

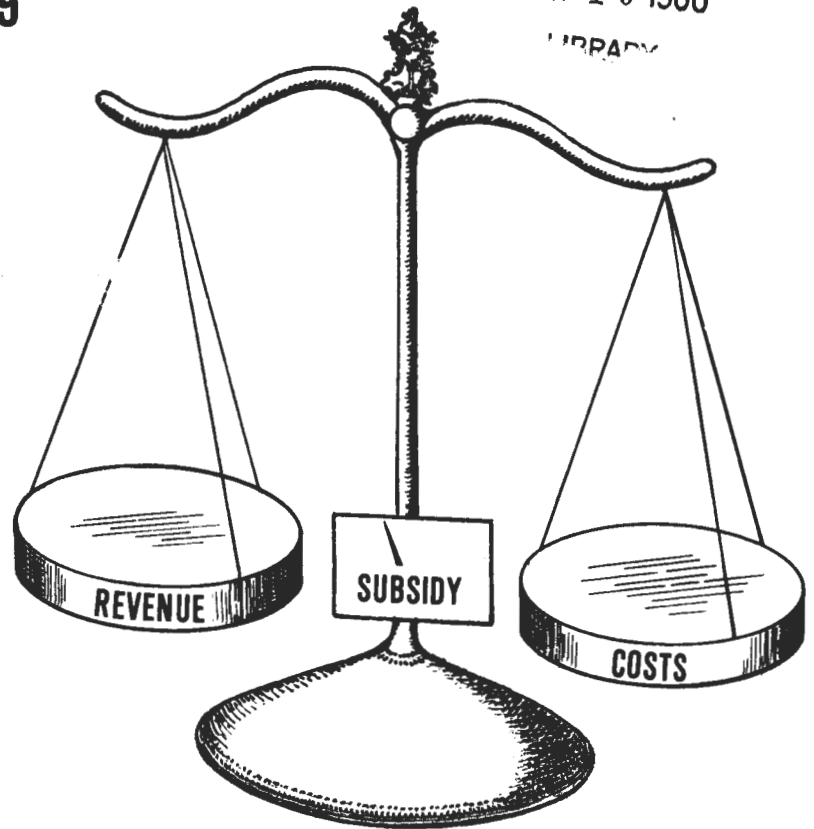
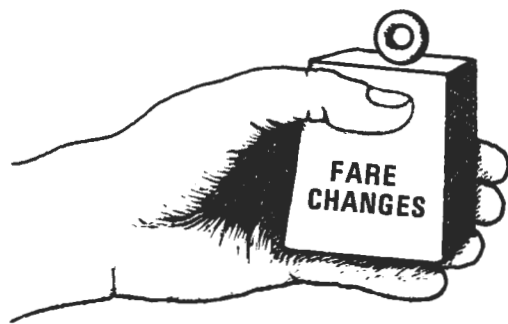
# TRANSIT PRICING TECHNIQUES TO IMPROVE PRODUCTIVITY:

Proceedings of the March 1979  
Forum on Recent Advances  
and New Directions

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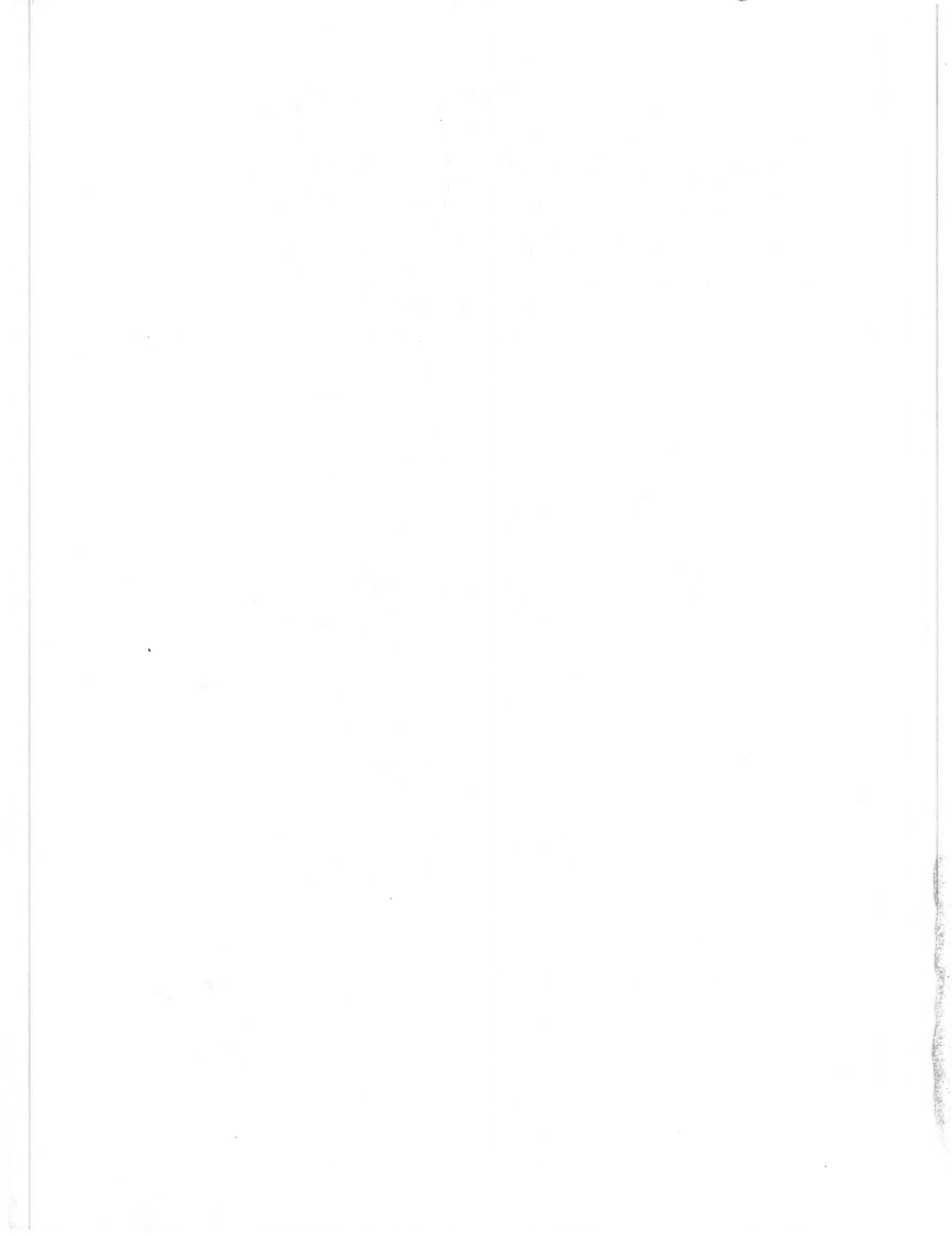
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Office of the Secretary



# **TRANSIT PRICING TECHNIQUES TO IMPROVE PRODUCTIVITY: Proceedings of the March 1979 Forum on Recent Advances and New Directions**

**Prepared by:**

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for Technology Initiatives**

**Supported by:**

**U.S. DEPARTMENT OF TRANSPORTATION  
Urban Mass Transportation Administration  
Office of Service and Methods Demonstrations  
and  
Office of the Secretary  
Office of Intergovernmental Affairs**



**June 1979**



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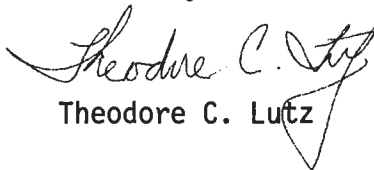
THE ADMINISTRATOR

I wish to bring your attention to this report which contains summary contributions from the Forum on Transit Pricing Techniques to Improve Productivity that convened at Virginia Beach in March 1979. The meeting was arranged to assist UMTA's Office of Service and Methods Demonstration in charting new directions for fare-related research and demonstration development. The Forum assembled distinguished researchers and practitioners that presented important guidance as to the actions needed to advance the state of the art of transit pricing.

We are pleased with the information compiled. The pricing of public transportation is an area of growing concern as scarce tax dollars raise the importance of fare box revenues as a source of transit financing. It is becoming clear that we must find improved techniques for defining and implementing pricing policies commensurate with service provided and desired impacts on segments of the transit market. Pricing policies affect all aspects of our transit service: efficiencies, system productivity and performance, and user convenience and attraction.

UMTA is committed to developing information to assist local decision making on fare policies. This report is a step toward establishing what is known and a guide to our research efforts. We look forward to working with transit operators, local government officials, researchers, and others in advancing industry practice. We welcome your expressions of interest in this research area and/or comment on the material presented in the report.

Sincerely,

  
Theodore C. Lutz



## FOREWORD

The Pricing Forum was a two day meeting consisting of general and focused discussions of transit pricing policies, recent advances, technological issues and research requirements. The overall perspective of and motivation for the forum was that pricing and fare-related innovations can play important roles in improving transit efficiency and increasing transit appeal, and that improvements in public transportation pricing will be a major response to increasing subsidy constraints.

The following pages summarize the content of each of the sessions, with emphasis on identifying the directions in which pricing innovation might proceed. The highlighting of the major points made by plenary session speakers is followed by summaries and abstracts. Each section contains Workshop Presentation Abstracts that describe current research development, and demonstration activities being undertaken by local governments, often with sponsorship by the Service and Methods Demonstration Program of the Urban Mass Transportation Administration, U.S. Department of Transportation.

Texts of major speeches appearing in italics underscore major themes pursued by forum participants.

The final section of this report contains an annotated bibliography and list of forum participants.

## HIGHLIGHTS OF PLENARY SESSIONS

After calling the meeting to order, Alinda Burke, Vice President of Public Technology, Inc., discussed the purpose of the forum and the role of Public Technology and the Urban Consortium for Technology Initiatives. She stressed that there is a need to discuss the largely technical issues and benefits of pricing innovations in non-technical terms so that they might be better understood by lay people.

Ronald Fisher, Director of UMTA's Office of Service and Methods Demonstrations, described the evolution of the UMTA transportation pricing program, and the increased contemporary importance of pricing and fare-related innovations. Bert Arrillaga, Chief of UMTA's Pricing Policy Innovations Division, elaborated the activities of the pricing program in developing new concepts, implementing demonstrations, evaluating locally-initiated projects, and sponsoring longer-range research and information dissemination activities. He stressed that the major objective of the forum was to solicit guidance for his program.

James Scheiner, Secretary for Administration, Pennsylvania Department of Transportation, presented a paper stressing the need to achieve a major shift to transit fare prepayment and move away from reliance on cash payment for individual trips. He discussed the attributes of prepayment, the variety of payment methods and plans that are developing, and the paramount importance of prepayment in helping secure increased user revenue to support industry growth in the 1980's.

Harold Geissenheimer, General Operations Manager of the Chicago Transit Authority, presented a paper relating the efforts that pricing innovations serve in modern transit operations and surveying pricing-related innovations in North American and European cities. He noted that--

- Fare revenue is a vital source of system finance.
- The controversial nature of fare changes makes achieving broad-based political support for pricing policies essential.
- Pricing and fare innovations are important components of marketing efforts.
- Special services should be matched with pricing variations to maximize user appeal.
- Fare policies should bear strong relation to the costs of different services, and service components.
- Pricing innovations should be evaluated for their impact on transit efficiency.



- The social, political, and environmental effects of pricing changes and innovations should be considered along with their impacts on transit finances.
- Transit operators should coordinate their pricing innovations with other transit, transportation, and urban programs.

Mr. Geissenheimer's speech was commented on by Michael Kelly, Manager of Advertising and Public Relations, Port Authority of Allegheny County, and Ronald Tober, Assistant Director of Operations of the Massachusetts Bay Transportation Authority. Kelly stressed the marketing role of pricing and related PAT's general pricing policy. PAT has found that users are quite willing to pay relatively high fares for quality and convenient service. Tober discussed efficiency effects of pricing innovations, noting improved boarding speeds resulting from the MBTA pass program, and its experience with very low fares in off-peak periods.

Paul Dygert, Transportation Program Manager of Peat, Marwick, Mitchell and Co., presented a paper on transit research needs. He emphasized that transit service and pricing policies have to be based on both the objectives that transit hopes to meet, and the needs and preferences of the specific market sub-groups related to the objectives. He concluded that transit commonly does not adequately tailor services to the needs and preferences of its present and potential users and that it must do so if it is to have any meaningful increased impact on congestion, energy conservation, and air quality.

Ronald Hollis, Chief of the Office of Financial and Program Analysis, Division of Mass Transportation, California Department of Transportation, commented on the transit impacts of California's Proposition 13. So far, only a few operations have been very strongly effected by curtailed property tax support, but this may worsen in the future. Hollis foresees growing subsidy constraints and feels that innovative fare policies can minimize the effects of increased user funding of transit expense.

In a Charge to the Workshops, Ronald Fisher encouraged participants to offer their opinions, suggestions, and recommendations that will help UMTA improve its transit pricing activities. He reiterated the major themes brought out by other speakers, and emphasized UMTA's concern to enlist the support of transit pricing experts to help meet contemporary challenges and implement effective innovation.



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## OPENING COMMENTS

ALINDA C. BURKE  
VICE PRESIDENT  
PUBLIC TECHNOLOGY, INC.

*It is my pleasure to welcome you all to this meeting on Transit Pricing Techniques to Improve Productivity, A Forum on Recent Advances and New Directions. Our purposes are to discuss the state-of-the-art in transit pricing policies and related issues and to chart new directions to guide UMTA's transit pricing research and demonstrations program.*

*I would like to say just a few words about the sponsors of the forum.*

- *The mission of the Pricing Policy Innovations Division of the Office of Service and Methods Demonstration, Urban Mass Transportation Administration, U.S. DOT, is to develop and test innovative pricing-and fare-related policies and associated service improvements to promote public transit development and reduce reliance on single-occupancy auto use. We'll hear more in the next few minutes on UMTA's demonstrations and pricing program from Ron Fisher and Bert Arrillaga.*
- *The Urban Consortium for Technology Initiatives, founded in 1974, provides a forum for identifying problems faced by the nation's most populous cities and counties and a means of guiding the effort to solve these problems through the application of technology. The Consortium brings together local and Federal officials, private industry leaders, and representatives of the research community, encouraging public and private investment in the development of new products and systems to improve the delivery of local public services and provide cost-effective solutions to urban problems.*
- *Public Technology, Inc. (PTI) is a non-profit, public interest organization established in 1971, to facilitate research, development and the application of available technology to State and local problems. PTI serves as secretariat to the Urban Consortium. PTI's primary functions include consolidating the urban research and development market, minimizing the risk involved in developing technology for the cities, assisting in the implementation and operation of new technologies, and establishing lines of communication among State and local governments.*

*Briefly, I'd like to offer a lay-person's perspective on the subject of transit pricing changes.*

*In general terms, pricing changes affect productivity by attracting more users, making transit more convenient, reducing boarding delays, increasing revenue and by improving analysis and allocation of transit costs. However, the assessment of innovative pricing concepts and methods is not extremely advanced (there are more questions than answers), and is also quite technical in character. Pricing innovations seem to be based on issues such as elasticity, cross-subsidy, and marginal costs, which to many people are difficult to understand.*

*From my perspective, which I think is similar to that of local officials and the general public, I'd like to stress the following. There is a need to demystify these here-to-fore technical issues and concepts if transit pricing techniques are to realize their potential role in improving transit productivity. Public understanding and acceptance of complicated pricing mechanisms will require effective communication of the need for and effects of pricing innovations both to elected officials and the general public. The public seeks information about the relative costs and benefits of transit service. Our response should indicate how pricing structures and innovations can improve the equity as well as the efficiency of transit services. Furthermore, the political sensitivity of fare policy makes the involvement of local political leaders in the design of pricing innovation essential to their adoption.*

*Finally, the need to advance technical knowledge within the transit pricing field is also important. I'm confident that in the next two days this assembly will recommend how this can best be done. However, to me it seems equally important that issues of pricing, equity, efficiency, and productivity (and the relations between these) become less the domain of economists and experts, and of more concern to a broader group of transportation decision-makers. If we identify needed technical advances, and mechanisms for broader dissemination, acceptance and implementation of research results, we will achieve the goals of this forum.*

PRICING INNOVATION  
AND THE UMTA DEMONSTRATION  
PROGRAM

RONALD J. FISHER  
DIRECTOR, OFFICE OF SERVICE  
AND METHODS DEMONSTRATIONS  
URBAN MASS TRANSPORTATION ADMINISTRATION

*I also am pleased to welcome you to this meeting, and thank you for your participation. My comments will briefly provide some background on UMTA's Pricing Innovations program.*

*The Service and Methods Demonstration Program is involved with all forms of innovative public transportation services that include variations in the delivery of conventional fixed route transit service and all types of paratransit service. Cutting across this broad interest in transit service is the issue of fares--should transit be provided free, at some heavily subsidized level to accomplish social or welfare purposes, or should the fare be set at or close to a break even level? The answer may well be all of the above depending on the nature of the target group for the service. UMTA's pricing program has sought to clarify these issues and encourage improved pricing practice in the transit industry.*

*Pricing of transit has a long history of acceptance. It is only recently that it has become a more complex process because of the multiplicity of public objectives that accompany the allocation of tax dollars to assist transit operations. Our purpose at this Transit Pricing Forum is to capture the latest thinking on the appropriate approach to policy analysis in this area and the methodology available to support such analyses. It is the continuing intent of the Service and Methods Demonstration Program to assist policy development in financing and pricing along with the development of promising new public transportation services.*

*It is becoming more apparent as we approach the 1980's that the focus is returning to the transit user as a source of revenue. Several basic principles are emerging for consideration:*

- Fares should be integrated so that while there may be a mix of services, the user has the convenience of one fare.*
- Non-cash revenue collection is preferred from an operating perspective, and by many users.*

- *Fare structures should be simple yet still identifiable by market segment.*

*While not directly within the scope of this forum, it is also clear that as the focus shifts back to the fare box as a source of revenue, corresponding attention must be given to the pricing of auto use. Contributing to the substantial shift away from transit in the 1950's and 1960's was the significant upward climb in the cost of private transportation remained constant or fell.*

*However, there is a unique opportunity ahead to apply transportation pricing policy more universally. Since the 1960's, the public sector has attempted to reverse the imbalance by taking over most of the previously privately operated transit systems. Now, however, it appears that there are inadequate public resources to achieve the public objective of modal balance through tax subsidies, as evidenced by the renewed focus on transit fares. Consequently, pricing techniques applied to the auto, i.e., parking spot and corridor pricing, and area license schemes will become an increasingly attractive strategy for achieving the public objectives of increased ride sharing via transit and paratransit.*

*Although auto pricing techniques do not currently have much political support, neither did parking meters in the 1940's nor reserved lanes for buses in the 1950's and 1960's. Yet, these restraints on the automobile are generally accepted in the late 1970's. Consequently, while this Forum has focused on the pricing of public transportation services, it is recognized that we must prepare to view the pricing of transportation comprehensively. Complementing transit pricing activities, a great deal of work is also underway in the Pricing Policy Division of the SMD Program to develop operational tests of the various pricing techniques to discourage low occupancy auto use. It may be timely to discuss these results at a meeting similar to today's, in the early 1980's.*



DIRECTIONS FOR TRANSIT PRICING  
RESEARCH AND DEMONSTRATIONS  
AND THE PURPOSE OF THIS FORUM

BERT ARRILLAGA  
CHIEF, PRICING POLICY DIVISION

*I want to give you a warm welcome to this Forum on Transit Pricing Techniques. It has been over a year since we realized the time was right to hold this Forum, and I am very happy to see it become a reality.*

*The purpose of this forum is:*

- *To bring together a mix of transportation professionals with an interest or responsibility in transit operating policies--transit operators, trade association and labor union officials, Federal, State, and local government officials, and university/private sector research engineers.*
- *To discuss key operational and research issues regarding pricing policies.*
- *To report on existing price/service innovations that are being performed by local transit properties.*
- *To identify major pricing related problems faced by the industry in their daily operations and identify changes that may be occurring in practices and policies, and*
- *To recommend research and demonstration activities necessary to improve policy making that can be immediately considered for implementation by the Office of Service and Methods Demonstrations.*

*I would like to emphasize the last statement. We would like this forum to be an opportunity for you to express your views on the program and the direction you think it should take in the near future. We have taken the liberty of providing numerous abstracts and short workshop presentations of the different projects we are supporting. However, I do hope these are brief and would serve only to stimulate discussions. One of the reasons we are gathering here in this forum is for you to lay out your views regarding the future direction of the demonstration program. An idea of where we are heading or where we should head may be easily drawn by having an idea of what we have accomplished in the past, and what the plans are for the near future.*

I should warn you at the outset that because of your yearly budget cycle there is a tendency for a short term outlook of projects. Thus, we often do not look beyond a two year project development period.

Low-Fare and Fare-Free Transit--Title II of the Urban Mass Transportation Act of 1964 gave us the responsibility to enter into demonstration programs of low and fare-free transit. Because of the expected costs of these demonstrations, we took a careful approach to experimenting in this area implementing the most cost effective projects.

We implemented two off-peak fare-free demonstrations in Trenton, New Jersey and Denver, Colorado and one fare-free demonstration oriented toward the CBD in Albany, New York. We have plans to implement one additional CBD fare-free demonstration in large active downtown and two or three fare promotional demonstrations.

Once this effort is completed, we will not implement other demonstrations in this area. It is our perception that the transit community is increasingly concerned with the capturing of fare revenues to cover escalating costs in a fair and equitable manner for different market groups with different abilities to pay. We intend to concentrate in this area.

Fare Prepayment and Post Payment--The process of collecting such fares at boarding is outdated, causing inconvenience to users and operating inefficiencies to the operator. There is ample room for the encouragement of numerous methods and techniques to improve fare collection.

Early efforts in this area were aimed at determining the payoffs of having major employer centers enter into a partnership with transit agencies to aid in promoting and distributing fare prepayment instruments. Numerous distribution methods are being tested, including payroll deduction in Sacramento, California and Jacksonville, Florida.

We were also interested in determining optimal price discounts that will maximize the take up pattern of fare prepayment instruments while minimizing fare loss. Thus, we implemented two price reduction of fare prepayment instruments in Austin, Texas and Phoenix, Arizona.

New efforts in this area aimed at studying the specific market preference to different prepayment mechanisms or elements of fare prepayments. For example, under what circumstances and what markets prefer daily, weekly, or monthly passes? What are the advantages of post billing procedures as compared to prepayment? Can credit cards, bank cards, or even special transit cards be effectively used for the daily accounting of trips and post billing? Could these post billing procedures be used with minimum hardware?

As you well know, the transit community is quite concerned about recent issues of tight money, less resources for operating subsidies, and a greater desire to capture more revenues from the farebox. We have initiated some demonstration efforts to deal with these problems. The demonstrations are designed to encourage the payment according to service provided. Thus, we are encouraging the formal tests of distance based fares, time differentiated fares, or value based fares depending on service quality.

Fare Integration for Intermodal and Interagency Coordination--  
The basic aim of this is to encourage mode integration and agency coordination by establishing simplified joint fare structures in a region where transportation is provided by several operators or where more than one mode is used.

Fare integration would produce a passenger fare structure with identical fares for broken or continuous journeys of the same length regardless of the mode, or combination of modes, used. Thus, passengers within the area covered would be able to change vehicles as required, with all fare barriers eliminated. The revenues from the joint fare program could be divided among the agencies in some proportion to the travel costs generated by the traveler.

While only one project is proposed for the near future, present negotiations have shown widespread interest in this area. San Francisco, Chicago, New York, Montgomery County, and Bridgeport have shown interest in testing fare integration methods. Atlanta and Washington, D.C. are moving forward on related schemes and will cooperate in the evaluation of their local initiatives.

Self-Service and Cancelling Fare Collection System--Self-service fare collection can be defined as a system in which the regular operating staff of transit vehicles or trains do not normally intervene to collect fares, nor to sell, cancel, or check tickets or passes, nor to check these operations carried out by the passengers themselves, who have electro-mechanical devices available for this purpose. Instead a random post check of passengers is made to determine compliance similar to what is done for parking meters in the U.S. The function might be picked up as part of the street supervising and traffic check operation now carried out by U.S. transit properties. The elimination of the supervision of the fare collection activity by the driver allows free access to the vehicles by all the doors and yields an improvement in the speed. The removal of fare collection responsibilities from the driver also permits the transit property to implement a highly flexible fare structure having a wide variety of fare classifications and payment mechanisms which could not have been adopted using conventional techniques without significant driver involvement and service delays. It is especially important to develop such a scheme, if a mix of different types of services and pricing policies are ultimately to be implemented in a large urban area.

At present, a review of self-service self-cancelling operations in Europe has been completed. Numerous demonstration concepts have been identified to be tested in the near future. It is expected that more project concepts will be implemented over the next couple of years.

Fare and Service Level Change--Experiments are being designed to provide guidelines to the transit industry as to the benefits and disbenefits of introducing various levels of fare changes and service improvements.

We will build on this effort to test carefully structured fare and service changes so as to be able to compute the effects on:

- a) transit markets (new vs. old riders, peak vs. off-peak, shoppers, students, elderly and handicapped, premium services),
- b) costs, both operating and labor, and
- c) modal split from auto and non auto users.

Fare and service elasticities will be computed by different levels of the following stratifications: a) fare changes (systemwide, temporarily, or geographically restricted), b) new routes (headways, frequency, and area coverage changes), and c) improvements in hours of service, speeds, boarding, deboarding, reliability and security.

Transfer Cost Elimination and Network Simplification--Depending on the urban area and trip purposes, it has been found that ten to fifty percent of the transit trips involve transfers for reaching final destinations. Most transit systems require an additional fare for transferring among vehicles where already the inconvenience and the waiting time associated with the transfer is a sufficient disincentive for the transit trip.

The objective of this demonstration is to evaluate and study the effect of transit transfer fares on transit usage and to develop means for eliminating transfers and simplifying network routes. A detailed study is being performed describing the extent of the transfer problem, its disadvantages to the user, and possible benefits that it provides to the transit operator. Specific recommendations will be made for demonstration concepts that should be undertaken to minimize problems associated with transfer mechanisms.

It is expected that short term demonstrations will be undertaken in numerous cities to test the impact of eliminating transfer fares and performing network route simplifications. From a selective list of transit properties, information will be obtained on transit

transfer usages in situations of higher transfer usage, including the factors leading to such usage. Information will be obtained to determine the revenue loss to the transit operator due to the elimination of transfer charges and the added convenience to the transit user. Strategies will be developed for developing alternative ways of dealing with the cost and convenience of transit mechanisms. These strategies may include ways of collection transfer charges without the problem of involving inconvenience to the transfer user and improving the accountability of transfer passengers to the transit operator.

Some of the questions to be addressed will include: Which transit trips are most accountable for transfers? Which market segments are more prone to transfer? How does the marginal cost of transfer charges to the originating fare affect transfer usage? How do transfer revenues affect total operating costs? How does the disincentive of transfer compare to the disincentive of transfer waiting time?

In closing, I hope the description of the types of projects we are considering for the next two years will provide the basis for the discussions of key research issues and the general content of the Pricing Program. I have reviewed the abstracts you have submitted, and they have indicated we are heading in the right direction. I commend you for the work you have done in preparing for this Forum and for the work that lies ahead during the next two days.

## WORKSHOP I: TRANSIT FARE PREPAYMENT SUMMARY

The Transit Fare Prepayment Workshop considered several kinds of prepayment programs (tickets, passes), employer-oriented pass programs, the pass pricing, and fare prepayment for intermoded trips. A great many needs or information gaps were identified, and three major recommendations were generated.

### Workshop Consensus

There were three general areas of consensus:

1. The first area focuses on the transit operator's immediate need for information on the design and implementation of prepayment programs. Though many issues surrounding prepayment remain unanswered and must be evaluated, the group's consensus was that information such as that presented in the workshop is very valuable and should be disseminated, possibly in tentative or evolving format, to a wide range of transit operators and local officials. A Prepayment Guidance Manual would include demonstration findings, data from on-going programs, suggested approaches to different areas of emphasis, resources available, contacts, etc. This recommendation supports the major emphasis of a key speaker at the forum, Jim Scheiner, who stressed the need to achieve a major shift of prepayment, and that diversity is needed in the development of prepayment plans. The provision of UMTA guidance on prepayment was seen as the best approach to encouraging this extension and adoption of prepayment methods.
2. The second and somewhat less general area is based on the relative success of employer-based programs (Boston, Sacramento) and the strong potential that these hold for the future. Transit as an employee benefit is likely to gain increased acceptance, both in terms of employer involvement (e.g., administrative support, payroll deduction) and subsidy. Promotion of employer subsidy, at least to the extent of auto and parking related subsidies, could become an important strategy to minimize effects of future fare increases. While pass programs oriented to all transit users help generate revenues, greater prospect for extensive market penetration at lower public cost may be achieved through employer-based programs. This emphasis would reflect the importance of convenience as a factor motivating pass use.
3. The third area of consensus integrates the growing importance and acceptance of fare variations, such as distance-based fares and peak-off-peak differentials, with the attributes of passes. Passes of different denomination might be promoted to encourage redevelopment of distance-based fares, as passes can ease the problems of zone fare collection. Similarly different priced peak and shopper's passes could ease introduction of peak-period surcharges, with off-peak passes operating as permits requiring supplement fares in peaks. Technologically-advanced fare collection systems are also desirable to facilitate increased fare variation. The possibility that prepayment may enable transit to

recover increased revenue and be more efficient is a perspective that seems to have been overlooked by the more immediate questions such as rider response to passes, appropriate discounts, and distribution methods. This broader or longer-term orientation should become a stronger part of UMTA prepayment demonstrations.

### Unresolved Issues

More specific issues that remain unresolved are listed below. Investigation of these areas might best be accomplished through very focused demonstration or market research activities. Collaboration with systems where fare prepayment is fully institutionalized (e.g., London Transport) may also prove valuable.

- Far more analysis of the elasticities of demand with respect to price for specific user subgroups is needed. Prepayment plans, to optimize benefits, should reflect different user price sensitivities, to the extent feasible. Experience with student fare plans and family weekend passes has not been adequately documented. The potential for shifting peak to off-peak traffic through prepayment plans has not been verified. In general, prepayment options further complicate efforts to predict the effects of price variations on transit demand. Very focused investigation, perhaps using micro-survey techniques, is warranted.
- Analysis of prepayment programs has focused on aggregate ridership growth. Assessment of individual rider loss in systems where total ridership is growing may prove valuable.
- Impediments to integration of fares in multi modal transit regions need to be evaluated, and the potential impact of fare integration ascertained.
- The reactions of pass vs. cash-paying users to fare increases need to be evaluated. Can use of prepayment be institutionalized by raising fare of cash-paying riders? Can prepayment plans be used to camouflage or reduce the perceived effect of fare increases? Can prepaid passes ease reintroduction of distance-based fares?
- We still do not know enough about the administration costs of prepayment and if net operating cost savings can result (e.g., reduced dwell times due to faster boarding). An assessment of net operating costs of prepayment programs would be useful.
- What price discounts on prepayment mechanisms are justified due to increased user appeal, increased operating efficiency, or administrative savings? Appropriate long-term pricing and short-term promotion policies should be considered.

- More information is needed on the types of support programs that, along with fare prepayment pricing policies, can effectively encourage desired travel behavior or other objectives (for example, off-peak pricing with large flexitime program).
- Going beyond individual fare prepayment mechanisms, appropriate combinations or sets of fare prepayment plans should be developed. User preferences given the choice between similar options (e.g., between short and long-term plans or passes and tickets) should be evaluated.
- Should passes be transferable or should they be personalized? How would this effect total sales, peak-off-peak distribution of trips, etc.
- What off-peak group riding plans are feasible? What success have these had to date?
- Can multi-ride tickets be sold at quantity discounts such that the per ride cost of a twenty-ride ticket is less than that of a ten-ride ticket?
- More information needs to be documented on the effectiveness and costs of different prepayment distribution systems: through employers, direct mail, third party, and over-the-counter. Should credit card payment of prepayment plans augment existing cash payment and payroll of prepayment plans augment existing cash payment and payroll deduction methods?



## WORKSHOP I: TRANSIT FARE PREPAYMENT ABSTRACTS

Co-moderators: Beth F. Beach, Sacramento Regional Transit District  
Raymond Shea, Regional Transportation Authority, Chicago

Reporter : Patrick Mayworm, Ecosometrics, Inc.

### List of Presentations

#### Overview of Prepayment Methods, Mechanisms, and Benefits

David J. Forkenbrock, University of Iowa

1. Local Programs
  - Prepaid Ticket Sales in Wilmington, Delaware  
Stephen R. Welch, Delaware Authority for Regional Transit
  - Employer Marketed Passes in Boston  
Ernest S. Deeb, Massachusetts Bay Transportation Authority
2. UMTA Demonstrations: Employer Involvement
  - Sacramento - Implementation; Evaluation  
Beth F. Beach, Sacramento Regional Transit  
Michael Holoszyk, SYSTAN, Inc.
  - Jacksonville - Implementation; Evaluation  
Ruth Sargent, Jacksonville Transportation Authority  
Thomas E. Parody, Charles River Associates, Inc.
3. UMTA Demonstrations: Promotional Discount of Prepaid Passes
  - Phoenix Implementation  
Chester "Ed" Colby, City of Phoenix
  - Austin Implementation  
Patricia Gregory, City of Austin
  - Evaluation of Phoenix and Austin Demonstrations  
John Crain, Crain and Associates
4. Fare Prepayment for Intermodal Coordination
  - European Examples  
Michael Beesley, The London Graduate School of Business Studies
  - American Examples: Chicago and Washington, D. C.  
James W. Kaempf, Regional Transportation Authority, Chicago  
Tom S. Brinton, Washington Metropolitan Area Transit Authority

#### Project Development and Further Innovations

Patrick Mayworm, Ecosometrics, Inc.

WORKSHOP; TRANSIT FARE PREPAYMENT

SUBJECT : PREPAYMENT METHODS, MECHANISMS, AND BENEFITS

TOPIC : OVERVIEW

SPEAKER : David J. Forkenbrock (319) 353-5001  
Urban and Regional Planning  
University of Iowa  
Iowa City, IA 52242

SUMMARY OF MAJOR POINTS:

Transit fare prepayment has been with us for over a half century, and is a part of the marketing programs in nearly all properties. Though prepayment accounts for a relatively small fraction of all boardings, it is widely recognized that prepayment contributes to increased ridership through greater convenience and user cost savings. As important as cost savings are, most studies have indicated that convenience is the key user benefit of prepayment.

Improved convenience through prepayment may be vital in making fare increases palatable to the consumer. Clearly, higher fares, brought on by transit improvements, cost increases and subsidy constraint, have the potential to stifle transit revival. But an important factor in consumer opposition to higher fares is the highly visible way in which they are paid. Users must pay at the time service is provided, usually with correct change. Expenditures involved in using the auto are well-hidden, with the actual private cost (to say nothing of social costs) normally underestimated substantially. Prepayment moderates the visibility of fares, thus reducing sensitivity to fare change, and makes transit more comparable to auto use.

Making payment for prepaid passes convenient further reduces the negative consumer reaction to fares (and fare hikes). Several transit properties accept major credit cards in the sale of passes. Utilizing the technology of 24-hour banking, vending facilities could allow pass purchase with credit cards at remote sites. An added benefit is that the stigma of paying in advance for a service (auto users post-pay) would be dispelled by lag in credit card billing. Going one step further, special credit cards issued by the transit provider itself show potential. A major advantage of this more advanced scheme is its compatibility with zone fares. Insertion of the card upon boarding and leaving the vehicle allows precise pricing schemes.

Keeping things simpler, one way in which prepayment can be used to increase revenues is to offer several forms of instruments (e.g. passes), each good for a different interzonal distance. The operational problems of zone fare collection are thus diminished, and user discontent with multiple payments is avoided.

A related potential of prepayment is to facilitate peak-hour pricing. Peak and off-peak passes could be offered; if the latter were used during peak hours, they would become permits with a supplementary cash payment required. This cash payment acts as an out-of-pocket disincentive to riding during the peak.

Sale of prepaid transit instruments at the workplace deserves stronger promotion than it has received to date. Raising fares would be a particularly fortuitous time to secure employer subsidy of passes. With such subsidy, users may perceive the pass to be a bargain. Employer benefits include reduced parking requirements, an expanded pool of potential workers and improved employee attendance.

For prepayment to reach full potential in increasing user-generated revenues, several practical issues may be addressed. In the case of passes or permits, a realistic break-even point must be the basis for pricing. To the extent that transit riders are economically rational when it comes to prepayment, they have to be quite certain that they will make at least the number of trips needed to enjoy savings. An analysis of commuters in Detroit indicated that expected cost per trip assessments are quite often made.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Transit fare prepayment offers significant potential to directly and indirectly improve transit and attract riders. UMTA should investigate some of the specifics associated with prepayment, e.g. fare elasticities for prepaid riders vs. cash-fare riders, and other points elaborated above.

#### KEY LITERATURE REFERENCES:

Huron River Group, Inc. Transit Fare Prepayment. Final report prepared by W. R. Hershey et al. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1977. Available from NTIS - (PB 265-277)

WORKSHOP: TRANSIT FARE PREPAYMENT

SUBJECT : LOCAL PROGRAMS

TOPIC : PREPAID TICKET SALES IN WILMINGTON, DELAWARE

SPEAKER : Stephen R. Welch (302) 658-8960  
Delaware Authority for Regional Transit  
P.O. Box 1670  
Wilmington, DE 19899

SUMMARY OF MAJOR POINTS:

The Delaware Authority for Rapid Transit strongly relies on prepaid tickets, with 65 percent of its revenue coming through this mechanism. The program has existed for a number of years, and has recently been the focus of expanded marketing efforts utilizing discounts, temporary promotions, etc. Administrative costs of tickets are small, for both production and distribution, and the use of tickets mitigates the transferability problem associated with prepaid passes. Tickets also provide better user data than can be derived from pass sales. "Quantity pricing" enables increased flexibility to meet the needs and preferences of particular market segments. Tickets can be sensitive to peak off-peak fare variations, e.g., by requiring double payment (2 tickets) in peaks. Analysis shows that 5-7 percent of all tickets sold are never used. This, together with the increased demand resulting from the convenience of prepayment, justifies a small discount to ticket users. Market acceptance of prepaid passes has been strong, probably due most to increased convenience and reduction of the perceived cost of transit.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Further investigation of the attributes of prepaid tickets should be initiated. Specific issues include:

1. User preference for tickets vs. passes should be ascertained.
2. Which is more meaningful in revenue response--a permanent discount or periodic sales?
3. How important is the physical make up of the pre-paid fare in determining market acceptance?
4. Determine how tickets can be more accurately counted on a daily basis.

KEY LITERATURE REFERENCES:

Ongoing assessment of DART revenue checks and monthly ticket sale data could provide valuable market analysis and related information.

WORKSHOP: TRANSIT FARE PREPAYMENT

SUBJECT : LOCAL PROGRAMS

TOPIC : EMPLOYER MARKETED PASSES IN BOSTON

SPEAKER : Ernest S. Deeb (617) 722-5218  
Pass Program Manager  
Massachusetts Bay Transportation Authority  
50 High Street, 4th. Floor  
Boston, MA 02110

SUMMARY OF MAJOR POINTS:

Of all U. S. transit operations, the MBTA's Pass Program is the most extensive. In 1978 the Program continued its growth and accomplishments. By December, the number of participating employers reached 781, with 32,067 Passholders. These passholders represent monthly revenue of more than \$495,000 or approximately 12% of the total revenue (an increase in passholders of 42% and an increase in employers of 49% over 1977). Passholders come from 156 cities and towns in the Commonwealth. It is estimated that 4,800 new trips a day were taken by passholders using transit for the first time in 1978. This daily increase represents approximately 1,470,000 new trips per year, or 31% of the Authority's total increase in ridership for 1978, based on its ridership/revenue estimates for the year.

There is indication that employers enrolled in the Pass Program have experienced an increase in transit users among their employees, as opposed to a comparable number of employers showing no change or a slight decrease, who are not enrolled in the program. We feel this has been caused by the dissemination of information about the service within these companies.

To further increase ridership and sales, we submitted a proposal to the Commonwealth's Insurance Commissioner, requesting that committed transit users, i.e., passholders, receive a 10% reduction on their 1979 automobile insurance premium. A favorable decision on this proposal was announced in November, 1978, a first for transit in this country.

In 1978 nineteen employers paid 50 to 100% of the monthly cost of the pass for their employees. This new concept in employee benefits is responsible for the shift to transit of 22 to 34 percent of the passholders within these companies. Efforts to encourage greater employer subsidy will be a major priority in 1979. Along with encouraging subsidy, we are trying to persuade major employers to offer staggered or flexible work hours to their employees. This program, called the Variable Work Hours Program, was developed to help alleviate peak-hour congestion.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

A model or guide to serve as a Procedures Manual for any authority wishing to establish, or improve upon a fare prepayment incentive program should be developed.

KEY LITERATURE REFERENCES:

MBTA Pass Program material (basic information) is available from the above address.

WORKSHOP: TRANSIT FARE PREPAYMENT

SUBJECT : UMTA DEMONSTRATIONS; EMPLOYER INVOLVEMENT

TOPIC : SACRAMENTO, CALIFORNIA

SPEAKER : Beth F. Beach (916) 444-7591  
Sacramento Regional Transit District  
P.O. Box 2110  
Sacramento, CA 95810

SUMMARY OF MAJOR POINTS:

This demonstration was designed to increase ridership and test various marketing tools through employer involvement in the distribution of monthly transit passes to their employees, either through payroll deduction, over-the-counter sales, or some other form aimed at increasing the convenience of purchasing a pass. Efforts were also made to encourage employer subsidization of the pass.

This presentation highlights the threefold marketing program consisting of: (1) creating public awareness; (2) gaining employer participation; and (3) encouraging employee participation. Employer participation is discussed in greater depth to cover the main reason for participation versus non-participation. The effects of a 25 percent price discount for a three-month period is covered in terms of participation by employers and employees, and the advantages and disadvantages of this type of discount.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Diffusion of the information obtained in this and similar demonstrations is required. Broad recommendations for creating pass programs should be released. Options to consider are a roving seminar and a manual providing guidelines for setting up this type of program, including documentation of the results of the different techniques tested.

KEY LITERATURE REFERENCES:

SYSTAN, Inc., Evaluation Plan for the Sacramento Transit Fare Prepayment Demonstration. Los Altos, CA: SYSTAN, Inc., 1978. Available from Urban Systems Division, Transportation Systems Center, Cambridge, Massachusetts 02142.

Public Technology, Inc. SMD Briefs. Washington, D. C.: Public Technology, Inc., 1978-present. Current information on selected UMTA demonstrations. Available from Public Technology, Inc., 1140 Connecticut Avenue, N.W., Washington, D. C. 20036.

WORKSHOP: TRANSIT FARE PREPAYMENT

SUBJECT : EMPLOYER INVOLVEMENT DEMONSTRATIONS

TOPIC : EVALUATION OF SACRAMENTO FARE PREPAYMENT DEMONSTRATION

SPEAKER : Michael Holoszyk (415) 941-3311  
SYSTAN, Inc.  
P.O. Box U  
Los Altos, CA 94022

SUMMARY OF MAJOR POINTS:

Prior to project, monthly passes were available at 37 outlets in the metropolitan area. Passes cost \$12.00. Regular fare is 35¢, so a monthly pass represents an 18% discount for a daily commuter (42 trips/month). Pass sales have increased steadily since July 1976 when they became cheaper than paying cash for the daily commute. When employer pass sales began in May 1978, pass sales were about 25% higher than a year ago, although the rate of growth has been declining over time. About 20% of all riders used the monthly pass.

Prior to an employer joining the pass program, employees at that firm were surveyed. Major results from the "before" survey were:

- Among employees who use transit at least occasionally, about a third used monthly passes.
- For every five people who ride the bus every day to work, there were four people who rode one to four days a week, and for whom the monthly pass was generally not economically advantageous.
- Even among daily bus commuters (5 days/week), only 62% used the monthly pass. Of the remainder, almost half said they still didn't use the bus enough because of vacations, sick days, travel, etc. Twenty percent said it was inconvenient to buy, and 20% disliked the cash outlay. Only 7% didn't know about the pass or where to buy it.

A second employee survey was made among pass purchasers only during December 1978, the last month of a 3-month, 25% pass discount at participating employers. Key results were:

- Pass sales among participating employees increased by 89%. System-wide pass sales were about 26% higher than that would have been expected, based on pre-discount trends. In January 1979, following the discount, systemwide pass sales were 11% higher than expected.
- About 15% of those buying passes in December didn't use transit before.



- Transit usage by all participating employees during December rose an estimated 14%, which resulted in a systemwide increase of 2%.
- Former pass users who bought passes during the discount period did not change their transit usage behavior; former daily-paying users who bought passes increased their commuting use of transit by 10% but did not change their non-work trip transit usage. Former non-users made both work and non-work trips by transit, but the non-work trips comprised only about 10% of the work trips.
- Employee fare revenues during the discount were 8% lower than before the discount, resulting in a system-wide revenue loss of about 1.2%, excluding demonstration funds. Revenues from new riders attracted are likely to make up this loss within a few months.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA

Additional research on the responses of different user groups to multi-ride tickets vs. unlimited use passes is required. In addition, a comprehensive effort should be initiated to collect ridership and pass/ticket sales data from all transit systems to determine what market shares are captured by different priced tickets and passes.

#### KEY LITERATURE REFERENCES:

SYSTAN, Inc. Evaluation Plan for the Sacramento Transit Fare Prepayment Demonstration. Los Altos, CA: SYSTAN, Inc., 1978. Available from Urban Systems Division, Transportation Systems Center, Cambridge, MA 02142.

SYSTAN, Inc. "Summary Reports on Employee Surveys" Unpublished reports. n.d. Available from SYSTAN, Inc., P.O. Box U, Los Altos, CA 94022.

WORKSHOP: TRANSIT FARE PREPAYMENT

SUBJECT : EMPLOYER INVOLVEMENT DEMONSTRATIONS

TOPIC : JACKSONVILLE IMPLEMENTATION

SPEAKER : Ruth Sargent (904) 633-2643  
Marketing and Service Development Manager  
Jacksonville Transportation Authority  
1022 Prudential Drive  
Jacksonville, FL 32207

SUMMARY OF MAJOR POINTS:

At the time of grant award in October 1977, the project scope and schedule remained flexible and subject to change in response to an impending revision of the overall system fare structure. During the year's delay before project implementation, a comprehensive fare analysis was conducted for JTA by UMTA consultants. Other preparatory tasks included: hiring of project manager, selection of advertising/public relations and data collection subcontractors, screening and selection of potential employer participants by designated categories, pass design and pricing analyses, and conducting initial (pre-fare increase) on-board passenger survey (September 1978). Actual project implementation commenced in October 1979, when the new fare took effect. Remaining work tasks, primarily enrollment of participating employers and preparation of collateral materials, were compressed into a three month period. Distribution of passes began February 15th.

Employer solicitation was generally accepted with surprising enthusiasm and high-level participation. However, initial month's pass sales were disappointing. Re-evaluation and revision of employee communication strategies is underway, as well as moves to ease some restrictions on pass use. Attempts to minimize revenue loss and crossover by present weekly pass users to cheap monthly pass and to determine whether the pass is overpriced and over-restricted are especially intricate because of heavy emphasis on radial routing and resulting transfer problems in Jacksonville.

RECOMMENDATION FOR FURTHER WORK IN THIS AREA:

UMTA-sponsored facilitation of interaction between properties presently operating Transit Fare Prepayment projects is suggested. Eventual UMTA manual with special attention to practical adaptations by other properties would be particularly valuable.

KEY REFERENCES:

McGillivray, R.G. "Plan for Demonstrations of Transit Fare Prepayment Promoted by Employers in Jacksonville." Working paper No. 5066-6-4. Washington, D.C.: The Urban Institute, 1977.

WORKSHOP: TRANSIT FARE PREPAYMENT

SUBJECT : EMPLOYER INVOLVEMENT DEMONSTRATIONS

TOPIC : JACKSONVILLE EVALUATION

SPEAKER : Thomas E. Parody (617) 266-0500  
Charles River Associates, Inc.  
200 Clarendon Street  
Boston, MA 02116

SUMMARY OF MAJOR POINTS:

The Jacksonville Transit Fare Prepayment (TFP) demonstration makes monthly transit passes available for purchase by employees at their employment sites with minimum of personal inconvenience. The evaluation will identify and measure the impacts on the transit operator and participating employees and employers. (Unlike the Sacramento demonstration, this pass will not be sold to the general public).

Employer concerns being evaluated include the reasons behind the decision to participate, or level of participation. Will the firm subsidize the price of the pass? What type(s) of distribution procedures are most effective? What type and level of internal market and promotion is desirable? A second group of employer related issues examines the costs and benefits of the TFP program to participating employers. For example, what are the resources required to maintain the program? How do they vary by type of distribution program. Can employers reduce the cost of providing parking spaces for employees? The major data source will be personal interviews with employers.

Employee issues being analyzed consist of the basic decision to purchase a pass, and the extent this decision is influenced by actions undertaken by employers (e.g., subsidies). A second set of issues is concerned with evaluating changes in transit travel behavior, drawing on before and after employee surveys. Additional trips made with a pass will be categorized by trip purpose.

Transit Operator impacts being measured include ridership and revenue changes, administration and distribution costs, transit productivity changes, and improvements to cash flow. The major data sources include transit operator records and before and after employee surveys.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Fare prepayment plans providing varying discounts for peak and off-peak service should be evaluated.

KEY LITERATURE REFERENCES:

Charles River Associates. Evaluation Plan: Jacksonville Transit Fare Payment. Boston: Charles River Associates, 1979.

Parody, Thomas and Daniel Brand. "Forecasting Demand and Revenue for Transit Prepaid Pass and Fare Alternatives." Paper presented at the 58th Annual Transportation Research Board, January 1979. Mimeographed.

WORKSHOP: TRANSIT FARE PREPAYMENT

SUBJECT : PROMOTIONAL DISCOUNT OF PREPAID PASSES

TOPIC : PHOENIX IMPLEMENTATION

SPEAKER : Chester "Ed" Colby (602) 262-7242  
Public Transit Administrator  
City of Phoenix  
251 West Washington Street  
Phoenix, AZ 85003

SUMMARY OF MAJOR POINTS:

In 1976, a Five-Year Transit Marketing Model was developed by the City of Phoenix Public Transit Administration. The goals of the marketing program were to increase average daily bus ridership from 20 to 112 thousand. These marketing efforts were to be undertaken in concert with an accelerated operational improvements program intended to reach a much improved transit system by 1982-83. However, during this accelerated transit program, the overall ridership productivity was not to decrease.

The marketing program would be directed toward specific target groups through use of a fully integrated communications effort. Market research included a market segmentation study which pointed out that Phoenixians were terribly uninformed about public transportation. Over 60% of the nonriding sample knew exactly nothing about bus routes, schedules and fares. One-third knew "just a little" and only 2-4% said they knew a great deal about public transportation in Phoenix.

The initial marketing objective thus became: to increase public awareness about the Phoenix bus, where it goes, when it goes, where to get it, and how much it costs. This whole program was designed to increase adult fare ridership.

In late 1977, the "big 10" ticket book was introduced. The principle advantage was convenience to the bus rider, low initial investment and since it was a "drop" ticket, it should reduce bus stop dwell time. The Ten-Ride Ticket was thought to be a better item to discount during the 20 and 40% transit sales. During this time, the system average speed was increased by nine-tenths of a mile per hour.

In 1978, major marketing efforts included two separate reduced fare demonstrations jointly sponsored by UMTA and the City of Phoenix. Transit Sale I, a 20% discount on books of 10 and 20 ride tickets, plus monthly passes, was held in January-February. Transit Sale II, a 40% discount, was held during September-October.

Marketing efforts included a multi-media mix including newspapers, television and radio commercials, outdoor, direct mail, in-bus posters and counter display cards at over 100 ticket outlets. Publicity and public relations added strength to the total effort. Phoenix Mayor, Margaret T. Hance, a strong booster of public transit, appeared at numerous press conferences to introduce segments of the campaign. Total advertising impressions reached over 34 million.

Awareness of the attributes of the transit system continues to improve. In February, 1979, daily ridership increased to over 40,000 patrons per day. This was some 13,000 passengers per day over last year, with only a 12% increase in daily mileage. More importantly, \$100,000 extra dollars came in through the farebox.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Research conducted during the sales indicate that although system ridership is increasing, the high loss rate of current riders is alarming. Research should explore ridership retention rates in growing transit systems.

#### KEY LITERATURE REFERENCES:

McGillivray, R.G., "Reduced Price Promotion of Transit Fare Prepayment in Phoenix," Working Paper 5066-6-3, Washington, D. C.: The Urban Institute, 1977.

Public Technology, Inc. SMD Briefs, Washington, D. C.: Public Technology, Inc. 1978-present. Current information on selected UMTA Public Technology, Inc., 1140 Connecticut Ave., N.W. Washington, D. C. 20036.

Evaluation reports will be available in late 1979.

THE IMPORTANCE OF PRICING  
AND FARE INNOVATIONS

JAMES T. SCHEINER  
DEPUTY SECRETARY FOR ADMINISTRATION  
PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

*In the 2½ decades after World War II, the transit industry was decimated by the automobile--damage was far greater than anyone could have anticipated. Who would have guessed that national transit ridership would plummet from 23 billion trips in 1945 to under 7 billion trips in 1970? Who would have guessed that the industry would be completely socialized, not by national decree, but as a result of over 100 independent local actions? Who would have guessed that the financial position of the industry would erode from one of marginal profitability to one of deep deficit, with all capital improvements as well as 50¢ out of every operating dollar paid by taxpayers?*

*The current decade has been little more than a holding action for the transit industry. While Federal, State and local funding has supported dramatic transit improvements in some cities; it has only halted the decline in others. In a few, the decline has persisted despite public financial support, although at a decelerated pace. On a national basis, public financial support has not, in aid of itself, been an engine for industry growth. If transit is to grow in the 1980's, it will not be propelled by additional tax dollars. Rather, revenue dollars will be needed to do the job.*

*While forecasting conditions in the U.S. Transit Industry is as difficult today as it was after World War II, there is cause for optimism. The cost of owning and operating an automobile is rising dramatically. Depreciation, interest, insurance, maintenance and gasoline costs typically fall in the \$100-150 per month range, with parking and tolls additional. Transit-preferential highway facilities, coupled with automobile restrictions, are becoming imperative from both local and national perspectives. Not only can such projects reduce dependence on foreign oil, they can also relieve congestion to public transportation financing in New York. This raises a paradoxical question--can the transit industry cope with success?*

*A few years ago, a transit operator said to me, "We can't afford to carry any more passengers; we lost 75¢ on each passenger trip." I have come to realize that there is a solution to this problem--increase revenue through the fare structure.*

Unfortunately, the transit industry is singularly ill-equipped to convert a strengthening market into additional revenue. Reliance on exact fare coin collection as the principal transit revenue generating mechanism is obsolete. In what other industry does a customer have to search for such coin combinations as 40¢, 45¢ or 55¢ for a twice-a-day purchase? In what other industry does the seller reject a dollar bill in payment, as do some transit agencies? The dilemma facing the transit industry today is analogous to the dilemma that the telephone company would face if pay phones were the only means of making calls. Clearly, the need for the transit industry to innovate is urgent.

When the transit fare was a nickel, collecting money through the fare box was relatively uncomplicated for both the customer and the transit system. The flat quarter fare (now a vanishing breed) had the same advantages, with the quarter acting as a token in common circulation. Today, with the many large metropolitan areas having a 50¢ transit fare, and with the 50¢ fare under examination by several other transit agencies, the need for an alternative to cash fare payment becomes acute. Four years ago, when the Milwaukee transit system raised its fare from 50¢ to 60¢, revenue actually declined. While such phenomenon is unlikely to occur again today, it does signal that the impact of a fare increase may be compounded above the 50¢ range.

At whatever price level, reliance on cash fare collection limits options for the transit manager. If a small revenue increase is needed to balance an operating budget, the manager must raise the fare by a full nickel. Such an action will be visible, and may be unpopular. Non-cash payment plans can alleviate this situation, especially where discounts are offered. They also permit "fine-tuning" of revenue to precisely meet fiscal objectives.

Not only does cash payment limit the transit manager, it also inhibits the customer from making better utilization of transit service. There is something immediate, and distasteful, about paying cash for each and every trip. Retailers have found charge accounts to be a boom for sales. In places where transit advance payment plans have been tried, the results are encouraging. In Dallas, for example, the transit system accompanied a fare increase with a monthly pass plan and a \$5.00 punch card plan. In an internal memo, the DTS controller describes the results as follows:

"During the first months of fiscal 1978, DTS has operated approximately the same number of scheduled miles of service as the previous year while hauling approximately 215,000 additional revenue passengers with an increase in total passenger revenue of some \$651,000."



*The Dallas experience demonstrates that, if innovative and aggressively marketed pre-payment plans accompany a fare increase, extra revenue need not be obtained at the expense of passenger losses.*

*With additional revenue needed to serve as the engine for transit industry growth, and with innovative revenue collection techniques able to mitigate the adverse impact of fare increases, every transit agency should consider reducing its dependence on fare box cash. Transit systems should deliberately chart a course which leads to non-fare box payments providing the bulk of passenger revenue. Just as no two transit agency fare structures are alike today, no two courses to achieve fare pre-payment goals will be alike. This diversity is welcome. It reflects differences in taste and culture across the nation's urban areas. UMTA's Service and Methods Demonstration Program, with its variety of pricing demonstration projects, supports diversity. At this conference, we are responsible for extending the horizons of innovation. We are the innovators.*

*Technology is the siren song of the innovator. It beckons with a promise of exciting breakthroughs. In transit fare collection, the concept of credit card billing, incorporating length of trip and time of travel factors, is easily imagined. Perhaps there has never been an environment more hostile to such a system, however, than the transit bus. While we must press ahead with technological innovation, particularly in the rapid transit area, I believe that most of the breakthroughs in transit fare collection will be procedural.*

*Where should we look for these procedural innovations? The first place to look is within the transit industry--in such places as Portland, Dallas, Pittsburgh and Boston, as well as the UMTA demonstration cities. Where non-cash revenue collection is working, it should be documented, reported and publicized.*

*The second place to look for revenue collection ideas is in other industries. Where would doctors and hospitals be without the payroll deduction method of paying health care costs? For that matter, where would the Federal government be without payroll deduction? Payroll deduction for transit fares is an idea whose time has come. Where employers subsidize parking, they should also subsidize transit. Not to do so is discriminatory to the employee as well as detrimental to energy conservation and environmental improvement efforts. At the very least, the transit agency should offer significant public relations benefits to employers who support pre-payment programs. As a further step, governments at the local level should consider legislating incentives or penalties to encourage employer transit programs in central business districts.*

*Enrollment by mail in transit clubs is another idea adapted from a successful private industry practice. These clubs could offer special transit shoppers' bargains and give-aways as well as the transit pass. With these and other transit pre-payment concepts, there must be a sales effort. Rather than waiting for people to drop their coins into the fare box, the transit agency must aggressively pursue subscribers.*

*After looking at practices in transit and other industries, there may still be room for a few new ideas. An example of a relatively new idea came to light in a recent labor negotiation. The transit system's operators had been selling tickets, but they objected to ticket sales on the grounds that operators were held responsible for revenue losses. To address this problem, we developed a concept of "revenue loss reimbursement," whereby the operator would buy his tickets at 95-97% of face value, the remaining 3 to 5% would be the operators to keep, as a non-taxable reimbursement for loss.*

*Operator distribution of a pre-payment ticket or pass has two major advantages: first, it is convenient for patrons; second, it creates an entrepreneurial environment for the operator. The major disadvantage of an operator-administered payment plan is that it significantly expands the workload of an individual whose principle responsibility is safe, dependable operation of the vehicle. In systems which handle high volumes of passengers, operator administration of a pre-payment plan would not be feasible.*

*In closing, I would like to stress three points which are vital when considering innovation in transit fare collection:*

- *Revenue increases are needed to support transit industry growth in the 1980's--increased reliance on revenue growth is essential, both to offset inflation and to support service expansion.*
- *Cash payment into the fare box is an obsolete way to collect the bulk of transit industry revenue--the principle advantage of public transit, which is its low cost relative to automobile ownership and operation, is obscured by cash payment of fares.*
- *Diversity is needed in the development of non-cash payment plans--what works for one transit system may not work for another.*

*The challenge of modernizing passenger revenue collection is enormous, but it is an undertaking which is vital to the growth of the transit industry in the decades ahead.*

## WORKSHOP II: FREE AND REDUCED FARE TRANSIT SUMMARY

Workshop II reviewed examples of fare-free off-peak, CBD fare-free programs, and other fare-based promotional incentives. The presentations and discussions yielded a consensus on current key issues surrounding free and reduced fare transit, identified issues requiring further clarification, and resulted in a set of recommended new initiatives and priorities to advance knowledge and application of fare-free techniques.

### Workshop Consensus

Participants viewed fare-free as an important component of marketing strategy for both system-wide and focused promotions and as having permanent operating policy applications. There were three areas of consensus:

- System-Wide Free Fare

Initiating a fare-free all-day experiment was not considered necessary by the workshop participants. The two major off-peak fare-free experiments in Mercer County and Denver should be reviewed in detail and follow-up long-term analysis and evaluation should be developed for one or both demonstrations, to maximize the value of the existing system-wide data. The workshop concluded that a cross-sectional comparison between Mercer County and Denver might provide insights useful in the generalization of fare-free experience regarding, e.g., demographic impacts.

A major subject of discussion was fare-free's capability as a cost-effective investment in attracting new transit ridership. Denver's year-long experience implies that new ridership may compensate, in a reasonably short time, for revenue losses during a period of no fares. Early indications are that fare-free programs may have long-term effects, and that benefits should be assessed in this context. Further, there are indications that the promotional effect of free or reduced fares may be greater than for other forms of promotion at equivalent cost levels, though it is difficult to separate the effect of fare reduction from supportive advertising and public relations. These interim findings might be further clarified by examining existing data and determining the motives (i.e., low fare vs. improved system awareness) of new riders and their retention as permanent riders.

- Focused Promotion

Fare-free incentives are suggested for a more focused application than has been implemented. Temporary fare-free service should be promoted as a tool for introducing and stimulating demand for new services, for attempting to revitalize weak routes prior to service reduction, and for encouraging transit use for shopping trips to the CBD or outlying shopping centers. In the latter case, third-party (e.g., merchant) support can be invested, either through direct subsidy or token reinforcement techniques.

- CBD Free Fare

Fare-free incentives have been shown to be cost-effective marketing tools when provided at major focal points of transit service such as a CBD. An information brochure about these demonstration projects might be prepared by UMTA and widely distributed throughout the transit industry. Disseminating information on the success of a large number of CBD fare-free experiments, as well as information on where it has failed, is an essential element in encouraging other transit properties to adopt the technique. An important aspect of the information distributed to transit properties should be a review of institutional arrangements that can be creatively applied to share the costs of continuing fare-free projects. UMTA should seek to resolve remaining issues (see below) and improve documentation of the technique by supporting evaluation of locally initiated programs.

### Unresolved Issues

In contrast to demonstration work to date, workshop participants recommended unresolved issues be addressed through small-scale implementations of fare-free incentives. There are two vital issues concerning the time required for effective use of fare-free as a promotion tool:

- How long does the promotion have to remain in effect to attract permanent increases in ridership?
- How long of a time period must elapse before a subsequent fare-free incentive will also generate ridership increases?

The following subjects could also be clarified through research, analysis of existing data, or minor new experiments:

- Specific research is needed to isolate the salient parameters of free and reduced-fare programs. For example, the effects of factors such as CBD size and economic stability and vitality, the nature of parking restrictions, and the nature of the fare-free program (i.e., limitations on fare free-hours) on the success of the program need to be ascertained. The impact of major marketing and urban redevelopment projects, on the CBD fare-free successes with which they are associated, needs to be determined.
- Existing data should be examined to determine the appeal of free and reduced fares for different socio-economic groups. This could be extended by suggesting how free and reduced fares should be targeted for more effective impact (perhaps via user-side subsidies).

- Alternatives to universal application of free fares should be investigated. Can a rider be given one free ride for every five or is it necessary for all rides to be free in order to maintain high ridership levels?
- Modelling-oriented research should evaluate fare free-data to determine if free fares act more as habit breakers than as just one component of travel demand. The suitability of rational vs. behavioral models for explaining fare-free response should be investigated.

### Suggested New Initiatives

Workshop participants recognized that the SMD program has demonstrated that a number of marketing, fare incentive, and service improvement programs are cost-effective techniques for increasing transit ridership. The workshop consensus is that a narrower definition of objectives is needed to take advantage and build upon the general effectiveness of these techniques.

To date, of necessity, the demonstrations have been framed with the objective of demonstrating the techniques' effectiveness against myriad objectives, e.g., increased ridership, reduced air pollution, reduced traffic congestion, maintenance of service equity, and service to transit dependents. The major change in the direction of the SMD program that the workshop is recommending is that since the overall effectiveness of the techniques have been demonstrated, major priorities should be on communicating the results of the demonstrations to date, and encouraging local transit operators to utilize creatively the experience across the country to meet local objectives to improve the efficiency and effectiveness of transit.

Moreover, with many transit systems experiencing ridership gains, promotional efforts will shift towards more specific concerns than simply encouraging overall increases in general ridership. Fare incentives should come to be used as tools for managing demand selectively. The workshop thus recommends that future UMTA efforts focus on more narrowly-defined objectives such as specific market segments, market areas, or route objectives, rather than on the general evaluation of techniques across multiple broad objectives.

The workshop discussed three areas of demonstration possibilities as appropriate for SMD involvement:

- System-wide Demonstrations
  - 1) Reduce the operating deficit by a stated percentage under trend by increasing permanent revenue and operating economies using free and reduced fare techniques.

- 2) Use reduced-fare passes or other prepaid mechanisms, decrease the amount of revenues collected in the fare box from the current 70-100% to at least a 50%.
- Market Segment Demonstrations
    - 1) Use free and reduced fare techniques to introduce 35% of new residents in an area to transit for non-work trips and 50% to transit for work trips over a period of 1 year.
    - 2) Test the ability of fare-free service for various length short periods with occasional repetition to retain new transit riders as regular riders making five or more trips per week over a one year period.
    - 3) Provide that 85% of transit dependent families in an area learn of transit alternatives available to them, using fare and other marketing techniques.
    - 4) Implement combined transit improvement programs offering fare incentives to markets most sensitive to fares (i.e., inner city areas) and improved levels of service to service responsive markets (i.e., commuters) with attention to equalizing subsidies applied to each market.
  - Market Area or Route Specific Demonstrations
    - 1) Increase transit trips per capita in a service area by 25% in 1 year.
    - 2) Increase ridership on a route by 50% in 6 months.

## WORKSHOP II: FREE AND REDUCED FARE TRANSIT ABSTRACTS

Co-moderators: John J. Gaudette, Denver Regional Transportation District  
Robert Prowda, Tri-County Metropolitan Transportation  
District of Oregon

Reporter: Vincenzo Milione, Urban Mass Transportation Administration

### List of Presentations

- Travel Demand and Research Focus  
Michael A. Kemp, The Urban Institute
  - Operating Focus  
James I. Scheiner, Pennsylvania Department of Transportation
1. Off-Peak System-Wide Fare-Free Demonstrations
    - Mercer County, New Jersey - Planning and Implementation; Evaluation  
Richard L. Hollinger, New Jersey Department of Transportation  
David Connor, DeLeuw, Cather and Company
    - Denver, Colorado - Implementation; Evaluation  
John J. Gaudette, Denver Regional Transportation District  
Sherrill Swan, DeLeuw, Cather and Company
    - Salt Lake City Proposal  
Frank Spielberg, SG Associates, Inc.
  2. CBD Fare-Free Programs
    - Survey of Experience and Potential  
Steven B. Colman, DeLeuw, Cather and Company
    - Seattle's "Magic Carpet"  
Rod Armour, Seattle Metro
    - UMTA Demonstration in Albany, New York  
Jack Reilly, Capital District Transit Authority
  3. Free or Reduced Fares for Transit Promotion
    - Transit Fare Promotions: Survey and Demonstration Development  
Ulrich F. W. Ernst, The Urban Institute
    - Token Reinforcement for Off-Peak Ridership  
Peter B. Everett, Pennsylvania State University

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : OVERVIEW

TOPIC : TRAVEL DEMAND AND RESEARCH FOCUS

SPEAKER : Michael A. Kemp (202) 223-1950  
Transportation Studies Program  
The Urban Institute  
2100 M Street, N.W.  
Washington, D. C. 20036

SUMMARY OF MAJOR POINTS:

UMTA's involvement in fare-free and reduced fare transit demonstrations can be traced in large part to the mandate of Title II of the 1974 National Mass Transportation Assistance Act. Congressional interest in authorizing expenditures under Title II centered mostly on all-day systemwide fare abolition; there is also evidence in the language of the act of a concern for learning about the costs and benefits of such policies.

At the SMD Program's request, The Urban Institute has delineated a program of research to generate empirical evidence about the consequences and costs of a range of transit fare and service policies, with particular emphasis on fare-free services. The approach adopted was first to list exhaustively the potential outcomes of fare and service level strategies. Broadly categorized, these outcomes concern the demand for transit services, the quality of service experienced by the passenger, the operating costs, the managerial effects on the transit industry, the effects on the Urban Transportation system as a whole, the incidence of impacts, and other, longer-term considerations. The current level of understanding about each of the potential outcomes was summarized, and priorities were suggested for their future investigation.

The appropriateness of four different general research activities to appraise the more important potential outcomes was next explored. These were the analysis of existing transit operating experience, with or without the collection of new data, and the mounting of social experiments, either in a "real world" operating environment or else in some form of simulated setting. Specific studies were suggested in four general categories, and advantages and disadvantages were appraised. On this basis, priorities were recommended for Federal support for each 13 different types of study.



The most important conclusions of this program design work were that, first, the range of possible consequences ensuing from major transit operating changes (such as fare elimination) is a very broad one, and the causal processes involved are complex and very imperfectly understood. It is important that the research be very carefully designed to take adequate account of the complexities. Secondly, although Title II mentions only demonstrations of fare-free services, it was concluded that other methods of research would be more cost-effective for learning about many of the potential consequences of transit fare policies.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Kemp (1976), cited below, includes a detailed discussion of recommended projects.

#### KEY LITERATURE REFERENCES:

Kemp, Michael A. The Consequences of Short-Range Transit Improvements: An Overview of a Research Program. Washington, D. C.: U.S. Department of Transportation, Urban Mass Transportation Administration, 1976.

Kemp, Michael A. "A Summary of Federal Involvement with Fare-Free Transit Service," Working Paper 5100-1-1. Washington, D. C.: The Urban Institute, 1976.

Pucher, John R. and Jerome Rothenberg. Pricing in Urban Transportation: A Study of Empirical Evidence on the Elasticity of Travel Demand. Cambridge, Mass.: Massachusetts Institute of Technology, Center for Transportation Studies, 1976.

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : OVERVIEW

TOPIC : OPERATING FOCUS

SPEAKER : James I. Scheiner (215) 545-8000  
Transportation and Safety Bldg.  
Pennsylvania Department of Transportation  
Harrisburg, PA 17120

SUMMARY OF MAJOR POINTS:

More than five years of interest, assessment and experimentation with fare-free transit has resulted in the realization that free or reduced fare programs may be cost-effective elements of a long run transit operating strategy to control deficit. More particularly, issues we presently need to explore include:

- In order to maximize the present value of transit system revenues over a five-year period, should the system be run free for the first three to six months?
- Are there time periods when a permanent reduced/free-fare can reduce the total operation deficit?
- Are there portions of the system which should be run "free" to simplify use and transfers, with fares on the rest of the system raised to cover normal revenue losses?

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Existing data from the Trenton, Denver and other demonstrations should be examined from these financial perspectives. Extended monitoring of after-demonstration effects will be required to this end. New, shorter range demonstrations might also be developed for more focused assessment of these effects.

KEY LITERATURE REFERENCES:

DeLew, Cather & Co. "Denver Off-Peak Free-Fare Public Transit Experiment." Unpublished interim report. October 1978.

Scheiner, James I. "The Patronage Effects of Free-Fare Transit." Traffic Quarterly (January 1975).

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : OFF-PEAK SYSTEM-WIDE FARE-FREE DEMONSTRATIONS

TOPIC : MERCER COUNTY PLANNING AND IMPLEMENTATION

SPEAKER : Richard L. Hollinger (609) 292-5722  
New Jersey Department of Transportation  
Bureau of Operations Research  
1035 Parkway Avenue  
Trenton, NJ 08625

SUMMARY OF MAJOR POINTS:

The objectives of the fare-free off-peak Mercer County Demonstration were to determine the effects of free bus rides on: diverting people from autos, increasing mobility of elderly and low income people, increasing economic viability of the central city and reducing the increase of vehicle miles of travel. To conduct the demonstration, it was necessary to obtain the cooperation of the Mercer County governing body who paid the local match for the Federal funds and the Mercer County Improvement Authority who operates the bus system. Data availability has also been a key issue. Retail sales data for the area was the most difficult to obtain due to the reluctance of retail stores to release sales information. Publicity for the project included posters, news releases to media and paid advertising in newspapers and radio stations. A consultant was hired to design and distribute promotional material as required.

Several problems arose during implementation. Bus drivers opposed the demonstration shortly after implementation. Later analysis indicated increased delays and other factors involved, but improved bus driver orientation at the outset would probably have reduced early opposition. The fare-free demonstration also became the scapegoat for an incident where a 28-year old "youth" was stabbed by a bus driver in self-defense. Local police and shopping mall security forces indicated an increase in complaints concerning youths although no significant increase in serious incidents was found in the data. The elderly also registered complaints along with bus drivers regarding inconsiderate and rowdy youths on buses. After several months, complaints decreased to the previous level although discussion with drivers has indicated continuing dislike of the program.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

As many complaints concerned youths, it seems that a primary concern is to clearly define what service transit is to provide. Also, perhaps "free" access is too "easy" and a minimal fare such as a nickel would provide low cost travel but still reduce trips of least need.

KEY LITERATURE REFERENCES:

Spielberg, F. "Plan for a Demonstration of Off-Peak Fare Free Bus Service in Mercer County, New Jersey." Working paper No 5066-8-1. Washington, D. C.: The Urban Institute, 1977.

Public Technology, Inc. SMD Briefs. Washington, D. C.: Public Technology, Inc. 1978-present. Current information on selected UMTA demonstrations. Available from Public Technology, Inc., 1140 Connecticut Ave., N.W., Washington, D. C. 20036.

Evaluation reports are in preparation.

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : OFF-PEAK SYSTEM-WIDE FARE-FREE DEMONSTRATION

TOPIC : MERCER COUNTY EVALUATION

SPEAKER : David Connor (212) 868-0800  
DeLeuw, Cather and Company  
1250 Broadway  
New York, NY 10001

SUMMARY OF MAJOR POINTS:

- Increases in Bus Use: Since implementation of free service, Mercer Metro off-peak ridership has increased approximately 45-50 percent during free-fare periods. It appears that slightly less than half of the new off-peak bus trips would not have been made if fares had been charged, and a small percentage were diverted from the peak travel periods.
- On-Board Effects: Increased use of the bus service by young people has been associated with increased complaints regarding on-board rowdiness and harassment. This appears to be mostly a real increase in serious on-board incidents. Bus drivers have been particularly vocal about the rowdiness, and have complained that the program has caused schedule adherence problems.
- Effects on On-Time Performance: One effect on Mercer Metro operations has been an increase in the run time of buses and in the occurrence and length of bus delays in the downtown area.
- Effects on Cost and Revenue: The major impact of the program has been the loss of revenue, though there has been some need for additional bus and driver assignments during fare-free periods.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

- Investigation of behavior, attitudes and reasons for non-use of program by peak-period bus users and general public.
- Investigation of the relative value (benefit) of an equal investment in service improvements (i.e. to measure marginal benefits of pricing versus service changes).

KEY LITERATURE REFERENCES:

DeLeuw, Cather & Co. Trenton Free Fare Demonstration Project Evaluation Plan. Prepared by Cobert Knight. Washington, D. C.: U.S. Department of Transportation, Urban Mass Transportation Administration, 1978. Available from NTIS.

Final Evaluation reports are in preparation.

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : OFF-PEAK SYSTEM-WIDE FARE-FREE DEMONSTRATIONS

TOPIC : DENVER IMPLEMENTATION

SPEAKER : John J. Gaudette (303) 759-1000  
Regional Transportation District  
1325 South Colorado Boulevard  
Denver, CO 80222

SUMMARY OF MAJOR POINTS:

Denver's transportation problem is most importantly an air pollution problem. Both long and short-term transit development is seen as a primary component of efforts to improve air quality. Legislative proposals to provide transit service free of charge have been considered, but never enacted due to the expense and uncertainty associated with free-fare transit. "Transit Awareness Day" activities were developed, including a "Transit Awareness Month" and Transit Awareness Day," to promote public transit use. Initial response to these campaigns was encouraging, and led to the UMTA funded one-year demonstration of system-wide fare-free transit for the off-peak.

After one-year's operation with off-peak free fares, which resulted in an overall 30 percent increase in transit use, fares were re-instituted on February 1, 1979. Preliminary conclusions from the experiment are that the majority of riders attracted to transit due to free fares are being retained, and that the one-year period of free fares may have been longer than necessary to have attracted most of the new ridership.

The major implication of the demonstration is that fare-free transit can be a very effective marketing tool when provided for a short period of time, on selective services, and to serve specific objectives. Considering the extended or long-term effects of short-term fare promotions should be a major element of fare policy evaluation.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

The following questions have arisen from the demonstration experience:

1. Over what period of time is a fare-free incentive program most effective in generating and retaining ridership; could the same results as experienced in Denver been achieved with a one week, one month, or six month free-fare period?
2. Can fare-free be an effective marketing technique on selected routes or classes of service?

3. What complementary service improvements (if any) are most effective in combination with free fares?

KEY LITERATURE REFERENCES:

DeLeuw, Cather & Co. "Denver Off-Peak Free-Fare Public Transit Experiment." Unpublished Interim report. October 1978.

Public Technology, Inc. SMD Briefs. Washington, D. C.: Public Technology, Inc. 1978-present. Current information on selected UMTA demonstrations. Available from Public Technology, Inc., 1140 Connecticut Ave., N.W., Washington, D. C. 20036.

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : OFF-PEAK SYSTEM-WIDE FARE-FREE DEMONSTRATIONS

TOPIC : DENVER EVALUATION

SPEAKER : Sherrill Swan (415) 495-6060  
DeLeuw, Cather and Company  
120 Howard Street  
P.O. Box 7991  
San Francisco, CA 94120

SUMMARY OF MAJOR POINTS:

From February 1978 through February 1979 Denver (RTD) conducted a fare-free demonstration. Fares were free all hours but 6AM to 8AM and 4PM to 6PM on weekdays, and all day Saturday and Sunday. Short-term ridership gains from free fares were substantial; average monthly ridership increased by about 30 percent due to free fares. Survey projections and early ridership estimates indicate that 60 percent to 70 percent of the ridership gain will be maintained at least during the initial few months of reinstated fares.

Travel Demand Issues

- Previous mode of new bus trips: About one-third of the trips attracted by the program were made by bus riders during the peak period; about one-third were made by auto users; about 20 percent of the trips were never made before.
- Characteristics of new riders: Almost a quarter of all off-peak fare-free riders were new riders. Total household incomes of new users were slightly higher than that of prior riders; there is a higher percentage of young to middle age adults (17 to 44 years of age) among new riders.
- Impact of free fares on prior riders: Two-thirds of riders who used RTD before free fares rode the bus more often because of the program; less than 5 percent rode less often.
- Improved mobility: It appears that to some degree free fares have enhanced mobility. Three indicators are: (a) percentage of new bus users (62 percent) not having access to autos; (b) of the surveyed new off-peak trips, almost one-half were made by persons without access to autos for those trips; and (c) about one-fifth of all new off-peak trips were never made before.



## Transportation Supply and Cost Issues

- Service level: Crowding on buses was cited as an initial problem. Vandalism and harrassment of drivers were also problems.
- Impact on Transit Operations: The major effect was a reduction in driver morale. Only about a one percent increase in RTD service was required.
- Costs Associated With Free Fares: Sacrificed revenues for the year of free fares are estimated at \$3.7 million. Additional operating costs were estimated to be in the \$30,000 to \$40,000 per month range, about one percent of total operating costs.

## Secondary Effects

- Auto diversion to transit did not significantly affect regional air quality. CBD effects have not yet been quantified. A large majority of the public and RTD riders appeared to favor the free fare program, but the majority of the public and the riders were not willing to accept increased taxes to pay for continuance of the program.

## RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Medium and long-term impacts of this project must be evaluated to determine the effectiveness of fare-free programs in inducing sustained ridership increase. Analysis of short and long-term costs and benefits of the fare-free program should be a priority research task. Whether or not a shorter period of fare-free operation would have produced similar results must also be ascertained. External factors that may have effected demonstration results must also be considered.

## KEY LITERATURE REFERENCES:

Studenmund, A. H., David Conner, and Sherrill Swan. "An Interim Analysis of the Free-Fare Transit Experiments." Report prepared for the 1979 Annual Meeting of the Transportation Research Board, Washington, D.C.

Swan, Sherrill. Early Evaluation Findings on the Denver Off-Peak Free-Fare Public Transit Experiment. San Francisco, CA: Deleuw, Cather & Co., 1978.

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : OFF-PEAK SYSTEM-WIDE FARE-FREE PROJECTS

TOPIC : SALT LAKE CITY PROPOSAL

SPEAKER : Frank Spielberg (703) 750-3363  
SG Associates, Inc.  
4200 Daniels Avenue  
Annandale, VA 22003

SUMMARY OF MAJOR POINTS:

The primary reason for the defeat of the off-peak fare-free proposal in the Salt Lake Metropolitan area was the conflict between urban Salt Lake County and other rural counties over control of regional agencies.

Rural counties were concerned that were free fare successful and continued beyond the demonstration period, resources used to provide lightly patronized services in low-density areas would be diverted to providing free service in urbanized Salt Lake County.

The operating authority was reluctant to give up a source of revenue not subject to legislative review.

A side issue was the offering of fare-free service during hours of travel by school children and the fear by the operator that "free" public transit would be used to replace school bus service in some communities.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Subsidy programs need to consider equity impacts in terms of both user benefits and incidence of tax support. To avoid sub-regional dispute, comprehensive improvement programs offering balanced subsidization policies should be developed.

KEY LITERATURE REFERENCES:

A report on the defeat of the project has been submitted to UMTA.

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : CBD FARE-FREE PROGRAMS

TOPIC : SURVEY OF EXPERIENCE AND POTENTIAL

SPEAKER : Steven B. Colman (415) 495-6060  
DeLeuw, Cather and Company  
120 Howard Street  
P.O. Box 7991  
San Francisco, CA 94120

SUMMARY OF MAJOR POINTS:

Since 1973, downtown fare-free zones have been applied in a number of different cities under varying conditions. In addition, they have received considerable attention in many more cities for evaluation and future application. Among the more important conclusions gained from experience to date are:

- The zones can create a large relative increase in downtown transit ridership.
- New ridership is primarily attracted during the mid-day, and consists mostly of downtown employees and shoppers.
- The cost per new rider is quite reasonable--generally below 10 cents.
- The non-user impacts-- on traffic, parking, and air quality-- are generally minor. While retail sales stimulus is an oft-stated goal of fare-free zones, the apparent increase attributable to them is quite small (under 1 percent).

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

There is a strong need to determine quantitative impacts in three areas: the dollar value of benefits received by fare-free riders; the amount of increased CBD retail sales; and the impact on regional transit system ridership.

KEY LITURATURE REFERENCES:

Ernest, Ulrich F. W. "Short Term Policies for Downtown Revitalization: A Preliminary Assessment." Working paper 5110-4-1. Washington, D.C.: Urban Institute, 1978.

Urban Institute. "Low-Fare Free-Fare Transit--Some Recent Applications by U.S. Transit Systems." Prepared by K.M. Goodman and M.A. Green. Washington, D.C.: U.S. Department of Transportation, Urban Mass Transportation Administration, 1977. Available from NTIS.

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : CBD FARE-FREE PROGRAMS

TOPIC : SEATTLE'S "MAGIC CARPET"

SPEAKER : Rod Armour (206) 447-6781  
Municipality of Metropolitan Seattle  
821 Second Avenue  
Seattle, WA 98104

SUMMARY OF MAJOR POINTS:

Seattle's "Magic Carpet", or downtown free-transit zone, has been in existence since 1973. Since then, intra-area ridership has tripled and the project has helped attract patronage throughout the system. The greatest free zone ridership increase has been between 11:00 A.M. and 2:00 P.M. in the CBD, and system ridership increases have been greatest during commuter hours.

The fare collection method was adapted to "pay in the country." This decreased boarding time per passenger in the CBD by nearly 20%, but crowded buses outside the fare free zone are delayed by pay-as-you-exit.

Downtown Seattle has experienced a two percent reduction in traffic volumes and air pollution as a result of the fare-free zone, and retail sales in the area have increased by about one percent (\$5 million annually). Peripheral parking patterns have remained essentially unchanged.

Operating the fare-free zone adds about 4 cents per fare-free passenger, compared to about 90 cents per revenue passenger for the overall Metro system. The total cost (including sacrificed revenue) of fare-free operation is about \$150,00 annually.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Alternative methods for financing fare free zones (e.g. CBD merchant contributions) should be investigated.

Methods for operating multiple fare free zones should be developed.

KEY LITERATURE REFERENCES:

DeLeuw, Cather and Co. Case Studies in Reduced Fare Transit: Seattle's Magic Carpet. Unpublished draft report. 1978.

Municipality of Metropolitan Seattle. Seattle's Magic Carpet: The First Two Years. Seattle, Washington: The Municipality, 1976. Available from Seattle Metro.

Municipality of Metropolitan Seattle. Magic Carpet Evaluation Report. Jointly prepared by the Municipality of Metropolitan Seattle and the City of Seattle. Seattle, Washington: The Municipality, 1977. Available from NTIS. Also available from Seattle Metro.

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : CBD FARE-FREE PROGRAMS

TOPIC : UMTA DEMONSTRATION IN ALBANY, N.Y.

SPEAKER : Jack Reilly (518) 457-2388  
Capital District Transportation Authority  
110 Watervliet Avenue  
Albany, NY 12206

SUMMARY OF MAJOR POINTS:

The downtown Albany fare-free zone (Freewheeler) started operation in November 1978. In this project, fares are abolished for all bus trips in a 0.5 square mile downtown area between 9:00 A.M. and 3:00 P.M. on weekdays and between 9:00 A.M. and 6:00 P.M. on Saturdays. Midday service headways in downtown corridors vary from 2-3 minutes to 30 minutes.

To date, internal ridership has increased from 1200 passengers per weekday to about 3000. There have been no adverse effects on regular transit operations.

Significant emphasis will be placed on project evaluation to estimate effects on retail sales, diversion of trips from other modes and incidence of project benefits. Surveys were conducted before the project began (downtown residents, downtown employees, shoppers, transit riders and area residents). These will be repeated in October 1979. Some aggregated retail sales tax data will be made available.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

The project will terminate in November 1980. The surveys and additional data should provide insights into the market for free CBD bus trips, the effect on transit operations and revenues and the impact of such projects on downtown activity. Recommendations for further work are premature at this time.

KEY LITERATURE REFERENCES:

Cambridge Systematics, Inc. Albany CBD Fare Free Demonstration Evaluation Plan. Cambridge, MA: Cambridge Systematics, Inc., 1978.

Urban Institute. "Demonstration Plan for a Fare Free Zone in Albany, NY" Working paper 1200-34-1. Washington, D.C.: The Urban Institute, 1978.

WORKSHOP: FREE AND REDUCED FARE TRANSIT

SUBJECT : FREE AND REDUCED FARES FOR TRANSIT PROMOTION

TOPIC : TRANSIT FARE PROMOTIONS: SURVEY AND DEMONSTRATION DEVELOPMENT

SPEAKER : Ulrich F. W. Ernst (202) 223-1950  
The Urban Institute  
2100 M Street, N.W.  
Washington, D. C. 20037

SUMMARY OF MAJOR POINTS:

The presentation focuses on the broad spectrum of promotional fare reductions and eliminations that have been used by transit systems both in the U. S. and abroad. This survey is designed to explore such areas as: (1) restrictions in time and space, (2) targeting to market segments, (3) extent of additional promotion efforts, (4) involvement of other groups and institutions, (5) combination with service variations, and (6) implementation mechanisms.

The examination of the available evidence suggests that promotional fare reductions can generate substantial additional ridership during the promotional period, particularly in off-peak hours. There is little reliable indication of the degree to which other objectives (increased retail sales, lasting increases in overall paid ridership) are being accomplished.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

The presentation outlines the major design elements of a demonstration project scheduled for Scranton (Pennsylvania) and sketches the kinds of questions that will be answered through this demonstration. Mention is made of the development of a conceptual framework for exploring the role of promotional fare incentives in changing travel behavior in a dynamic context.

KEY LITERATURE REFERENCES:

No really significant literature pieces presently exist. An Urban Institute Working Paper on this topic will be available in Summer 1979.

WORKSHOP: FREE AND REDUCED FARE TRANSIT  
SUBJECT : FREE AND REDUCED FARES FOR TRANSIT PROMOTION  
TOPIC : TOKEN-REINFORCEMENT FOR OFF-PEAK RIDERSHIP  
SPEAKER : Peter B. Everett (814) 865-1467  
Division of Man-Environment Relations  
The Pennsylvania State University  
University Park, PA 16802

SUMMARY OF MAJOR POINTS:

Travel behavior can be viewed as a function of reinforcement, or rewards and incentives. Auto use currently involves much reinforcement, and transit use entails little reinforcement. A strategy to increase transit use could/should be built on increasing "reinforcers." Many reinforcers for transit use are possible (e.g. improved service) but one reinforcer easy to deliver without large institutional or operating changes is the concept of token reinforcement.

Tokens would be delivered to boarding passengers during promotional period (which could become permanent). Tokens could be redeemable for a variety of goods and services, or discounts towards them, by merchants served by transit. The costs would be supported in part by the merchants, recognizing the customer traffic benefits and marketing benefits of the program. Tokens given to passengers could vary in value in an unpredictable fashion, to have maximum impact on behavior.

Studies to date show that a 10 to 75 percent increase in ridership can be derived from this form of promotion.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

The token-reinforcement concept should be implemented in a large urban area to stimulate off-peak ridership. Attention should be paid to determining the long-range impact on transit and the economic viability of sustaining such a program. The different possible parameters of token reinforcement (e.g., token predictability, type of merchants involved) should be explored in order to determine the most effective procedures.

KEY LITERATURE REFERENCES:

- Deslauriers, B. C. and P.B. Everett. "The Effects of Intermittant and Continuous Token Reinforcement on Bus Ridership." Journal of Applied Psychology. (August 1977).
- Everett, P. B. et al. "Effects of a Token Reinforcement Procedure on Bus Ridership." Journal of Applied Behavior Analysis. (1974).

IMPROVING TRANSIT PRICING - A MANAGEMENT FRAMEWORK

HAROLD H. GEISSENHEIMER  
GENERAL OPERATIONS MANAGER  
CHICAGO TRANSIT AUTHORITY

The report that I'm giving represents a joint effort by staff of the UMTA Pricing Innovations Program, Public Technology, Inc. and the Chicago Transit Authority to develop what might be called a "suggested management framework for pricing innovations", but would probably best be called just a set of considerations that are important to transit authority pricing policies. While some of us "on street" transit managers may not agree that specific innovations will have the effects that the UMTA "innovators" often claim, it's our feeling that implementing transit pricing and fare-related improvements requires top level management commitment to a number of basic ideas.

Generally, we've identified eight basic considerations that would frame transit pricing policies. These are:

- Fare revenue is a vital source of system finance.
- The controversial nature of fare changes makes achieving broad-based political support for pricing policies essential.
- Pricing and fare innovations are important components of marketing efforts.
- Special services should be matched with pricing variations to maximize user appeal.
- Fare policies should bear strong relation to the costs of different services, or service components.
- Pricing innovations should be evaluated for their impact on transit efficiency.
- The social, political, and environmental effects of pricing changes and innovations should be considered along with their impacts on transit finance.



- *Transit operators should coordinate their pricing innovations with other transit, transportation, and urban programs.*

*These ideas, we feel, must underly pricing policies and pricing innovations. In the next few minutes I'll explain these in more detail.*

*Probably the most important consideration framing transit pricing policy is that fare revenue must be considered as a major source of system finance. We've all come to realize that we can't expect transit subsidies to continue to grow as they have in recent years. In fact, after a number of years of relative stability in fare levels, a growing number of systems have had to face fare increases again. This re-emphasis of the budgetary importance of fare revenue should lead to improved analysis of alternative fare policies and impacts. Moreover, when faced with no alternative to higher fares, we will find that even greater emphasis on cost control and improvements in transit efficiency is necessary.*

*Closely allied to the importance of fare revenue is the role of clearly established fare policies, as adopted by policy boards and properly communicated to the public. The highly controversial nature of fare changes and relative pricing incentives offered to different user groups makes broad support for pricing policies essential. The support of politicians, the media, major employers, downtown business and other special interest groups needs to be consciously nurtured if new pricing policies and fare innovations are to succeed.*

*Service development and marketing is another primary function of pricing strategies and innovations. Though in most cases we know ridership is more responsive to service improvements than fare changes, properly coordinated fare incentives can have vitally important effects. These innovations include prepaid pass plans, discounting of prepaid tickets and passes, low-fare downtown circulation services, special transfer provisions, special fare promotions, and fare programs for Sundays, holidays and tourists. Their effects may include improving user convenience, introducing transit to new users, stimulating system use in off-peak periods, and maintaining transit's positive image.*

*Sophisticated pricing policies also recognize that different groups of riders respond differently to fare changes and incentives. Market segmentation is important to setting fare levels and selecting innovations.*

*Fundamental to marketing is providing current users with the type of service they require or prefer, or developing new services to attract new users. Special services such as park-and-ride and express routes have very strong appeal, and users are often willing to pay higher fares for the quality differential.*

Subscription bus services are another example of price-quality variations which, because of the high cost of serving long peak-period trips, have often operated with fares set at break-even levels. In many ways, quality-based fares are just an extension of the distance-based fares that many of us rely on.

Generally, full application of transit marketing will lead to increased variations in services and fares. Moreover, if services are more closely tailored to the existing and latent demands of users and potential users, it is quite possible that increase proportions of operating cost can be recovered from the new special services.

I am told that UMTA sponsors research and will consider demonstrations for price and service improvements that would, for example, significantly reduce waiting times, use smaller vehicles (that possibly provide door-to-door service at one or both ends of a route), decrease crowding in peak-periods, etc. These are bold but clearly evolving innovations, that could well lead to both improved financial viability and increased market appeal. Though we all can envision the political barriers to such service variations, they may be pursued because they could lead to ridership increases with reduced subsidy per passenger, a very salable consideration.

Strongly related to marketing and service variations is another major element of a framework for transit pricing: the costs of different services. Recent advances in cost allocation methods enable more precise identifications of the costs of providing service on particular routes, in certain time periods, etc. In addition to enabling greatly improved decision-making on route performance and service levels in general, the methods can assist in identifying undesirable cross-subsidies between routes or service categories. This information can lead to improving both the efficiency and equity of transit service, for example by determining appropriate peak/off-peak fare differentials, or appropriate surcharges for special or higher quality services. Overall, as transit services continue to develop and become more diverse, pricing decisions will have to rely on improved methods of cost allocation and estimation.

Improving the operating efficiency of transit is another approach to thinking about fare innovations. Many fare related innovations can have positive effects on efficiency. For example, widespread use of transit passes can significantly reduce boarding times, particularly in peak periods. Passes can also lead to savings in fare collection expenses by reducing security costs or improving cash flow. Distance-based fares can encourage more ridership in off-peak periods, when trip lengths are generally

shorter, as well as recover more revenue from peak-period users. Peak/off-peak fare differentials offer the possibility of shifting at least some peak riders to the off-peak, though their more important effect may be to improve equity between transit users by keeping fares in closer relation to the costs of service at different times of day. Yet to be implemented in the U.S. are the self-service/self-validating ticket systems common in European cities, which can enable boarding from rear doors and thus speed operations. All of these innovations offer possible gains in efficiency, and likely will become more common in the near future.

The increased complexity or inconvenience for users that some of these innovations may entail are important factors that also have to be considered. The trade-off between convenience of simple fare structures and the efficiencies of more complicated structures has to be more clearly appraised. In the future, increasing financial constraints on transit will probably lead us to at least consider more complicated fare structures, to maximize efficiency and minimize ridership loss due to higher fares. However, the discouraging effect of more complex fare structures is a factor we must keep firmly in mind.

Another important set of considerations that frame the context of pricing innovations is the impact of various improvements on the adopted goals for transit operation. These goals include energy conservation, congestion and pollution relief, downtown development, improved service for special user groups, and others. What might be stressed is that transit pricing decisions are not just financial but also social and political. Transit goals and objectives should be assessed for consistency, and should be defined so as to assist service development, pricing, and other operating decisions. The impacts of specific pricing changes, special services and other innovations need to be assessed in a disaggregate or very focused manner. This is necessary in order to maximize goal achievement, whether this be the provision of service to target groups, or effects on objectives such as air quality. This "impact segmentation" approach complements a market segmentation exercise, and is a necessary evaluation tool for developing effective and therefore efficient fare structures.

Some mention of external considerations effecting pricing innovations is also necessary. A potentially very significant innovation for cities where transit is provided by multiple operators or involves different modes is the concept of fare prepayment for intermodal coordination. This can greatly increase the convenience of transit use, and stimulate significant new ridership. Carried further, the concept could be applicable to virtually all cities as a way to integrate and coordinate taxi operations with transit.

*Transit pricing innovations must also consider the wider urban and transportation planning process. For example, low or free fares for downtown services are an important component for downtown revitalization programs, but standing alone their minor impact may not be worth their financial burden.*

*Possibly of greatest effect on transit revenue issues is the price of the competition...the automobile. The financial department of any city's transit authority ought to be the strongest advocate for removing existing subsidies on automobile use, whether through parking taxes or other mechanisms available to local decision-makers. When fare increases are necessary, coordinating them with new auto-use disincentives can offset ridership loss. This wider view on transit pricing issues requires increased emphasis from all of us concerned with transit development.*

*Other factors important to transit pricing could also be identified. In summary, however, once one has accepted that fares are a vital element of transit finance, it could be concluded that there are two primary (and sometimes overlapping) concepts that shape transit pricing innovations. These are that pricing innovations are necessary to increase the convenience and attraction of transit, and that pricing is an important tool for improving transit productivity. This, I would say, is the essence of our job in stimulating transit pricing innovations.*

TRANSIT PRICING TECHNIQUES  
AN OBSERVATION

JAMES R. MALONEY  
EXECUTIVE DIRECTOR  
PORT AUTHORITY OF ALLEGHENY COUNTY\*

*It is essential for a forum on transit pricing techniques to consider what the base price of a transit ride should be before we even begin to talk about discounts and different methods of prepayment. As you just heard in Mr. Geissenheimer's talk, fare revenue is a vital source of system financing.*

*PAT's fare box brings in roughly about 45 percent of our annual revenue. Unfortunately, this percentage is on the decline. With this in mind, the American transit industry cannot afford to work from an unrealistically low price base.*

*In terms of price for a transit ride, we at PAT take a somewhat different approach. We have calculated that our cost of providing a single transit trip is about a dollar. That cost is a combination of operating expenses plus capital expenses. If all of the transit agencies in this country would add up their costs accordingly, I think they would find their cost of a transit ride is very similar to PAT's. Our pricing approach is that the fare should be 50 cents for a basic transit ride, the remaining 50 cents of the true cost being made up in subsidy. One of our industry's problems in terms of pricing is that in our zeal to encourage ridership, we have lowered our price and in many cases, transit agencies are in a desperate search for money to balance the books.*

*Discounts are not the only way to stimulate or maintain current ridership levels. In our most recent market research in Pittsburgh, convenience, not savings, has become the predominant need of our customers. To prove this point, PAT has just offered a completely prepaid annual pass. The cost: \$175.00, which maintained the same discount that our annual permit offered. (The permit was priced at \$125.00 base plus 10¢ per ride). There was intense opinion and temptation to give even a further discount to lure customers, with the idea that \$175 was just too high a price to pay for transit. Those temptations were resisted on the basis that we felt our riders were willing to trade off price for convenience. Apparently our research was correct. We were able to increase sales by nearly 20 percent.*

*\* Delivered by L. Michael Kelly, Jr., Manager, Advertising and Public Relations, Port Authority of Allegheny County.*

*We also found that perceived value is very important in marketing. You might recall that many years ago Toni offered a home permanent priced at about 25 cents. The product was a disaster and after the Madison Avenue experts re-examined their marketing plans, they had the feeling that at 25 cents people perceived the product to be worthless. They repackaged the same product and placed a higher price on it and it became a marketing success.*

*In short, as I mentioned in the beginning of this brief message, it is essential for a forum on transit pricing techniques to consider what the base price of a transit ride should be before any discounts are given. We must also take into account Americans' increased yearning for convenience, and finally, to make sure the perceived value of a transit ride equates with the level of service delivered. Even at 50 cents per ride, public transportation is still one of the best bargains in today's cost of living.*

## WORKSHOP III: SYSTEM AND MARKET ANALYSIS SUMMARY

Workshop III reviewed current projects aiming to increase public transit productivity through improved service evaluation and considered the state of knowledge of consumer preferences for fare and service combinations.

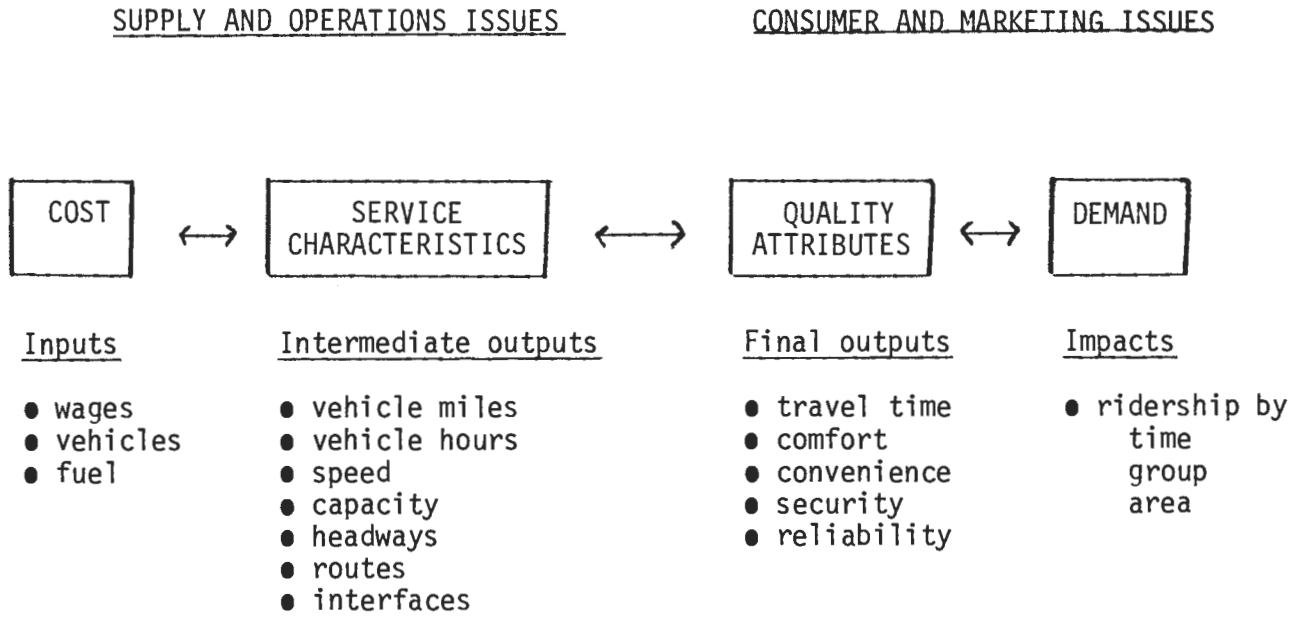
### Workshop Consensus

Many of Workshop III's specific recommendations can be related to the schematic structure shown in Figure 1. The connection between the costs of supplying a particular transit service and the ridership that will result involves intermediate relationships of critical importance. Costs can be related relatively easily to certain types of service characteristics, such as vehicle hours, frequency of service, schedule reliability, travel time from stop to stop, and vehicle miles of service. These describe the service from the supply or operations point of view, but do not relate directly to the price that might be charged based on what the potential patron perceives as desirable or undesirable.

The consumer or marketing perspective is typically under-emphasized in transit service evaluation. Service characteristics must be related to quality attributes that are valued by the rider, such as waiting time, comfort, trip travel time, security, likelihood of securing a seat, and predictability of arrival time at destination. Travel demand responds to quality attributes, not to intermediate variables. Increased attention to the analysis of transit service quality as it affects the price a passenger is willing to pay should be a priority.

- The workshop identified a range of useful directions for additional research, but stressed improved communication and dissemination of existing concepts and innovations not yet fully applied as its major recommendation. Short courses, workshops, manuals, etc. should be developed for the use of local planners and operators who may not be aware of the results of recent studies and demonstrations.
- The workshop also stressed the importance of institutional structures for transit planning, development, and decision-making. UMTA efforts promoting a multi-modal perspective on transit needs, evaluation, and service provision should be intensified. Projects presently focusing on conventional transit service evaluation should be broadened to increase emphasis on unserved and

FIGURE 1. COST, DEMAND, AND INTERVENING VARIABLES.





potential transit needs. Results of research and demonstrations of improved institutional frameworks for service provision (e.g., integrated operations) should be more widely disseminated, with replication and adaptation promoted.

### Suggested New Initiatives

Suggestions for short and medium-term programs include the following:

- Use of willingness-to-pay and consumer surplus concepts is encouraged for evaluation, and for design of innovations. Some explanation of and rationale for these concepts would be helpful for local planners and operators.
- Strong involvement of local operations in the design of evaluation systems is essential to both improve system design and stimulate the use of new concepts.
- Improved methods for direct sample surveys of transit ridership and potential ridership should be widely disseminated. Guidelines could be prepared in the form of a readily transferrable manual to ease pitfalls, compromises, integration of purposes and strategies, interpretation, etc.
- Direct survey data can be supplemented, and to some extent supplanted, by automated patronage counting equipment. UMTA efforts in this area should be accelerated. For a variety of reasons, current methods for ridership estimation are not sufficiently reliable.
- Access to data already and routinely collected could be greatly improved through data management and information retrieval techniques. UMTA should develop courses that will improve local capability to develop and take full advantage of data oriented evaluation techniques and capabilities.
- Cost and revenue data should be obtained by route, route segment, and time period, with the intent of assessing the effectiveness of various service components with respect to subsidy constraints and local transit goals.

- Use of sophisticated cost allocation methods, probably relying on three variable models of cost per mile, (hour and peak bus) should be encouraged. These methods would provide significant improvement from estimates based on unit costs, e.g., average cost per vehicle mile, and would assist in relating costs to service characteristics. UMTA should actively promote this increased level of specificity of analysis.
- A great deal of productive work can be done to further specify transit cost functions and delineate cost components. The limited work to date needs to be assessed, with emphasis on advancing theory and empirical relationships in areas such as the effects of work rules and the correct assignment of capital and overhead costs to service categories (especially peak vs. off-peak).
- Demand characteristics relating transit patronage to service quality of transit and other modes are essential to effective service development. Most work to date has emphasized the overall response of ridership to fare changes and has focused on conventional transit and standard service levels. Far more disaggregate information is needed if transit policies are to be increasingly tailored to the preferences of specific submarkets. Elasticity oriented research needs to focus on subjects such as the effects of general inflation, prices of competitive modes, variations by city size and extent of congestion, peak-off-peak fare differentials, geographic sub-areas such as the CBD or low-density suburbs, high quality services, complex fare structures including prepayment, specific market segments and special user groups, new trips vs. mode shifts, interaction effects between price and service quality changes, long vs. short term, cross-sectional vs. time series statistical models, and fare increases vs. decreases. Attention should be directed to developing manuals or other guidance to encourage application of research findings derived in this area.

- Measures labelled above as quality attributes are elusive and largely lacking. Recognition is needed that these are different from service characteristics such as vehicle miles, and efforts need to be directed at measuring quality attributes for purposes of estimating both demand elasticities and cost functions. Transit service evaluation should increase its marketing/consumer orientation. Research should establish relationships between quality improvements, demand response, and service costs.
- Three methodological strategies now in use all have application in obtaining information on price, service and supply elasticities: surveys and direct observation emphasizing revealed preference, clinical experiments under controlled environments, and statistical models including simultaneous equations. To maximize practical applications, research must involve rather than simply consult with transit operators.
- Tradeoffs, potential conflicts, complementarities, and synergisms between services directed at specific market segments (e.g., vanpools, special commuter services, elderly and handicapped services) and scheduled fixed route service have not been resolved despite the pressure of current policy needs (such as section 504 requirements and energy issues). Assisting resolution of these issues is a primary example of how the information generated by the previous recommendations could be put to very productive use.

## WORKSHOP III: SYSTEM AND MARKET ANALYSIS ABSTRACTS

Co-moderators: James C. Echols, Tidewater Transportation District  
Commission  
David T. Hartgen, New York State Department of  
Transportation

Reporter: Douglas Lee, Transportation Systems Center

### List of Presentations

#### Overviews

- Transit Service Evaluation: General Practice and Advanced Operations  
James C. Echols, Tidewater Transportation District  
Commission
  - Service Provision Decision-Making at the MPO Level  
Ronald F. Kirby, The Urban Institute
1. Productivity Projects and Related Research
    - Los Angeles Criteria Study  
Wolfgang Jakobsberg, CENTS, Inc.
    - Concepts, Hypotheses, and Institutional Impediments  
Ralph E. Rechel, Institute of Public Administration
    - Omaha Implementation  
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    - Current Transit Demand Research at The Urban Institute  
Michael A. Kemp, The Urban Institute
    - Transit Fare Sensitivity by Demographic Group  
David T. Hartgen, New York State Department of Transportation
    - Responses of Elderly and Handicapped People to Fare Changes  
Essie Burnworth, Chase, Rosen and Wallace, Inc.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : OVERVIEWS

TOPIC : TRANSIT SERVICE EVALUATION: GENERAL PRACTICE & ADVANCE OPERATIONS

SPEAKER : James C. Echols (804) 627-9291  
Tidewater District Transportation Commission (TDTC)  
P. O. Box 660  
Norfolk, Virginia 23501

SUMMARY OF MAJOR POINTS:

Last July, TDTC began an UMTA sponsored, special technical study to develop a prototype system to evaluate regular bus service performance. The project is in cooperation with the Massachusetts Bay Transportation Authority (MBTA) which represents large transit systems; TDTC represents small-to-medium sized systems (less than 500 buses).

Together with MBTA, TDTC has completed the first phase of the project which was a survey of North American transit operators to determine the extent to which performance evaluation is now used throughout the industry. Our findings indicate that (1) very few transit operators have a comprehensive procedure for evaluating transit service and (2) there are very few measures and standards of performance being used by transit operators.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

TDTC and MBTA will develop and test bus service evaluation procedures.

KEY LITERATURE REFERENCES:

Massachusetts Bay Transportation Authority and Tidewater District Transportation Commission. Bus Service Evaluation Procedures: A Review. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1977.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : OVERVIEWS

TOPIC : SERVICE PROVISION DECISION-MAKING AT THE MPO LEVEL

SPEAKER : Ronald F. Kirby (202) 223-1950  
The Urban Institute  
2100 M Street, NW  
Washington, D. C. 20037

SUMMARY OF MAJOR POINTS:

In many metropolitan areas, decisions on transit fare and service changes are made by those directly responsible for transit service provision: the staff or policy board of the transit operating agency. The MPO's, traditionally concerned with long-range planning, have had little or no input into short-range transit planning. Consequently, there has been no formal process for incorporating short-range transit options into the TSM planning process, and no mechanism for comparing these options with paratransit and other possible TSM actions. Some transit operators have begun to develop formal evaluation criteria and procedures which would permit the comparison of transit options with other TSM actions if a workable institutional framework could be established for TSM planning.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Two directions are suggested for further development. The first would address the need for workable institutional arrangement to permit comprehensive planning and programming along the lines envisaged for the TSM planning process. The second concerns the evaluation criteria and procedures: the formulation of the measures, the techniques employed to place numerical values on the measures, and the ways in which the measures are used in practice to evaluate projects.

KEY LITERATURE REFERENCES:

Kirby, Ronald F., and Green, Melinda A., "Policies and Procedures for Transit Service Development." Working Paper 5066-7-1. Washington, D. C.: The Urban Institute, 1978. Also published in Traffic Quarterly, April 1979.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : PRODUCTIVITY PROJECTS AND RELATED RESEARCH

TOPIC : LOS ANGELES CRITERIA STUDY

SPEAKER : Wolfgang Jakobsberg (301) 881-1270  
CENTS, Inc.  
1500 East Jefferson Street  
Rockville, MD 20852

SUMMARY OF MAJOR POINTS:

The Criteria Project in Los Angeles developed inexpensive methods for collecting, processing, analyzing and maintaining data on patronage, revenues, costs and service levels by line and for different hours of the day. It demonstrated how the data could be applied in order to identify the location and trip-making behavior of current and potential transit users, measure the utilization and productivity of individual transit lines, and specify specific changes in routing and scheduling of individual lines in order to improve service and productivity.

The sampling techniques (data collection and processing methods) resulted in data on the origin and destination of passengers, their addresses, trip purposes, fares, transfers and assorted socio-economic characteristics. Returns from on-board surveys ranged between 75 and 80 percent of those solicited and made it possible to keep these costs down to 9¢ per boarding passenger. Subsequent advances promise to reduce the costs in the Omaha and Columbus demonstration even further.

Overall, the Criteria Project has moved the frontier beyond data collection, processing and analysis to data utilization. Large and medium sized properties already have considerable data and often more data will not improve management of their resources. The problem today is that the data that they have is not exactly right for the purpose to which it must be put, and that the data is difficult to retrieve and is therefore not used as widely as it should be.

Surveys and other forms of data collection are always time consuming, require considerable labor and, even when the least expensive methods are used, are costly to administer. Common sense suggests that a data collection effort of any type consider all of the possible data that could be collected by that method and do so in a manner that will allow that data to be used for the most effective purposes. This kind of planning is rarely done; too often survey efforts are needlessly repeated. CENTS has demonstrated as part of the Criteria Project that an on-board survey, for example, can replace traditional boarding and alighting checks and collect all of the other data needed to estimate ridership origin/destination and characteristics. All that must be done is to consider this use in designing the sampling plan so that desired precision (3-5%) is obtained. By integrating various needs

for data into one data collection effort, considerable savings result. In the case above, the cost of getting the boarding and alighting data was reduced by over 80 percent.

When data is available, it is often difficult to access and use. Managers and technical staffs have real-time demands placed on them which require them to answer a question, make a decision or solve a problem in days or hours. Even transit properties that have large EDP departments and computers that harbor the data can rarely, if ever, get access to that data in the time required. The present inability to access data quickly and directly discourages use of the available data base, and frequently results in decisions based on old impressions and incomplete information. The Criteria Project demonstrated a method by which a lay-person who is unschooled in computers and computer programming can get access to any item in the data bank, order analyses and presentation formats and receive a response within minutes. The Omaha and Columbus demonstration projects will take this capability even further and develop special interactive programs for different organizational levels.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Wide efforts to disseminate these methods and advance general industry practice are required.

#### KEY LITERATURE REFERENCES:

Center for Transportation Studies (CENTS) and Southern California Rapid Transit District. Methods for the Inexpensive Acquisition and Application of Transit Data. n.p., 1977.

Southern California Rapid Transit District. Transit Information Exchange (Criteria Study) Bulletins. Los Angeles, CA.: Southern California Rapid Transit District, n.p., particularly "Using Transit Data," "Measuring Transit Patronage," "Estimating Potential Transit Patronage." Available from SCRTD, 425 S. Main Street, Los Angeles, CA. 90013, or CENTS, Inc.



WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : PRODUCTIVITY PROJECTS AND RELATED RESEARCH

TOPIC : CONCEPTS, HYPOTHESES, AND INSTITUTIONAL IMPEDIMENTS

SPEAKER : Ralph E. Rechel (202) 333-3236  
Institute of Public Administration  
904 New Hampshire Avenue, N. W.  
Washington, D. C. 20037

SUMMARY OF MAJOR POINTS:

The transit industry is often criticized by outside observers for lack of detailed knowledge about operating costs of specific routes and services and for continued use of 100 percent censuses of riders one day each year (or every three or four years) as the basis for estimating traffic data by route. Historical reasons or excuses for these conditions have lost the validity they may have had because of two contemporary developments. The first and most important has been the great rise in public assistance funds from all levels of government. When these funds came to account for 40 to 60 percent of total revenues, transit management became accountable to the taxpayers and their public bodies for the efficient and responsive application of manpower, vehicles, and consumable resources provided to them. The second development consists of low cost sampling programs for on-board rider surveys and for household trip-making data collection. Sample survey techniques became practical at the same time that transit accounting classifications were revised to functional bases to provide information for the Section 15 reports now required by UMTA.

The simultaneous arrival of solutions to the lack of specific route and service cost, and traffic knowledge makes a continual flow of valuable/detailed information possible for the first time, at affordable cost. This information will directly assist specific management decisions on every type of service change and route adjustment considered by transit managers.

The ridership and home interview techniques were originally developed by UMTA in the "Los Angeles Criteria" exercise and have been confirmed in various applications. Operating cost data for each route now requires only adaptations of data from run-cutting outputs and operator assignment sheets available in some form on every property. The major objective is to more accurately reflect the costs of various provisions in labor agreements on each route and service. As operator wages and fringes above amount to about 55 percent of total transit operating expenses, properly adjusted cost allocations by route and service are of great importance.

The present group of Transit Resource Productivity Demonstration offers an opportunity to combine improved ridership and operation cost data into a productivity analysis framework based on individual routes. On each route particular services (peak, mid-day base, evening, Saturday and Sunday) will be analyzed and routes may be segmented if major rider volume changes occur at particular locations. Number of riders by service, socio-economic group, and trip purposes will be ratioed to vehicle, employee, and fuel inputs for each route or segment. The basic analytical techniques can be extended to in-depth, comparative analysis of all routes and services extensive enough for major system route revisions and are adaptable to paratransit area or corridor services.

A major objective of the demonstrations is to determine the actual cost and effectiveness of the package of information gathering and analytical techniques and the extent of its usefulness for typical medium-sized transit operations such as Omaha. There it will flow into a management information system.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

The pricing application of findings of the productivity demonstrations (i.e., cost differentials for services and routes) may hinge on the ability to implement price variations. Hence, fare mechanisms that will permit or facilitate increased complexity without increased boarding delay, user confusion, or other difficulties need investigation. Magnetic card equipment would permit the most extensive fare variations.

#### KEY LITERATURE REFERENCES:

Andersen (Arthur) and Company. Urban Mass Transportation Industry Uniform System of Accounts and Records and Reporting System. 4 volumes. Washington, D. C.: Arthur Andersen and Company, 1977.

Center for Transportation Studies (CENTS) and Southern California Rapid Transit District. Methods for the Inexpensive Acquisition and Application of Transit Data. n.p., 1977.

Federal Register. "Uniform System of Accounts and Records -- Implementation." (January 19, 1977) Part II.

Rechel, Ralph E. "Plan for a Demonstration of Means for Measuring Transit Resource Productivity and Adjusting Services or Revising Routes in Omaha, Nebraska." Working paper, Washington, D. C.: Institute of Public Administration, 1978.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : PRODUCTIVITY PROJECTS AND RELATED RESEARCH

TOPIC : OMAHA IMPLEMENTATION

SPEAKER : James B. Reed (402) 341-7560  
Metro Area Transit  
2615 Cuming Street  
Omaha, NE 68131

SUMMARY OF MAJOR POINTS:

The goals and objectives of the demonstration are:

1. To actively engage the top levels of transit management in expressing transit service goals and policies in explicit terms and to carry out these goals in daily operation by devising performance standards or criteria for each route, and evaluating route performance in relation to the standards.
2. To base these route performance evaluations on uniform and useful measurements which should be integral parts of any comprehensive management system: (a) of the quality and quantity of transit service provided; (b) of the number and group identity of riders on each service; (c) of the equipment and employee resources and operating expenses required to provide each existing service. The analysis provided by these route evaluations should enable management to attain the most productive (or cost effective) application of available resource inputs--employees, vehicles, consumables and operating right-of-way--to meet chosen public transportation goals.
3. To greatly increase the availability and usefulness to management of market information--defined as current data on the travel patterns, trip purposes and on socio-economic categories of all urban trip-makers within the public transportation zone of influence--with major emphasis on public transportation user groups. These data are to be prepared by line, corridor and community and by operating period with linkage to similarly prepared cost and revenue data.
4. To provide transit operators with the capability to easily and continually prepare the measurements and productivity analyses required by Objectives #2 and #3 for each actual or prospective transit route or demand-actuated service area by operating period (peak, base, Saturday, Sunday) and by rider group identity. These data would be adapted to and included in the MAT management information system.
5. To improve specific productivity of all resources devoted to transit operation with principal emphasis on (a) human resources and (b) operating right-of-way.

6. To provide a system for analyzing the application of resources which can easily accommodate all types of public transportation services and could eventually allocate each type of service in a Transportation System Management (TSM) program to its most productive role, considering service characteristics, relative efficiency in use of resources and net revenue effects including taxes and user charges.
7. To use a series of technical demonstrations conducted by MAT to carry forward, refine and integrate for management application a number of tools developed by UMTA, now ready for general implementation: (a) moderate cost collection and analysis of transit ridership and entire market data; (b) extension of Section 15 requirements for functional accounting and reporting to the costing of individual routes using relatively simple procedures; and (c) application of UTPS-derived or other EDP programs for assistance in short- and medium-term management decisions on changes in the application of available resources to specific routes and services.
8. To provide local management with a methodology for comparing the effectiveness of various uses of UMTA Section 3 and Section 5 financial assistance in responding to local, State and national urban transportation goals and mobility policies.
9. To fully engage UMTA technical studies programs (Section 9), training programs (Section 10 and 11) and elderly and handicapped programs (Section 16) in support of management decisions on the most productive application of locally available resources to the implementation of locally adopted public transportation policies.
10. To provide regional (MPO), State and Federal planners and programs managers with uniform, comparable and specific measures of productivity and transportation objective fulfillment.

Implementation to date has included selection of consultant, determination of data requirements and collection methods, design of management information system (MIS), initial use and refinement of MIS.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Possible Phase II: Supplier integration through productivity analysis seminars in all transit systems participating in similar projects. Dissemination implementation program and products to other transit operators.

#### KEY LITERATURE REFERENCES:

Rechel, Ralph E. "Plan for a Demonstration of Means for Measuring Transit Resource Productivity and Adjusting Services or Revising Routes in Omaha, Nebraska." Working paper. Washington, D. C.: Institute of Public Administration, 1978.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : PRODUCTIVITY PROJECTS AND RELATED RESEARCH

TOPIC : COLUMBUS IMPLEMENTATION

SPEAKER : William Bownas (614) 228-3831  
Central Ohio Transit Authority  
51 North High Street  
Columbus, Ohio 43215

SUMMARY OF MAJOR POINTS:

To develop new management tools and to enable more effective utilization of resources, UTMA has initiated Transit Resource Productivity Demonstrations (TRPD). These projects are intended to:

- Provide management with information tools to control daily transit operations.
- Develop scientific methods to manage system growth and development.
- Introduce new, inexpensive, and statistically valid techniques for collection, processing, and analyzing data on patronage, revenue, and expenses.
- Demonstrate the utility of these new techniques for improving productivity and utilization of transit resources by identifying areas in need of additional transit service and the adjustment of routes and service levels to meet these needs.
- Train management, operating, and technical staffs to use patronage, expense, and revenue data in decision making.

Specific tasks include:

- Development and deployment of methods to estimate socio-economic profiles, travel needs, and trip characteristics of existing transit riders and potential riders for each route and time period.
- Develop and apply methods to allocate operating expenses, capital expenses, and subsidies to each route and time period.
- Key and process on-board, roadside, and household data, and expense, revenue and subsidy data.
- Prepare resource productivity analysis of all COTA routes, time periods and relevant operations.

- Establish internal procedures to maintain data, data estimation and collection methods, and productivity techniques.
- Develop localized and management-oriented processing and retrieval capability.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

The Central Ohio Transit Authority project represents a testing of TRPD techniques for small transit systems. Demonstrations are also underway in a medium and large-sized city. In subsequent phases of this project, UMTA hopes to expand the use of TRPD techniques and determine their effectiveness in various types of transit operations. The framework will also be widened to focus on all modes of public transportation, i.e., including paratransit.

#### KEY LITERATURE REFERENCES:

Rechel, Ralph E. "Plan for a Demonstration of Means for Measuring Transit Resource Productivity and Adjusting Services or Revising Routes in Columbus, Ohio." Working paper, Washington, D. C.: Institute of Public Administration, 1978.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : PRODUCTIVITY PROJECTS AND RELATED RESEARCH

TOPIC : VANCOUVER PRICE/SERVICE IMPROVEMENTS

SPEAKER : David Ashcraft (206) 696-8185  
Vancouver Transit System  
1416 Main Street  
Vancouver, Washington 98660

SUMMARY OF MAIN POINTS:

The Vancouver demonstration will experimentally integrate fare reductions and service improvements to obtain empirical information on how transit service and fare elasticities compare. Modal shifts from auto to transit will also be evaluated. Both conventional transit and paratransit (ridersharing) options will be expanded through the demonstration. Complementary service improvements, such as traffic engineering and park-and-ride projects, will also be developed. The overall intention of the project is to develop and effectively utilize a data base oriented to consumer preferences (elasticities), and to demonstrate the relationships between this knowledge and improved productivity of public transportation.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

A seminar for transit operations participating in similar projects would assist identification of directions for additional work. This should not be held until the current initiatives are more advanced.

KEY LITERATURE REFERENCES:

Project documentation is being prepared.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : PRODUCTIVITY PROJECTS AND RELATED RESEARCH

TOPIC : BUS COSTING METHODS

SPEAKER : Subhash R. Mundle (215) 545-8000  
Simpson and Curtin  
1346 Chestnut Street, Suite 800  
Philadelphia, Pennsylvania 19107

SUMMARY OF MAJOR POINTS:

The operating cost of transit service varies by time of day, as well as by the type of service provided. The cost variations predominantly depend on labor utilization efficiency under given labor contract provisions and scheduling practices. In the past, the industry has relied on simplistic cost models--like cost per vehicle mile--resulting in inaccurate estimations of operating cost.

There have been advancements in cost allocation techniques in recent years. These models can be classified into two broad categories--regression models and unit cost models. One of the most comprehensive analyses of the bus cost allocation method was performed by Morgan. This analysis indicates that distribution of vehicle utilization by time of day and scheduling practices are the two most important factors in determining marginal and total cost of transit services. Ferreri studied the impact of different variables on cost model accuracy and concluded that, though two-variable models were acceptable for long-range planning purposes, three- or four-variable models were more accurate for short-range service improvements and fiscal planning. The cost allocation concepts developed so far satisfactorily reflect actual operating conditions, however, many assumptions and simplifications are required for practical applications. Further research is warranted to test the sensitivity of different techniques and to optimize the complexity and justified level of accuracy.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Evaluation of pricing policies requires accurate estimation of operating costs by time of day and type of service. Existing methods should be evaluated and demonstrated more widely. There is a need to develop readily applied cost allocation models. Also, attention should be given to developing cost allocation procedures for paratransit, as well as bus and fixed-guideway systems.



KEY LITERATURE REFERENCES:

Arthur Andersen and Co. Bus Route Costing for Planning Purposes. TRRL SR 108 UC. Crowthorne, Berks.: Transport and Road Research Laboratory, 1974. Available from T.R.R.L., Crowthorne, Berks, England.

Cherwony, Walter and Mundle, Subhash R. "Peak-Base Cost Allocation Models," Transportation Research Record 663, Washington, D. C.: Transportation Research Board, 1978.

Ferreri, Michael G. "Development of Transit Cost Allocation Formula," Highway Research Record 285. Washington, D. C.: Highway Research Board, 1969.

Levinson, Herbert "Peak-Off-Peak Revenue and Cost Allocation Model," Transportation Research Record 662. Washington, D. C.: Transportation Research Board, 1978.

McClenahan, J.W. et al. Two Methods of Estimating the Crew Costs of Bus Services. TRRL SR 364. Crowthorne, Berks.: Transport and Road Research Laboratory, 1978. Available from T.R.R.L., as above.

Proceedings of the Symposium on the Costing of Bus Operations. TRRL SR 180 UC. Crowthorne, Berks: Transport and Road Research Laboratory, 1975. Available from T.R.R.L., as above.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : IMPACTS OF FARE AND SERVICE CHANGES

TOPIC : ELASTICITY CONCEPTS: LIMITS OF EXISTING KNOWLEDGE

SPEAKER : Richard H. Pratt (202) 466-8230  
R. H. Pratt & Co. Division  
Barton-Aschman Associates, Inc.  
1730 K Street, N. W.  
Washington, D. C. 20006

SUMMARY OF MAJOR POINTS:

The average ridership responses to conventional fare increases and decreases on typical local bus operations approximate an arc elasticity of -0.40. A wide range of individual results are reported, however, particularly in the instance of fare reductions. The role of inflation in ridership responses has not been examined; a key question with respect to keeping deficits in line. Neither has much been done to quantify the impact on patronage of concurrent driving cost changes.

It is apparent that ridership responds least to fare changes on rapid transit, in large cities, and in other circumstances where transit service is exceptionally good or the cost of alternate modes is high. Conversely, ridership is most sensitive to fares on local bus operations, particularly in the suburbs, and wherever transit service is light. The impact of fare changes on off-peak and weekend transit patronage is typically twice the corresponding percentage impact on peak period transit volumes. These phenomena suggest underlying relationships that should be amenable to modeling. Variance in the competitive position of transit and auto travel seems to provide a more consistent explanation of differences in ridership response than the concept of transit captivity.

There is a particular lack of understanding about the effect of fare changes which are operable during certain hours only, or which apply only to limited geographic areas such as the CBD, or involve fare restructuring or purchase and subsidy of bulk fares or passes. Similarly, the effects on particular market segments of any type of fare change remain for the most part poorly understood.

On the order of one out of every two or three trips attracted to transit by fare reductions would otherwise have been made as an auto driver. The implications of the remainder--former auto passengers, walkers, or trips not made previously--remain speculative. The results of bus frequency changes in connection with fare changes are inconclusive with respect to the question of which has the greater impact. Nearly all fare decreases result in loss of revenue, emphasizing the need to understand socio-economic implications.

## RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Better data collection in connection with fare changes remains a prime requirement. In addition, more innovative analysis of available data would serve as a start toward better understanding the implications of the fare changes of the late 1970's.

Work should be done on integration of travel demand modeling with elasticity observations to provide a sketch planning model for better understanding and prediction of fare-ridership-revenue relationships. Parallel research is needed on the benefits accrued by the public in connection with travel changes induced by fare reductions.

There should be an effort to determine explicitly how fare policy is best handled in the face of pervasive inflation. Work is also needed on the effect of fare-related convenience factors on ridership, e.g., the effect on even vs. odd change exact fares, simple vs. complex fare systems, and passes vs. conventional fares.

## KEY LITERATURE REFERENCES:

Goodman, Keith M. and Melinda A. Green. Low Fare and Fare-Free Transit: Some Recent Applications by U. S. Transit Systems. Prepared by the Urban Institute for the Urban Mass Transportation Administration. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1977. Available from NTIS PB271-077.

Holland, Dempster K. A Review of Reports Relating to the Effects of Fare and Service Changes in Metropolitan Public Transportation Systems. Prepared by the Center for Urban Programs, St. Louis University for Federal Highway Administration. Washington, D. C.: U. S. Department of Transportation, Federal Highway Administration, 1974. Available from NTIS PB234-069/AS.

Kemp, Michael A. "Reduced Fare and Free-Fare Urban Transit Services--Some Case Studies." Working paper No. 1213. Washington, D. C.: The Urban Institute, 1974.

Pratt, Richard H., Neil J. Pederson and Joseph J. Mather. Traveler Response to Transportation System Changes--A Handbook for Transportation Planners. Prepared by R. H. Pratt Associates, Inc., for Federal Highway Administration. Washington, D. C.: U. S. Department of Transportation, Federal Highway Administration, 1977. Available from NTIS PB265-830/GLS.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : IMPACTS OF FARE AND SERVICE CHANGES

TOPIC : TRANSIT SERVICE ELASTICITIES

SPEAKER : Kumares C. Sinha (317) 494-4669  
Professor of Civil Engineering, and Associate Director  
Center for Public Policy and Public Administration  
Purdue University  
West Lafayette, Indiana 47907

SUMMARY OF MAJOR POINTS:

In estimating ridership and revenue changes associated with transit fare and service improvement, both price and service elasticities are necessary. Perceived quality of service depends on riding time, excess travel time, (walk, transfer, wait), service reliability, convenience, comfort, cleanliness, and security. Rider behavior with respect to both price and non-price variables varies by mode, trip purpose, time of day, and rider characteristics. City size, congestion, and land use patterns also effect responses to fare and services changes. Other observations include:

1. Long run service elasticity is higher than short run service elasticity. There is a time lag of rider response.
2. Excess travel time elasticities are much higher than riding time elasticities, particularly in off-peak periods.
3. Average value of headway elasticity is about -0.5, with wide variation. Headway is most important to middle and upper income riders, when the initial service is relatively infrequent, and when the trips served are short. For lower income groups or when initial service is frequent, fare changes may have stronger impact.
4. Average values of riding time elasticity for peak and off-peak periods are -0.35 and -0.45, respectively; excess travel time values are -0.70 and -0.90, respectively; corresponding values for fare elasticity are -0.2 and -0.40.
5. Service elasticities are usually much higher than fare elasticities, as much as 2 to 5 times depending on trip purpose and rider characteristics. Higher values are associated with work trips/higher income users.
6. Fare elasticity for rail transit is much lower than for bus transit; and suburban bus transit shows higher fare elasticity than urban service. Short distance fare elasticities

are likely to be twice that of long trips. Also, fare elasticities of choice riders may be twice that of captive riders. Fare decrease elasticities are usually lower than fare increase elasticities.

7. Little quantitative information exists on rider sensitivity to variables such as system reliability, comfort, convenience, cleanliness, and security. Yet evidence does suggest that these variables strongly influence ridership, particularly for certain market segments.

A vital qualification for using elasticity values is that the rider's decision is based on combined utility involving all relevant influencing factors. It is incorrect to consider a specific elasticity value without explicitly considering associated factors. The importance of service parameters as determinants of rider sensitivity to price cannot be understated.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

In view of growing subsidy constraint, it is important to assess relationships between service and fare levels for various market segments, to enable decisions on options, improve transit performance, and increase understanding of where and when various pricing strategies are appropriate. Analysis of the combined effects of service and price changes could be instrumental in increasing levels of cost recovery, and in attracting new demand. Innovative transit and paratransit service types that offer high levels of service should be analyzed from the perspective of developing potentially self-supporting transit, particularly for the peak-period. Existing and potential methods for focusing transit subsidies to specific user groups (e.g., wider application of user-side subsidy, provision of transit passes to low-income persons) also need further development.

#### KEY LITERATURE REFERENCES:

Extensive literature exists on the subject. An example of the application of elasticity information is:

Sinha, K. C. and A. S. Bhandari. A Comprehensive Analysis of Urban Bus Transit Efficiency and Productivity: Part II -- Analysis of Options to Improve Urban Transit Performance. Prepared by Purdue University for the Urban Mass Transportation Administration. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1978.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : IMPACTS OF FARE AND SERVICE CHANGES

TOPIC : CURRENT TRANSIT DEMAND RESEARCH AT THE URBAN INSTITUTE

SPEAKER : Michael A. Kemp (202) 223-1950  
Transportation Studies Program  
The Urban Institute  
2100 M Street, N. W.  
Washington, D. C. 20037

#### SUMMARY OF MAJOR POINTS:

An analysis is currently underway of the factors influencing the patronage of the San Diego Transit Corporation bus system over a period of forty months beginning in January 1972. This research is based on a belief that it is possible to learn more from readily-available transit operating data than has been done in the past, and it should represent an advance over previous time series analyses in three different ways. First, the data base is particularly good: the observations are pooled time series and cross-sectional (by bus route) in nature, they contain a relatively wide variation in fare level and service attributes, and they are more accurate than customary operating data. Secondly, the level of service is being described in more detail (by such variables as speed, frequency, duration, load factor, age of vehicle, etc.) than the more customary proxy measures (such as vehicle miles operated). And thirdly, the model is a simultaneous equation which attempts to take better account of the interactions between demand and supply, and the influence of demand on service quality. Knowledge of these latter relationships has important implications for how demonstrations should be designed and evaluated. Initial estimation results for the model are very promising, and more definitive results are expected soon.

Additionally, The Urban Institute is currently analyzing time series operating data for a number of recent bus fare increases (using a much simpler single-equation demand model) in order to infer the elasticities for different market segments. Suitable data have been obtained from Fort Worth, Erie, Rochester, Newport (Kentucky), and Tulsa.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Extend the current San Diego work by (i) taking more explicit account of socio-economic and demographic influences on ridership, and (ii) adding a cost model in order to demonstrate the applicability of this type of research as a management tool. Encourage similar analyses with other existing data sets. More precisely defined and better executed experiments to test the impacts of specific fare and service changes are required.

KEY LITERATURE REFERENCES:

Alperovich, Gershon, Michael A. Kemp, and Keith M. Goodman. "An Econometric Model of Bus Transit Demand and Supply." Working Paper No. 5032-1-4. Washington, D. C.: The Urban Institute, 1977.

WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : IMPACTS ON FARE AND SERVICE CHANGES

TOPIC : TRANSIT FARE SENSITIVITY BY DEMOGRAPHIC GROUP

SPEAKER : David T. Hartgen, Ph.D. (518) 457-6920  
Head, Planning and Research Unit  
Planning and Research Bureau  
New York State D.O.T.  
1220 Washington Avenue  
State Campus  
Albany, New York 12232

SUMMARY OF MAJOR POINTS:

Using a technique known as trade-off analysis, preference elasticities for transit fare increases and decreases can be estimated for different socio-economic groups. A NYSDOT-sponsored survey of 1,000 households in the State, conducted in November 1974, provided data on which two notable conclusions are based: (1) preference elasticities for fare decreases are significantly lower than preference elasticities for fare increases; (2) fare-decrease elasticities vary for different stratifications of the population, while fare-increase elasticities are very nearly the same for all socio-economic groups. The results imply, of course, that fare reductions are not likely to produce the ridership projected from fare-increase elasticities.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

1. Careful tests of fare-reduction impacts via before/after surveys by demographic groups.
2. Dissemination of research findings.

KEY LITERATURE REFERENCES:

Donnelly, E. P. "Preference Elasticities of Fare Changes by Demographic Groups." Transportation Research Record 589. Washington, D. C. Transportation Research Board, 1976.



WORKSHOP: SYSTEM AND MARKET ANALYSIS

SUBJECT : IMPACTS OF FARE AND SERVICES CHANGES

TOPIC : RESPONSES OF ELDERLY AND HANDICAPPED PEOPLE TO FARE CHANGES

SPEAKER : Essie Burnworth (703) 836-7120  
Chase, Rosen & Wallace, Inc.  
901 North Washington Street  
Alexandria, Virginia 22314

#### SUMMARY OF MAJOR POINTS:

Reduced fare programs for elderly and handicapped (E&H) transit users have been investigated in detail. Approximately 180 transit operators were interviewed by telephone and questioned about their reduced fare program characteristics, past and present, and about the impacts this program has had on operations, revenue, ridership, administrative workload and insurance coverage. These questions addressed concerns expressed by transit operators at the inception of the UMTA requirement for half fare for E&H riders during off-peak periods.

Project findings include: (1) a substantial majority of transit operators in cities had a reduced fare program for the elderly before Section 5; (2) a majority of the current reduced fare programs are available to riders at all times, not just off-peak; (3) transit fares appear to be independent of city size, ranging from up to 25¢ for transportation of handicapped and to 50¢ for adults (base fare); (4) in nearly all cases, expected negative impacts of the half-fare requirement had not materialized; (5) ridership on reduced fare programs had increased on the average of 30% when existing time of day restrictions were removed; and (6) the elderly and handicapped market appears to be strongly attracted by transit fare decreases but is relatively insensitive to fare increases. Eight instances of fare changes to existing reduced fare programs were studied in detail. Analysis of these cases indicated that the arc elasticity of elderly and handicapped ridership to fare decreases is about -1, whereas it is nearly 0 for fare increases.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

The many current reduced fare programs for elderly and handicapped patrons offer opportunities for further testing the validity of the fare elasticities calculated during this project. Careful data collection before and after a change in fare policy is necessary in order to accurately interpret ridership response.

The prevailing trend seems to be the removal of time restrictions on reduced fare programs. Additional analysis of the impact of offering reduced fares for the elderly and handicapped at all times could be very useful to transit operators contemplating such fare policy changes.

Another productive subject for additional work is specialized transportation services for elderly and handicapped people and the transit operator's role in the provision of these services. Limited data now available indicate that paratransit or specialized services attract a large percentage of the elderly and handicapped market segment away from fixed route services, even when the fare is considerably higher.

KEY LITERATURE REFERENCES:

Grey Advertising, Inc., Chase, Rosen and Wallace, Inc., and Smith and Locke Associates, Inc. Off-Peak Half-Fare Study Inventory. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1976.

Grey Advertising, Inc., Chase, Rosen and Wallace, Inc., and Smith and Locke Associates, Inc. Off-Peak Half-Fare Study: Ten Case Studies. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1976.

Grey Advertising, Inc., Chase, Rosen and Wallace, Inc., and Smith and Locke Associates, Inc., Impacts of Elderly and Handicapped Fare Policies, (in preparation).

## TRANSIT FARE POLICY

What Do We Want To Do And What Do We Need to Know?

PAUL K. DYGERT  
MANAGER  
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### I. INTRODUCTION

#### A Historical Perspective

Through most of the history of transit, fare policy largely concerned the average level of fares, and little attention was given to differentiating fares among types of users. In transit's early days automobiles were not a competitive factor in limiting transit prices and fare policy typically was set by regulatory agencies. Transit firms in the 19th Century city were issued franchises which gave them monopolies in their markets and, in turn, subjected them to governmental control and regulation. These firms, like the public utilities which frequently owned them, were generally permitted to set their prices at levels which would yield a return for the investors.

Early in the 20th Century, it became apparent that transit firms were, or were going to be, experiencing financial problems. The automobile had become an established mode of transportation by the end of World War I, and transit ridership was declining. The decline was exacerbated by the Great Depression, when fewer people needed transit to get to and from work, and it was difficult to finance equipment modernization.

At the same time, limitations imposed by franchises and regulatory agencies kept fares from rising despite increasing costs. Average transit fares were 7.1 cents in 1924, and 16 years later, in 1940, had declined to 6.7 cents.<sup>1/</sup>

Since 1940, each decade signaled a different trend in transit fare policy. These trends are partly revealed in the published data on average fares (see Table 1 at the end of this paper), but they are also partially obscured because different firms have gone through the transition cycle at somewhat different times.

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<sup>1/</sup> Wilfred Owen, The Metropolitan Transportation Problem (Washington: The Brookings Institution, 1956), p. 90.

for particular groups in the community. The emphasis of the discussion is on the need for adequate market research, a need which dominates all other aspects of fare policy if transit is to achieve the objectives established for it.

### Types of Transit Markets

In an important respect, the objectives a community has for its transit system define the individual markets that the system should be attempting to develop and serve. It is these markets toward which fare policy should be directed and which will determine much of the content of that policy. That objectives can also provide criteria for the identification of markets, or market segments, can be seen from the two following examples.

The objective of reducing air pollution, traffic congestion, and energy consumption requires that fare and service policies be directed toward the commuter market, primarily the suburban commuter. An off-peak, free-fare policy for downtown circulation, for example, will not effectively attack the problems of congestion, air pollution, and energy consumption, because that is not the market that is causing the bulk of the problem.

It is not enough, however, to devise fare and service policies which will attract commuters to rail or express buses that are providing long distance, line-haul service. Service must also be provided for the intra-suburb, suburb-to-suburb, and intracity commuter who can frequently be better served by car pools or van pools than by rail or express bus systems. So the objective of reducing congestion, air pollution, and energy consumption requires fare and service policies that will attract several different commuter markets.

Considering another rather different example, the objectives of providing public transportation services to low-income persons adds a very different dimension to transit fare policy. It turns out to be the case (which is not intuitively obvious) that low fares designed to aid low-income persons will not attract any significant numbers of commuters from their automobiles to transit. So fare policy must provide a different package of fares and services for commuters, to accomplish the objectives for that market, than it does for low-income persons, to accomplish the objectives for that market.

A generalized schematic picture of the linkages between objectives, market segments, and service characteristics is shown in Figure 1. The figure illustrates the point that has just been made: to accomplish specific objectives for a transit system, one must focus on specific markets. It does no good to provide low youth fares if one's objective is to make significant reductions in congestion and air pollution or to create economic development.

The next step, as shown in Figure 1, is to proceed from market segments to identifying service characteristics which appeal to specific markets. This is essentially a market research problem and will be considered in the next section.

### Market Characteristics

It is important, at the outset, to be clear about a point that, by now, should be familiar to everyone: fare policy is related, explicitly or implicitly, to a service policy. A service policy simply means the set of characteristics of a transit system that are provided to a user when she or he pays a fare.

A dozen or so years ago, some theoretical economic ideas were developed which argued that it was the characteristics of goods or services that people purchased, rather than the goods or services themselves. It was also shown that it is possible to determine what people are willing to pay for different amounts of the most important characteristics of a good. This notion simply says that when one buys a transit trip, an automobile, or a sirloin steak, one is really buying a set of characteristics. It is as if the price one paid for the good or service could be decomposed into amounts that represented the value of each of the major characteristics. Most of those "component characteristics" prices will be positive (since one will pay positive prices for characteristics one wants), but some may be negative if buyers would prefer less of the characteristics.

For example, it is generally considered that the elapsed time required for a trip is an important characteristic of transit service. One would expect an increase in elapsed time to reduce the amount a user is willing to pay for a transit trip. Putting it another way, it is expected that a transit user will generally be willing to pay more for an express than for a local trip. Then elapsed time (or the frequency of stops) is a characteristic which would be expected to have a negative price component: the less the elapsed time, the more users would be willing to pay for the service, other things being equal.

We can now reiterate for a moment and see where we are in the argument. We started with the proposition that to achieve particular objectives of a transit system, one needs to focus on particular markets: in a sense the objectives literally define the relevant markets. (These are the first two blocks in Figure 1.) The second step in the argument is that to convert the potential demand in a market to actual demand (transit users) one must provide users the set of service characteristics for which they are willing to pay (blocks three and four in Figure 1). The next step is to see what we know and how much we need to find out about the preferred service characteristics in specific transit markets.

### III. WHAT DO WE NEED TO KNOW?

Turning to the question of what we need to know to devise an effective transit fare policy, it is useful to make a three-fold distinction among the things we already know; the things we have a pretty good idea about, but are not completely certain; and the things we really do not know.

#### Things We Already Know

We can begin with an inventory of the things we already know that have, or should have, a significant impact on the design of transit fare policies.

We know that, when the perceived cost of an auto trip and a transit trip are the same, a person will invariably choose the auto trip.

We know that the set of pricing policies which affect the perceived cost of an auto trip is the keystone of transit fare policy. As long as auto trips, particularly urban work trips, are heavily subsidized, it is unlikely that transit subsidies can or should be eliminated.

We know that, to achieve the objectives of reducing congestion, air pollution, or energy consumption, transit must make a major impact on the modal choice for work trips.

We know that fare reductions will not cause a sufficiently large modal shift to transit to significantly affect the objectives of reducing congestion, air pollution, and energy consumption.

We know that maintaining low average fares for the benefit of low-income persons also subsidizes middle- and upper-income persons who would be willing to pay more for their trips.

We know that many commuters are willing to pay relatively high fares for commuter or subscription services.

We know that elasticities with respect to service improvements are generally much larger in absolute value than are elasticities with respect to changes in perceived cost.

This last point is a very general proposition--too general to be very helpful in planning a transit fare policy. We have not arrived at some of the things we know, in part, but are not completely certain about.

### Things We Know In Part

In the group of things we know in part it will be useful to make a distinction between the generally accepted estimates we have for fare and service elasticities (which the arguments has already implied are largely irrelevant to the purposes being considered) and the very sketchy information we have which may be relevant, but the value of which is quite uncertain.

### Largely Irrelevant Information

The argument that is being developed here clearly implies that the rather extensive body of literature on average fare elasticities, and on average service elasticities based on readily available measures of service is largely irrelevant to the kinds of information one needs to do a meaningful market analysis and to devise an effective transit fare policy. This is not to denigrate the work that has been done in the past since any research has its own objectives and historical perspective. But it does argue that many of the fare and service elasticities widely discussed in the transit industry are not necessarily relevant to the process of devising fare policies for particular transit firms.

From the viewpoint of the present discussion, there are two main problems with most of the existing estimates of transit fare or service elasticities. The first problem is that the estimates have not been made for specific markets but generally cover groups of markets which would be expected to have quite different elasticities for fares and service characteristics. The second problem is that the "service characteristics", such as vehicle miles, often used in the analysis, are simply not relevant to the design of a transit service and fare policy. A single fare elasticity estimate (or even separate peak and off-peak estimates) or the estimates of service elasticities for vehicle miles, access time, or travel time across an entire transit system fail to provide much information that is useful for the design of a fare policy.

### Relevant But Sketchy Information

Some of the types of information that would be relevant to the kinds of transit fare policies being considered here are given in Table 2 through 10. These data resulted from surveys conducted in Baltimore and in Columbia, South Carolina. The tables are given here, not because the data in them are necessarily applicable to fare policy development in some other community, but because they are indicative of the kinds of information required, and the kinds of questions that need to be asked. The Baltimore data are based on a random telephone survey, so they reflect the views of current nonusers as well as users of the transit service.

The data in Table 2 indicates how much Baltimore respondents in various income groups indicated that they would be willing to pay for more frequent service. These data still, however, are not differentiated among specific types of markets.

Responses given in Tables 3 through 6 indicate the relative preferences of Baltimore residents for low cost versus frequent service, dependability, at-the-door service and short wait. The results are stratified by relevant categories of income, employment, age, or sex, as appropriate. These results are certainly not definitive, nor are they adequately differentiated by specific markets. Yet they do indicate some relevant preferences for particular service characteristics.

Selected results of a mail survey of residents of Columbia, South Carolina, are given in Tables 7 through 10. In this survey, each respondent was asked, given a hypothetical free fare, how much more he or she would be willing to pay for each of nine service characteristics. These characteristics included crime prevention; pick-up at the door; on-time service; air conditioning; waiting time reduced from 20 to 10 minutes; heated, cooled, dry bus shelters; clean, comfortable seats; riding time reduced from 20 to 10 minutes; and the certainty of getting a seat. The average results for all respondents are given in Table 7, and the results stratified by employment, status, income, and age group are shown in Table 8 through 10, respectively. Again, the essential point here is not the results, but the kinds of questions asked and the ways in which the data are stratified.

### Research Requirements

The foregoing discussion, particularly that of the immediately preceding section, provides a clear indication that the development of an effective transit fare policy needs to begin with some solid, largely conventional, market research. This market research should begin with a determination of the specific markets that need to be developed to achieve the community's objectives for the transit system.

Once the markets have been defined, it is necessary to ascertain the specific transit system characteristics that will induce potential riders in that market to use transit. For example, one can readily identify a number of service characteristics that are measurable and that would be expected, a priori, to be relevant to the choice of transit over auto as the primary mode for work trips. These characteristics are:

- frequency, or headway (either an expected wait time for a random passenger arrival, or a schedule delay for passenger arrivals to meet a published schedule);



- *service dependability (probability of service being no more than X minutes behind schedule);*
- *expected transit trip time relative to expected auto trip time;*
- *variance in transit trip time relative to variance in auto trip time;*
- *probability of getting a seat;*
- *probability of the air conditioning system working;*
- *convenience of collection/distribution (walk time);*
- *perceived transit trip cost relative to the perceived auto trip cost (including parking cost);*
- *availability of mid-afternoon "early" schedule;*
- *availability of mid-to-late-evening "clean up" schedule.*

*Perhaps not all of these characteristics would be relevant, and other important ones may have been overlooked. A carefully designed market research program would normally be capable of determining the relevant characteristics in any community for any major transit market. Similar list of characteristics could be determined for each of the other major transit markets in the community.*

*The next step would be to determine, either through surveys or marketing tests, how much riders would be willing to pay for transit with these characteristics. Such initial survey data as that developed in Columbia and reported in Tables 7 through 10 would be useful. Data should, however, be developed for different levels of base fares than the free-fare base used in the Columbia survey. Demonstration projects, accompanied by appropriate promotion and advertising, would provide data for confirming or revising the initial fare structure.*

#### *IV. CONCLUSIONS*

*The process for establishing an effective transit fare policy is a straightforward one, and is analogous to market research for other kinds of goods and services. Implementation of the process does, however, require a different approach than has traditionally been taken to establishing transit fares, and it requires a significant amount of specific information that transit operators do not routinely collect.*

*The end result of the process should be a set of fares and related service characteristics in the community's several market segments which would maximize achievement of the community's objectives for its transit system, subject to the constraints imposed by the prices of automobile trips, rider preferences, the costs of producing transit services, and the willingness and ability of the community to provide subsidies.*

*There are two additional implementation issues that need to be kept in mind. The most serious of these concerns the protection of low-income target groups. The implementation of an effective fare policy, which will involve many specific service improvements and corresponding fare increases, will only be possible or desirable if effective methods are also developed to provide subsidies for low-income groups.*

*The second issue concerns the possibility that, in some instances, for a more complex fare structure may also require more sophisticated fare collection equipment than are currently in place, particularly on bus systems. Much of what has been discussed here, however, can be implemented with existing fare collection systems.*

*Neither technical nor political issues should prove to be permanent barriers to the implementation of an effective transit fare policy. The current lack of adequate and relevant information on market responsiveness to different combinations of fares and services does, however, prevent us from devising policies which will increase transit usage and probably increase revenue at the same time.*

## TABLES<sup>1</sup>

<sup>1</sup> Tables 2 through 10 have been reprinted from Peat, Marwick, Mitchell and Co., Study of Public Transportation Fare Policy (Washington: U. S. Department of Transportation, Office of the Secretary) December 1976.

TABLE 1

Trends in Average Transit Fares  
All Modes

<u>Calendar Year</u>	<u>Average Fare</u>	<u>Average Annual Percentage Change</u>
1940	6.7¢	--
1945	6.9¢	0.6
1950	10.0¢	7.7
1955	14.8¢	8.2
1960	17.8¢	3.8
1965	19.7¢	2.0
1970	27.6¢	7.0
1975	33.0¢	3.6
1976	35.7¢	8.2
1977	37.7¢	5.6

Source: '78 Transit Fact Book (Washington, D. C., American Public Transit Association) May 1978, p. 32.

TABLE 2

**WILLINGNESS TO PAY HIGHER FARES FOR MORE FREQUENT SERVICE:  
BALTIMORE SURVEY RESULTS**

Income Level	Amount of Additional Fare (% of respondents)								Number of Respondents
	0¢ More	10¢ More	20¢ More	30¢ More	40¢ More	50¢ More	60¢ More	70¢ More	
Less Than \$3,000	52.0	36.0	8.0	1.0	1.0	2.0	0.0	0.0	100
\$3,001 - \$4,000	33.3	51.0	7.8	5.9	0.0	0.0	2.0	0.0	51
\$4,001 - \$8,000	21.7	57.5	11.3	6.6	0.9	0.9	0.0	0.9	106
\$9,001 - \$9,500	31.6	52.6	12.3	1.8	0.0	0.0	0.0	0.9	57
\$9,501 - \$11,000	18.6	50.6	15.7	2.9	1.4	2.9	0.0	0.0	70
\$11,001 - \$16,000	23.0	41.3	24.6	4.0	0.8	3.2	1.6	1.6	126
\$16,001 and above	19.0	36.6	30.8	5.9	2.9	2.6	1.1	1.1	273

Source: PMM&Co., Market Survey Working Paper #18, prepared for the Baltimore Region Phase II Transit Study, March 1975.

TABLE 3

PREFERENCES FOR LOW COST VERSUS FREQUENT SERVICE:  
BALTIMORE SURVEY RESULTS STRATIFIED BY INCOME  
LEVEL OF RESPONDENT

<u>INCOME LEVEL</u>	<u>LOW COST</u>	<u>VS.</u>	<u>FREQUENT SERVICE</u>
	<u>(Percentage of Respondents)</u>		
Less than \$3,000	66.7		33.3
\$3,001 - \$4,000	61.7		38.3
\$4,001 - \$8,000	50.0		50.0
\$8,001 - \$9,500	47.3		52.7
\$9,501-\$11,000	50.0		50.0
\$11,001 - \$16,000	48.1		51.9
\$16,001 and above	39.8		60.2

Number of Respondents = 761

Source: PMM&Co., Market Survey Working Paper #18, published in  
March, 1975 for the Baltimore Region Phase II Transit Study.

TABLE 4

**PREFERENCES FOR LOW COST VERSUS DEPENDABILITY:  
BALTIMORE SURVEY RESULTS STRATIFIED BY STATUS, AGE, AND  
INCOME LEVEL OF RESPONDENT**

<u>BY STATUS</u>	<u>LOW COST</u>	<u>VS.</u>	<u>DEPENDABILITY</u>
	(Percentage of Respondents)		
Employed Full-Time	18.0		82.0
Employed Part-Time	29.5		70.5
Homemaker	25.0		75.0
Pre-college Student	22.2		77.8
College Student	23.1		76.9
Retired	42.6		57.4
<u>BY AGE</u>			
14 - 18	20.3		79.7
19 - 24	26.2		73.7
25 - 34	18.9		81.1
35 - 54	20.5		79.5
55 and over	32.7		67.3
<u>BY INCOME LEVEL</u>			
Less than \$3,000	44.1		55.9
\$3,001 - \$4,000	39.6		60.4
\$4,001 - \$8,000	29.7		70.3
\$8,001 - \$9,500	19.3		80.7
\$9,501 - \$11,000	26.1		73.9
\$11,001 - \$16,000	19.5		80.5
\$16,001 and above	12.3		87.7

Number of Respondents by Status = 885; by Age = 897; by Income level = 765

Source: PMM&Co., Market Survey Working Paper #18, published in March, 1975 for the Baltimore Region Phase II Transit Study.

TABLE 5

PREFERENCES OF LOW COST VERSUS AT-THE-DOOR SERVICE:  
BALTIMORE SURVEY RESULTS STRATIFIED BY STATUS AND AGE  
OF RESPONDENT

	<u>AT THE DOOR SERVICE VS. LOW COST</u> (Percentage of Respondents)	
<u>BY STATUS</u>		
Employed Full-Time	19.6	80.4
Employed Part-Time	19.2	80.8
Homemaker	17.4	82.6
Pre-college Student	18.2	81.8
College Student	11.5	88.5
Retired	35.5	68.5
<u>BY AGE</u>		
14 - 18	15.7	84.3
19 - 24	10.0	90.0
25 - 34	18.0	82.0
35 - 54	18.6	81.4
55 and over	29.4	70.6
Number of Respondents:		
By Status = 900		
By Age = 912		

Source: PMM&Co., Market Survey Working Paper #18, published in March, 1975 for the Baltimore Region Phase II Transit Study.



TABLE 6

PREFERENCES OF LOW COST VERSUS SHORT WAIT:  
BALTIMORE SURVEY RESULTS DIFFERENTIATED  
BY SEX OF RESPONDENT

<u>SEX</u>	<u>LOW COST VS. SHORT WAIT</u> (Percentage of Respondents)	
	Male	54.1
Female	50.3	49.7
Number of Respondents = 876		

Source: PMM&Co., Market Survey Working Paper #18, published in March, 1975 for the Baltimore Region Phase II Transit Study.

TABLE 7

**AVERAGE AMOUNT RESPONDENTS WOULD BE WILLING TO  
PAY FOR EACH TRIP FOR EACH IMPROVEMENT:  
COLUMBIA SURVEY RESULTS**

<b>Improvement</b>	<b>Average Amount Respondents Would Pay (cents)</b>
Crime prevention	10.5
Pickup at the door instead of 7 minutes away	9.4
On-time service	9.0
Air conditioning	8.5
Waiting time reduced from 20 minutes to 10 minutes	8.4
Heated, cooled, dry bus shelter	8.1
Clean, comfortable seat	7.9
Riding time reduced from 20 minutes to 10 minutes	7.7
Certainty of getting a seat	7.4

**TABLE 8**

**HOW MUCH RESPONDENTS WOULD PAY FOR SERVICE IMPROVEMENTS:  
COLUMBIA SURVEY RESULTS STRATIFIED BY OCCUPATION GROUP  
OF RESPONDENTS**

OCCUPATION SERVICE IMPROVEMENT	AVERAGE AMOUNT RESPONDENTS WOULD PAY FOR IMPROVEMENT				
	EMPLOYED FULL-TIME	EMPLOYED PART-TIME	HOUSEWIFE	RETIRED	TOTAL
Cut waiting time from 20 minutes to 10 minutes	9.0	6.8	8.3	8.5	8.4
Pickup at-the-door, instead of 7 minutes away	9.7	6.9	11.0	9.5	9.4
On-time service	8.8	7.9	10.1	9.0	9.0
Certainty of getting a seat	6.7	7.0	10.2	7.9	7.4
Clean, comfortable seat	7.1	7.4	9.4	8.9	7.9
Air conditioning	7.9	7.4	10.0	9.0	8.5
Cut riding time from 20 minutes to 10 minutes	7.5	7.3	8.0	8.8	7.7
Prevent crime	9.7	10.1	12.1	11.4	10.5
Heated, cooled, dry bus shelter	7.7	7.5	9.2	8.8	8.1

**TABLE 9**

**HOW MUCH RESPONDENTS WOULD PAY FOR SERVICE IMPROVEMENTS:  
COLUMBIA SURVEY RESULTS STRATIFIED BY INCOME GROUP OF  
RESPONDENTS**

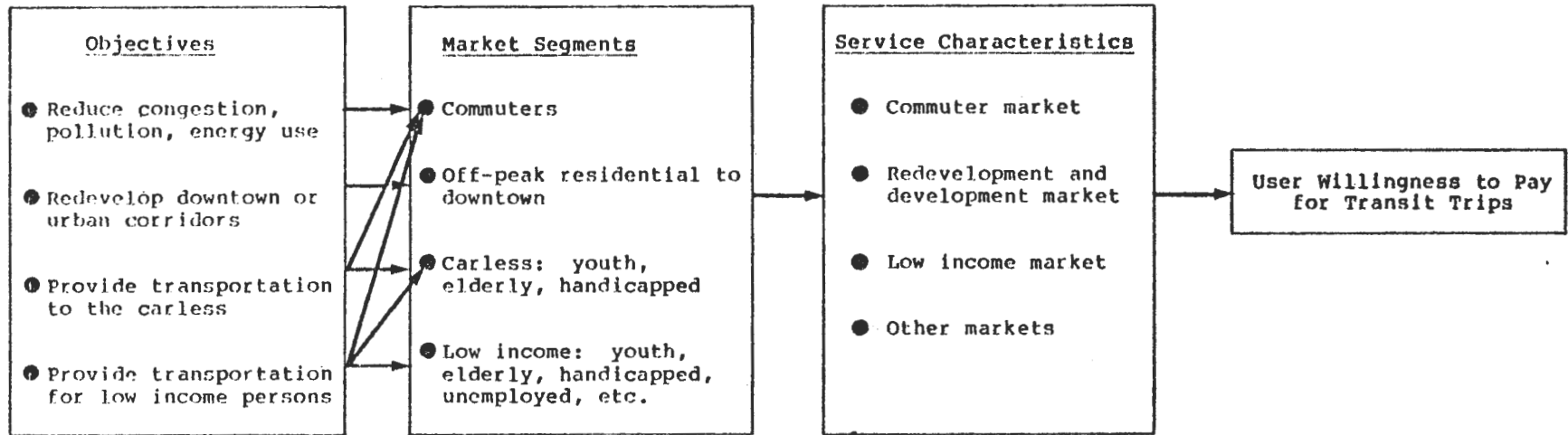
SERVICE IMPROVEMENTS	AVERAGE AMOUNT RESPONDENTS WOULD PAY FOR IMPROVEMENT						
	LESS THAN \$4,000	\$4,001 to \$8,000	\$8,001 to \$11,000	11,001 to \$18,000	\$18,001 to \$20,000	\$20,001 and above	TOTAL
Cut waiting time from 20 minutes to 10 minutes	8.1	7.0	7.9	8.0	7.5	9.2	8.4
Pickup at-the-door, instead of 7 minutes away	8.8	9.2	9.1	9.8	8.9	9.8	9.4
On-time service	9.9	7.5	10.7	10.1	8.8	9.2	9.0
Certainty of getting a seat	7.9	6.3	8.0	7.3	6.7	3.3	7.4
Clean, comfortable seat	7.8	7.4	8.5	7.6	7.2	7.3	7.9
Air Conditioning	7.9	9.3	7.5	8.1	7.9	8.6	8.5
Cut riding time from 20 minutes to 10 minutes	8.5	7.8	7.9	7.8	5.8	8.2	7.7
Prevent crime	9.0	9.5	10.8	10.7	10.4	10.2	10.5
Heated, cooled, dry bus shelter	8.8	8.6	8.9	7.3	8.3	7.0	8.1

**TABLE 10**

**HOW MUCH RESPONDENTS WOULD PAY FOR SERVICE IMPROVEMENTS:  
COLUMBIA SURVEY RESULTS STRATIFIED BY AGE GROUP OF  
RESPONDENTS**

SERVICE IMPROVEMENT \ AGE	AVERAGE AMOUNT RESPONDENTS WOULD PAY FOR IMPROVEMENT							
	14-21	22-26	27-31	32-41	42-51	52-61	62-88	TOTAL
Cut waiting time from 20 minutes to 10 minutes	7.8	7.5	6.7	8.8	8.6	9.3	8.9	8.4
Pickup at-the-door, instead of 7 minutes away	9.4	9.1	7.5	10.7	9.3	10.1	9.5	9.4
On-time service	9.6	10.0	7.8	8.9	8.4	9.7	8.7	9.0
Certainty of getting a seat	8.3	7.2	5.1	8.0	7.1	7.5	8.1	7.4
Clean, comfortable seat	8.3	7.6	6.1	7.6	7.9	8.2	8.7	7.9
Air Conditioning	9.0	8.0	6.9	8.8	8.5	8.5	8.9	8.5
Cut riding time from 20 minutes to 10 minutes	8.1	8.0	6.2	7.7	7.7	7.6	8.5	7.7
Prevent crime	10.8	10.6	9.2	10.8	10.5	10.1	11.3	10.5
Heated, cooled, dry bus shelter	9.4	8.7	6.7	7.7	7.8	9.1	8.8	8.1

FIGURE 1



## WORKSHOP IV: ADVANCES AND NEW DIRECTIONS SUMMARY

Workshop IV discussed fare variations (time, distance and quality based fares), alternatives to conventional fare collection methods, paratransit pricing issues, and improvements in transfer practices.

### Workshop Concensus

Much of the workshop discussion can be summarized around a few key concepts. The first is the possibility of using pricing techniques to increase the level of cost recovery from fares. It is likely that service and fare variations can be introduced to achieve this end while not significantly discouraging ridership. Existing knowledge of transit (and paratransit) demand relates that as a whole, users are more sensitive to service quality than they are to the fare level. This is particularly true for peak-period transit riders, when automobile levels of service are low. From these considerations, it can be inferred that if transit fares are raised selectively (e.g., in peak-periods only, for services or routes where the perceived level of service is higher than for other services, or for new services developed specifically to satisfy quality-conscious users), transit revenues will be increased while largely maintaining the level of ridership. Ridership could even expand if the increased revenue recovered from high cost and high quality service is applied to financing additional service.

### Suggested New Initiatives

Related to this vision of necessary innovation the workshop participants made the following recommendations for further UMTA initiatives:

- Industry experience with fare variations (time, distance, and quality-based fares) needs to be summarized. Revenue, ridership, and equity (individual user fares in relation to costs of service consumed) parameters of various fare structures need to be documented. The impact of fare structures on transit efficiency should be ascertained for both operating effects (e.g., boarding times) and system effects (e.g., service provision and demand for long vs. short trips). The abilities of different fare structures (time and/or distance based fares) to reflect correctly findings of cost allocation and marginal cost assessments of transit should be determined.

- Industry practice in the analysis of costs needs to be advanced. Cost allocation methods are useful for identifying high-cost services, routes and route segments, and for pin-pointing the most costly services. These techniques have not been used extensively to date. Existing methods need to be refined and validated, and their use should be promoted. Development of revenue-to-cost ratios for each route and route segment should become common practice, with the output of such analysis related for consistency to locally-adopted transit goals and objectives. Studies of the marginal cost of different categories of service should be intensified, and immediate efforts should communicate the results of early research in these areas.
  
- Service and fare elasticity knowledge needs to be refined, with research oriented more to specific market segments than it has been in the past. Efforts should seek to establish preferences for different price-quality combinations for both existing and potential users. Market research activities initially, followed by demonstration of higher quality services will be most useful to this end. UMTA should consider developing uniform survey methods for relating stated user preferences to service options feasible for conventional transit and for indicating where paratransit options are more feasible. These might take the form of scenarios integrating transit and paratransit modes by levels of service, satisfactory fare levels, sub-modal productivities, temporal and spatial applications, etc. Alternatively, MPO's and transit operators could be specifically funded to develop service diversification programs.
  
- A comprehensive report on the pros and cons of distance-based fares should be developed. This should include assessment of the effects (ridership, revenue, efficiency) of fare increases for graduated vs. flat fare systems. The use of computer models and other management aids for the evaluation of fare alternatives should be promoted.
  
- Impediments to fare and service variations need to be further evaluated. For example, typical cash payment fare procedures restrict the extent



to which fares can be varied, though this is not absolute. Self-service and driver provided receipt procedures can extend the feasibility of fare variations. Demonstration efforts in these areas should be accelerated. The ability of increased reliance on pre-paid passes to reduce negative attributes of fare variations (i.e., boarding delays, perceived fare system complexity) should also be determined.

- Existing data from paratransit research and demonstrations should be reviewed to compile the state of knowledge on fare and service elasticities for different user characteristics, trip purposes, and types of service. This is presently necessary to identify gaps and define further demonstrations.
- Analysis of competitive and complementary effects between conventional transit and paratransit should be increased.
- Additional paratransit research should focus on marginal cost pricing and appropriate discounts and surcharges for innovative taxi services. Improved cost analysis of taxis is required with an immediate focus being determination of effective peak/off-peak fare differentials.
- It must be noted that some participants did not view fare and service variations as a favorable direction for innovation. This view sees uniformity of transit service as most desirable, noting European examples of mature transit operations. UMTA might initiate research that would clarify how land-use, political, institutional, and other factors compare between European and American transit environments, to delineate the appropriateness of European models of transit evolution. The major issue is whether consolidated or market-specific transit offers greatest potential for meeting present and future urban transport needs.
- Some impetus for fare variation stems from recent research findings on the inequities involved with standardized fare practices. This research should be extended to include analysis of the incidence of local or regional taxes used to support transit. It may be found that fare

inequities (typically favoring suburban users) are off-set by tax contribution.

- One very general view shared by the group was that transit pricing policies cannot be fully effective where automobile pricing is distorted. UMTA should consider how sub-optimal auto pricing impairs transit pricing applications, and emphasize the interdependence between auto subsidies and transit deficits to local governments.

## WORKSHOP IV: ADVANCES AND NEW DIRECTIONS

### ABSTRACTS

Co-moderators: Harold Geissenheimer, Chicago Transit Authority  
Ronald Kirby, The Urban Institute

Reporter: Stewart McKeown, Urban Mass Transportation Administration

#### List of Presentations

1. Time Distance, and Quality-Based Fares
  - Peak/Off-Peak Fare Differentials: A Survey and Synthesis  
Carol A. Keck, New York State Department of Transportation
  - Impacts of Distance-Based vs. "Flat" fares  
Donald P. Ballou and Lakshmi Mohan, State University of  
New York at Albany
  - SCRTD Cast Study: Change from "Flat" to Distance-Based Fares  
G. Edward Vandeventer, Southern California Radpi Transit District
  - Quality-Based Fares: Concept and Existing Examples  
David P. Middendorf, Peat, Marwick, Mitchell & Co.
2. Fare Collection Costs and Innovations
  - Fare Collection Costs  
James Mateyka, Booz-Allen & Hamilton, Inc.
  - Demonstration of Self-Service Fare Collection  
Lawrence E. Diebel, The Mitre Corp.
  - Credit Card Fare Collection  
Lawrence E. Diebel, The Mitre Corp.
3. Transfer Policy Study  
Daniel Brand, Charles River Associates, Inc.
4. Paratransit Pricing Issues
  - Overview: Pricing Innovations for Paratransit  
Robert G. McGillivray, The Urban Institute
  - Price Elasticities for On-Call Paratransit Services  
Robert G. McGillivray, The Urban Institute
  - Impacts of Taxi Fare Changes  
Gorman Gilbert, University of North Carolina
  - User-Side Subsidy: Experience and Potential  
Larry A. Bruno, Urban Mass Transportation Administration
  - Paratransit Accounting: Billing and Costing Issues  
Joseph Revis, Institute of Public Administration

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : TIME, DISTANCE, AND QUALITY-BASED FARES

TOPIC : PEAK/OFF-PEAK FARE DIFFERENTIALS: A SURVEY AND SYNTHESIS

SPEAKER : Carol A. Keck (518) 457-3916  
New York State Dept. of Transportation  
1220 Washington Avenue  
State Campus  
Albany, NY 12232

#### SUMMARY OF MAJOR POINTS:

##### 1. Rationales for the concept

Two major rationales for charging fares differentiated by time-of-day exist: 1. Cost, efficiency, and equity considerations, and 2. considerations related to value of service. Peak-period services are far more costly to provide than off-peak services. Higher peak costs stem from the fact that transit service cannot be produced in small quantities--drivers and vehicles committed for peak service remain idle for much of the day. Extensive demand "shift" from peak to off-peak periods do not usually result from higher peak (or lower off-peak) fares, though lower off-peak fares can generate significant new ridership. To the extent, however, that a levelling of demand can be achieved through pricing, this represents improved efficiency. The equity perspective stresses that users' fares should reflect costs attributable to services they consume; "flat" fares usually represent significant cross-subsidy between users.

The value of service view holds that transit service components should be priced according to their perceived value, as represented by demand elasticities. Because peak-period demand is normally far more inelastic than is off-peak demand, peak fares should be higher. When fare increases are necessary, instituting time differentials will minimize ridership loss.

##### 2. Impediments

Historically the transit industry has not been oriented to reflecting cost differences with fare variations, but there are also a number of practical reasons that discourage variations. These include that the public may not perceive equity if differentials are too wide, that ill-will can develop from patron misunderstanding of fare system complexity, that fare differentials can result in increased administrative expense (or make data collection more difficult), and that higher peak transit fares are not likely to be politically popular and can be said to contradict other urban and environmental objectives.

### 3. An industry survey

In 1977, New York State DOT surveyed industry fare structures and impacts on ridership, revenue, and costs.

- Commuter rail services in Boston, Philadelphia and Pittsburgh rely on distance-based fares alone. None of the respondents felt that fare structure or collection system affects operating characteristics significantly. Commuter services in England offer off-peak differentials often exceeding 50 percent.
- Of rapid transit services, only San Francisco's BART and Washington's Metro use distance-based structures. D. C.'s structure includes peak/off-peak differentials. New York City and Boston have experimented with reduced off-peak fares (either in all off-peak hours or weekends/Sundays only), for promotional purposes. The London Underground offers significant off-peak savings.
- Light rail systems have attributed changes in operating speeds, revenues, efficiency and ridership to fare structure and collection mechanisms.
- Increasing numbers of bus systems have instituted time-based differentials. These include Washington, D. C. (as much as 40 percent); Akron, and Canton, Ohio; Erie, Pa.; and UMTA demonstrations of free off-peak service in Denver, and Trenton. Austin, Texas provides a 50 percent off-peak discount, sells tickets punched twice for a peak trip and once for an off-peak trip, and offers special off-peak transfer privileges.
- Special fare programs are available for the elderly and handicapped in nearly all cases, and for school children almost as often. However, rather than being a differential pricing technique, these programs were designed to achieve social ends: elderly and handicapped fares are available at all times, and school fares are usually limited to peak school travel hours. Such programs could be designed to encourage off-peak travel, but the lack of this suggests that the social and economic needs of the specific groups are more important than transit operator efficiency concerns.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

The major reason survey respondents cited for using their current fare structure were ridership incentives, ease of collection, revenue yield, and tradition. Much less often cited factors were user equity, service improvements, and performance. Perhaps these attitudes and behavior patterns should be of concern. Instead of looking at differential pricing techniques as equity measures, or ways to balancing charges with costs, or promoting efficiency, transit operators appear to be constrained by more immediate issues such as the need to show ridership increases, urges to simplify their administrative and accounting

procedures, or to increase revenues. UMTA might seek to establish more definitively the merits of fare differentials, and effectively communicate these to the transit and local political community. Further, the fact that distance-based fares are somewhat more common than temporal differentials may infer that fare system complexity is not a severe problem and that perceived equity or other factors are more important. The fact that transit costs vary by time-of-day as well as distance is probably not widely understood or accepted. Again, a "communication" effort is called for.

#### KEY LITERATURE REFERENCES:

- Habib, Philip. Fare Policy and Structure. Washington, D. C., U. S. Department of Transportation, Urban Mass Transportation Administration, Research and Education Division, 1978. Available from NTIS (PB 289-194).
- Weiss, D. C. and D. T. Hartgen. Revenue Ridership and Equity of Differential Time of Day Fares. Preliminary Research Reports 99. Albany, N. Y.: New York State Department of Transportation, 1976.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : TIME, DISTANCE, AND QUALITY-BASED FARES

TOPIC : IMPACTS OF DISTANCE-BASED VS. FLAT FARES  
(A decision model for evaluating transit pricing policies)

SPEAKERS: Donald P. Ballou and Lakshmi Mohan (518) 457-4951  
School of Business  
State University of New York at Albany  
Albany, NY 12222

SUMMARY OF KEY POINTS:

1. Decision Models for Transit Managers

Decision models emphasizing relationships between control variables such as transit fares and performance measures like revenue and ridership can significantly assist transit management decision-making. However, such models are not easy to design because of the behavioral nature of travel, data limitations and complex inter-relationships among variables. The decision calculus concept for addressing marketing problems, pioneered by John Little of MIT, offers a tested methodology for designing transit pricing decision models. A key feature of the decision calculus approach is recognition of the manager's judgments as an important data source for model calibration, especially when historical data are inadequate.

2. Design Considerations for Transit Pricing Decision Models

Since transit pricing is a political issue, the equity implications of proposed fare policies need to be examined in addition to the overall economic effects. This calls for a disaggregate model structure--traditional aggregate models of travel demand are incapable of assessing how rider groups are affected by changes in fare or other policies. Another vital consideration is that the model should be easily understood by transit managers; they are unlikely to use it if they do not have confidence in the output. This requirement dictates a simple model structure incorporating only important phenomena. Apart from the intellectual cost of understanding a complex model, time and financial costs of model development and data collection increase rapidly with model detail. A basic model should be the starting point and an evolutionary approach is recommended for expanding it, based on trade-off of cost against value of improved accuracy.

From these considerations, micro-simulation was used in model design to isolate individual rider response to changes in fare structure. The model first forecasts revised demand for each rider in the sample resulting from the new fare policy. This draws on elasticity estimates

provided as input to the model. Micro-simulation enables different elasticities to be applied to individual riders, thus accurately representing important travel demand factors. Individual estimates of ridership and revenue are calculated, then projected to the population using weighting factors and, lastly, aggregated according to rider characteristics of interest. The results are estimates of transit demand, revenue and average fare paid by classes of riders for each policy simulated. The output presents results in terms of "before and after" comparisons to facilitate user interpretation.

### 3. Evaluation of Distance-Based vs. Flat Fares (Albany, N. Y.)

The model was applied to assess effects of distance-based fares in the Albany, N. Y. metropolitan area, using data from an on-board survey conducted by the transit agency. Preliminary data analysis was performed to test the hypothesis that inequities exist in the present (essentially "flat") fare structure. It emerged that rider fare per mile spanned a wide range: 32% paid 10¢ or less, 44% paid between 11¢ and 25¢, and the remaining 24% paid between 26¢ and 76¢. The structure of inequities was found to correlate highly with demographics and other factors like trip purpose and time of day.

Various distance-based fare policies were tested as alternatives to the present large-zone system. These are basically variations of a simple fare-per-mile policy, with additional step-functions and maximums or minimums. Some of the policies include a fare differential policy for peak and off-peak hours. Output was analyzed with regard to overall impact on revenue and demand, and a detailed study was made of which groups are hurt or benefitted most by each new policy compared to the existing one. Conclusions are that distance-based fare policies can be devised to maintain revenue and ridership levels while improving equity. Sensitivity analysis was performed on the elasticity estimates used, showing that the conclusions drawn were quite robust.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

1. Revenue, ridership and equity implications of distance-based fares should be evaluated for different types of urban environments, to identify most beneficial applications.
2. The UTPS and other transit planning packages should be augmented with components for evaluating transit pricing policies.
3. Transit equity considerations should receive increased attention generally.



KEY LITERATURE REFERENCES:

- Ballou, Donald P. and Lakshmi Mohan. Final Report on the Transportation Research Project. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1979. (Available from authors on request.)
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WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : TIME, DISTANCE, AND QUALITY-BASED FARES

TOPIC : SCRTD CASE STUDY: CHANGE FROM FLAT TO DISTANCE-BASED FARES

SPEAKER : G. Edward Vandeventer (213) 972-6132  
Planning Department  
Southern California Rapid Transit District  
452 S. Main  
Los Angeles, CA 90013

SUMMARY OF MAJOR POINTS:

After a long history of distance-based fares, the desire to simplify the fare system motivated a changeover to a flat fare at the time of the energy crisis. Later, the resulting high subsidies of long trips brought about a return to distance-based fares. Rather than return to the previous system of zones, the new structure tied "distance steps" to freeway operation. Among the goals of the new structure were: getting the most additional revenue with the least collection cost, and maintaining maximum simplicity for the majority of riders.

Although there was a loss of approximately 10% of the long distance riders, the overall ridership is now up 3%. The operating ratio has increased from .35 to .46. There was significant irritation expressed by people who faced large fare increases. Much switching between lines was observed, although not always to a lower-priced service.

Significant opposition to distance-based fares comes from some of the people inside the transit agency, particularly in the planning and marketing functions. Peak pricing and quality based fares were considered, and might be considered again, but some questions will have to be resolved first.

Although some backsliding has occurred since the distance related structure was adopted, there seems to be a basic commitment to the concept. Certain technical work can help to assure its viability.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

1. Innovations in methods for collecting distance based fares should be developed.
2. Simultaneous determination of pricing decisions (i.e., public policies) for transit and automobile travel should be encouraged. Theories of congestion pricing should be extended and related to bus transit pricing issues.

KEY LITERATURE REFERENCES:

Detailed description of SCRTD fare structures and ongoing analyses of ridership and effects are available.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : TIME, DISTANCE, AND QUALITY-BASED FARES

TOPIC : QUALITY-BASED FARES: CONCEPT AND EXISTING EXAMPLES

SPEAKER : David P. Middendorf, Ph.D (202) 223-9525  
Peat, Marwick, Mitchell & Co.  
1990 K Street, N.W.  
Washington, D. C. 20006

SUMMARY OF MAJOR POINTS:

Quality-based fares represent an attempt to relate the fare to the quality of the service provided. Higher fares may be charged, for example, for express service or for a guaranteed seat. Quality-based fares are not necessarily the same as distance-based fares. Although distance-based fares are related to the higher cost of serving longer trips, they do not always imply that a better service is being provided. Quality-based fares are compatible with the new emphasis on transit marketing and market segmentation. Quality-based innovations represent the design and provision of different services to meet the needs of different groups. The fare charged can depend on the perceived quality of service and the cost of providing it.

Quality-based fares recognize two established facts: (1) transit demand is price inelastic, and (2) transit demand is more sensitive to changes in service quality than to changes in fare. There is evidence that many people may be willing to pay higher fares for certain kinds of transit service or for certain improvements in service. Quality-based fares, therefore, may be one way of increasing both ridership and revenue. Existing examples include express bus services, subscription bus services, airport services, special transit services for sport events, shared-ride taxi service, and van pools.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Compile, analyze, and document previous surveys, studies, and basic research dealing with the response of transit ridership to changes in the quality of transit service to determine:

1. What types of service improvements are more important to transit users and to people who do not use transit.
2. The relative importance of various attributes of a transit service.
3. How different market segments perceive the relative importance of fares and service quality.

4. Which quality innovations are most feasible for conventional transit operations, assessing opportunities, impediments, etc. and which are best provided by para-transit operations.

KEY LITERATURE REFERENCES:

- Meyer, J. R. and J. A. Gomez-Ibanez. Improving Urban Mass Transportation Productivity. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1977. Available from NTIS. (PB 266-920).
- Peat, Marwick, Mitchell & Co. Study of Public Transportation Fare Policy. Washington, D. C.: U. S. Department of Transportation, Office of the Secretary, 1976. Available from NTIS (PB 287-341).
- Peat, Marwick, Mitchell & Co. Analyzing Transit Options for Small Urban Communities. 3 volumes. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1978. Available from NTIS.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : FARE COLLECTION COSTS AND INNOVATIONS

TOPIC : FARE COLLECTION COSTS

SPEAKER : James A. Mateyka (301) 951-2410 or 2411  
Principal  
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4330 East West Highway  
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SUMMARY OF MAJOR POINTS:

Detailed cost analysis of six very different U. S. transit systems showed that the direct operating cost of fare systems is between 1.3 percent and 2.9 percent of total operating costs. The bulk of these costs (84 percent) are attributable to personnel requirements. Fare collection costs are kept low by passing the transaction burden on to the customer (exact change requirements) and by restricting transit price options (area-wide "flat" fares are common).

Typical on-board fare collection practices entail substantial hidden costs. The necessary sub-optimal vehicle design and utilization is reflected as reduced vehicle unit line haul capacity, reduced passenger safety and convenience, impaired accommodation of the elderly and handicapped, increased travel times, and headway instability.

Operating costs of alternative off-board fare collection options were estimated in three case studies. Curbside automats in Syracuse, NY were estimated to increase fare collection costs by 125 percent; "community supported" transit in Lancaster, PA would reduce fare collection costs by 89 percent; and user prepaid passes in Westport, CN increased fare collection costs by only 2 percent.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Demonstrations of innovative fare collection approaches should be conducted in selected locations with new fare collection systems, new vehicle fleets, and new fare structures.

KEY LITERATURE REFERENCES:

Booz, Allen and Hamilton, Inc. Impact of Fare Collection on Bus Design. Final Report. Volumes I and II. Prepared by James Metayko, et al. Washington, D. C.: U.S. Department of Transportation, Urban Mass Transportation, Administration, 1979.

Daniels, Charles J., H. Judson Holcombe and James A. Mateyka.  
Future Transit Bus Designs. Technical Paper No. 780058.  
Detroit, MI: Society of Automotive Engineers, 1978.

Scheiner, James I. and Subhash R. Mundle. "Cost Analysis of Current  
U. S. Surface Transit Fare Collection Systems." Transportation  
Research Record 663. Washington, D. C.: Transportation Research  
Board. 1978.

Werz, H. "Automatic Fare Collection on Surface Transport." Pub-  
lished in the Technical Papers of the 40th International Congress  
of the International Union of Public Transport. Brussels, Bel.:  
International Union of Public Transport, 1973.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : FARE COLLECTION COSTS AND INNOVATIONS

TOPIC : DEMONSTRATION OF SELF-SERVICE FARE COLLECTION

SPEAKER : Lawrence E. Deibel (703) 827-6910  
The MITRE Corporation/Metrek Division  
1820 Dolley Madison Blvd.  
McLean, VA 22102

SUMMARY OF MAJOR POINTS:

The Office of Service and Methods Demonstration, Urban Mass Transportation Administration, is sponsoring a program to demonstrate self-service in the U. S. The objectives of the program are to determine the feasibility of using self-service under revenue conditions; to demonstrate the value of such a system for implementing flexible fare structures; to establish the improved operating efficiency resulting from the implementation of such techniques; and to ascertain the public response to self-service. Self-service fare collection makes the passenger responsible for determining and paying the proper fare prior to taking a trip. Complete monitoring or control of the payment of the proper fare is not performed by vehicle drivers, station attendants, or automatic equipment; all or nearly all responsibility for fare enforcement falls to special personnel who randomly check compliance.

The main focus of the UMTA program is the opportunity offered by self-service for the adoption of more flexible fare structures without significant increases in complexity, or driver workloads. The ability to implement such features as short-term passes, special user discount passes and tickets, multi-ride tickets, off-peak differentials, etc. provides the possibility to tailor a fare policy that will encourage increased and new ridership and at the same time increase the revenue from each market segment. Other potential benefits of self-service include increased system efficiency, the reduction of workload, the improved movement of passengers within the vehicles, and possible reductions in equipment costs.

The primary obstacle to self-service implementation in the U. S. is the question of fare evasion. Within this issue lies not only the common reference to the cultural differences between European society and the U. S. but whether or not a U. S. transit property has or could have the authority to enforce self-service and to back it up with the fines and other penalties necessary to encourage compliance. Other barriers to or disadvantages of self-service include labor issues, revenue security and compatibility, and the cost of self-service.



## RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Current efforts by UMTA to demonstrate self-service fare collection in the U. S. can be used as a means of implementing and evaluating pricing policies. Because self-service is conducive to a highly flexible fare structure, shifts from flat fares to zonal fares, prepayment options, fare incentives and disincentives, and "through ticketing" options can be implemented without significant modification to the basic fare collection procedures.

## KEY LITERATURE REFERENCES:

- Eiseman, Gloria H. Self-Service Fare Collection -- Review of Legal and Labor Constraints on U. S. Implementation. McLean, VA: MITRE Corporation, 1979. Available from MITRE. MTR 79 N 00119.
- Metropolitan Atlanta Rapid Transit Authority (MARTA), Planning Division. Fraud Estimation Phase of the Fare Collection Study -- Summary Report. Atlanta, GA: MARTA, 1975.
- Strickland, Lester R. Self-Service Fare Collection: Survey of European Systems. McLean, VA: MITRE Corporation, 1979. Available from MITRE Corporation. MTR - 79 W 00087.
- Werz, H. "Automatic Fare Collection on Surface Transport." Published in the Technical Papers of the 40th International Congress of the International Union of Public Transport. Brussels, Bel.: International Union of Public Transport, 1973.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : FARE COLLECTION COSTS AND INNOVATIONS

TOPIC : CREDIT CARD FARE COLLECTION

SPEAKER : Lawrence E. Deibel (703) 827-6910  
The MITRE Corporation/Metrek Division  
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McLean, VA 22102

SUMMARY OF MAJOR POINTS:

Since 1973, the Urban Mass Transportation Administration (UMTA) has sponsored several projects directed at the use of credit cards for fare collection. These include studies by Stanford University and Rensselaer Polytechnic Institute and demonstrations by the Valley Transit District in Bristol, Connecticut and the Tri-County Metropolitan Transportation District (Tri-Met) in Portland, Oregon. The Stanford effort analyzed the use of a magnetically-encoded credit card for fare payment, and the Rensselaer project examined the feasibility of using data obtained through credit card collection as a basis for a bus transit operations management information system. Both the Valley Transit and the Tri-Met demonstrations were directed at special transportation services; both used a punched-card form of card.

The objective of the present UMTA program is to demonstrate a credit card fare collection system for use by the general transit user. The immediate concern of the project is to determine the reasons for the less than complete success which the previous demonstrations experienced and to assess the merits and risks of the broader demonstration.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

The evaluation performed of the Tri-Met demonstration revealed no significant hardware or conceptual deficiencies. A closer examination of the merits of solid-state memory and alternative encoding techniques is desirable prior to proceeding with system specification.

KEY LITERATURE REFERENCES:

Buckley, R.F. et al. Design and Analysis of an Automatic Credit Card Fare Collection System. Stanford, CA: Stanford University, 1974. Available from NTIS (PB 237-092).

DiCeasare, F. and G. Solo. A Computerized Bus Transit Management Information System Using Credit Card Fare Collection Data. Troy, NY: Rensselaer Polytechnic Institute, 1976. Available from NTIS.

RRC International, Inc. System Operation Aspects of the Valley Transit Demonstration Program. Troy, NY: 1974.

Strickland, Lester R. and P. Wood. TRI-MET Automated Fare Billing System. McLean, VA: The MITRE Corporation, 1977. Available from NTIS (PB 275-661).

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : TRANSFER POLICY STUDY

SPEAKER : Daniel Brand (617) 266-0500  
Charles River Associates, Inc.  
200 Clarendon Street  
Boston, MA 02116

SUMMARY OF MAJOR POINTS:

The Transfer Policy Study examines how transit operators and users are affected by different transit transfer policies. A transfer policy is defined as a set of operator actions which in some way affects the movement of passengers between transit vehicles as part of a continuing trip. Reduced transfer charge, schedule coordination, pulse (timed transfer) scheduling, dynamic control of buses at transfer points, through routing, and provision of schedule information are all examples of what a transfer policy might include.

Transfer policies currently employed by the transit industry are being compiled through extensive discussions with knowledgeable operating, planning, and marketing personnel from a wide variety of transit properties. The impacts of different transfer policies on cost, operations, ridership, revenue and user satisfaction are being investigated. Relationships are being sought between successful applications of particular transfer policies and site-specific factors such as historical and current patterns of passenger flows, the route structure and the shape and size of the area covered, the layout of the CBD, existing transfer charges, and degree of schedule adherence. Guidelines which are useful for the transit operator in choosing a transfer policy are being suggested.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

A product of the study will be recommendations for demonstrations of improved transfer policies, formal evaluations of certain specific changes in transfer policies, and possible further analysis of existing data from transit properties with specific transfer policies.

Additional analysis, possibly to yield guidance for improved local practice, is appropriate for through routing practices and schedule coordination, as well as dynamic control of buses. Study of the demand impacts of double transfers (e.g., bus-rail-bus and car-bus-rail) is also warranted.

KEY LITERATURE REFERENCES:

Reports documenting the completed study will be available in mid to late 1979.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : PARA TRANSIT PRICING ISSUES

TOPIC : OVERVIEW: PRICING INNOVATIONS FOR PARATRANSIT

SPEAKER : Robert McGillivray (202) 223-1950, Est. 417  
The Urban Institute  
2100 M Street, N.W.  
Washington, D. C. 20037

SUMMARY OF MAJOR POINTS:

There are 5 areas of consideration in this topic:

1. Service and fare integration between transit and taxicab feeder-- Miller (1977) has examined two cases: Arabi (Louisiana) and Peterborough, Canada. In both cases there were joint fares, radio communication. In Peterborough a fixed route bus with an estimated deficit of \$2.30 or more per passenger was replaced with a shared-ride cab feeder with a deficit of \$0.65 per passenger.
2. Integrated fixed route and dial-a-ride--Yet unpublished Urban Institute work discusses two cases: Westport (Connecticut) and Danville (Illinois). Neither are fully integrated. They compete to some extent and have separate fare structures. In Westport the fixed route service is cheaper per ride, while in Danville the reverse is true.
3. Shared-ride taxi fare structures--To permit deviation, zoned (or flat) fare structures are needed, rather than traditional meter or mileage charges. A recently implemented demonstration in Montgomery (Alabama) attempted a change-over to a fine-grained grid, which is nearly continuously variable. It was difficult to accomplish, as operators resisted changing their established ways.
4. Shared-ride taxicab subsidies--There are two common subsidy methods for private operations. Provider-side subsidies are usually on a per vehicle-mile or per vehicle-hour contract basis. User-side subsidies are basically discount fares with the operator receiving reimbursement up to full (profitable) fare. This is a better incentive structure for performance of the operator. He seeks fares rather than miles or hours.
5. Ridership for work trips--Carpools, vanpools, and subscription buses are three ridesharing modes. For all these there is usually a coordinator. An employer or public agency acts as a broker (for matching), may subsidize (operations, purchases), and is often involved in issues such as insurance, cash flow, contracts, fares.

Carpools are quite informal. It has been discovered that a higher proportion of carpool users do not pay the full share of their costs to drivers. Subscription buses tend to be more formal than carpools or vanpools. Often a club arrangement succeeds (Reston, Virginia). In principle, subscription service would be part of most transit operations. The service is much like express bus, except for organization (i.e., reliance on established rider agreements).

There are four ongoing UMTA/SMD sponsored vanpool demonstrations. These are in Knoxville (Tennessee), San Francisco (California), Minneapolis (Minnesota) and Norfolk (Virginia). In all, transfer payments between overseeing agencies, drivers, and riders are quite complex. In Norfolk and Knoxville, drivers have flexibility in setting fares. Recommended fare structures have been designed by overseeing agencies so that the lease fee and other driver expenses can be covered by eight passengers. Drivers keep the excess. In all cases fares are basically monthly pass contracts. In at least one case, two weeks advance notice to quit is required of passengers.

#### RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

1. Summarize research and research needs on ride-sharing with regard to:
  - fare structures;
  - service levels;
  - institutional and regulatory arrangements;
  - planning and start-up;
  - fare elasticity;
  - service elasticity;
  - rider characteristics;
  - major sub-markets.
2. Design monitoring (data collection) framework for existing ride-sharing programs and/or demonstrations of ride-sharing concepts.
3. Continue monitoring and analysis of transit and para-transit integration, taxicab fare structures, and para-transit subsidies.

#### KEY LITERATURE REFERENCES:

Green, Melinda A. "Implementation of Paratransit Services in Westport, Connecticut." Working paper #5109-1-4. Washington, D. C.: The Urban Institute, 1978.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : PARATRANSIT PRICING ISSUES

TOPIC : FARE ELASTICITIES FOR ON-CALL PARATRANSIT SERVICES

SPEAKER : Robert G. McGillivray (202) 223-1950, Ext. 417  
The Urban Institute  
2100 M Street, NW  
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SUMMARY OF MAJOR POINTS:

### Introduction

Knowledge of jitney service is presently almost nil. There is no elasticity evidence to draw upon; moreover, there is very limited jitney service in the U. S. However, jitneys are important in some less developed countries. There are two distinct service types: exclusive-ride taxicab (ERT) and dial-a-ride (DAR). Shared-ride taxicab (SRT) is one form of DAR, but typically has a service level more nearly like most ERT than like bus-based DAR.

We employ two empirical elasticity concepts. Fare elasticity of demand is defined to be the percent change in a measure of ridership given a one percent fare change. The shrinkage (or growth) ratio is the most common empirical elasticity measure used. It is evaluated at the point of initial conditions--the "before" situation. The arc elasticity is evaluated at the average of the "before" and "after" situations. The ratio measure is useful for planning services or evaluating the benefits of a change. Arc elasticity has the advantage of being a symmetric measure--the measure is invariant to whether the change is an increase or decrease.

### Result

Ewing and Wilson (1976) report on four systems: three of these are public DARs and one is a private SRT. The SRT fare and service levels are much higher than those for the DARs. Arcs and ratios are variable--ranging from about .1 to .8 and .1 to .7 in magnitude, respectively.

In Danville, (Illinois), three fare changes resulted in estimates of arcs which were surprisingly stable at about .6 magnitude. However, ratios varied from .3 to 1.4 in magnitude with the higher magnitude, of course, being associated with a fare reduction. Other estimates are reported in the paper.

Heaton, Carla, Jesse Jacobson and James L. Poage. Comparison of Organizational and Operational Aspects of Four Vanpool Demonstration Projects. Washington, D. C.: U. S. Department of Transportation, Transportation Systems Center, 1979.

Kirby, Ronald F. "A Grid Fare Structure for Shared Taxi Services." Working paper 5050-2-7. Washington, D. C.: The Urban Institute, 1976.

Miller, Gerald. "Taxicab Feeder Service to Bus Transit." Working paper 5050-2-8. Washington, D. C.: The Urban Institute, 1976.

Urban Institute. Paratransit Planning Guidelines. In preparation at the Urban Institute.



## Tentative Policy Conclusions

- On-call para-transit services are fare inelastic
- ERT and DAR are probably somewhat more fare elastic than conventional transit, i.e. fare elasticity estimates tend to be concentrated at higher magnitudes than those for scheduled transit.
- Low service level DAR is probably less fare elastic than ERT or SRT. This could be due to both the relative position on the demand curve and to the greater degree of captivity of users of low service level DAR.
- Seasonal and secular trends appear to be important.
- Indirect evidence suggests that level of service is very important.
- In the Danville case, handicapped users appeared to have twice the magnitude of response to a given fare change as the non-handicapped elderly.

## RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

1. Further analysis of the detailed target group data obtained in Danville and from other SMD demonstrations is recommended. Attention should be trained on differences in person characteristics, trip purpose, and area.
2. Measurement of service elasticities should be given greater attention.
3. Demand-oriented demonstrations where fare or service level variations are carefully controlled and measured would be helpful in assessing the range of elasticity variation.

## KEY LITERATURE REFERENCES:

Ewing, Reid H. and Nigel H. M. Wilson. Innovations in Demand Responsive Transit. Cambridge, MA: Massachusetts Institute of Technology, 1976.

Fitzgerald, Peter G. "Danville RTR Price Change Analysis." Unpublished Memorandum, Crain and Associates, 1978.

Fravel, Frederick D. and Gorman Gilbert. Fare Elasticities for Exclusive Ride Taxi Service. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1978. Available from NTIS.

McGillivray, Robert G. "Fare Elasticities for On-Call Paratransit Services." Working paper 1186-3-1. Washington, D. C.: The Urban Institute, 1979.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : PARATRANSIT PRICING ISSUES

TOPIC : IMPACTS OF TAXI FARE CHANGES

SPEAKER : Gorman Gilbert (919) 933-5204  
Department of City and Regional Planning  
University of North Carolina  
Chapel Hill, NC 27514

SUMMARY OF MAJOR POINTS:

Taxicab operating data from 24 firms across the United States were used to test eight hypotheses regarding the impacts of fare increases on taxicab ridership level. The results show that taxicab demand is primarily inelastic with respect to fare increases with some evidence suggesting that higher fare levels produce more elastic responses. The data does not indicate that drop charge increases produce more elastic responses than do mileage charge increases. The results do show substantial variations from city to city, indicating that entrepreneurial expertise is an important factor in influencing consumer response.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

1. Examine disaggregate (i.e., different user) responses to fare increases.
2. Examine response of users in Seattle and San Diego to now-pending fare de-regulations.
3. Examine service elasticities.
4. Test the effects of end-of-month fare discounts for taxi services.

KEY LITERATURE REFERENCES:

Fravel, Frederick D. and Gorman Gilbert. Fare Elasticities for Exclusive - Ride Taxi Service. Washington, D.C.: U. S. Department of Transportation, Urban Mass Transportation Administration. Available from NTIS.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : PARATRANSIT PRICING ISSUES

TOPIC : USER-SIDE SUBSIDY: EXPERIENCE AND POTENTIAL

SPEAKER : Larry A. Bruno (202) 426-4984  
Office of Service and Methods Demonstrations  
Urban Mass Transportation Administration  
U.S. Department of Transportation  
2100 Second Street, SW  
Washington, D. C. 20591

SUMMARY OF MAJOR POINTS:

In recent years the costs of providing public transportation services have increased at an alarming rate. These services have traditionally been supported through a provider side subsidy, which purchased a given level of service regardless of usage. User-side subsidies, on the other hand, allow users to purchase services on a per trip basis. In this manner only trips actually made are subsidized.

Two mechanisms have been employed to implement the user-side subsidy concept. The first allows the user to pay for a portion of the trip by signing vouchers. The voucher is then redeemed at the subsidizing body by the provider. The second permits the user to purchase transportation tickets or tokens at a price substantially below face value. The user may then utilize the tickets at face value to purchase transportation services.

User side subsidies have been primarily incorporated in programs for certain target groups such as the elderly and handicapped. UMTA's Service and Methods Demonstration Program has sponsored four demonstration projects utilizing the concept for these special services. The projects are located in Danville, Illinois; Montgomery, Alabama; Kinston, North Carolina; and Lawrence, Massachusetts. All of the projects have employed private taxi operators as transportation providers with subsidies ranging from 75% to 50% per trip. In addition, Montgomery and Lawrence have utilized the concept for their fixed route bus services.

In Danville the project was expanded to utilize the concept in fixed route transit services that serve the general public. Users may pre-purchase tickets for forty cents, each good for a one day transit trip. If the user does not choose to use the pre-purchased tickets the charge at the farebox is one dollar for each trip. The transit providers are subsidized only on a per trip (ticket) basis.

## RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

Utilization of the user-side subsidy concept is moving in three different areas. First, many localities are considering or are in the process of implementing user-side projects to provide elderly and handicapped services. Second, although a full analysis of the expanded Danville project is not yet complete, it appears that the concept could be applicable in small urban areas for fixed route and demand responsive services to serve the general public. This is especially important in light of the new starts anticipated under the UMTA Section 18 small urban and rural program. Finally, the concept is being investigated for potential uses in achieving coordination of social service transportation services.

## KEY LITERATURE REFERENCES:

Fitzgerald, Peter. User-Side Subsidies for Shared Ride Taxi Service in Danville, Illinois: Phase I. Crain and Associates, 1977. Available from NTIS (PB 292-805).

Kirby, R. F. and F. L. Tolsen. Improving the Mobility of Elderly and Handicapped Through User-Side Subsidies. Report No. UI-5050-4-4. Washington, D. C.: Urban Institute, 1977.

Kirby, R. F. and F. L. Tolsen. "Supporting Mass Transportation in Small Urban Areas Through User-Side Subsidies: A Demonstration in Danville, Illinois." Working paper No. 1186-4-6. Washington, D. C.: The Urban Institute, 1978.

McGillivray, Robert G. "User-Side Subsidies for Urban Transportation Services." Working paper No. 5096-0-1. Washington, D. C.: The Urban Institute, 1977.

WORKSHOP: ADVANCES AND NEW DIRECTIONS

SUBJECT : PARATRANSIT PRICING ISSUES

TOPIC : PARATRANSIT ACCOUNTING: BILLING AND COSTING SERVICES

SPEAKER : Joseph Revis (202) 667-6552  
Institute of Public Administration  
1717 Massachusetts Avenue, NW  
Washington, D. C. 20036

SUMMARY OF MAJOR POINTS:

An important aspect of pricing services for paratransit systems is assuring that the pricing structure bears relationship to the costs generated. Though public policy decision-making may not always require that price fully recover costs from revenues (through the price mechanism), efficiency requires that all costs be fully identified so that "real" resource costs are known and accounted for. Full cost information is essential for both effective operations and to accurately ascertain what part of costs are to be covered by user revenue and what part from alternative sources (i.e., public support).

For presently operated paratransit services, there are substantial gaps in cost information both in terms of the degree of coverage as well as the range of variations in the account definitions. These problems are particularly true for paratransit services operated by social service agencies but also affect other operations (i.e. taxis, etc.).

In this context, IPA has developed (under a grant from AOA) a set of uniform cost accounts along with service and operating definitions. These have all been related to UMTA Section 15 accounts so that interchange can occur with public transit.

The paper describes these accounts and explores the relationship between cost and service, uniform definition and effective pricing and project management. It also describes the importance of an effective and uniform data collection and management system, and describes the results of direct application of the system in two sites.

RECOMMENDATIONS FOR FURTHER WORK IN THIS AREA:

A research program should attempt to document and demonstrate the desirability of pricing variations for all paratransit services, and "bring home" the deficiencies of standardized price and cost-sharing practices. Taxi experiments should include group fares, shared taxi fare structures, and reliance on discounts for taxi trips for special times, places, and trip purposes. Use of discounts (rather than surcharges, as are used in some cities during

peaks) would foster diversity in service-price combinations and could improve taxi utilization. Better cost accounts and traffic data are necessary to develop and support appropriate variations. Social, service paratransit also requires similar advancements in accounting, with the additional concern of improved and equitable cost sharing. Knowledge of cost parameters and variations needs significant advancement to achieve improved service coordination.

#### KEY LITERATURE REFERENCES:

Institute of Public Administration. Planning, Implementation and Operation of Transportation Services for Older Americans. Information and Training Materials. Prepared by Joseph Revis et. al. Prepared for the Administration for the Aging. U. S. Department of Health, Education, and Welfare. The following segments are of particular interest:

- Case Study No. 8, "Ottomwa, Iowa and Oats in Missouri";
- Technical Memorandum No. 7, "Transportation Costs and Service Guidelines for Coordinating Agency Service";
- Technical Memorandum No. 8, "Uniform Recording of Transportation Services and Operations." Reports available from I.P.A.
- Revis, Joseph, "Coordination, Costs and Contracting Transportation Services." Paper Presented at the Third National Rural Conference, June 1978, (Copies available from IPA).
- Revis, Joseph, "Joint Funding and Depreciation." Paper Presented at the Third National Rural Conference, June 1978. (Copies available from IPA).

SUBSIDY CONSTRAINTS AND TRANSIT FARES  
IN A "PROPOSITION 13" ATMOSPHERE

RONALD I. HOLLIS  
CHIEF, OFFICE OF FINANCIAL AND PROGRAM ANALYSIS  
DIVISION OF MASS TRANSPORTATION  
CALIFORNIA DEPARTMENT OF TRANSPORTATION

*I have been asked to discuss with you today some of the impacts on transit service in California from the renowned Proposition 13 and, in particular, on fares.*

*Before I do that, however, I will need to provide you with a familiarization of California's transit characteristics and funding apparatus. From there, I will explain some of the impacts of Proposition 13, what has been done to alleviate the impacts and some of the new directions that transit subsidies in California are taking relative to transit fare revenue.*

*As you might expect, we have not seen the last of the impetus behind Proposition 13. We now have a new constitutional amendment initiative for the next ballot in California, called "The Spirit of 13." This initiative qualification effort was lead by Paul Gann of the renowned Jarvis-Gann duo. As you know, Proposition 13 severely limited the property tax source of revenue to local government. This new initiative strikes at the expenditure side of government--both State and local--by limiting the increases in expenditures to relative cost of living and population increases. It is somewhat similar to an initiative sponsored by Governor Reagan in 1974 that was killed by the voters.*

*The current initiative was probably qualified with public feelings similar to the theme of the movie Network's "I'm mad as hell." Paul Gann says the politicians didn't get the message and have pushed Proposition 13 as a tax shift rather than as a tax cut.*

*Where does the transit industry fit into all this? They are being caught up in the effect without being an acknowledged cause. Transit properties have never been independent financially, but have been subsidized, in turn, by land developers, electric power companies, and government. The current financial problems of the industry have been caused by operating costs which have risen faster than farebox revenues and most tax source revenues. This increasing deficit has increasingly been absorbed by higher taxes imposed by local government first, and then State government which, in turn, have provided their own policy and funding constraints.*

*In California there are 140 separate transit operators statewide with budgets ranging from \$262 million per year at Southern California Rapid Transit District, down to less than \$10,000 per year at Adelanto*

in the Mojave Desert east of the Los Angeles Basin.

It is noteworthy at this point to tell you that publicly owned transit is segregated into four basic institutional arrangements: Cities, counties, special districts, and publicly owned nonprofit corporations.

Examples of each are:

City operation: San Francisco Municipal Railway  
County operation: San Clara County Transit District  
Special District: Southern California Rapid Transit District  
Nonprofit Corporation: San Diego Transit Corporation

There are variations of the special districts that are not pertinent to us here, other than to say that there are over 5,000 special purpose districts that have varying bases of creation from State Legislatively authorized statute to local joint powers agreements.

The financial bases and sources for all these institutional arrangements of transit operators vary, with some relying on one or another source more heavily than others. In order to give you a quick perspective, consider the total of all the operators' revenues last year:

	<u>Percent</u>
Passenger Revenues	22.5
Miscellaneous Operating Revenues	0.7
State Sales Tax (TDA)	21.5
UMTA Section 5	12.0
UMTA Section 3	12.9
Property Tax	15.2
Local Sales Tax	8.1
Local General Funds	0.9
Miscellaneous	6.2
	<u>100.0</u>

You can see immediately that property tax, the tax impacted by Proposition 13, is a relatively small part (15%) of the transit scene in California. It is a different perspective, however when you look at individual cases. Consider also that the total average reduction was 57% of the 15%. Also that fares represent the single most (22.5%) flexible source pretty much controlled by the operator.

Let's look now at individual tax sources and their constraints.



First, State sales tax, or TDA as we call it (Transportation Development Act). This Act has more far reaching impacts than any other tax source, mainly because it contributes 22% of all funding of all the 140 earlier mentioned transit operators. It also, as might be suspected, has the most strings attached and is the most complicated. It has some advantage that most government sources do not have, such as funding before expenditure, rather than by reimbursement, and a formula allocation allowing a predictable income.

Some of the constraints are a 50% match, maintenance of effort similar to the Section 5 maintenance of effort, and capital expenditure minimums of 15%. Of course, there are many loopholes and twists for the innovative or even noninnovative to discover. The 50% match didn't really exist if you were in your first years of operation. If you used the majority of the funds for capital, a match wasn't required; or if you used Federal funds for operating, a match was not required; or if you were in a county of less than 500,000 population, you could obtain a waiver from the State Transportation Commission from the 50% match. These are just a few of the complications.

The maintenance of effort (or MOE) was probably the most loop-hole-free constraint. But prior to Proposition 13 it really didn't bother anyone because local tax support, which it applied to, was mostly nonexistent or wasn't growing fast enough to be a problem. During the life of the TDA through last year, local tax support grew at an annual compounded rate of 5.7% a year. This compares to rates of 11.6% for fare revenues, 23% for TDA and 12.6% for total budgets. The MOE was eligible for waiver by the Transportation Commission in counties of less than 500,000 population, similar to the 50% match.

I only mention the capital expenditure requirement because it was once a serious constraint. In the first few years of the Act, 75% of the TDA funds received had to be expended for capital purposes. Although capital was defined unusually, it caused severe budget complications (including several sets of books) for the medium operators with larger operating expense needs. Legislature finally changed the Act by reducing the 75% to 15%, except for San Francisco's Muni which still must comply with the 75%. Nobody has had problems with the 15%, that I'm aware of.

In summary of TDA constraints and relating back to the main theme of this presentation, TDA constraints did not appear to cause negative impact on fare setting policy.

One of the intents stated in the Act was to stabilize fare levels from the rising pace evident in the late 1960's and early 1970's. It did this initially by aiding in establishing flat fares and fare reductions.

Local taxes, other than property taxes, do have some direct impacts on fares. One of these is the one-half percent sales tax in the three Bay Area Rapid Transit District (BART) counties of San Francisco, Contra Costa and Alameda. This tax is authorized by Legislature. It is the only sales tax that did not come about by a local county election. It was originally imposed by Legislature to fund the completion of BART. After BART started operations and it was discovered that fares did not cover operating expenses, the tax was extended in lifetime to temporarily cover BART operating expenses. No strings were attached. In 1977, Legislature authorized the tax on a permanent basis and expanded its availability to Alameda-Contra Costa Transit District and San Francisco Muni, who both operate totally within BART's area. But they attached some strings. For AC Transit and S.F. Muni the funds could only be used for new additional services. And a first for Legislative involvement, and applying to all these operators--fare related eligibility requirements were imposed. Fares had to be maintained to cover one-third of the operating budget in order to receive a share of the funds. Initial recommendations were 40%. BART did not have problems with this because its distance based fare produced a ratio of 35.4% in Fiscal Year 1977-78. AC Transit and S.F. Muni do have problems because their relatively low flat fares produce in the range of 27% to 29% of operating costs. Since the passage of this bill, they have raised these ratios on the order of 1 to 2%, but the outlook is not promising without a general fare increase or rather unusual increase in productivity. This consequence has been politically painful in San Francisco. The California Environmental Quality Act (CEQA) was interpreted by the Courts to apply to transit fares which meant environmental impact reports were required in addition to public hearings for proposed fare increases. Legislature modified this requirement to exempt fare increases from the environmental impact reports, for fare increases to maintain existing services and cover impacts of Proposition 13. These changes caused a substantial opposition from the environmentalists, who felt that CEQA provisions were being watered down. In addition, substantive outcries have come forth from the citizens to any suggestion of raising the 25¢ flat fare and the 5¢ senior citizen and handicapped fare.

Proposition 13 dealt some specific blows and aggravated problems for the AC Transit and San Francisco Municipal Railway. 93.9% (\$121.4 million) of the property tax used by transit in the state is in the three BART counties. 37% (\$44.9 million) of the three-county total was used by San Francisco Muni and 17.6% (\$21.4 million) was used by AC Transit. The balance was used by BART for construction bond repayment and as a result, was exempt from Proposition 13 cut-backs. After Proposition 13, for Fiscal Year 1978-79, 83.7% of the F.Y. 1977-78 amount of property tax used by transit in the state was expected to remain. San Francisco Muni lost \$4.2 million, or 9.4% and AC Transit \$13.8 million, or 64.5%. Why the big difference?

*San Francisco Muni benefited from account juggling within the City, by allocating more of the remaining property tax to the railway. This was made possible by the \$4.7 million bail-out to cities, counties, and school districts from the State surplus. AC Transit, a special district, did not benefit, obviously, as well. Funds appropriated for State bail-out of special districts were relatively small (\$125 million out of \$4.7 billion) and AC Transit was only able to receive a little less than \$3 million from the State, therefore cutting their property tax loss to a bit over \$10 million. But as expected, this small amount of State aid brought more strings. In order to receive the funds, employee pay increases could not be greater than that of State employees' increase, which was zero. This provision has recently been ruled unconstitutional by the State Supreme Court so that pay increases can be resumed if funds can be found. The bail-out bill also stated Legislative intent that in the longer-term, lost property tax revenues were to be made up by user charges for services rendered by the specific agencies.*

*What was done to other fund constraints? The most serious problem was caused, as might be expected, by the TDA MOE. No matter how small the use of property tax, a drop of \$1 from the previous two-year average made the operators completely ineligible for State TDA funds. This, in turn, triggered the UMTA Section 5 MOE because of the large loss of TDA funds in the Federal MOE. Realizing the potential disaster, Legislature passed an emergency measure suspending the TDA MOE for two years. This gave us a little more breathing room, but still required a change in the UMTA MOE because the State bail-out funds were insufficient to maintain the UMTA MOE level. With a substantial lobbying effort, particularly by our Department, Senator Cranston was successful with an amendment to the 1978 Surface Transportation Act changing the UMTA MOE to include fares in the average. Thus, increased fares could be used to make up the loss in property tax.*

*As an aside, we were surprised at the opposition that came out from some operators on our proposals to eliminate the UMTA MOE. Apparently, some of the operators here in the East feel that the MOE was necessary in order to retain the flow of local and State taxes to their operations.*

*The State TDA MOE's future is uncertain. In Fiscal Year 1980-81, it will come back into effect and will apply to the reduced levels of local property tax used during Fiscal Years 1978-79 and 1979-80. There is presently a legislative proposal to eliminate the MOE requirement which our Department supports but passage of the bill is less than certain.*

*Looking at all the transit operators as a whole, Proposition 13 impacts are not readily visible. Changes between actual operating results for Fiscal Year 1977-78 and projections for Fiscal Year 1978-79 cannot be specifically tied to reactions from Proposition 13 or other reasons. Here are some comparisons:*

<u>Operating Data</u>	<u>F.Y. 78/79 Projected</u>	<u>F.Y. 77/78 Actual</u>	<u>F.Y. 78/79 % Change</u>
Total Passengers	821,943,200	762,471,649	+ 7.8
Vehicle Service Hours	20,617,821	19,941,377	+ 3.4
Vehicle Service Miles	304,056,861	282,900,339	+ 7.5
Public Employees	20,221.9	20,641.7	- 2.1
Contractor Employees	511.4	490.5	+ 4.3
Operating Cost/ Passenger	0.86	0.79	+ 8.9
Operating Cost/ Vehicle Service Hour	34.14	30.31	+ 12.6
Passengers/Vehicle Service Hour	39.9	38.2	+ 4.5
Passengers/Vehicle Service Mile	2.70	2.70	0
Vehicle Service Hours/Employee	994	994	+ 5.3
Passenger Revenue	216,799,928	199,246,005	+ 13.4

I think that on balance a majority of the statistics show improvements in productivity with passenger revenue increasing at a greater rate than operating costs, possibly because of some projected fare increases.

A fear we all had, that there would be severe cuts in service, does not appear to have materialized, at least not yet. And of course the projections for F.Y. 78-79 may be significantly overstated.

Now that we are over the crisis of handling Proposition 13, there are some efforts to clarify and simplify the Transportation Development Act. Our department has proposed that all the matching requirements, MOE and other complications mentioned earlier be eliminated from the Act by Legislature. Because of the concern by Legislature, and also from our own observation, we proposed that operators have a single eligibility for the funds by maintaining fare and local tax revenues at one-third of the operating expenses. Note that this was different than the requirement for the San Francisco Bay Area operators that have to maintain the one-third from fares alone. We felt that with the flexibility of our proposal, individual local decisions could be made on fare levels and tax support. For the small operators in the nonurbanized areas, we proposed that Federal funds received for operating assistance or revenue sharing could be used to meet the one-third requirement. A bill has been introduced into the Legislature on the Assembly side by the Transportation Committee Chairman, Walter Ingalls. The bill incorporates most of our proposals with some variations. In its most recent amended form, it attempts to offer solutions

to operator problems from our proposal by setting three criteria for operators to use in gaining fund eligibility. These are:

1. Fare revenues and local tax funds equal one-third of operating costs.
2. Fare revenues equal to one-fifth of operating expenses if the ratio was less than one-fourth in Fiscal Year 1978-79.
3. Fare revenues equal one-third of operating expenses if the ratio was one-fourth or greater for Fiscal Year 1978-79.

Services outside urbanized areas and elderly and handicapped services are exempt from the requirements. Also the first two years of new service increments are exempt.

Not all Legislators are in agreement that one-third of operating expenses in the appropriate level or amount for the transit riders to be paying. Some do not understand why it is not 100 percent or greater and others are convinced that anything less than 50 percent is an indication that the transit operator is inefficient. Some are appalled at the 25-cent, 35-cent, and 50-cent flat fares that are common throughout California. They would be even more appalled if they knew some of the trips are 50 miles for 35 cents. There have not been any moves to legislate fare structure yet, but if transit doesn't increase its fare revenue at least comparable to inflationary rates then I expect there will be legislative action to set fares. In some local government quarters, this idea may be acceptable in order to spread the heat around for the increases.

In summary, time is running out for transit operators getting ever increasing help from the State. Local government, likewise, is already and will be even more constrained because of actions similar to Proposition 13.

There seems to be an even more urgent need for operators to relook at fares and previous fare policies. While our Department has avoided involvement in transit fare setting, some of the things we have said are: Current users should not be penalized to the extent traffic will bear; look for discount opportunities and other ways to stimulate ridership; don't cut out off-peak services before a real effort is made to raise off-peak demand. We have resisted efforts to institute operator-by-operator productivity comparisons because of the many quantifiable factors, but realize at the same time there are opportunities to make fares better reflect the services provided and service productivity variations.

*While there are many things that operators may do themselves, there are equal or more opportunities for nontransit-operating government agencies to take the initiative on improving our own operations and facilities, to allow the operator to receive bigger bang for the buck.*

*I look forward to exploring these opportunities at this forum.*

## ANNOTATED BIBLIOGRAPHY

The following selection and description of research and other reports is provided as a guide to the key literature of the transit pricing field. The reports may be obtained by written request or order from the following addresses, or others as shown:

National Technical Information Service  
Springfield, Virginia 22161

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

The Urban Institute  
2100 M Street, N. W.  
Washington, D. C. 20036

Transport and Road Research Laboratory  
Crowthorne, Berkshire RG11 6AU  
ENGLAND

New York State Department of  
Transportation  
Planning Research Unit  
1220 Washington Avenue  
State Campus  
Albany, New York 12232

### GENERAL

- U. S. Department of Transportation, Research and Special Programs Administration, Transportation Systems Center. Service and Methods Demonstration Program Annual Report. Washington, D. C.: U. S. Department of Transportation, 1978. Available from National Technical Information Service. PB 292-008/GLP.

This report contains a description of the Service and Methods Demonstration Program for fiscal year 1977. Program activities and accomplishments are reviewed, including current and future demonstration project descriptions, project findings, and support activities. Demonstration program categories include conventional transit service, pricing policy and service variations, paratransit service, and special user transportation.

- U. S. Department of Transportation, Urban Mass Transportation Administration, Office of Transit Management. "Pricing" chapter of the Transit Marketing Management Handbook. Washington, D. C.: U. S. Transportation Administration, UPM-40, 2100 Second St., S. W., Washington, D. C. 20590.

This chapter of the Transit Marketing Management Handbook discusses the use of pricing strategy as one component of the process of marketing transit services. Pricing strategy refers to the establishment of specific pricing policies in order to foster the attainment of transit system goals. Fare level, structure, and collection techniques can all be considered as policy options to serve general and specific ends. Case studies of fare changes and innovations are included.

Peat, Marwick, Mitchell & Co. Public Transportation Fare Policy. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1976. Available from National Technical Information Service. PB 287-341/2GLP.

This report identifies the issues with which any fare policy must deal and presents information to aid transit operators in resolving these issues. Factors affecting fare policy are grouped into three categories: institutional, demand, and cost factors. Institutional factors include fare tranes, types of fares, fare collection techniques, and the role and objectives of the various groups involved in pricing transit. Demand factors are most concerned with the responsiveness of users and potential users to changes in fares, service characteristics, and the price of automobile trips. Cost factors are concerned particularly with the characteristics of transit service production.

The Urban Institute. The Consequences of Short-Range Transit Improvements: An Overview of a Research Program. Prepared by Michael A. Kemp. Washington, D. C.: U. S. Department of Transportation, 1978. Available from The Urban Institute.

This paper presents an overview of a proposed program of research designed to improve understanding about the costs and consequences of various transit fare and service level policies, with emphasis placed on the evaluation of fare-free transit services.

## FARE POLICY EVALUATION

Peat, Marwick, Mitchell & Co. Transit Pricing Manual. Prepared by the Office of the Secretary of the U. S. Department of Transportation. Washington, D. C.: U. S. Department of Transportation, 1976. Available from National Technical Information Service.

The Transit Pricing Manual is prepared for transit managers and the members of their management and policy boards who are directly responsible for designing and establishing transit pricing strategies. The manual provides guidance for designing new transit pricing strategies to result most effectively in increased ridership and reduced operating costs. It contains descriptions of how to delineate transit markets (i.e., market segmentation), which fare levels and fare structure to use, how to measure the impact of fare levels and structure on current and potential transit riders, and which fare collection techniques to employ.



Cambridge Systematics, Inc. CITRAN Fare Policy Evaluation: Summary Report.  
Arlington, Texas: North Central Texas Council of Governments, 1978.

This study established the principles on which CITRAN (City Transit Service of Ft. Worth, Texas) fare decisions should be based and the procedures for making those decisions. The study emphasizes focused delineation of transit objectives, and formulation and evaluation of fare structure alternatives, devised with concern to market segments, to maximize objective fulfillment. Analytical techniques for evaluating forecasting of the ridership, cost, and social and environmental impact of fare alternatives are documented. Attention is directed to the development of market segment fare elasticities for the following rider groups: adult peak-period trips, adult off-peak trips, adult work trips, adult non-work trips, elderly and handicapped trips, children and student trips.

Simpson & Curtin. Dallas Transit System Fare Structure Study, Final Report. Prepared for North Central Texas Council of Governments. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1977. Available from National Technical Information Service.

This study represents a concentrated effort by the Dallas Transit System (DTS) to re-examine its fare structure. It addresses the following subjects: Is transit a private enterprise?; Fare Policies for Dallas; Current DTS Revenue and Ridership; Revenue and Ridership Impacts of Discrete Fare Actions; DTS Fare Structure Alternatives; Recommended DTS Fare Structure. An appendix contains the adopted fare policies. The report provides a useful framework for fare-policy decision-making.

## FARE PREPAYMENT

Huron River Group, Inc. Transit Fare Prepayment. Prepared by W. R. Hershey, et al. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1976. Available from National Technical Information Service. PB 265-227/9GLP.

Fare prepayment encompasses all methods of paying for transit rides other than by cash. Types of prepayment include (1) those which allow the purchaser a fixed number of rides, usually over an unlimited time period (tickets, tokens, punch cards) and (2) those which are valid for an unlimited number of rides over a fixed time period (passes, permits). This report documents the use of prepayment by transit operators and preferences for prepayment by transit users. The study concludes that fare prepayment can be an important element of a transit system's marketing program, both for attracting and holding riders and for building the system's image. Employer-sponsored programs for distributing and subsidizing prepayment instruments are popular among users and seem to have significant potential.

Ecosymetrics, Inc. Transit Fare Prepayment Summary Guidelines, Final Draft Report. Prepared by P. D. Mayworm, et al. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1977.

These summary guidelines provide easy-to-understand state-of-the-art information for transit operators who wish to implement transit fare prepayment plans. They act as a companion document to the Huron River Group Study on transit fare prepayment. The guidelines present information concerning the various fare prepayment options; their advantages and disadvantages; their impacts on ridership, revenues, convenience and costs; and their market potential.

Beesley, Michael, et al. "Experience with Fare Prepayment Schemes in Four European Transit Systems." Working Paper #5110-9-1. Washington, D. C.: The Urban Institute, 1978.

The paper is a descriptive review of experience with transit fare prepayment schemes in 4 European transit systems. The analysis suggests 4 major conclusions: First, in each case about 10% of all transit users purchase the passes. Second, users travel more often or farther, since all passes are priced to offer substantial fare discounts as travel frequency and distance increase. Third, the average subsidy for each prepaid pass appears to be roughly one-fourth of its purchase price. Fourth, there is some evidence suggesting that such prepayment schemes contribute to maintaining or increasing patronage of transit systems.

Parody, Thomas E. and Daniel Brand. "Forecasting Demand and Revenue for Transit Prepaid Pass and Fare Alternatives." Paper presented at the 58th Annual Meeting of the Transportation Research Board, Washington, D. C.: January 1979. (Publication pending by TRD.)

This paper presents a relatively quick and low-cost methodology for forecasting demand and revenue impacts of alternative transit fare prepayment (TFP) instruments and transit fares. In addition, alternative TFP strategies and their price implications are derived in some detail from basic TFP objectives. The forecasting technique relies on price elasticities by individual market segments drawn from previous transit fare and service changes, and applies these to forecast impacts of proposed changes to the present system. The market segments are chosen so as to correspond with the issues being analyzed, thereby increasing the usefulness and accuracy of the procedure. Local data from the Jacksonville, Florida transit system illustrates the techniques application.

Systan, Inc. Evaluation Plan for the Sacramento Transit Fare Prepayment Demonstration. Los Altos, Calif.: Systan, Inc., 1978. Available from Urban Systems Division, Transportation Systems Center, Cambridge, Massachusetts 02142.

This plan proposes a method for documenting and evaluating the results of the Sacramento Transit Fare Prepayment Demonstration. This demonstration is oriented to increasing transit ridership and to improving transit marketing through employer involvement in the sale of monthly transit passes. The focus of the plan is an experimental design, which identifies the objectives of the demonstration and other issues raised by its implementation, and outlines a methodology for measuring demonstration impacts and identifying their causes. Data requirements, collection procedures and analysis techniques are specified.

## ELASTICITY

- R. H. Pratt Associates, Inc. Traveler Response to Transportation System Changes - A Handbook for Transportation Planners. Washington, D. C.: U. S. Department of Transportation, Federal Highway Administration, 1977. Available from National Technical Information Service. PB 265-830/GLP.

This handbook is a compendium based on past observation and estimation of traveler responses to different types of transportation system change. It is intended to aid transportation planners and decision-makers by providing familiarization with results obtained elsewhere and by providing insight pertinent to planning decisions concerning urban transportation options.

- U. K. Department of the Environment. Transport and Road Research Laboratory. The Effect of Fares on Bus Patronage. Prepared by P. H. Bly. TRRL SR 733. Crowthorne, Berkshire, U. S.: U. K. Department of Environment, Transport and Road Research Laboratory, 1976.

This report reviews available information on the elasticity of bus patronage with respect to the fares charged, both in the U. K. and in other countries. Estimates of overall fares elasticity obtained across individual fares changes, from time-series analysis and from cross-sectional data are all consistent with a typical mean value of -0.3 in a range from -0.1 to -0.6. These values appear to be much the same in the different countries from which the data were obtained, and they have been stable over time. Elasticities at off-peak travel times seem to be about twice those in the peak, short-distance elasticities are larger than those for long journeys, demand from non-captive passengers may be twice as elastic as that from captive passengers, and urban rail travel is found to be only half as elastic as bus travel.

- U. S. Department of Commerce. National Bureau of Standards. Elasticity of Transit Demand with Respect to Price: A Case Study. Prepared by Ralph E. Schofer. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1978. Available from National Technical Information Service.

This report describes the methodology and results of an empirical study of peak-period transit demand elasticity with respect to price (fare). Field observations were structured to capture the

reactions of morning inbound commuters to a peak-period fare increase introduced on September 1, 1975. The study is limited to bus and automobile travelers on the Shirley Highway and bus passengers on Lee Highway, both in Northern Virginia. The Shirley Highway buses provide express service on exclusive freeway lanes, whereas the Lee Highway buses provide traditional service on a signalized radial arterial. Various impacts are identified, quantified, and compared.

Donnelly, E. P. "Preference Elasticities of Fare Changers by Demographic Groups." Transportation Research Record 589. Washington, D. C.: Transportation Research Board, 1976.

Using a technique known as trade-off analysis, preference elasticities for transit fare increases and decreases were estimated for different socio-economic groups. Two notable conclusions from a 1974 survey using this technique are (1) preference elasticities for fare decreases are significantly lower than preference elasticities for fare increases and (2) fare-decrease elasticities vary for different stratifications of the population, while fare-increase elasticities are very nearly the same for all socio-economic groups.

#### FARE LEVELS-FREE AND REDUCED FARES

Caroulo, John R. and Roger P. Roess. The Effect of Fare Reductions on Public Transit Ridership. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1974. Available from National Technical Information Service.

The study was undertaken to determine the effects of various reduced fare programs on transit ridership. North American reduced fare programs were surveyed, and categorized by market and elasticity variations. 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 though significant ridership increases have been induced, reduced fare programs usually result in revenue losses. Refinement of pricing policies to meet specific objectives is inferred.

The Urban Institute. Low Fare and Fare-Free Transit: Some Recent Applications by U. S. Transit Systems. Prepared by K. M. Goodman and M. A. Green. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1977. Available from The Urban Institute and the National Technical Information Service. PB 271-077/OGLP.

This report is a reference document containing succinct case studies of the experience accrued by more than 40 U. S. transit systems that have introduced fare-free or reduced-fare services of one form or another in recent years. The report is a useful reference document for decision makers contemplating similar pricing policies as well as a preliminary planning guide for the development of demonstration programs to evaluate various transit pricing and service strategies.

Kemp, Michael. "Policies to Increase Transit Ridership: A Review of Experience and Research." Working Paper 5032-1-3. Washington, D. C.: The Urban Institute, 1977.

This paper explores the multiple interrelationships among factors that affect transit ridership, and identifies those combinations, documented by experience or postulated by research, that should result in increased ridership. Fare and service changes, costs, and community social and economic impacts are examined. The tentative conclusion is that subsidies spent on intelligent service improvements are more likely to bring greater increases in patronage than funding allocated to holding down or reducing fares. This conclusion, however, is placed in perspective by suggesting that while increased ridership is a legitimate goal of transit pricing policy, it should not be blindly pursued without considering the net social community effect.

Studenmund, A. H., Sherill Swan, and David Connor. "An Interim Analysis of the Free Fare Transit Experiments." Paper prepared for the 58th Annual Meeting of the Transportation Research Board. Washington, D. C., January 1979. (Publication pending by TRB.)

This paper summarizes early results from the analysis of system-wide off-peak free-fare transit experiments being conducted in Trenton, New Jersey, and Denver, Colorado. Total ridership and off-peak ridership gains due to free-fares are estimated. Description of changes in travel behavior and user characteristics thought to result from the programs are provided. Transportation supply and cost issues are evaluated.

Municipality of Metropolitan Seattle. Magic Carpet Evaluation Study. Jointly prepared by the Municipality of Metropolitan Seattle and the City of Seattle. Seattle, Washington: The Municipality, 1977. Available from NTIS (PB 271-214/9GLP) or Seattle Metro, 821 Second Avenue, Seattle, Washington 98104.

This report evaluates Seattle's highly successful Magic Carpet downtown free transit zone. Costs, ridership effects, impacts on traffic volumes, pollution, retail sales, and other considerations are documented.

## FARE STRUCTURE

Habib, Philip, et al. Fare Policy and Structure. Washington, D. C.: Department of Transportation, Urban Mass Transportation Administration, 1978. Available from National Technical Information Service. PB 289-194/3GLP.

This report presents the findings of a research effort relating fare policies and fare structures to passenger demand characteristics as

well as to operating expenses. The contemporary perspective of fare as only one element of transit financing is noted, and the use of fare policy as a tool for controlling costs is emphasized. The report puts forth arguments for time-varied fares as the most beneficial policy for reducing transit financial problems while still increasing ridership. It is shown that fare structures can be used to reduce peak vehicle requirements and effectuate operating cost savings.

New York State, Department of Transportation, Planning Research Unit.  
Distance-Based Transit Fares: Robin Hood or Sheriff of Nottingham?  
Prepared by Donald P. Ballou, David T. Hartgen and Lakshmi Mohan.  
PRR 145. Albany, N. Y.: New State Department of Transportation,  
1978.

Distance-based bus transit fares have been proposed as an alternative to basically flat fare structures in order to generate additional transit revenues while equalizing the costs patrons pay for services. The report states that flat fare structures generally distribute fares among riders in an unfair way, often reinforcing inequities existing in society. This paper describes a computer software system useful in analyzing alternative distance-based fare structures with regard to their effect on ridership, revenue, and equity. Results indicate that distance-based fare policies can be developed which maintain revenue and ridership levels while improving the equity picture.

New York State, Department of Transportation, Planning Research Unit.  
Revenue, Ridership, and Equity of Differential Time-of-Day Fares.  
Prepared by David L. Weiss and David T. Hartgen. PRR 99. Albany,  
N. Y.: New York State Department of Transportation, 1976.

This report examines the impact of differential time-of-day fares (i.e., lower off-peak and higher peak fares) on transit ridership, revenue, and equity to transit riders in seven cities in New York State. It is found that ridership and revenue levels cannot both be increased by any differential fare combination. However, certain combinations will improve equity and increase either revenue or ridership with less than a five percent loss in the other. The study further shows that fare increases are not reversible i.e., lost riders often do not return if fares are lowered. Fare policies to increase revenue appear feasible only in the largest cities, where fare elasticity is low.

U. K. Department of Environment, Transport and Road Research Library.  
Symposium on Public Transport Fare Structure: Papers and Discussions.  
TRRL Supplement Report 37 UC. Crowthorne, Berkshire, U. K.: U. K.  
Department of Environment Transport and Road Research Laboratory,  
1974.

This volume contains papers presented to a meeting, together with summaries of the discussions which followed presentation of the papers. The opening sessions of the symposium dealt with fare systems and their role in policy and considered the central problem of elasticity of travel demand as expressed by public response to changes in fare levels. Later sessions dealt with the effects of reduced and fare-free policies, and with the implications of different fare systems and policies for local government transit operators. A final session was concerned with social implications, including the effects of varying fare levels on satisfying the travel needs of individuals.

## FARE COLLECTION COSTS

Booz, Allen and Hamilton, Inc. Impact of Fare Collection on Bus Design, Final Report. Vol. I and II. Prepared by James Metayka, et al. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1979. Available from National Technical Information Service (late 1979).

Volume I covers trends in bus design and the movement towards self-service fare collection. The impact on transit operating costs of implementing three new off-board fare collection systems in conjunction with new bus designs is assessed. Volume II contains seven appendices, including detailed case studies of fare collection costs in six U. S. cities. Also discussed is the impact of the off-board fare system used in Switzerland and trends in bus designs in other European countries.

Scheiner, James I. and Subhash R. Mundle. "Cost Analysis of Current U. S. Surface Transit Fare Collection Systems." Transportation Research Record 663. Washington, D. C.: Transportation Research Board, 1978.

This analysis measures the capital and operating costs associated with collecting fares. Six very different transit systems were studied in detail to discern the costs of different fare collection methods. The direct operating cost of pay-on-board or prepared pass fare collection is low (less than two percent of total operating expense), but significant hidden costs are entailed. Reduction of these costs may offset the expense of alternative fare collection systems.

## SERVICE EVALUATION

Massachusetts Bay Transportation Authority and Tidewater District Transportation Commission. Bus Service Evaluation Procedures: A Review. Washington, D. C.: U. S. Department of Transportation, Urban Mass Transportation Administration, 1979. Available from National Technical Information Service.

The report presents the results of a literature review and survey of 71 transit properties in the United States and Canada regarding bus service evaluation procedures currently in use. The focus of the study was to identify service performance indicators and criteria used to evaluate bus service on a route-by-route basis. Three types of evaluation indicators (service design measures, operating performance measures, and economic or productivity measures) were identified, and a range of standards that have been developed for each indicator are reported. Appendices provide more detailed information on survey responses for small and large transit properties with bus ownership of 400 vehicles being the dividing point.

Rechel, Ralph E. "Plan for a Demonstration of Means for Measuring Transit Resource Productivity and Adjusting Services or Revising Routes in Omaha, Nebraska." Working Paper. Washington, D. C.: Institute of Public Administration, 1978. Available from Institute of Public Administration, 1717 Massachusetts Ave., N. W., Washington, D. C. 20036

This demonstration seeks to implement a plan for measuring and improving transit productivity and to assess the methods' cost, effectiveness, and application in medium-sized cities, such as Omaha. The entire effort is designed to maximize the practical use of available transit data through development of a management information system. Specific tasks to be addressed include "qualification of", perhaps transit goals, measuring the number and characteristics of current riders by route, transit revenues analysis, estimating operating expenses by route, productivity and financial analysis of transportation services by route, and identification of potential transit riders.

R. Travers Morgan and Partners. Bradford Bus Study, Final Report. Prepared for West Yorkshire Metropolitan County Council and West Yorkshire Passenger Transport Executive. London, U. K.: R. Travers Morgan and Partners, 1976. Available from West Yorkshire Metropolitan County Council, County Hall, Wakefield, WF1 2QW, England.

This report documents an extensive evaluation of bus operations in Bradford, England. It presents an analysis of the costs of providing and operating bus service. Included are average and marginal cost analyses, and cost allocations by time-of-day, day of week, and service type. The difficulties of existing cost allocation methods are presented.

McClenahan, J. W., D. Nicholls, M. Elms, and P. H. Bly. Two Methods for Estimating the Crew Cost of Bus Services. TRRL SR 364. Crowthorne, Berkshire, U. K.: U. K. Department of Environment, Transport and Road Research Laboratory, 1978.

This report describes the application of two methods of crew-costing in eight bus companies with widely varying methods of scheduling and



payment. Both costing methods take account of the effect of service peaks on crew costs. One method determines an average crew cost per bus-hour in peak and off-peak periods separately. The other estimates the numbers of duties of different types required to crew a given schedule. It was found that the methods could offer useful improvements in accuracy over average costing methods, for example, by enabling prediction of the costs of new schedules to within one or two percent, and by attributing cost variations to individual routes.

- U. K. Department of Environment, Transport and Road Research Laboratory. Symposium on the Costing of Bus Operations. TRRL SR 180 UC. Crowthorne, Berkshire, U. K.: U. K. Department of Environment, Transport and Road Research Laboratory, 1975.

This report contains the papers and discussions of a June 1975 meeting on cost analysis of bus operations. The need for and use of advanced costing methods in public transit planning and management and for allocation of subsidies is described. Alternative methods for cost allocation by route and time of day are summarized, and the limitations of the methods are considered. Discussions included the application of costing methods, deficiencies in present methods and needs for further work to advance the use of costing methods.

- Arthur Andersen and Co. Bus Route Costing for Planning Purposes. TRRL SR 108 UC. Crowthorne, Berkshire, U. K.: U. K. Department of Environment, Transport and Research Laboratory, 1974.

This report presents detailed documentation on the application of a route-specific transit cost analysis method. The components and variations of transit costs are discussed, with attention specifically focused on the crew or staff element. Pilot application of the methods in U. K. public transport operations is included. Findings include that all routes analyzed make net losses in peak periods (i.e., revenue does not meet allocated expenses) and that off-peak operations are significantly less deficit prone. Planning and management applications of cost analysis findings are discussed.

- Levinson, Herbert S. "Peak-Off Peak Revenue and Cost Allocation Model." Transportation Research Record 662. Washington, D. C.: Transportation Research Board, 1978.

This paper develops an approach to allocating bus service operating costs and revenues between peak- and off-peak periods. It shows how the economic performance of peak-period bus service depends on three relative measures--relative peaking, load factors, and the schedule efficiency of labor agreements.

- Cherwony, Walter and Subhash R. Mundle. "Peak-Base Cost Allocation Models." Transportation Research Record 663. Washington, D. C.: Transportation Research Board, 1978.

Rising deficits and subsidy limitations have increased concern with identifying route variations in operating cost. This paper calls for the development of cost formulas that are sensitive to peak and base conditions rather than a single system-wide model. Also described is the development of labor productivity and service indices for computing peak and base unit cost factors. Theoretical derivation as well as application of the concepts are presented.

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## PUBLIC TECHNOLOGY, INC./THE URBAN CONSORTIUM TRANSPORTATION PROJECT

For the past three and one-half years, city and county officials and representatives of the U. S. Department of Transportation's Urban Mass Transportation Administration, Federal Highway Administration, and Office of the Secretary have guided and supported transportation research and development, through the Urban Consortium for Technology Initiatives. Public Technology, Inc. has provided program management and staff support.

### What is PTI?

Public Technology, Inc. (PTI) is a nonprofit, public interest organization established in 1971 to facilitate research, development, and the application of available technology to State and local problems. Organized by the major local and State government associations, PTI's present Board of Directors consists of Alan Beals, Executive Director of the National Management Association; the Honorable Thomas Moody, Mayor of Columbus, Ohio, and 1977-78 President of the National League of Cities; and Robert A. Kipp, City Manager of Kansas City, Missouri, and 1977-78 President of the International City Management Association.

PTI conducts research, monitors local government demonstration of new technology/advanced management practices, and promotes technology transfer through publications, meetings, and on-site technical assistance. Three technology transfer networks established by PTI with National Science Foundation support are providing themselves effective vehicles for the dissemination of technology to urban areas. The Urban Consortium for Technology Initiatives includes 28 cities and 8 urban counties with populations over 500,000. The Urban Technology System is a network of 30 jurisdictions, with populations between 500,000 and 50,000. The Community Technology Initiatives Program has been established for cities with populations under 50,000. All three networks cooperate in areas of similar interest. Each of these networks is an experiment with a different approach towards technology transfer.

### How Does PTI Relates to The Urban Consortium?

The Urban Consortium for Technology Initiatives provides a forum for identifying problems faced by the nation's most populous cities and counties, and a means of guiding the effort to solve those problems through the application of technology. A permanent Urban Consortium Representative is appointed by the Mayor or Chief Administrative Official of each participating jurisdiction.

Needs in functional categories are addressed by 10 Task Forces, whose members are high-level officials of Urban Consortium jurisdictions. PTI acts as program manager and secretariat for the Urban Consortium.

## What is the Transportation Task Force?

The Urban Consortium's Transportation Task Force, with the support of the U. S. Department of Transportation, is actively pursuing solutions to priority needs identified by the Urban Consortium in the urban transportation area. Transportation Task Force members, representing 18 Urban Consortium jurisdictions, meet four times a year. Members of the Transportation Task Force have management responsibilities spanning the full range of local government transportation services. Current members are:

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City of San Antonio, Texas

Dr. John A. Dyer  
Transportation Coordinator  
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Mr. Richard Chudd  
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Mr. Barry Goodman  
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