SUMMARY
STUDY OF PUBLIC TRANSPORTATION FARE POLICY

Prepared for

OFFICE OF THE SECRETARY
U.S. DEPARTMENT OF TRANSPORTATION

DECEMBER 1976

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PMM&Co. PEAT, MARWICK, MITCHELL & CO.

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SUMMARY

INTRODUCTION

The factors which affect transit fare policy can be grouped into three categories: institutional, demand, and pricing rationale. Institutional factors include fare trends, types of fares, fare collection techniques, and the role and objectives of the various groups involved in pricing transit. Demand factors are concerned especially with the responsiveness of transit users and potential users to changes in fares, in transit service characteristics, and in the perceived price of urban automobile trips. Pricing rationale or cost factors are concerned particularly with the cost characteristics of the production of transit services. This report identifies the issues with which any fare policy must deal, and presents information that will aid individual transit operators to resolve those issues in their own operations.

INSTITUTIONAL FACTORS

Background

The early history of urban mass transportation dates from at least 1827, when the first commercial operation began in New York City with horse-drawn vehicles. After the introduction of the electric motor in 1888, several cities constructed surface rail lines, while New York, Boston, and Chicago constructed elevated or subway lines. By the turn of the century, however, it was evident that transit systems were in financial trouble. The problems were caused by high construction costs, long rides at low fares, the concentration of destinations in downtown areas, traffic peaking, and the expectation of population shifts to outlying areas. By the end of World War I, the automobile had become a major mode of urban transportation.

Despite rising costs, political pressure and the restrictions of transit operator franchises severely limited fare increases. The average transit fare was 7.1 cents in 1924, and had fallen to 6.7 cents by 1940 even though costs had climbed continuously. After a brief resurgence during World War II, transit continued to decline following the war, with a brief pause during the gasoline shortage in the winter of 1973 to 1974.

Over the 30-year period from 1945 through 1975, the following changes occurred in the transit industry:

- average fare increased from 6.9 cents to 32 cents, an increase of 364 percent;

- operating revenues rose some 45 percent;
- operating costs rose by some 231 percent;
- net operating income declined from a surplus of $313 million to a deficit of $1.5 billion;
- average salary per employee increased from $2,600 to $14,000, for an average annual increase of about 5.8 percent; and
- revenue passengers per employee decreased from 78,000 to 35,000.

As costs rose and patronage fell in the post-World War II period, transit firms fought for existence. More than two hundred transit firms disappeared from existence in the first two decades following the War as public pressure resulted in the public takeover of urban transportation systems in the 1960s. The number of publicly owned transit systems increased from 36 in 1948 to 333 by 1975.

A key factor in the decline of transit was the internal combustion engine. The advent of the automobile reduced personal transportation costs and permitted a dispersion of population from the central city. The outward movement of manufacturing was caused by the reduction in the cost of intra-city goods movement brought about by the truck.

If public transportation is to provide service within the spatial form of the contemporary city, it must have flexible service characteristics which are more comparable to the automobile than are current versions of public transportation. Manipulation of service prices, or fares, alone will not be very helpful: changes in service characteristics to meet market demands are also required.

Fare Trends

Fare patterns and trends were analyzed for 36 urbanized areas and reported in this study. It was found that, in general, fares increased steadily from 1945 to 1972, rising from 7 cents to 32 cents. Since 1972, however, there has been a trend toward stabilizing fares. Specifically, in the period from 1970 to 1972/73, 12 of the 36 urbanized areas increased their fares while five decreased fares. From 1972/73 to 1976, seven urbanized areas increased fares while four reduced fares. Only two of the urbanized areas had revenues which exceeded costs, while several had revenues which were less than one-half of cost.

The 1974 National Transportation Study (1974 NTS) data reported by the states for their 1990 transportation plans were analyzed and compared with the 1972 average fares and revenue-to-cost ratios. At the time that the 1974 NTS data were collected, the average transit fare for the nation was not expected to increase from the 32- to 34-cent level that prevailed in 1972. This suggests that at the time the data for the 1974 NTS were obtained, urbanized areas as a whole planned to pursue a policy of fare stabilization well into the future.

Types of Fares

Several types of fare structures are currently being used in the transit industry. These include:

Flat Fares. The flat fare is a single boarding fare that is independent of the distance traveled. It was particularly useful and popular when mass transportation served only limited-length routes in central cities. Approximately one-half of the North American transit firms reporting fare data to the American Public Transit Association are currently using flat fares. In the past five years, several transit firms have simplified their fare structures to offer flat fares. A major advantage of this kind of fare is that it is simple and convenient to use and control; the major disadvantage is that it offers the same price for trips with different costs and with different values to the transit user. The flat fare also tends to discriminate against the inner-city user and discourages off-peak neighborhood trips which could utilize excess capacity. From a cost and value of service point of view, the flat fare is most appropriate for service with similar trip lengths, usually in small networks.

Free Fare. The free fare is the extreme case of the flat fare. The user is charged nothing for the trip, and all of the costs are paid from subsidy sources. Like the flat fare, free fare has the advantage of simplicity.

When provided for a particular time, place, or group of passengers, it also has the advantage of promoting increased patronage as well as social goals and objectives. Because free transit requires full subsidization, however, it has the disadvantage of not charging passengers for the services they consume, particularly if those passengers are quite able to pay for the service.

Distance-Based Fares. Fares which vary with distance traveled may have either a cost or a value rationale. A long trip is both more costly to the transit supplier and more valuable to the transit user than

is a short trip. Fares which vary with distance would typically include a basic charge when boarding the vehicle, and an incremental charge which would depend on the distance traveled. The stage fare (i.e., the fare charged is based on actual distance travelled) is most appropriate on routes with a few designated stops, or where an automatic collection system eases the collection of differential fares. The more common approach to the distance-based fares is the zone system, in which the area served by the transit system is divided into zones, with the fare increased each time a zone boundary is crossed.

Time-Differentiated Fares. A time-differentiated fare is designed to charge higher fares in peak periods than in off-peak periods. Higher fares for peak traffic periods are justifiable on cost grounds because transit systems acquire most of their capital equipment to accommodate the peak period demands occurring in the morning and evening rush hours. The cost of the equipment that has been acquired to provide services to peak period users should be charged to those users even though there are congestion costs experienced directly by transit users as a result of crowding and reduced comfort during peak hours. A peak/off-peak differential can also be justified by differences in the value of the service. Persons who ride transit during peak periods typically have different requirements than do off-peak riders and are generally less responsive to changes in transit fares.

Value-Based Fares. A value-based fare is set at or close to the maximum price that an individual would be willing to pay for a service, rather than at the cost of supplying the service. A value-based fare can be used in two situations. The first situation is one in which a decision has been made to supply a fixed amount of service. The appropriate fare is the highest non-zero fare that can be charged and still utilize the full capacity supplied. In the second situation, in which special services are being considered, the fare should be set at the highest level that users are willing to pay. But the service should be supplied only if the revenue generated at that fare equals or exceeds the incremental cost of supplying the service. There are a number of value-based fares currently being used for the following kinds of services:

- services with special origins or destinations, such as services for sports events;
- subscription services or buspools;
- special services within limited areas, such as downtown shoppers services; and

. services for special groups, such as the elderly, school children, the handicapped, and so forth.

Fare Collection Techniques

Fare collection techniques are important for the transit firm because of the role that these techniques play in determining feasible fare policies. Moreover, the quality of transit service is affected by fare policy because the collection system used affects the speed and ease of ingress to and egress from the vehicle, the need to make special arrangements to pay fares, and the dwell times at stops.

Fare collection techniques also affect the complexity and cost of the collection devices required. The effective and efficient use of complex fare structures depends on the development of technically and economically feasible fare collection systems. To some degree, systems of prepaid passes can be used effectively to differentiate markets and to charge different fares in those separate markets. More generally, however, sophisticated systems of fares will require complex and sophisticated fare collection devices.

The fare collection techniques currently in use include the following:

On-Board Collection of Exact Fare. Of the 204 transit firms reporting on-board fare collection data to the American Public Transit Association (APTA), 116 reported having some form of exact fare requirement. Under this system, the bus driver carries neither change for fares nor the key to the locked farebox. The passenger deposits in the farebox the exact fare or a token or ticket purchased elsewhere.

Zone Charge. Most transit systems with zone charges use some form of ticket to identify the origin of the passenger or the destination paid for. The ticket is surrendered at the end of the ride with an additional fare, if necessary. Tickets may be issued either by the driver or by a machine.

Pay/Leave Collection. Under this system, the passenger pays upon leaving the vehicle. The technique is most appropriate for a zone system with a common origin for each passenger.

Transfers. Transfers are paper checks given to the passenger to permit switching from the initial vehicle to another vehicle for

continuation of a trip. Some transit systems permit free transfers between vehicles while others charge a small price.

Prepayment Plans. Prepayment plans involve the passenger's purchasing in advance a ticket, token, pass, or some other evidence of having paid for the trip. There are a number of advantages to prepayment:

- It provides greater convenience for the passenger.
- It increases the speed of fare collection.
- It makes transit more price-competitive with the automobile by making the incremental cost of an individual trip appear low, since no cash drop is required each occasion a trip is made.
- It permits differentiation of fares for different groups.
- It serves as a promotional device.
- It encourages participation by subsidizing particular groups.
- It aids in recordkeeping.

More extensive use of prepayment plans is recommended.

Automated Fare Collection. Automated fare collection devices range in complexity from a simple coin-operated turnstile to complex electronic systems that can compute varied fares and read magnetically-encoded tickets. Currently, automated fare collection is used primarily on rail systems. The use of sophisticated systems on buses is still awaiting the development of a device which is simple to use, reliable, and inexpensive.

GROUPS WHICH INFLUENCE TRANSIT POLICY

Transit fare policy is not established unilaterally by transit management, but is influenced by several groups, including users and nonusers. These groups may be viewed as an informal organization which determines transit management strategy, including fare policy. Each of the groups is defined by the role it plays in the organization; that is, by its contributions to and rewards from the organization. The groups are:

- owners, which include transit management and the governing boards;

- customers, which include transit users and others who contribute resources (money) that allow the transit firm to operate; and

- suppliers, which principally include suppliers of transit labor, managerial talent, capital financing (debt), or other goods or services.

Each group in the institutional environment of a transit firm will have a preference for a particular fare policy, and each can influence the firm in its selection of a policy. The range of pricing rationales includes:

- fares based on both average cost and marginal cost;

- fares based on the incremental value of the service to passengers; and

- fares reflecting the incremental benefits of transit service to non-passengers.

Table 1 gives a summary of the groups that influence fare policy decisions, their objectives for urban mass transportation, the role that they typically play in fare policy decisions, their pricing rationale, and their fare policy objectives.

DEMAND FACTORS

Before changing the fare or some other element of a transit service, the transit manager will want to estimate what effect the change is likely to have on ridership, costs, revenue, and the quality of service. Planners and public officials will also want to know the consequences of their actions intended to generate additional demand, increase revenue, lower costs, or increase the level of service to particular groups.

Demand elasticity is a measure which has been widely used to describe the responsiveness of transit demand to changes in such variables as transit fare, service characteristics, income, and the price of automobile trips. Generally, elasticity expresses the proportional change in one variable (like transit ridership) which results

TABLE 1: GROUPS THAT INFLUENCE FARE POLICY DECISIONS

GROUP	OBJECTIVE FOR URBAN MASS TRANSIT	ROLE IN PRICING	PRICING RATIONALE	PRICING OBJECTIVE
Transit Management	. maximize ridership, subject to financial constraints	. make pricing decisions . implement pricing decisions	. public benefit . value of service for high income users	. price low relative to competition to attract riders . offer special services at compensatory fares to attract riders . maintain or increase subsidies to relax financial constraints . provide convenient fare collection
Government	. ensure existence of public benefits provided by transit subject to constraints on subsidy payments	. finance portion of transit costs through subsidy . exert control over transit pricing and service decisions to varying degrees through the regulatory and financing processes . control roads, parking restrictions, and other factors which influence the alternative mode, the automobile	. public benefit . value of service for specific markets	. minimize subsidy payments . price low to achieve social objectives for transit . offer special services at compensatory fares to attract riders and reduce deficit . minimize competition from underpriced automobile trips
Transit Users	. obtain better transportation services or lower costs than are available from competing modes	. pay fares . demand specific transit services . participate in fare hearings or deliberations	. public benefit . value of service	. maintain low fares . offer special services at compensatory fares to meet customer needs . provide convenient fare collection
Transit Labor	. growing labor force . increasing wages	. increase transit costs through wage demands	. public benefit . value of service	. maintain stabilized fares . offer special services at compensatory fares . maintain or increase subsidies
Others: Merchants	. achieve high accessibility for potential customers	. advocate reduced fares to and within commercial area . subsidize lower fares	. value of service	. maintain low fares . maintain large subsidies . provide some subsidy for special service out of increased sales resulting from that service
Employers	. achieve transit accessibility to work for employees	. provide subsidies to employees . support transit through prepayment plans and organization of company buspools, in some areas	. value of service	. maintain low fares . maintain large subsidies . provide some subsidy for special services which reduce costs
Sponsor Groups (school boards, welfare organizations)	. secure mobility opportunities at low cost	. advocate and lobby for special reduced fares . subsidize reduced fares, in some areas	. value of service	. maintain low fares . maintain large subsidies
General Public	. good service . minimize subsidy	. vote funds . lobby for lower taxes	. cost of service . value of service	. maintain low subsidies

from a proportional change in another variable (such as fare or income). The positive or negative sign of the elasticity indicates whether the two quantities vary directly or inversely with one another. In value, elasticity ranges from zero (completely inelastic) to infinity (completely elastic). An elasticity of unity (1.0) indicates that the two variables being compared vary in equal proportions. A fare elasticity of -0.3 means that a one percent increase in fare causes a 0.3 percent decrease in patronage.

Estimates of Fare Elasticities

A number of studies have used different techniques to estimate transit fare elasticity. One of the earliest was the Curtin study, which estimated transit fare elasticity at -0.33. This estimate has been used as a rule-of-thumb by many transit managers and regulatory agencies. Studies by APTA of 281 cases of fare increases in 114 North American cities estimate transit fare elasticities to range from -0.004 to -0.97. The average price elasticity was also -0.33, but only 12.1 percent of the cases fell in the range of -0.31 to -0.35.

Elasticities in Specific Markets

Fare elasticities for specific market segments are more meaningful than is elasticity for the overall market. While there is a shortage of data for many of the specific markets in which one would be interested, there is evidence for a few specific markets.

Senior Citizens

The elasticity of the senior citizens' market shows a high degree of variation. A number of cities have reported little or no change in ridership resulting from a reduction in fares for senior citizens. At the other extreme, however, Los Angeles reported a 23.9 percent increase in elderly riders when fares were reduced by 33 percent, yielding a fare elasticity of -0.72. Generally, the fare elasticities average above -0.5 and are significantly higher than the Curtin rule of -0.33.

Peak and Off-Peak Markets

Analysis of elasticities of demand for a transit fare increase in New York in 1966, showed the morning and evening peaks to have elasticities of -0.07 and -0.15, respectively, compared with morning and evening off-peak elasticities of -0.24 and -0.44. An analysis of cross-sectional data for 30 British towns showed price elasticities of -0.19 for work trips and -0.49 for non-work trips.

High, Medium, and Low Income Markets

The fare elasticity of high income workers clearly is lower than the fare elasticity for medium and low income workers. Analysis of elasticities shows that high income workers have elasticities in the range of -0.1 to -0.25 for peak period trips, medium income workers have elasticities in the range of -0.3 to -0.4, and low income workers in the range of -0.3 to -0.5. The fare elasticities of workers for off-peak period travel is even higher for medium income (-0.4 to -0.75) and low income (-0.5 to -1.0).

Comparison of Price and Service Elasticities

Estimates of demand elasticities for variables measuring the quality or quantity of transit service have generally been higher in absolute value than corresponding estimates of price elasticity. Although sketchy, the available evidence suggests that selective improvements in transit service can induce more ridership than a moderate or even a large decrease in the fare.

In San Diego, service changes showed an elasticity of +0.68. Another study estimated an elasticity of +0.76 for bus miles of service. An estimate of fare and service elasticities for twelve urban British bus systems showed elasticities for vehicle miles to range from a low of +0.22 to a high of +1.19, with an average of +0.62. Average fare elasticity in this study was -0.31. A study of Montreal data for the period from 1956 to 1971 estimated fare elasticity at -0.15, elasticity for waiting time at -0.54, and elasticity for vehicular travel time at -0.27.

Analysis of the Shirley Highway express bus service (Washington, D.C.) showed that commuters who have a choice of modes for work trips consider the overall travel time to be much more important than the overall cost of the trip. Other studies tend to confirm these results.

Estimates of price and service elasticities for work trips and shopping trips in Boston showed access and line-haul time elasticities to be substantially greater than access and line haul cost elasticities for work trips. For shopping trips, elasticity for total cost was -0.32 and elasticity for overall trip time was -0.59. Similarly, the analysis for 30 British towns gave fare and service elasticities of -0.19 and +0.58 for work trips and -0.49 and +0.79 for non-work trips.

The San Francisco (BART) study showed that service characteristics such as total travel time, comfort, dependability, and the like would typically be more important than cost in a rider's selection of a mode. A survey of the Baltimore market showed substantial numbers

of persons would, depending on their income, be willing to pay moderately to significantly higher fares for improved service. Moreover, most respondents, except those with very low incomes, rated service characteristics as more important than low cost. Similar results were obtained from a transit survey in Columbia, South Carolina.

Analysis of subscription services suggests that transit services designed for a particular market segment, providing the service characteristics demanded by that market, can attract substantial ridership at compensatory fares. Evidence from these services is sketchy and not systematic, but it is indicative of what might be accomplished with a well-designed fare and service policy.

Cross Elasticities

Cross elasticity of demand for transit is the proportional change in transit ridership resulting from a proportional change in the cost of auto trips. Very few cross elasticity estimates have been made. Analysis of the Shirley Highway express bus service showed cross elasticities between +0.32 and +0.41 when a tax is added to the median auto commuting cost. The price elasticity for a 25 cent reduction in the daily cost of commuting by express bus was between -0.23 and -0.28. Hence transit ridership increases are more sensitive to the introduction of a tax to the auto commuting cost, than to a fare reduction.

Summary of Demand Factors

The evidence presented in this study strongly suggests that, in most circumstances, simply changing the fare will have only a minimal to moderate effect on the demand for public transit. Fare hikes normally generate more revenue at the expense of losing ridership, while fare reductions increase ridership usually at the expense of losing revenue. Tailoring only the fare to the different markets for public transit also appears to be ineffectual as a means of increasing both ridership and revenue. Although there is insufficient quantitative information about the demand for transit in certain particular markets, the available evidence does suggest that none of these markets is highly responsive to changes in the fare alone. Examples of typical fare elasticities are shown in Table 2 for six major market segments.

The speed, frequency, convenience, and certain other qualities of a transit service seem to have more of an effect on transit demand than does the fare level. Estimates of demand elasticities for variables measuring the quality or the quantity of transit service have generally been higher in absolute value than corresponding evidence of price elasticity. The combination of improved service packages

TABLE 2

TYPICAL FARE ELASTICITIES
BY MARKET SEGMENTS

Market Segments	Fare Elasticity	
	Peak Period	Off-Peak Period
1. High-Income Worker	-0.10 to -0.25	N.A.
2. Medium-Income Worker	-0.3 to -0.4	-0.4 to -0.75
3. Low-Income Worker	-0.3 to -0.5	-0.5 to -1.0
4. Student	N.A.	less than -0.3
5. Shopper	N.A.	-0.75 to -1.0
6. Elderly and Handicapped	N.A.	-0.25 to -1.0

N.A.: Generally not applicable because few trips are made by this market segment during the time period concerned.

and carefully selected pricing strategies that match the public's value associated with the new service is the most effective approach to increasing transit ridership and stabilizing operating deficits.

PRICING RATIONALE FACTORS

Transit fares may be set based on three alternative pricing rationales. The types of fares used to implement these rationales are the cost-based fare, the value-of-service fare, and the public benefit fare.

Cost-Based Fares

The first pricing rationale is the cost-based fare. This rationale has as its objective the proper allocation of production resources to transit service. The strategy for achieving the objective is to set fares based on the incremental (marginal) or average cost of providing an additional increment of service.

There are two measures of unit cost which are frequently used in economic analysis. One measure is long-run average total cost, which is the total cost divided by the number of transit units operated. The other measure is short-run incremental (or marginal) cost. (Marginal cost is the change in total cost resulting from operating one additional unit. Incremental cost is the change in total cost resulting from operating the next larger possible increment of service, which may be substantially greater than one unit.) Examples of long-run average and short-run marginal costs expressed on a per-vehicle-mile basis are presented in Table 3 for a cross section of bus and rail systems.

The argument for pricing any good or service at incremental cost is quite straightforward. The incremental cost of the next larger amount of output reflects the value of the resouces used in its production. If the additional output cannot be sold for at least its incremental cost, there is a presumption that the output is not worth the value of the resources used to produce it, and those resources should be allocated to a more valuable use.

The marginal costs considered should be short-run cost, which means that the size of the transit system (principally the number of vehicles, the size of the maintenance facilities, and the number of employees under contract) is fixed so that costs which can vary with the level of operation are mainly the cost of fuel consumption, that portion of maintenance which is proportional to miles or hours of operation, and incremental additions to the labor force if additional special service is being considered. These variable costs

TABLE 3

LONG-RUN AVERAGE AND SHORT-RUN MARGINAL COSTS
EXPRESSED ON A VEHICLE-MILE BASIS
(In 1975 Dollars)

COSTS	BUS		RAPID RAIL		COMMUTER RAIL	
	Average	(Range)	Average	(Range)	Average	(Range)
Average cost per mile (operating, maintenance, and general admin. costs)	$1.20	($.55 to $2.80)	$2.00	($1.20 to $3.35)	$4.00	($1.85 to $ 9.10)
Marginal cost per mile (maintenance and fuel costs)	$.40	($.15 to $.80)	$.60	($.40 to $.80)	$.85	($.35 to $2.30)

are the short-run incremental costs; they determine the prices at which the transit manager can supply successive increments of service. All other costs are irrelevant to the short-run supply decision because they are already committed and cannot be avoided by reducing the number of vehicle miles operated.

Value-of-Service Fares

The second pricing rationale, which aims at maximizing transit farebox revenue, considers only the demand for transit services and may disregard costs altogether. In this approach, fares would be set at levels which correspond to the incremental (or marginal) benefit of the service being priced.

Two sets of situations can be identified in which value-based pricing is an operationally useful approach to transit fare strategies. Probably the most important situation is one in which different services are offered in different market segments at different fares. The main point of market segmentation is to determine what transit services the users or potential users in different markets want and are willing to pay for, and to provide those services at fares which are equal to the value users place on them.

A second situation for marginal benefit pricing occurs in instances in which a decision has been made to provide a minimum frequency of service. Since it makes no sense to provide unused capacity, the economically justified fare is the highest non-negative fare which will cause the entire capacity to be utilized. Such a fare could, of course, be zero. From the viewpoint of the transit firm, this fare would meet the objective of providing maximum service to the community. From a financial viewpoint, however, the fare to charge under these assumed conditions is the one which maximizes revenue.

Public Benefit Fares

The third pricing rationale takes account of incremental benefit to non-users as well as to users in establishing fare strategies. The objective of the public benefit rationale is the maximization of social benefits derived from increased transit use (such as the reduction of air pollution, congestion, and energy consumption). The strategy for achieving this objective is to set transit fares below marginal cost, specifically at a point below marginal cost that will encourage the supply and use of transit services at a socially desired level. The essence of this pricing rationale is that transit subsidies should be provided in situations where it is evident that subsidies could help to achieve some real social benefit.

The notion of social benefits includes the following:

- Transit can provide several benefits to the public. These benefits, including reduced pollution, congestion, and noise as well as improved and revitalized downtown land use, accrue to everyone in the community regardless of their use of, or contribution to, transit. No one in the community would demand transit service separately for these purposes since benefits are not proportional to contributions.

- Certain groups in society that are more dependent on transit, such as the young, poor, elderly, or handicapped, would demand more transit if they could afford those services; and the public in general would benefit from the improved travel opportunities of these groups.

Through regulating and subsidizing reduced fare levels, government can affect the provisions of transit service. In particular, transit managers responding to increased demand for the lower priced service could increase the supply of service and, correspondingly, increase the provision of social benefits.

Summary of Pricing Rationale Factors

The findings in this study suggest that transit services should be priced in peak periods at long-run average costs and in off-peak periods at marginal costs. To follow this approach, the transit manager should analyze the operating costs for his system. Peak period, long-run average costs will be determined to include all operating and maintenance expenses, annualized capital expenses, and full overhead allocation as if only peak period service were provided. The off-peak marginal costs will typically be incremental costs for off-peak service and will include only fuel, replacement parts, and other maintenance costs associated with the off-peak route mileage. Labor, overhead, and annualized costs typically would not be included. Examples of long-run average costs and off-peak marginal costs were shown previously in Table 3, based on cost data for a cross-section of United States transit operations, and are expressed in 1975 dollars.

The information developed on market segments, service characteristics and elasticities, and costs should be used to prepare cost and revenue analyses of alternative fare and service packages for each of the market segments identified. The purpose of the analyses is to determine the effects of different combinations of fares (average

peak and off-peak fares have been calculated and are shown in Table 4 for the consideration of the transit manager) and services by market segment, ridership, revenue, cost, congestion, deficit, pollution, and other variables of interest to the transit manager and to the community. By manipulation of fare and service characteristics by market segment, transit management should be able to approximate the combination which will allow it to achieve as many of its objectives as is possible under the constraints within which services are operated.

TRANSIT MANAGEMENT STRATEGY

The analysis of the institutional, demand, and cost aspects of the transit market makes it clear that no single, generalized approach to transit fare policy is possible. The approach to be taken to arrive at a fare policy will be much the same for all transit operators, however, because there are certain key questions with which all transit operators must deal in determining a fare policy.

To be effective, fare structure must be an integral and complementary part of an overall strategy of transit management. Accordingly, fare policy must be complementary with policy decisions concerning marketing, operations, and finance. This study emphasizes throughout that fare policy cannot be developed independently from service policy. This means there is a necessarily close relation between operating policy and fare policy, particularly as operating policy affects the types and reliability of services provided. If the objectives of increased ridership and improved financial conditions are to be met, operating policy must be integrated with fare policy in a coordinated marketing strategy. Most importantly, a successful fare policy should reduce the need for operating subsidies.

The major issues with which any transit fare policy must deal include the specific institutional environment in which a particular firm operates, demand issues, and cost and subsidy issues. One of the major institutional issues with which any transit firm must deal in setting a fare policy is the competition of automobile trips. Transit fares cannot be set at economically appropriate levels until such time as automobile trips are economically priced. Other institutional issues include the continuing concern with operations rather than with marketing, and the continued emphasis on subsidies and social benefits of transit.

On the demand side of the market, it is essential that opportunities be sought to identify individual transit markets that have potential for development with the right combination of service characteristics,

TABLE 4

AVERAGE FARES BASED ON PEAK AVERAGE
COSTS AND OFF-PEAK MARGINAL COSTS
(Costs/Mile divided by Passengers/Mile
in 1975 Dollars)

	PEAK PERIOD		OFF-PEAK PERIOD	
	Average	(Range)	Average	(Range)
Bus[1]	$.41	($.19 to $.97)	$.28	($.10 to $.28)
Rapid Rail[2]	$.47	($.28 to $.78)	$.28	($.18 to $.19)
Commuter Rail[3]	$1.18	($.54 to $2.68)	$.50	($.20 to $.68)

[1]Based on 2.9 passengers per vehicle mile from 1974 NTS for total 1972 system. Peak is set at 2.9 passengers per vehicle and off-peak is assumed to be 1.45.

[2]Based on 4.3 passengers per vehicle mile from 1974 NTS for total 1972 system. Peak is 4.3 passengers per vehicle and off-peak is assumed to be 2.15.

[3]Based on 3.4 passengers per vehicle mile from 1974 NTS for total 1972 system. Peak is 3.4 passengers per vehicle and off-peak is assumed to be 1.7.

NOTE: These fares are based on total system averages. It is recommended that the transit manager apply specific rates of passengers per vehicle separately for the peak and off-peak. Also the fares are in 1975 dollars and should be increased to reflect current dollar values.

fare structure, and promotion. Current examples include commuter and subscription services. Peak and off-peak fares should also constitute a key part of any transit firm's fare policy. A fare policy which combines a peak period fare differential with an urban traffic control scheme can reduce traffic congestion, improve average trip time, reduce air pollution, and reduce the transit deficit simultaneously.

On the cost side of the market, a desirable relation between cost and fare must be determined for each specific market segment. It has been argued that, in general, fares should be set at long-run average cost for peak period operation and short-run marginal cost for off-peak operation.

Nonetheless, from the cost viewpoint, transit fare policy should move toward pricing individual transit services provided for specific market segments at their average or marginal cost. Subsidies would then be provided selectively and deliberately in those situations where they are fully justified; that is, where marginal costs were below average costs.

In addition, special subsidies could be provided in situations where it was evident that those subsidies could help to achieve some real social benefit (i.e., provide service for the transportation disadvantaged). Although the general policy of subsidizing fares to increase transit demand (with the justification of reducing air pollution, congestion, and energy consumption) has not proven successful, evidence suggests that subsidies provided to improve transit service characteristics (particularly for specific transit markets) might prove beneficial.

There are vast arrays of public policies and programs at the federal, state, and local levels which may have implications for transit fare policy. The approach to fare policy recommended in this study is consistent with the national transportation policy statement. This approach stresses the self-sufficiency of specific transit markets, and emphasizes marketing, the generation of revenue, and the possibilities for reducing transit subsidies. If some form of urban automobile restraint or control system were instituted as an essential adjunct to a successful public transit fare policy, the current highway development policies would probably place less emphasis on expanding the urban highway system. Finally, the recommended approach is consistent with the transportation system management program, environmental protection policies, and energy conservation policies.

RECOMMENDATIONS FOR NEW FEDERAL POLICIES

To date, determining transit pricing strategies is the prerogative of a local municipality. In fact, the U. S. Department of Transportation (DOT) has no regulation or policy (other than the off-peak, half-price regulation applying to the elderly and the handicapped) to encourage local governments to implement specific transit pricing strategies that would increase ridership and revenues.

Recognizing that the current trend among transit managers is to stabilize transit fares and to depend on Federal, state, and local governments for increased operating assistance, it is recommended that DOT create new administrative and regulatory procedures that will involve the Federal Government more directly in setting standards for transit pricing. In particular, there are six new DOT policies that would provide significant incentives for local municipalities to use improved transit pricing strategies. These include:

- revisions in the Section 5 grant programs provided through the Urban Mass Transportation Administration (UMTA);
- revisions in UMTA Section 9 planning grant regulations;
- the acceleration of research and development on automated fare collection devices for buses;
- the initiation, beginning in January 1979, of a research program to analyze the cost, revenue, and ridership data submitted to DOT under the Financial Accounting Reporting Elements (FARE) regulations; and
- the development of new administrative directives to rectify the underpricing of the highway system and its usage; and
- provision of better information.

Each policy is discussed below.

Revisions in UMTA Section 5 Grant Program

DOT should implement new administrative grant provisions to encourage efficiency in the use of UMTA Section 5 funds for operating assistance. The current provisions provide local communities with little or no incentive to increase fare revenue or to reduce costs. As

a general rule, the public should be charged the full cost of the service provided when it can be shown that they are satisfied with that service. Market research studies conducted in some large and medium size cities have demonstrated the effectiveness of joint service and pricing strategies.

Accordingly, all Section 5 applications should include a report on relevant market studies that have been performed to provide evidence on the effectiveness of fare and service packages for each urban area. These market studies should delineate what price the public is willing to pay for the transit services being provided. The fare charged should enable the transit property to cover, through fare box revenues, a reasonable share of the long-run average costs. A commitment should be made by the urban area documenting the proportion of long-run costs that fare revenues will cover. This proportion should be maintained, unless firm evidence can be provided that a new proportionate share is preferable. This new policy would encourage urban areas to control rising operating deficits as cost increases are incurred.

DOT might also consider changing the grant allocation formula to include response to public need and sound fiscal management. For example, Section 5 grants could be allocated on the bases of ridership and increments in fare box revenue. The ridership factor would help to reduce the current disparity in per-rider allocations. The incremental revenues factor would permit increased allocations in proportion to ridership and fare increases. Substitution of either or both factors for the present population and population density factors would certainly provide significant incentives that do not now exist in the program. These and other revisions to the Section 5 grant program are under active consideration by UMTA.

Revisions in UMTA Section 9 Planning Grant Program

The DOT regulations concerning the planning requirements should place emphasis on sound fiscal management. In particular, the Transit Development Program and Transit Alternative Analysis regulations could be revised to include strong planning provisions requiring local municipalities to analyze alternative transit pricing strategies. To retain its planning certification, a local metropolitan planning organization (MPO) would have to demonstrate that its planning of service and major systems improvements was based on sound fiscal planning. In particular, the MPO would have to demonstrate that it had fully evaluated a reasonable number of alternative transit pricing strategies, including peak/off-peak differential pricing (i.e., assessment of average cost/marginal cost trade-offs); alternative fare structures, such

as zone versus flat systems; and alternative fare collections systems, including use of prepaid pass systems.

The analysis of alternative pricing strategies would have to involve marketing research sufficient to document and report on the major market segments and the associated transit service characteristics. Detailed evidence could be required to demonstrate that fare elasticities had been investigated at least for the major market segments.

Acceleration of Research and Development on Automated Fare Collection Devices for Buses

The most significant constraint on industrywide adoption of a distance-based fare for buses is the lack of automated fare collection devices that are reliable, compact, and inexpensive. The new automated systems, such as the one employed by BART, have permitted the successful implementation of a complex fare structure based on distance traveled and scheduled travel speed. The same potential exists for bus operations providing premium/express service between the suburban areas and the central business district. Such devices would enable transit operators to charge a fare based on actual distance traveled and hence to increase revenues.

UMTA is currently undertaking research and development of automated fare collection devices for buses and is experimenting with European and English models. It is recommended that this research program be expanded and accelerated so as to accomplish the mission of developing a reliable, compact, and low-cost device for buses that can be quickly deployed on all bus properties.

Initiation of DOT Research Program with FARE Data

The 1974 National Mass Transportation Assistance Act requires each transit property, beginning January 1979, to report to UMTA on a regular basis: cost, revenue, ridership, and service performance data. The reporting of this data on a regular basis is mandatory if transit properties are to retain their eligibility to receive UMTA Section 5 operating assistance grants. As this valuable and extensive fiscal, demand, and service data base becomes available, DOT should initiate a new transit pricing research program to study new pricing strategies, fare elasticities, and fare-and-service cross elasticities. The research results would form the basis for developing new DOT guidelines on transit pricing strategies.

Revisions in Highway Regulations

DOT should examine possible administrative actions to correct highway pricing and ways to improve regulations that would require local municipalities to base urban highway prices on marginal congestion costs (i.e., implement congestion pricing). A more equitable highway pricing policy would probably have a greater effect on transit fare policies than any other aspect of the highway program.

Such a policy should foster the efficient use of the existing highway system as an integral part of an urban transportation system that includes public mass transit. Hence, highway pricing should reflect short-run costs, principally those of congestion and pollution. The Transportation System Management (TSM) program, in particular, could place high priority on the use of auto pricing policies such as parking taxes and regulation of the parking supply. Local communities could then increase transit fares without fear of unfair price competition from the automobile.

Little policy-level research has been conducted on highway pricing strategies and their probable impacts. It is therefore difficult to envision the development of the regulations necessary to encourage urban areas to employ effective auto pricing strategies. An extensive research program should be implemented to evaluate what auto pricing levels should be and what regulatory and administrative procedures DOT will need for motivating urban areas to implement effective highway pricing strategies in conjunction with appropriate transit services and pricing strategies.

Better Information

The above five policies are generally longer range opportunities for DOT. In the meantime, there are immediate possibilities for educating transit managers on transit pricing combined with service improvement packages. This policy report contains considerable data on market segmentation, fare elasticity, fare levels and structure, and fare collection techniques. Dissemination of this information throughout the transit industry would provide considerable educational benefit.

UMTA is currently continually updating its Transit Marketing Management Handbook and this document should also be widely circulated throughout the transit industry.

DOT could make extensive distribution of the Transit Pricing Manual prepared as part of this Fare Policy Study. This manual has been

written specifically for the transit manager; it discusses the application of transit pricing strategies and provides the market and pricing information and procedures necessary for setting new pricing strategies that will increase ridership and stabilize and/or selectively reduce operating deficits.

FURTHER RESEARCH

Based on the analysis of transit demand conducted in this study, several requirements for further research are apparent. First, there is little need for additional fare elasticity studies of the "shrinkage ratio" type conducted for an entire, undifferentiated conventional transit market. Neither fare nor service elasticities for entire markets are of particular relevance to the design of transit fare policy or marketing strategy.

There is great need for studies of the demand for transit in specific markets, with estimates of user response to particular fare and service characteristics in these markets. In some instances, the studies might consist of carefully designed surveys intended to elicit information from existing and latent transit markets concerning their responses to specific kinds of fare and service changes. Surveys of this sort have many problems inherent in them, but they can be used to design demonstration services and other small experiments to validate the results of the surveys.

Also, continued detailed analyses should be made of customer response to specific kinds of transit services, particularly the commuter and subscription services. These services frequently offer service characteristics such as convenient accessibility, high frequency during peak periods, high reliability, low arrival time variance, and high probability of seat availability which should attract substantial additional patronage, even at compensatory fares. The research that is required on the demand for transit is good market research, with the objective of designing transit service packages and offering them at fare structures that will attract customers.

Finally, the effects of various promotion fares on long-term transit ridership have not been adequately studied. It is not clear whether these promotion fares have achieved their long-term objective of attracting new riders to transit. Research programs should be developed to test the effectiveness of promotional fare schemes and the effectiveness of discounted transit pass systems. This research program should involve the use of FARE data, when the urban areas' reporting

commences after January 1979. In the meantime, it is appropriate to foster new market research to test the effectiveness of new pricing schemes.