the base fare by the Kansas City Area Transportation Authority was authorized effective October 1, 1971. The base fare was lowered from 50¢ to 40¢, a 20% reduction. The fare reduction program was established after passage of a 1/2¢ sales tax levied within the city limits. The fare reduction itself was one of the major issues which attributed to the successful passage of the sales tax program.

After lowering the fare, passenger revenue fell by 19% over the next year. (9) There was a corresponding 6% decrease in passenger ridership throughout the year 1972. The results of this fare program were very discouraging.

TULSA

The Metropolitan Tulsa Transit Authority reduced its bus fare on March 20, 1973. The 30¢ fare with 5¢ zonal increments was reduced to a flat 25¢ base fare. This fare change lowers fares by as much as 45¢ per trip. The program was approved and is being subsidized by the city of Tulsa. The estimated cost of the program is $30,000 for the first three months of the program, depending on ridership changes. Service improvements, amounting to over 40,000 miles per month, were also undertaken.

The effect of the program has been a ridership increase of over 500,000 trips in 1973, over 1972.(10) By 1973, passenger revenue had also increased due to the combination of the fare reduction and service improvements. The program has achieved its dual purpose of increasing ridership and of providing a better transit service. Due to the combination of fare reduction and service improvements, the exact ridership increase due to the fare reduction cannot accurately be calculated. A study is being undertaken to ascertain the effects of the fare reduction on ridership.

HADDONFIELD

In an effort to increase ridership on the Dial-A-Ride Bus Demonstration Program, the adult base fare was reduced from 60¢ to 30¢ on October 20, 1973. Senior citizen fares were reduced from 30¢ to 15¢. The immediate effect of the fare reduction was a 10% increase in ridership in the first month.(11) By February, 1974, ridership had increased by 13%. This was calculated comparing actual ridership totals to assumed February ridership totals had no fare decrease occurred. This corresponds to a shrinkage ratio of -0.26. The reduction has had limited success in increasing ridership since a substantial portion of the 13% ridership increase was due to the energy crisis.

ST. LOUIS

The Bi-State Transit System implemented a transit improvement program on November 12, 1973 which included a reduction of the base fare from 45¢ to 25¢ and the reduction of the fare for senior citizens from 45¢ to 15¢. Funding for the transit improvement program, which also includes new service and service improvements, is received from the proceeds of the 1/2 cent transportation sales tax levied in the County of St. Louis. The objective of the program was to provide maximum transit service to the area.

On an annual basis, the fare reduction and the new county services generated almost nine million new riders.(12) Additional riding on pervious routes increased by 15%. The principal increase was during the off-peak hours, 26.8 per cent during the midday and 24.1 during the evening hours. Morning peak travel increased by 8.3 per cent and afternoon peak

travel increased by 10.2 per cent. This suggests that shoppers and senior citizens are taking advantage of the reduced fare. The shrinkage ratio for this reduction is -0.34. The arc elasticity for this reduction is -0.24.

NEW CASTLE, PENNSYLVANIA

As part of a Department of Housing and Urban Development (HUD) demonstration project, the New Castle Transit Authority reduced its off-peak hour fares from 25¢ to 10¢. This experiment lasted for 23 days in 1968. The experiment failed to meet its objective of increasing ridership. There was no detectable increase in overall ridership, but a better distribution between peak and off-peak riders did occur. With this redistribution of ridership, the actual operating costs per passenger were reduced by two cents per passenger.(13) It was concluded that a fare reduction in the off-peak hours causes a redistribution of riders that may reduce total operating costs.

CHAPTER 5

FREE FARE PROGRAMS

The majority of free transit programs in the United States have been started in recent years. Most free fare programs pertain to a special group such as senior citizens or to a special route such as a CBD shuttle loop. A table in the appendix lists the free fare transit programs in North America. Most of the programs conducted have not been able to quantify demand changes due to the elimination of fares due to other service changes implemented simultaneously. One of the only known properly conducted experiments was conducted on the campus bus system at Kent State University in 1967. (1) It was found that a no fare campus bus system drew 2.2 times the patronage of a 5¢ fare and 2.7 times the patronage of a 10¢ fare. An experiment in Auburn, New York eliminated the 25¢ fare for one month. (2) The Central New York Regional Transportation Authority experienced an increase from 18,000 to 80,000 revenue passengers for that month. The arc elasticity of this reduction is -0.70.

In June 1973, the Chicago Transit Authority (CTA) instituted a free fare program for all Evanston and Wilmett, Illinois rapid transit riders, using the service locally. This program was instituted because the existing bus service was non-functioning due to a strike. Local ridership increased by 2,000% (3) during the demonstration on the rapid transit route. The new ridership came from regular CTA riders making additional trips and strikebound former Evanston Bus Company riders commerical business in Evanston increased by approximately 5%. The demonstration was considered a great success. The fact that the existing service provided enough capacity to handle the increased ridership was an important factor in this success.

A free fare (off-peak hours) week in September, 1973 was offered in Madison, Wisconsin. Ridership increased an average of 93.5% as compared to an average week when the 25¢ fare was in effect. (4) This corresponds to an arc elasticity of -0.29. After the program was ended, an increase in ridership was still being experienced. Therefore, some increased revenue obtained after the experiment was due to the experiment.

In implementing a free transit program, the amount of revenue loss is simply the sum of the current passenger revenues. There are two elements that may result in a savings when applied to free transit. First, the speed of the transit vehicle may increase due to the elimination of the fare collection procedure. This increase in the vehicle's speed may reduce operating costs. The second savings comes from the elimination of fare collection personnel, of tokens and transfers, of maintenance, of fare collection machines, and of accounting and administrative costs for money collection. For rail and rapid transit systems, the personnel savings would be large.

The only quanitative attempt to estimate the cost of a major Metropolitan free transit system was done in the CRA report. The costs of a metropolitan Boston free transit system was estimated at $75 million. (5) The costs of a nationwide free transit system would be about $2 billion per

year. These are 1966 estimates.

COMMERCE, CALIFORNIA

The primary example of free transit in the United States is the municipal bus system in Commerce, California. Commerce is the only muncipality in the nation with totally free bus service. Commerce is a small town located in Southern California with a population of 10,5000. Although small, Commerce has a massive tax base provided by 1,500 corporations doing business within its city limits. The population of Commerce is made up roughly of 70% Mexican-American decent and many have incomes at near poverty levels.

In 1962 the city decided to take control of the existing transit system. This decision was based on a study that indicated that it would be less expensive for the city to take over operations than to subsidize the existing system.(6) The system began with two used buses and a limited schedule. Today, the city operates on a five-day, three-route bus system. The routes are oriented to connect the residential areas with the shopping and park areas. The majority of riders, 1,200 passengers daily, are housewives, senior citizens, and students. Only a handful of residents use the buses to commute to work. Roughly 7% to 8% of the population use the bus daily compared with the national average of 4% for communities of this size. Ridership has been stable in the last eight years as has the city's population. The annual cost of bus service is approximately $145,000 per year which is subsidized from the city's general revenues which come from a manufacturing sales and use tax. Residents in Commerce pay no city taxes.

The applicability of the Commerce experience to other communities is limited. Its small size places its transit problems in a different class than major metropolitan areas. Only 20% of its land area is zoned for residential, limiting its population. The other 80% is industrial and provide all of the city operating expenses. Traffic congestion in Commerce is as bad as in the rest of the Los Angeles Metropolitan area. Nevertheless, residents indicate that the bus service has given them a mobility that has had a marked effect on their life styles. Because of the free bus, the residents are able to participate in many activities that would be unaccessible to them with a fare paying transit system.

RALEIGH COUNTY, WEST VIRGINIA

A demonstration project was established by the Office of Economic Opportunity (O.E.O) in Raleigh County, West Virginia to provide transportation for the rural poor. The area is characterized by severe economic problems. About 30% of the population was classified as being in poverty in 1967. The project provided free bus service for the poor. It was funded at a total of $150,000 over a period of 19 months. Average round trip length was 45 miles that took three hours. The poor saved an average of $1.40

per trip.

Trip distribution changed significantly when the free service was implemented.(7) Social and shopping trips increased substantially. The people who rode the buses traveled more than they ever did before. Forty-three (43) percent made more trips than they ever did before. The number of trips per person did not increase greatly, from 6.5 per month to 6.8 per month. Travel to Beckly, West Virginia, the regional shopping center, increased greatly from 53% of all destinations to 83% of all destinations. Travel on the free bus system consisted of more multipurpose trips which shows a real economy of scale factor operating.

The benefits of the system are much more important than travel figures. The system can stimulate the economic development of the region. Such programs can affect the employment status of the poor by providing greater access to jobs. They can directly increase the real income of the poor by giving them goods and service and can change their life styles by providing access to opportunities outside of their isolation. An economic analysis calculated the overall benefits of the program to be $91,500 and of that, the poor received 92% of the benefits.

SEATTLE, WASHINGTON

On January, 1973 two separate transit systems were merged into one to form the Seattle Metro. The base fare for the new public authority was set at 20¢ with 10¢ zonal increments. The city of Seattle has decided to attack a problem similiar to most major metropolitan areas - increasingly severe traffic congestion especially in its downtown area and the problem of pollution the traffic creates. Seattle's experiment to attack these problems is the creation of a free transit zone in the city's downtown area. Covering a 105 square block area, the "Magic Carpet" zone connects three districts of downtown Seattle - the City and County governments district, the City's financial district and the retail business district. These three districts attract thousands of people daily and most of them bring cars. The plan was conceived by aides of Mayor Wesley C. Uhlman partly in an effort to meet the strict air quality standards laid down by the United States Environmental Agency for Seattle. The program is funded by a $64,000 city council appropriation and is the extend for one full year beginning on September 9, 1973. The no fare service is extended throughout the Magic Carpet zone replacing the old shuttle buses that had circled the area with a 10¢ fare for over twenty years.

One of the most important benefits of the program will be the reduction in air pollution due to the increased transit usage. It has been estimated that approximately twenty percent of all automobile trips in the area are internal to the area. A 50% reduction in traffic would lower pollution levels by 14%. Another benefit of the free service will be the increased accessibility of the area. With this increase in accessibility, the number of transit shopping trips should increase. Early indications of increased shopping and restaurant trade reinforce this thinking. The increase usage of transit should decrease traffic congestion and have a positive effect on the energy

situation. It is also felt that bus service in this area would be speeded up due to the elimination of fare collections. This has been the case as the elimination of boarding delays has resulted in a slight but unquantified increase in travel speed.

Based on limited survey results and analysis, the Magic Carpet has been an unqualified success. Ridership in the Seattle CBD has increased by 30%, thereby reducing air pollution emissions and improving transit travel speeds.(8) This increase in demand has resulted in the leasing of 15 additional buses from other cities for use in the Magic Carpet service. A grant from UMTA will enable extensive analysis of the service and its benefits beginning in January 1974.

AMHERST, MASSACHUSETTS

A major experiment with the use of free mass transportation is the demonstration project being funded by UMTA in Amherst, Massachusetts.(9) A $475,000 grant to the University of Massachusetts is provided to encourage students and commuters in the Amherst area to use free bus service instead of automobiles. The project, which will run for 18 months, was implemented in early 1973. The remaining cost of the project will be provided by student fees, parking fees, and funds from the university. The no fare service will be introduced coupled with increases in the costs of parking spaces on the campus, and a limiting of that parking space. The University's ability to adjust its parking policy so as to encourage the use of mass transit is a major factor for UMTA making the grant.

Amherst, Massachusetts is a small city that is out-numbered and overwhelmed by the universitites in it with the University of Massachusetts being the largest college in its limit. In an effort to halve further freeway construction and traffic congestion, the existing no-fare bus service on campus will be doubled and expanded to serve several apartment complexes where the students live. In addition to serving the University, it will also serve the 12,000 residents of Amherst. UMTA is anxiously awaiting to measure in a full-scale experiment what effect free transportation will have on an auto-dependent community. The results of the experiment will also be used to access the potential of using this type of idea in other urban areas to encourage greater use of public transportation.

CHAPTER 6

PROMOTIONAL REDUCED FARE PROGRAMS

Promotional reduced fare programs have become increasingly popular in the United States. These include shopper specials, one day free transit and other special, limited programs. There have been no attempt to evaluate the long run benefits of such programs and whether the benefits outweigh the costs. Two such programs are described in this section.

BOSTON, MASSACHUSETTS, "DIME TIME"

The Massachusetts Bay Transportation Authority (MBTA) has implemented an experimental fare reduction program applicable to three rapid transit lines into Boston. (1) The program, which began April 2, 1973, permits all riders boarding between the hour of 10 a.m. and 1 p.m. on weekdays to ride for a reduced fare from 25¢ to 10¢. The only exception to the "Dime Time" program is at the three new South Shore rapid transit stations on the Quincy line where the fare has been reduced from 50¢ to 25¢ for Boston bound passengers.

Results from the experiments are neither startling nor very revealing. Ridership and revenue statistics were obtained during March 26, one week before the program began, and all data is compared to these figures. The five weeks from April 23 for which data has been collected reveal a revenue loss and a reduction in daily number of passengers. By the week of May 7 revenue losses exceeded $3,000 per day. The data collected indicates; 1) That proportionally more riders are riding between 10 a.m. and 1 p.m. on the rapid transit lines, 2) That the total ridership is producing less revenue that before and there is no way to discover that riders at reduced fares are or are not regular MBTA patrons making more frequent trips.

A market analysis indicates that "Dime Time" does attract new ridership and tends to distribute trips more uniformly between the busier periods before and after the midday hours. As for revenue, "Dime Time" seems unlikely to produce a profit as the revenue due to the increase in ridership is not great enough to offset the passenger revenue loss of the reduced fare.

NEW YORK CITY, SUNDAY HALF FARE PROGRAM

The New York City Metropolitan Transportation Authority (MTA) has initiated an experiment involving two rides for the price of one on Sundays starting December 16, 1973. It was initially scheduled to run for a five Sunday period but was extended until June 30, 1974. The objective of the experiment is to encourage people in the energy crisis to leave the family cat at home and use public transportation. (2)

Under the MTA "Save on Sunday" program, a person purchasing a subway token receives a coupon entitling him to pass through the gate at no charge when he makes his return trip only on that Sunday. On the L.I.R.R. and the Harlem, Hudson and New Haven Commuter lines Sunday passengers receive a round trip ticket for the normal one-way fare. Bus riders get return tickets good for only that day but the return coupon cannot be used interchangeably between buses and subways. Over two dozen attractions in theatres, exhibitions and restaurants in Manhattan offer discounts to holders of "Special Sunday" and commutation tickets as well as a number of Long Island and Connecticut restaurateurs.

The public response to the Sunday program has been phenomenal. Chairman of the MTA William J. Ronan has said, "From all indications, we are achieving success in our marketing efforts to introduce and reacquaint thousands of residents of the New York region to our new surface and rail equipment." All MTA facilities have showed a substantial increase in ridership over the average of the three Sundays that preceded the half-fare program. The percentage increases are as follows;

MABSTOA	25%	NYC BUSES	43%
SIRTOA	27%	L.I.R.R.	49%
SUBWAYS	33%	HARLEM, HUDSON & NEW HAVEN	61%

MABSTOA - Manhattan and Bronx Surface Transit Operating Authority

SIRTOA - Staten Island Rapid Transit Operating Authority

Since the program began, the MTA's transit facilities have carried 9,280,000 additional riders which means that 7,100,000 gallons of gasoline were saved. This calculation assumes that all riders would use cars for the trips. Overall ridership has increased by approximately 37%. This corresponds to a price elasticity (shrinkage ratio) of -0.74. Even with this ridership increase passenger revenue has declined by $800,000 but the MTA considers the program a great success.

CHAPTER 7

SUMMARY AND CONCLUSIONS

This report has attempted to investigate the experience of reduced fare programs in North America. The report has been limited to the analysis of the demand aspect of these programs. It does not provide an in-depth discussion on the social and environmental aspects of these programs. Such aspects must be considered in any final operational decision regarding reduced fare plans.

The majority of reduced fare programs in North America were identified. Information regarding the nature and the objectives of each program was given. Included in the listing were senior citizen programs, reduced base fare programs, free fare programs and promotional reduced fare programs. A literature search was undertaken and reported regarding the state-of-the-art in transit demand analysis. The formulation and applicability of fare elasticities was examined.

Each reduced fare program was analysed. The effect of the fare reduction on transit ridership was determined. Shrinkage ratio and arc elasticity formulation was attempted for each program. From this wealth of empiricial data, general trends as to the change in ridership due to these programs were determined. It was also determined whether the objectives of each particular program were satisfied.

All of the empirical evidence indicates that transit ridership does exhibit a significant increase as a result of fare reduction programs. This conclusion is evidenced by Table 7.1.

Table 7.1

Ridership Increases Due to Fare Reduction Programs

City	Base Fare Program	Percent Ridership Increase
Atlanta		19.0
Cincinatti		40.0
St. Louis		15.0
San Diego		23.0

Senior Citizen Programs	
Baltimore	8.0
Los Angeles	23.9
Madison	20.0
Miami	34.5
New York	26.7
Pittsburgh	34.3
Minneapolis	99.0
Philadelphia	44.7
South Bend, Ind.	20.0
Washington, D. C.	26.0
Off Peak Base Fare	
Louisville	50.0
Central Business District Free Fare	
Seattle	30.0

The magnitude of these increases shows the relative success such programs are experiencing and the great amount of public acceptance to these programs. The average percent increase for this table is 32%, a significant figure. The average of the base fare programs is 24%, which is obtained from evidence regarding systems with high levels of service. The limited experience with reduced base fares for systems with low levels of service reveals a much larger demand reaction to fare reduction (i.e. Iowa City). This average increase for senior citizens is a significant 34%. This shows the high elasticity for demand reported for senior citizens. It also shows that the demand for travel is more elastic for senior citizens than the demand of the rest of the riding public. The smallest ridership increase was experienced by the Baltimore program. From the limited information obtained for that program, the reason for the small percentage increase is unknown. The off-peak Louisville program experienced a larger increase in ridership than all of the reduced base fare program. This supports the theory that off-peak travel is more elastic than peak hour travel.

The elasticities experienced by the programs analyzed in this report are also significant. These elasticities show that travel demand is sensitive to changes in transit price. The results vary considerably from system to system and it was found impossible to develop a "Simpson & Curtin" type relationship for fare decreases. As more empirical data comes into existence, such a formulation should be attempted. The shrinkage ratios for reduced base fare programs range from -0.3 to -0.7. The mean shrinkage ratio of

-0.46 shows that the demand to these programs is significant and is more than is predicted by the "Simpson & Curtin" formula. This tends to suggest the elimination of the use of that formual to predict demand changes for fare reductions.

An examination of the shrinkage ratios for senior citizen fare reductions shows that the demand for travel by senior citizens is very elastic. The mean shrinkage ratio of -0.56 shows that travel by senior citizens is more sensitive to fare changes than travel by the entire riding public. The range of shrinkage ratios, from -0.1 to -0.7, show the difficulty involved with attempting to predict ridership changes for a fare reduction for a particular transit system. All that can be said with certainty is that ridership increases will result to a certain degree, and that this increase in ridership in the off-peak hours will be composed of new trips by riders and trips previously made in the peak hour shifted to take advantage of the fare change.

The one empirical experience with an off-peak base fare reduction shows a shrinkage ratio of -0.50, a very large value. All the evidence indicates that the "Simpson & Curtin" formula (-0.33 shrinkage ratio) does not work for fare reductions.

Although fare reductions cause a significant ridership increase, the increase is not large enough to make up the loss revenues due to the fare decrease. Therefore, without exceptiion in the programs discussed here, fare reduction programs result in a net loss in revenue. The arc elasticities for the various programs demonstrate this fact. Althouth the arc elasticities of both reduced base fare programs (mean, -0.32) and senior citizen reduced fare programs (mean, -0.38) are significant, they are not even close to the -1.0 value which represents the dividing line between gaining and losing revenues. With a value -1.0 or larger, revenue gains result. From a point of view solely of making money, fare reduction programs are not justified. Before embarking on a fare reduction program the majority of transit systems had already secured an external funding source in anticipation of revenue losses.

While these programs have not been successful financially, almost every program had succeeded in meeting its specific objective. There have not been any programs with the objective of increasing revenue. As documented in the report, the majority of social and environmental objectives have been satisfied. Even the recent Seattle program has evidence that it is meeting its air pollution reduction objective. The prime objective of the majority of programs has been to increase transit ridership. The preceeding table has documented the success in that area. The social objectives are impossible to measure but in the majority of cases, the responsible transit system has felt that the social objectives have been satisfied as evidence by the ridership increases.

The empirical evidence gives support to the statements made earlier in the report about the relative elasticities of various ridership segments. Off-peak travel is more elastic than peak travel. This can be seen from the larger ridership increases for off-peak programs than base fare programs. The frequency in work trips is fixed in number but non-work trips are more flexible and respond greater to fare reduction. The components of the

St. Louis ridership increase support this conclusion. In St. Louis, peak hour travel increased by 9% while off-peak travel increased by 25%. Although there is little empirical evidence in existence, weekend travel tends to be more elastic than weekday travel. In Atlanta, weekend travel increased by approximately 60% while weekday travel increased by only 30%. This tend was also experienced in Cincinatti. Bus travel tends to be more elastic than subway travel. This has been shown with the New York City fare increase experience. The shrinkage ratio for surface lines ranged from -0.31 to -0.34 and for subways ranged from -0.12 to -0.17. In the New York MTA Sunday program, ridership increases on subways and buses have been 33% and 43% respectively. Transit demands seem more elastic in areas with low levels of service than areas with high levels of service. The Pittsburgh senior citizen program experience, where the elasticity for the area outside Pittsburgh was -0.57 and the elasticity for Pittsburgh was -0.26, validates this conclusion. This data tends to confirm Carsten's findings obtained using a regression analysis.

There is no empirical evidence regarding cross-elasticities which measure degree of traffic diverted to transit resulting from a fare change. The Atlanta experience did conclude that almost 2/3 of the new rider trips, previously made the journey by car. This results in the elimination of 21,600 auto trips. Most programs do not cause a visible decrease in auto congestion. The only work attempting to measure cross-elasticities was done in the Charles River report which concluded that cross-elasticities are either non-existant or are close to zero.

In the measurement of demand elasticities, certain observations should be made. The arc elasticity is a better measure of elasticity than the shrinkage ratio. This arises from the fact that the value -1.0 for arc elasticity is the dividing line for revenue change. For shrinkage ratios no such break point exists. Transit systems should use this measure rather than the shrinkage ratio for demand measurements. Regression analysis as a demand estimation technique should also be investigated by transit systems for development. The measurement of ridership increases vary from system to system and probably account for part of the reason for the large range in ridership increases experienced in this report. In some off-peak programs, ridership shifts from peak to off-peak hours are not measured. Such a procedure introduces an error in ridership increase and revenue loss calculations. A problem also exists in the isolation of the effect of the fare decrease from other changes in the system implemented simultaneously. For this reason, it is hard to state with any degree of certainty the exact demand increase due to the fare change. This was the case in the Tulsa fare reduction. A monitoring procedure should be developed to standardize measurement techniques for fare reduction programs.

The evidence presented in this report supports the feeling that service characteristics are a more important variable than fare for increasing transit demand. Demand is more sensitive to changes in travel time, frequency, and comfort than changes in transit price. This is evidant from the various commuter surveys that indicated service changes are more important than fare changes. In the San Diego fare and service change program, the elasticity of the fare change was -0.42 but the elasticity of the service improvements was larger, +0.75. This clearly shows the greater elasticity of demand toward changes in service characteristics.

Before embarking on an ambitious reduced fare program, a transit system should make an in-depth analysis of the costs and benefits of such a program. A trade-off between reducing fares and improving the service should be investigated. A methodology for measuring the costs and the ridership increase of each of the alternatives must be accomplished. As many alternatives as possible should be investigated. All tangible benefits must be measured and all intangible benefits considered. Only then can a program for achieving the best improvements for optimizing the operation of the transit system be developed.

Appendix

Table A-1

Senior Citizen Reduced Fare Program

City, State, System	Actual Rates: Senior Citizens	Actual Rates: Adults	Date* Implemented	I.D. Card Required	Age: M	Age: F	Time: Mon. Fri.	Time: Sat.	Time: Sun.	Change in Patronage Since Started	Estimated Profit or Loss
Albuquerque (N. M.) Transit System	20¢	30¢	10-68	Medicare	65	65	--ALL HOURS--			23% increase in Sr. Citizen patronage.	NR
Altoona, Pa. - Transp. & Motor Buses for Public Use Authority	11/$2.00	30¢	7-12-71	Medicare	62	62	-- ALL HOURS--			Increased	Project to be sufficent to make up reduction in fare.
Andover, Ma. - Trombly Motor Coach Service	20¢	30¢	3-69	City issued cards	65	65	10p.m. - 3p.m.	No Service		Riding increased in the off peak hours.	NR
Ann Arbor Trans. Authority (Mich.)	20¢	35¢	1-3-67	Yes	65	65	-- ALL HOURS --			NR	NR
Asheville (N. C.) Transit Authority	20¢ 5/$1.00 Tickets	30¢ 7/$2.00 Tickets	3-70	Medicare	65	65	10a.m. - 3p.m. All Days			None	$8,034 Loss

* This was intended to mean the initiation date of the program. Although several responses appear to relate to the initiation date of the particular fare cited.

City, State, System	Actual Rates Senior Citizens	Actual Rates Adults	Date Implemented	I.D. Card Required	Age M	Age F	Time Mon. Fri.	Time Sat.	Time Sun.	Change in Patronage Since Started	Estimated Profit or Loss
Baltimore, Maryland Maryland D.O.T.	15¢	30¢	4-72	D.O.T. Photo I.D.	65	65	9a.m. -4 p.m. 6p.m. -7a.m.	-- ALL HOURS --		Increase of less than 1%	$561,400 in first year
Bedford, Ohio - Garfield Hgts. Coach Lines, Inc.	15¢	40¢	1-70	Yes	65	65	9a.m. -3p.m.	-- ALL HOURS --		Substantial increase in Sr. Citizen patronage	Not determined
Binghamton, N.Y. Broome Transit System	20¢	35¢	3-1-71	Yes	62	62	9a.m. -3 p.m.	-- ALL HOURS --		Appears to be little change	NA
Boston, Mass. - Massachusetts Bay Transportation Authority	Surface 10¢ Rap. Tr. 10¢	Surface 20¢ Rap. Tr. 25¢	8-15-69	MBTA Photo I.D. Card	65	65	-- ALL HOURS --			NA	NA
Cedar Rapids, Indiana Regional Transit Authority	15¢	25¢	10-4-68	Yes	65	65	-- ALL HOURS --			NR	NR
Chelmsford, Mass. - Marinel Transportation, Inc.	25¢	45¢	6-70	Yes	65	65	-- ALL HOURS --			NR	NR
Chicago (Ill.) Transit Authority	20¢	45¢	4-20-69	CTA Medicare	65	65	-- ALL HOURS --			NA	$3,500,000 loss
Cleveland (O.)	25¢	50¢	3-11-73	Yes	65	65	9a.m. to 4p.m. 7p.m. to 12 Mid.	5a.m. -12 Mid.		NA	$569,000 loss

City, State, System	Actual Rates: Senior Citizens	Actual Rates: Adults	Date Implemented	I.D. Card Required	Age: M	Age: F	Time: Mon. Fri.	Time: Sat.	Time: Sun.	Change in Patronage Since Started	Estimated Profit or Loss
Dallas (Tex.) Transit System	10¢	35¢	7-1-71	Yes	65	65	9a.m. -4p.m. After 6p.m.	--ALL HOURS--		NA	$135,000 loss
Des Moines, Iowa - Iowa Regional Transit Corporation	35¢	45¢	5-1-61	Yes	65	65	10a.m. -3p.m. After 6:30p.m.	--ALL HOURS--		No noticeable change	NA
Denver Meto Transit Denver, Colo.	25¢	35¢	4-18-71	Yes	65	65	--ALL HOURS--			NR	NR
Des Moines, Iowa	35¢	45¢	11-1-70	Yes	65	65	10a.m. -3p.m. 6:30p.m. -Mid.	--ALL HOURS--		NR	NR
Detroit, Mich. - Department of Street Railways	15¢	40¢	5-15-56	Medicare, Co. issued I.D.	65	65	9a.m. -3p.m. 6p.m. -6a.m.	-- ALL HOURS--		Increase in Sr. Citizens patronage.	$1,500,000 loss
Duluth Transit Authority (Minn.)	25¢	35¢	12-15-71	Yes	65	65	10a.m. - 2p.m. (Sun. - Fri.)			NR	NR
Euclid (O.) Municipal Transit System	15¢	25¢	9-8-67	Yes	65	65	-- ALL HOURS --			Approx. 7% overall increase	Break even basis
Eugene, Ore. - Lane Transit Dist.	20¢	30¢	5-1-71	Medicare	65	65	------NR------			NA	NA
Flint, Michigan Transportation Co.	25¢	35¢	4-20-66	Yes	65	65	-- ALL HOURS --			NR	NR

City, State, System	Actual Rates: Senior Citizens	Actual Rates: Adults	Date Implemented	I.D. Card Required	Age: M	Age: F	Time: Mon. Fri.	Time: Sat. Sun.	Change in Patronage Since Started	Estimated Profit or Loss
Fort Wayne (Ind). Public Transportation Corporation	20¢	35¢	6-1-71	Medicare, Co. issued I.D.	65	65	9a.m. -3p.m. 6p.m. -9a.m.	-- ALL HOURS --	Increase in mid-day ridership	$58,303 loss
Fresno (Cal.) Transit	10¢ plus $2/ mo. pass	30¢	8-1-71	Medicare	62	60	-- ALL HOURS --		Small increase	$40,000 loss
Gardena (Cal.) Municipal Bus Lines	20¢	25¢	3-1-67	Yes	65	62	-- ALL HOURS --		None	NA
Grand Rapids (Mich.) Transit Authority	15¢	35¢	11-29-71	Yes	65	65	-- ALL HOURS --		None	$35,000 loss
Greenfield, Mass. - Municipal Transit	10¢	20¢	4-22-69	Yes	65	65	-- ALL HOURS --		NA	NA
Hartford, Conn. - The Connecticut Co.	15¢	25¢	4-1-63	Yes	65	65	9a.m. -3:30 p.m. 7p.m. -7a.m.	-- ALL HOURS --	NR	NR
Itheca (N.Y.) - Community Transit	8/$1.00 Tickets	25¢	9-1-71	No (g)	65	65	-- ALL HOURS --		No noticeable change	NA
Jamaica (N.Y.) - Buses, Inc.	10¢	30¢	2-3-72	Yes	65	65	-- ALL HOURS --		Small increase	None
Kansas City Metro Transit Authority (Missouri)	25¢	40¢	10-72	Yes	65	65	-- ALL HOURS --		NR	NR

City, State, System	Actual Rates Senior Citizens	Actual Rates Adults	Date Implemented	I.D. Card Required	Age M	Age F	Time Mon. Fri.	Time Sat. Sun.	Change in Patronage Since Started	Estimated Profit or Loss
Las Vegas (Nev.) Transit System	20¢	50¢	2-22-71	Yes	65	65	-- ALL HOURS --		NA	NA
Long Beach (Cal.) Public Transportation Co.	20¢	30¢	3-14-71	Co. issued I.D.	65	65	9a.m. -3p.m. After 6p.m.	--ALL HOURS--	NA	$30,000
Los Angeles, Cal.* Southern Cal. Rapid Transit District	10¢	30¢	6-1-72	Medicare	65	62	9a.m. -3p.m. 7p.m. -Mid.	5a.m. - Mid.	NA	NA
Madison Metro Wisconsin	15¢	25¢	8-73	Yes	65	65	--ALL HOURS --		NA	NA
Maple Heights (O.) - Transit System	20¢	25¢	4-1-68	Co. issued I.D.	65	65	9a.m. -3p.m. 7p.m. -Mid.	--ALL HOURS--	NA	NA
Medford, Ore. - Mt. Ashland Stage Lines	30¢	35¢	9-1-71	Medicare	None		-- ALL HOURS --		NA	NA
Miami, Florida Metropolitan Dade Co. Transit Authority	15¢	30¢	10-1-72	Yes	65	65	9a.m. -4p.m. 6:30p.m. to 7a.m.	--ALL HOURS--	NR	NR
Michigan City, Ind. - Municipal Coach	10¢	25¢	-/-/70	Medicare	65	65	-- ALL HOURS --		NR	$4,000 loss

City, State, System	Actual Rates Senior Citizens	Actual Rates Adults	Date Implemented	I.D. Card Required	Age M	Age F	Time Mon. Fri.	Time Sat.	Time Sun.	Change in Patronage Since Started	Estimated Profit or Loss
Milwaukee & Suburban Transport Corporation Wisconsin	25¢	50¢	5-14-73	Yes	65	65	9a.m. -3p.m.	-- ALL HOURS --		8%-10% increase	$750,000/yr
Mobile, Alabama City D.O.T.	10¢	30¢	6-28-72	Yes	65	65	-- ALL HOURS --			NR	NR
Montebello (Cal.) Municipal Bus Lines	15¢	25¢	6-14-70	Co. issued I.D.	65	62	-- ALL HOURS --			Increase less than 1%	$10,000 loss
New Bedford, Mass. - Union Street Railway Company	15¢	30¢	7-71	Yes	58	58	-----NR-------			Slight increase	None
New Haven, Conn - The Connecticut Company	20¢	30¢	11-67	Yes	65	65	9a.m. -3:30 After 7p.m.	--ALL HOURS--		NA	$200,000
New Jersey (Statewide) D.O.T.	½ Adult Fare	Base	9-10-73	Yes	62	62	9:30a.m. -4p.m. 7p.m. -6a.m.	--ALL HOURS--		NR	NR
New York (N.Y.) City Transit Authority	15¢ Rapid Transit 17.5¢	35¢	7-1-69	Yes	65	65	10a.m. -4p.m. After 7p.m.	--ALL HOURS--		Increase in Senior Citizen Patronage	NA
Norfolk, Virginia Tidewater Metro Transit	25¢	35¢	5-24-73	Yes	65	65	9:30a.m. -4p.m. 6p.m. -2a.m.	--ALL HOURS--		NR	NR

City, State, System	Actual Rates: Senior Citizens	Actual Rates: Adults	Date Implemented	I.D. Card Required	Age: M	Age: F	Time: Mon. Fri.	Time: Sat.	Time: Sun.	Change in Patronage Since Started	Estimated Profit or Loss
Oceanside, Cal. - City of Oceanside Transportation System	15¢	25¢	3-1-71	Co. issued I.D.	62	62	-- ALL HOURS--			Negligible	Negligible
Omaha, Nebraska Metro Area Transit	20¢	40¢	7-1-72	Yes	65	62	-- ALL HOURS --			NR	NR
Oxnard (Cal.) Transit	15¢	20¢	2-2-70	Medicare	65	62	-- ALL HOURS --			None	$2,400 loss
Phoenix Transit Corporation (Arizona)	20¢	35¢	7-2-73	Yes	65	65	-- ALL HOURS --			NR	NR
Portland, Oregon - Tri-County Metro. Transportation Dist. of Ore.	10¢	35¢	10-4-73	Medicare	65	65	9a.m. -3p.m. -- ALL HOURS--			Increase in Senior Citizen Patronage	NA
Providence, R.I. - R.I. Public Transit Authority	20¢	35¢	1-4-70	Medicare	65	65	-- ALL HOURS--			2% Increase	None
Pueblo (Colo.) Transportation County	15¢	25¢	-/-/70	Medicare	65	65	-- ALL HOURS --			None	$12,000 loss
Rochester, N.Y. - Regional Transit Service Incorporated	25¢	40¢	2-13-72	Medicare	65	65	9a.m. -3:30p.m. 6p.m. -2a.m.	--ALL HOURS--		Increase in Senior Citizen Patronage	$326,000 loss
Sacramento (Cal.) Transit Authority	20¢	15¢	4-1-73	Medicare	65	65	-- ALL HOURS --			NA	NA
Saginaw, Mich. Delta Bus Inc.	35¢	40¢	2-15-71	NR	65	65	-- ALL HOURS--			NR	NR

City, State, System	Actual Rates: Senior Citizens	Actual Rates: Adults	Date Implemented	I.D. Card Required	Age: M	Age: F	Time: Mon. Fri.	Time: Sat. Sun.	Change in Patronage Since Started	Estimated Profit or Loss
St. Louis, Mo. - Bi-State Transit System	15¢	25¢	11-12-73	Yes	65	65	9 a.m. to 4 p.m. 6 p.m. to 6 a.m.	--ALL HOURS--	NA	NA
Salem, Oregon - City of Salem	15¢	25¢	9-1-71	Medicare	65	65	9 a.m. - 4 p.m.	-- ALL HOURS--	NR	NR
Salt Lake City, Utah Transit Authority	$9.00 Mo. Pass	30¢	10-1-68	Yes	65	65	--ALL HOURS--		NA	NA
San Antonio Transit System (Texas)	10¢	25¢	9-1-72	Yes	65	62	--ALL HOURS--		Increase by over 30% since 1st month	NR
San Buenaventura, Cal. - Ventura City Transit	10¢	20¢	10-69	Social Security Medicare	65	65	--ALL HOURS--		Increased from $70,000 1st year to 90,000 per yr.	$7,000 loss
San Diego (Cal.) Transit Corp.	25¢	40¢	11-8-70	Co. issued I.D.	65	62	Not Valid 6-9AM 3-6PM	--ALL HOURS--	Increase in Senior Citizen patronage	$197,230
San Francisco (Cal.) Municipal Railway	5¢	25¢	6-30-69	Medicare	65	65	9:30 a.m. 3:30 p.m.	--ALL HOURS	Not Noticeable	$650,000 loss

City, State, System	Actual Rates: Senior Citizens	Actual Rates: Adults	Date Implemented	I. D. Card Required	Age: M	Age: F	Time: Mon. Fri.	Time: Sat.	Time: Sun.	Change in Patronage Since Started	Estimated Profit or Loss
Santa Barbara (Cal.) Metropolitan Transit Dist.	15¢	30¢	12-6-70	Medicare	65	65	--ALL HOURS--			Not significant	NA
Savannah Transit Authority (Georgia)	20¢	30¢	11-16-70	NR	65	65	9:30 a.m. to 3:30 p.m.			NR	NR
Seattle, Washington Dept. of Transportation City of Seattle	10¢	20¢	1-1-73	Co. issued I.D.	65	65	--ALL HOURS--			NA	$70,000 per year
Sioux City (Ia.) Transit	25¢	40¢	12-70	Medicare	65	65	9 a.m. - 3 p.m.	No Service		None	$1,500 loss
Sioux Falls, S. Dakota - Sioux Transit, Incorporated	20¢	25¢	6-1-70	Medicare	Medicare Qualified		9 a.m. - 4 p.m.	No Service		Not noticeable	NA
South Bend (Ind.) Public Transportation Corp.	15¢	30¢	1-25-65	Medicare Social Security	65	65	9 a.m. - 3 p.m.	No Service		20% increase	10% Profit
Springfield (Ill.) Mass Transit District	20¢	25¢	7-1-68	Special I.D.	60	60	--ALL HOURS--			NA	NA
Stamford, Conn-The Connecticut Company	15¢	25¢	4-1-63	Yes	65	65	9 a.m. to 3:30 p.m. 7 p.m. to 7 a.m.	--ALL HOURS--		NR	NR
Statesville (N.C.) Motor Coach Company	20¢	25¢	-/-/66	Yes	None		--ALL HOURS--			Decrease and continuous decline.	NR

City, State, System	Actual Rates Senior Citizens	Actual Rates Adults	Date Implemented	I. D. Card Required	Age M	Age F	Time Mon. Fri.	Time Sat.	Time Sun.	Change in Patronage Since Started	Estimated Profit Or Loss
Syracuse, N. Y. - Cayuga Cantro	20¢	35¢	10-11-70	Yes	65	65	10am to 4pm	--ALL HOURS--		NR	NR
Tacoma (Wash.) Transit System	10¢	25¢	9-10-67	Yes	65	65	--ALL HOURS--			Increased	$40,000 loss
Terre Haute (Ind.) Transportation Utility	20¢	25¢	6-71	Soc. Sec.	None		--ALL HOURS--			None	NR
Texarkana, Twin City Transit Texas - Arkansas	20¢	35¢	7-13-70	NR	NR	NR	8pm to 4pm			NR	NR
Toledo (O.) Area Regional Transit Authority	30¢	40¢	6-1-71	Medicare	None		------None-------			Not sufficient experience	
Torrance (Cal.) Transit System	10¢	35¢	11-7-70	Medicare Co. issued I. D.	60	60	-----None--------			About 30% increase in Senior Citizens.	$6,000 loss
Washington, D. C. - D.C. Transit System, Incorporated	25¢	40¢	5-10-71	Co. issued I.D.	65	65	9:30 am-3pm 7pm-3pm	Not Good	ALL HOURS	None that can be measured	$250,000 loss
Yakima (Wash.) City Lines	$2/Mo. Pass	25¢	7-10-69	Soc. Sec.	65	65	NR	--ALL HOURS--		Increased	NA
Worchester Bus Co. (Mass.)	30¢	35¢	10-15-69	Medicare	None		10am to 4pm	--ALL HOURS--		NR	NR
Youngstown, Ohio	25¢	50¢	5-12-71	Medicare	65	65	--ALL HOURS--			NA	NA

City, State, System	Actual Rates: Senior Citizens	Actual Rates: Adults	Date Implemented	I. D. Card Required	Age: M	Age: F	Time: Mon. Fri.	Time: Sat. Sun	Change in Patronage Since Started	Estimated Profit Or Loss
CANADIAN COMPANIES										
Edmonton (Alta.) Transit System	$5.00/ Year	25¢ Ride	1-28-67	None	None		--ALL HOURS--		NR	NR
Guelph (Ont.) Transportation Commission	9/$1.00 Tickets	25¢	3-8-71	Co. issued I.D.	65	65	--ALL HOURS--		Negligible	$13,000 loss
Kingston (Ont.) Public Transit System	15¢ 8/$1.00 Tickets	25¢ 5/$1.00 Tickets	2-69	None	65	65	--ALL HOURS--		Minimal	NA
Kitchener, Ont. - Public Utilities Commission	10¢	25¢	-/-/70	City issued I.D.	65	65	--ALL HOURS--		None	$106,000 loss
Ottawa (Ont.) Transportation Commission	25¢ 5/$1.00 Tickets	30¢ 4/$1.00 Tickets	3-6-68	City issued I.D.	65	65	--ALL HOURS--		NA	NA
Peterborough, Ont. - Border Transit Limited	10/$1.00 Tickets	20¢ 6/$1.00 Tickets	6-18-69	City issued I.D.	65	65	--ALL HOURS--		None	$7,256 loss
Red Deer (Alta.) Transit System	15¢ 10/$1.00 Tickets	20¢ 6/$1.00 Tickets	-/-/67	City issued I.D.	65	65	--ALL HOURS--		No estimate but considerable increase	$20,
Sarnia (Ont.) Transit Co.	12.5¢	25¢	10-9-71	NR	NR	NR	------NR-------		NR	NR
Sault Ste. Marie (Ont.) Transportation Comm.	10/$1.00 Tickets	25¢ 5/$1.00 Tickets	11-64	Co. issued I.D.	65	65	--ALL HOURS--		NA	NA

City, State, System	Actual Rates Senior Citizens	Adults	Date Imple mented	I.D. Card Required	Age M	F	Time Mon. Fri.	Sat.	Sun	Change in Patronage Since Started	Estimated Profit Or Loss
Vancouver, B.C. - B.C. Hydro & Power Authority	15¢	25¢	3-1-72	Yes	65	65	--ALL HOURS--			NA	$2 Million
West Vancouver (B.C.) Municipal Transportation	10¢	20¢	11-70	Co. issued I.D.	65	65	10 a.m. - 3 p.m. Aft. 7 P.M.	ALL HOURS		NA	NA
Windsor, Ont. - Sandwich, Windsor & Amherstburg Rwy. Company	25¢	35¢	8-70	Yes	65	65	9 a.m. - 3 p.m. Aft. 7 p.m.	--ALL HOURS		NR	$75,000 loss
Winnipeg, Man. - Metropolitan Corp. of Greater Winnipeg	10¢ Cash or Tickets	25¢ 5/$1.00 Tickets	10-1-69	Co. issued I.D.	65	65	--ALL HOURS--			Slight increase	$300,000 loss

Table A-2

Senior Citizens Free Transit Programs

City, State, System	Actual Rates Senior Citizens	Adults	Date Implemented	I.D. Card Required	Age M	Age F	Time Mon. Sat. Sun. Fri.	Estimated Annual Cost
Allentown, Pa. Lehigh & Northhampton Transportation Authority	Free	45¢	7-1-73	Yes	65	65	9 a.m. to 5:30 p.m. after 6:30 p.m.	$250,000
Culver City, Municipal Bus Lines, Calif.	Free	30¢	11-1-69	NR	65	65	-------All Hours-----	NR
Erie Metropolitan Transit Authority, Pa.	Free	30¢	10-1-68	NR	65	65	-------All Hours-----NR	
Honolulu, Hawaii, Mass Transit Lines	Free	25¢	5-70	Yes	65	65	-------All Hours-----	$1.05 million
Philadelphia, Pa. Southeast Pa. Trans. Authority	Free pay 10¢ during peak hrs.	35¢	7-73	Yes	65	65	9 a.m. - All Hours 3:30 p.m. 6:30 p.m. - 9 a.m.	$6.2 million
Pittsburgh, Pa. Port Authority of Alleghany Company	Free	40¢	7-1-73	Yes	65	65	9 a.m. --All Hours-- 4 p.m. 6:30 p.m. - 4 a.m.	NR

Table A-2

Senior Citizens Free Transit Programs

City, State System	Actual Rates: Senior Citizens	Actual Rates: Adults	Date Implemented	I.D. Card Required	Age: M	Age: F	Time: Mon. Sat. Sun. Fri.	Estimated Annual Cost
Minneapolis-St. Paul, Minnesota, Twin Cities Metropolitan Transit	Free	30¢	11-16-69	Yes	65	65	9 a.m. ---All Hours--- 3 p.m. 6:30 p.m. - 7 a.m.	$1 million
Canadian Companies								
Calgary (Alta.) Transit System	Free	25¢	4-11-66	Yes	65	65	9 a.m. ---All Hours--- 4 p.m.	NR
Lethbridge (Alta.) Transit System	Free	10¢	8-1-69	Medicare card	65	65	-------All Hours-----	$83,000

Table A-3

Free Fare Programs in North America

Area	Program Total	Funded	Comments
Auburn, N. Y.	Abolished 25¢ flat fare for one month 4-1973	None	Increase in ridership from 18,000 to 88,000 per month.
Commerce, California	City-wide no fare since 1962	Manufacturing Sales Tax	Industrial City with large tax base and small transit system.
Raleigh County, West Virginia	Free bus service for rural poor in Appalachia	Office of Economic Opportunity Grant	Program considered a success.
Madison, Wisconsin	One week free transit in Sept. 1973.	General City Revenue	Ridership level higher after the experiment ended than before.
Special Groups and Route			
Amherst, Massachusetts	Univ. Mass students on campus	UMTA grant, parking fees	Students run bus service. Experiment for 18 months.
Evanston, Illinois	Free fare on CTA rapid transit line to Evanston for local riders	CTA Demonstration Grant	Project lasted 3 weeks (June, July 1973).
Univ. of Irvine, California	Students use county buses	Student fees	None
Univ. of Iowa	Campus system	Student fees parking income	Handles over 12,000 passengers daily.

Table A-3

Free Fare Programs in North America

Area	Program Total	Funded	Comments
Kent State, Ohio	Student campus system since 1967	Student fees	Student operated system handles over 22,000 passengers daily.
Santa Cruz	Students use county bus free	Student fees	Increase in ridership for fare paying non-students as well as students.
Seattle	Free CBD bus loop	City of Seattle	Overall 56% increase in ridership.
U. OF W. Virginia (Morgantown)	Campus bus system	Student fees	Handles 20,000 passengers daily.

Other cities with free bus service in their CBD's are Dayton Ohio, Nashville Tennessee, Duluth Minnesota, Akron Ohio, Chattanooga Tennessee, Birmingham Alabama and Sacramento, California.

DATA OBTAINED THROUGH
4TH QUARTER 1972

SUMMARY OF SPECIAL REDUCED FARES AND PROCEDURES

(FOR THE BLIND, HANDICAPPED, UNEMPLOYED AND WELFARE RECIPIENTS)

AMERICAN TRANSIT ASSOCIATION
STATISTICAL DEPARTMENT

KEY LIST OF SYSTEMS REPORTING SPECIAL FARE

No.	City	State	Name of System
1.	Albuquerque	New Mexico	Albuquerque Transit System
2.	Calgary	Alberta	Calgary Transit
3.	Cleveland	Ohio	Cleveland Transit System
4.	Denver	Colorado	Denver Metro Transit
5.	Detroit	Michigan	Department of Street Railways
6.	Edmonton	Alberta	Edmonton Transit System
7.	Everett	Washington	Everett Transit System
8.	Fresno	California	Fresno Transit
9.	Holyoke	Massachusetts	Holyoke Street Railway Company
10.	Honolulu	Hawaii	City. and County of Honolulu
11.	Jamaica	New York	Long Island Railroad
12.	Kitchener	Ontario	Public Utilities Commission
13.	Los Angeles	California	Southern California Rapid Transit District
14.	Medford	Massachusetts	Hudson Bus Lines
15.	Montreal	Quebec	Montreal Urban Community Transit Commission
16.	Omaha	Nebraska	Omaha Transit Company
17.	Palo Alto	California	Peninsula Transit Lines, Inc.
18.	Phoenix	Arizona	Phoenix Transit Corporation
19.	Portland	Oregon	Tri-County Metropolitan Transportation Dist. of Oregon
20.	Rochester	New York	Regional Transit Service, Inc.
21.	Rockford	Illinois	Rockford Mass Transit District
22.	Salt Lake City	Utah	Utah Transit Authority
23.	San Francisco	California	San Francisco Municipal Railway
24.	Santa Monica	California	Santa Monica Municipal Bus Lines
25.	Schenectady	New York	Schenectady Transit Corp.
26.	Seattle	Washington	City of Seattle - Department of Transportation
27.	Spokane	Washington	Spokane Transit System
28.	Tacoma	Washington	Tacoma Transit System
29.	Toronto	Ontario	Toronto Transit Commission
30.	Vancouver	British Columbia	British Columbia Power & Hydro Authority
31.	Windsor	Ontario	Sandwich, Windsor & Amherstburg Railway Company
32.	Winnipeg	Manitoba	City of Winnipeg Transit System
33.	Mobile	Alabama	City of Mobile

Note: 94 Transit Systems did not report having any such special fares.

System	Basic Fare	Blind	Handicapped	Unemployed	Welfare Recipients	Designating Authority	Identification Method	Comments
1.	0.30	Pass $1.00 per year	0.15	--	--	Doctor determines amount of blindness and reports to blind association	Yearly pass signed by transit manager.	0.15 special rate for retarded persons to and from special schools.
2.	0.25	0.16	--	--	--	City Council	I. D. card issued by transit system.	Receives grant of $8500 per year to transport all members of the Canadian National Institute for the Blind.
3.	0.45	Free	--	--	--	Cleveland Society for the Blind	Show authorized pass and accompanied by a fare-paying passenger.	Passes reissued every 3 years. The photo I.D.'s signed by the director of CSB and general manager of CTS.
4.	0.35	0.25	0.25	--	--	Physician	Special I.D. card.	0.25 fare for mentally retarded and military personnel in uniform.
5.	0.40	Free	--	--	--	Board of Street Railway Comm.	White cane or seeing eye dog.	Transportation for welfare recipients is provided for in welfare allowance by social agency.
6.	5/1.25 $10 per month	Free	Free war vet amputees	--	--	City Council. Individuals are identified by their association.	I. D. Pass	City Council pays ETS for passes issued.
7.	0.25	Free	--	--	--	Mayor's office	I. D. Pass	0.15 fare for Social Security recipients (62 and older).

System	Basic Fare	Blind	Handicapped	Unemployed	Welfare Recipients	Designating Authority	Identification Method	Comments
8.	0.30	Pass $2.00 per month	--	--	--	NR	NR	Individual must be legally blind. Pass sold only at City Hall.
9.	0.25	Free	--	--	--	NR	NR	If a blind person is accompanied by a fare-paying passenger with vision, there is no charge for the blind person.
10.	0.25	Free	--	--	--	Administration and city council	transportation badge or authorized cane.	The city and county of Honolulu is studying the feasibility of providing transit service for the handicapped. Fare would be either reduced or free.
11.	0.70 first class	50% off first class	--	--	--	ticket agent acting on the basis of instructions issued & filed with MTA	must have ticket issued by the ticket agent.	
12.	0.25	Free	--	--	--	Canadian National Institute for the Blind	special pass	Special rate for senior citizens (age 65 & over) $0.10 on special pass issued by City of Kitchener. City pays $0.15 difference on number of passes issued
13.	0.30	0.05	--	--	--	Districts Board of Directors	white cane, red tipped white cane, or seeing eye dog	The $0.05 blind fare is applicable to each eligible person for each bus used, regardless of applicable fares or distance traversed. No transfers issued or accepted on blind fares.

System	Basic Fare	Blind	Handi-capped	Unem-ployed	Welfare Recipients	Designating Authority	Identification Method	Comments
14.	0.25	Free	--	--	--	Driver of Bus	State law-driver is acquainted with the law	
15.	0.35	Free	--	--	--	*	*	One fare for the blind and the person who rides with him. Handled in cooperation with association for the blind. Identification card and/or white cane.
16.	0.40	Free	--	--	0.35	Omaha Blind Ass'n & State & County Welfare Depts.	Blind carry I.D. cards, welfare recipients are given accomodation tickets.	*Blind are free if accompanied by a paying adult. The cards for the blind are issued to the Omaha Blind Ass'n upon request, along with a photo. The welfare accomodation ticket costs 35.6¢ each in books of 100.
17.	0.25	0.15	--	--	--	bus driver	if blind by law	*Also 15¢ for anyone who has to ride with the blind person to help him. We do not have many persons who use the blind fare.
18.	0.35	Free	--	--	--	NR	blind are given card by state.	
19.	0.35	0.25	--	--	--	Oregon State Blind Comm.	special card	Cards are purchased by Tri-Met for issuance by the Blind Comm. Same form as "honored citizen" cards for those over 65 is used.

System	Basic Fare	Blind	Handi-capped	Unem-ployed	Welfare Recipients	Designating Authority	Identification Method	Comments
20.	0.35	Free	--	--	--	As in for blind of Rochester & Monroe County	Picture pass issued by the Association	The special fare pass allows a seeing-eye dog or guide to ride free with blind person.
21.	0.35	0.30	--	--	--	Place of employment	NR	
22.	0.30	0.30	--	--	--	Blind Center		Blind persons may buy Student Pass at Blind Center for $9.00 per mth.
23.	0.25	Free	--	--	--	doctors. certificate	pass	
24.	0.25	Free	--	--	--	city	blind pass issued to residents by city	Blind person must come into our office and show proof by letter that he/she is legally blind; also proof of residence.
25.	0.30	Free	--	--	--	verifying letter	A pass properly signed & cane or seeing-eye dog accompanying the blind person.	
26.	0.25	Free	--	--	--	City Ordinance provides free passes for legally blind who are indigent residents of the city.	The blind person who qualifies is issued a pass.	We have a special reduced rate for senior citizens of $2.00 per month-they must be 65 or or older and income limitations of $2,000 for a single person and $3,000 per married couple. We are continually being besieged for reduced rates for handicapped unemployed and welfare recipients.

System	Basic Fare	Blind	Handicapped	Unemployed	Welfare Recipients	Designating Authority	Identification Method	Comments
27.		Free	--	--	--	Handled by Lions Club	pass	
28.	0.25	Free	--	--	--	When citizen is declared legally blind.	Police Dept. takes picture sealed on Transit pass-signed by Director of Transit	General fund of city pay Transit Dept. $300 per year.
29.	0.30	Free	Free	--	--	Canadian National Institute for the Blind.	pass	The only handicapped who receive special consideration are veterans of the armed forces who are amputation cases and are registered with War Amps of Canada and wear a special button-hole badge which permits them free transportation. For Blind and War Amps free transportation the Metropolitan Council reimburses the T.T.C. an amount of $169,000 annually
30.	0.25	Free	Free	--	--	Organization to which he belongs CNIB or War Amputees Ass'n	special pass is issued.	
31.	0.30	Free	--	--	--	The Company	passes	
32.	0.25	0.10	--	--	--	CNIB	I.D. cards	
Canadian National Institute for the Blind, or War Veterana Amputee Association.								
33.	0.30	Free	--	--	--	NR	Pass	Effective 3-26-73

John Caruolo
New Jersey Department of
Transportation
1035 Parkway Avenue
Room 3100
Trenton, New Jersey 08625
December 18, 1973

Mr. Charles Krumbine
Dade County Metro Transit Authority
Market & Planning
P.O. Box 887
Miami, Florida 33152

Dear Mr. Krumbine:

As a partial requirement for a Master's Degree from Polytechnic Institute of New York, I am involved in a research project on the effect of fare reduction on public transit ridership. This project is funded by the Urban Mass Transit Administration (UMTA).

The Dade County Metro Transit Authority has instituted a reduced fare program for the elderly. In reference to our phone conversation of December 12, 1973, I would like to request the following information concerning the program:

1. Appropriate before (at least one year in advance of implementation) and after ridership data.
2. Appropriate before (at least one year in advance of implementation) and after passenger revenue data.
3. Any studies completed on the effect of the program.
4. Description of the exact nature of the program, it's implementation, background information and accompaning public information program.
5. Financing of the lost revenue due to the program.
6. Any other improvements made in the system implemented simultaneously that would also affect ridership (i. e. improvement in service etc.)

Your cooperation will be greatly appreciated.

Thank you,

John Caruolo

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4. June L. Shmelzer, "Elderly Ridership and Reduced Transit Fares: The Chicago Experience," Transportation and Aging: Selected Issues, (May, 1970), p. 128.

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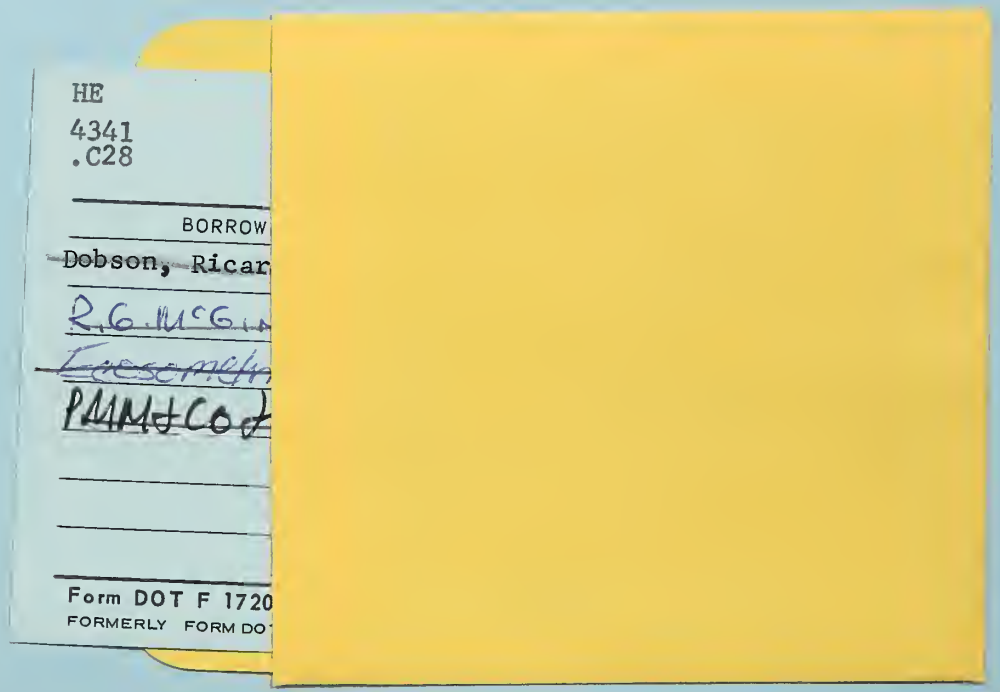
VITA

JOHN R. CARUOLO

General Background:	Born May 9, 1951, in Philadelphia, Pennsylvania and raised in the Metropolitan Philadelphia area. Secondary education received at the Gloucester City High School, Gloucester, New Jersey.
Educational Background:	
1973 - 1974	Polytechnic Institute of New York, Brooklyn, New York. Under Urban Mass Transportation Administration (UMTA) fellowship grant, course requirements completed toward Master of Science in Transportation Planning during academic year 1973-1974. MS Degree awarded June 1974 upon acceptance of the project report by the Department of Transportation Planning and Engineering and the Graduate School.
1968 - 1972	Villanova University, Villanova, Pennsylvania. Completed course requirements and awarded Bachelor's Degree in Civil Engineering by the Department of Civil Engineering in May, 1972.
Professional Associations:	Member, Institute of Traffic Engineers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