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**Urban Mass
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# Service and Methods Demonstrations Program Summary Report

## December 1981

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16. Abstract

This report summarizes the activities and accomplishments of the UMTA Service and Methods Demonstrations Program for FY 1979, 1980, and 1981. Overall program objectives, current activities, and future directions are briefly described. Current demonstration projects are identified in each of the four major program areas of conventional transit service innovations, pricing and service innovations, paratransit services, and transportation services for special user groups. In addition, ongoing program activities in the areas of evaluation methodology and information dissemination are discussed.

This report also presents major new findings concerning the costs, impacts, and implementation considerations of the following innovative transportation service concepts: systemwide transit route restructuring, transit transfer policies, articulated bus, auto-restricted zones, transit fare prepayment strategies, free-fare transit, vanpooling, transportation brokerage, taxicab regulatory revisions, high-speed waterborne transit service, bicycle-transit integration, wheelchair accessible fixed-route bus service, door-to-door transit services for special users, user-side subsidies, coordination of social service agency transportation, special purpose transit services for inner-city residents, and rural public transportation. This information was obtained from detailed evaluations of SMD-sponsored demonstrations and case study analyses of locally initiated projects.

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# PREFACE

This Program Summary Report was prepared for the Urban Mass Transportation Administration's (UMTA) Office of Service and Methods Demonstrations (SMD) by the Office of Systems Research and Analysis at the Transportation Systems Center (TSC). Bruce Spear was the principal author of this report. Contributing authors include the following members of TSC's Urban and Regional Research Division: Robert Casey, David Damm, Lawrence Doxsey, Joel Freilich, Carla Heaton, Debra Loo, Elizabeth Page, Howard Slavin, and Robert Waksman.

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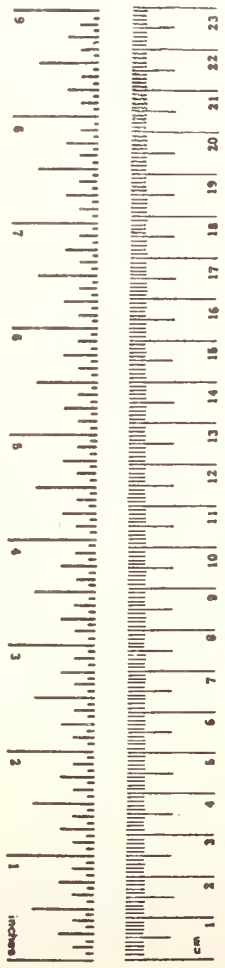
Clare Vann, of Raytheon Service Company, assisted in the final editing and preparation of this report. Finally, Fred McGovern, of Raytheon Service Company and Donna D'Alessandro and Terry McTague of TSC's Urban and Regional Research Division contributed many hours in typing and revising the text.

# METRIC CONVERSION FACTORS

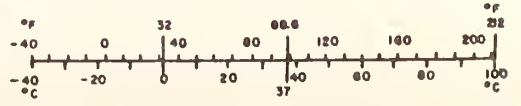
## Approximate Conversions to Metric Measures

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




## Approximate Conversions from Metric Measures

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



# EXECUTIVE SUMMARY

The Urban Mass Transportation Administration's (UMTA) Service and Methods Demonstrations (SMD) Program was established in 1974 to promote the development and widespread adoption of innovative transit services and transportation management techniques throughout the United States. The program focuses on concepts that use existing technology to create improvements which require relatively low levels of capital investment and which can be implemented within a short time frame. Through the SMD Program, these concepts are demonstrated in real-world operational environments and evaluated to determine their costs, impacts, and implementation characteristics. Evaluation findings are then disseminated through various media to transportation planners, policymakers, and transit operators in the United States and abroad.

The SMD Program is an integral component of UMTA's overall program of urban transportation research, development, and demonstrations (RD&D), and supports UMTA's primary research goals of reducing urban transportation needs, improving mass transportation service, and meeting total urban transportation needs at minimum costs. Moreover, the innovative services and methods developed through the SMD Program have helped local areas to address broader national goals, such as improved environmental quality, energy conservation, accessible transportation for the handicapped, and, most recently, maintenance of adequate transit service in the face of rising costs and decreased public subsidy levels.

The SMD Program is continually seeking innovative concepts worthy of further development and testing. Potential demonstration projects have emerged from ideas conceived within the SMD Program, from other UMTA research efforts, and from promising strategies which had received limited application in the United States or elsewhere. These ideas are initially analyzed in feasibility studies or case studies to determine the desirability of testing them in a full-scale demonstration.

A successful SMD demonstration requires a significant degree of commitment and cooperation from both UMTA and the local project staff. Potential sites are carefully screened to insure that specific demonstration prerequisites are satisfied and that the local project staff understands and accepts its role in the demonstration process. Demonstration funding levels vary considerably across projects, depending upon the nature of the concept, the extent of evaluation activities, and the availability of other funds or resources.

Each demonstration project is subjected to a rigorous evaluation which documents the planning process, implementation issues, and operating characteristics, and carefully analyzes the impacts of the new service or method on users, providers, and the general public. Evaluation findings help determine whether the demonstrated concept should be strongly endorsed by UMTA, whether additional testing or replication is needed, or whether the results were so disappointing as to preclude further study. In those cases where multiple demonstrations of one concept have been conducted, comparative, crosscutting analyses are undertaken in order to glean transferable findings about that concept.

From its inception in 1974 through the end of FY 1980, the SMD Program had awarded nearly 90 demonstration grants. Evaluation activities have been completed on 24 of these demonstrations and on another 38 special evaluations of projects not directly funded by the program. Current activities include 54 ongoing demonstrations and 24 special evaluations involving over 30 different innovative service and methods concepts. In addition, the program is conducting several analytical and planning studies of potential demonstration concepts, crosscutting studies of concepts implemented at more than one demonstration site, and special research aimed at improving the state of the art in evaluation methodology.

This report contains a brief summary of the activities and accomplishments of the SMD Program during FY 1979, 1980 and 1981. Emphasis is given to highlighting the relevant findings of the service and methods concepts being tested, the gaps that still exist in our understanding of their effectiveness, and the direction of future efforts to fill these gaps. Project activities are organized into four major program areas: (1) conventional transit service innovations, (2) pricing and service innovations, (3) paratransit services, and (4) transportation services for special user groups. SMD activities in the areas of project evaluation and information dissemination, which are common to all four of these program areas, are summarized first.

## PROJECT EVALUATION

Since the principal output of an SMD project is the knowledge gained from its evaluation, the SMD Program has made a major commitment to performing sound, objective, and comprehensive evaluations. The objectives of an evaluation are threefold: (1) to assess the institutional and operational feasibility of the demonstrated concept or technique; (2) to measure the transportation, economic, social, and other relevant impacts of the demonstrated concept; and (3) to provide guidance, based on operational experience and findings obtained from the demonstration, for future applications of the concept or technique.

An SMD evaluation represents a cooperative and coordinated effort involving three major organizations: (1) UMTA's Office of Service and Methods Demonstrations, which is responsible for overseeing and coordinating all aspects of the SMD Program, with special emphasis on demonstration development and administration; (2) the local project staff, who are responsible for implementing and operating the demonstrations and performing most of the data collection needed for evaluation; and (3) the U.S. Department of Transportation's Transportation System Center (TSC), which is responsible for the SMD evaluation program, including evaluation planning and management, evaluations of individual projects, crosscutting evaluations of the innovative concepts, and evaluation methodology development. Each of these organizations may be supported by private contractors or universities.

The SMD evaluation process is based on a well defined set of activities and interfaces among the principal organizations and their contractors. Each evaluation addresses three basic questions: (1) What changes were made to the transportation and/or activity systems? (2) What were the impacts of these changes? (3) Why did these impacts occur? To answer these questions,

evaluation activities consist of careful documentation of the events and circumstances surrounding the implementation and operation of the project, as well as detailed analyses of the impacts and cause-and-effect relationships. Because demonstrations vary with respect to objectives, relevant issues, complexity, content, and context, the scope and emphasis of each evaluation must be tailored to the specific characteristics of the project.

Evaluation activities are generally conducted at two levels -- individual project evaluations and broader crosscutting analyses which synthesize the experience and findings from several projects. The individual project evaluations provide detailed, site-specific information on project implementation, operations, and impacts, and are especially useful in guiding refinements and adaptations of the concept in other locales. The crosscutting studies tend to have greater validity and more widespread applicability for planning and policymaking purposes because they have a broader experiential and statistical base and because they take account of the sensitivity of findings to variations in site conditions, project scale, target market characteristics, and operational variants.

SMD evaluations attempt to maximize the quality and usefulness of information gained from the demonstrations by employing a carefully integrated combination of qualitative and quantitative evaluation methods. The selection of specific design elements and measurement techniques for each project evaluation is made with a view toward achieving valid evaluation findings within practical constraints. Strategies such as time series analysis, the use of consumer panels, and control groups are typically employed to strengthen evaluation designs.

The SMD Program has pioneered the application of innovative data collection and measurement techniques as part of its evaluation efforts. Experiments in the use of travel diaries, in which respondents keep sequential records of all trips over some period of time, have been conducted in conjunction with demonstrations of specialized transportation services for elderly and handicapped people to get better estimates of changes in mobility. Similarly, evaluations of SMD vanpooling projects have employed multiple-day vanpool logs and maps in vanpooler surveys to measure circuity, service reliability, and day-to-day variability in vanpool occupancy levels. Finally, SMD projects involving downtown pedestrian improvements have led to the development of innovative procedures for counting pedestrians and monitoring the travel, activity, and expenditure patterns within the project area.

Further efforts are currently underway to develop improved methods for demonstration evaluation. The design and administration of travel surveys are being carefully studied with respect to increasing sampling efficiency, participation rates, and measurement validity. Another recently initiated study is attempting to identify appropriate methods for assessing both the process by which urban transportation innovations are planned and implemented, and the political/institutional impacts of demonstrations. This study will also make recommendations to assist the evolution of the SMD Program as an arena for institutional experimentation.

## INFORMATION DISSEMINATION

Recognizing that information transfer plays an essential role in the diffusion and adoption of innovative concepts, the SMD Program has endeavored to develop an effective program for disseminating its evaluation findings.

There are a number of ways in which project findings can be used. Demonstrated concepts may be replicated elsewhere based on recommendations from project evaluations. The identification of issues that can impair successful implementation is useful in planning similar projects. Even when the basic concept is found to be unfavorable or too costly, certain components of a demonstration may be transferable. Data on project costs and operating characteristics may be useful for transportation planning studies and in analyses leading to investment decisions. Finally, data obtained from project evaluations can be valuable in supporting policy research at all levels of government and in the development of improved methodologies for transportation planning and evaluation.

Evaluation findings are used by a variety of groups, including transit operators, transportation planners, specific groups who may be significantly affected by a new service concept, and policymakers at all levels of government. Each group is different with respect to the issues of interest to it, its level of technical sophistication, and the amount of information it is willing to absorb. Therefore, the SMD Program has devoted considerable effort to identifying these target audiences and to developing effective channels of communication by which appropriate information can be disseminated quickly and efficiently.

Publications have been the principal medium for disseminating findings from project evaluations, results of analytical or crosscutting studies, and guidelines for planning and implementing innovative concepts. Project evaluation and case study reports contain detailed descriptions of the project and its implementation history, analyses of project impacts, and a discussion of transferability implications. The SMD Program also prepares summaries of key project findings and crosscutting analyses of concepts which have been replicated across several project sites. These summaries may appear as SMD staff studies or as articles in professional journals or transit industry publications. Another publication -- SMD Briefs -- provides short summaries of noteworthy interim findings from current projects. The SMD Program has also prepared manuals to guide local urban areas in planning and implementing new services that have been proven in demonstration projects. These manuals are published in separate volumes intended for policy-level officials, project leaders, and the planning team.

During FY 1980, the SMD Program launched a major effort to upgrade its publication distribution system. These changes will help keep publication costs down while improving the overall efficiency of SMD report distribution. Moreover, these changes should help open a more effective two-way channel of communication between SMD staff and their intended audience.

Technical conferences, seminars, and workshops provide another important medium for presenting SMD findings. The opportunity for face-to-face discussion with other researchers, potential users, and policymakers provides useful feedback to the SMD staff and often stimulates new ideas for

demonstrations. The SMD Program has sponsored several conferences on specific concepts and on general topics such as new directions for transit pricing.

A site visit to a demonstration project offers a unique opportunity to observe project operations in detail and to meet with those who have been involved with its implementation and operation. The SMD Program strongly encourages site visits by representatives of other urban areas. During FY 1980, an SMD HOST Program was created which provided funding for certain exemplary demonstration sites to serve as hosts to groups of local officials from throughout the United States.

## CONVENTIONAL TRANSIT SERVICE INNOVATIONS

Today, transportation planners, policymakers, and transit operators are all confronted with the problem of how to maintain and improve urban transportation services in the face of escalating costs and increasing pressures to limit public sector expenditures. The potential solutions to this problem are based on one common tenet -- more efficient managment of existing transportation resources.

The SMD Program has always devoted considerable attention to the identification, development, and evaluation of innovative strategies to use existing transportation and urban resources more efficiently. Early SMD demonstrations focused on strategies to increase urban highway capacity by giving preferential treatment to high-occupancy vehicles (carpools, vanpools, and buses). More recently, the program has been investigating the merits of extending preferential treatment strategies to urban arterial streets as a means of reducing traffic congestion and improving bus operations in downtown areas.

Another major area of transportation resource management being studied by the SMD Program involves transit service improvement strategies. Current projects include route restructuring and strategies to improve service reliability and make transfers less onerous. In a related effort, the SMD Program is investigating the cost-effectiveness and appropriate application of articulated buses in U.S. transit operations.

A third major area of investigation involves the application of transportation management techniques to enhance the attractiveness of downtown commercial areas. Since conventional transit forms the backbone of public transportation service in these intensively developed areas, transit improvements and urban revitalization initiatives often go hand in hand.

Finally, the SMD Program is testing the use of computerized rider information systems to better inform passengers about bus arrivals and provide transit managers with improved system monitoring capabilities.

### Route Restructuring

The restructuring of transit routes represents one action which a transit operator may take in order to increase transit productivity or respond to long-range changes in regional travel patterns. However, because of its


By opening up its contraflow bus lanes to vanpools, Houston both increased the overall productivity of the lane and provided a strong incentive for auto commuters to rideshare.

potentially disruptive impacts on the trip patterns of existing transit users, route restructuring has been largely avoided by major transit properties until very recently.

The SMD Program recently completed a case study evaluation of a locally inititated, systemwide route restructuring program in Denver, Colorado. The route restructuring transformed an existing radially oriented system to a more grid-like pattern aimed at better serving the travel needs of metropolitan area residents. It also represented the first attempt by a major U.S. transit property to completely revise its route network at one time.

The Denver route restructuring was implemented without significant operational problems or confusion on the part of riders, thanks to extensive pre-implementation planning and a well designed information campaign. The route restructuring resulted in a short-term ridership drop of about 7 percent due to temporarily disrupted travel patterns, and a longer term net ridership loss of about 3 percent systemwide. Many former riders perceived that route restructuring had caused a deterioration in service levels--specifically, longer average walk distances and increased transfers. However, the net ridership impacts may ultimately be positive, since the new grid system is more understandable to first-time transit users and more consistent with the present and anticipated travel patterns in the Denver area.

Currently, the SMD Program is evaluating another locally inititated route restructuring effort in Los Angeles, California, and is sponsoring a demonstration involving transit route restructuring in Newport News, Virginia.

## Transit Reliability Improvements

Research conducted by the SMD Program in 1978 found that service reliability is considered to be one of the most important attributes of good transit service by choice riders. Following up on this research effort, the SMD Program is currently sponsoring a demonstration of strategies to improve service reliability in Minneapolis-St. Paul, Minnesota. Both predefined strategies, involving schedule modifications, and dynamic strategies, requiring real-time monitoring and control, are being tested. The evaluation will focus on the cost-effectiveness of these strategies with respect to operational improvements and on passenger awareness of the changes.

## Transit Transfer Policies

A transfer policy consists of a set of operator actions, involving vehicle routing and scheduling, transfer charges, information for passengers, and terminal facilities, which are implemented to serve passengers who must change vehicles in order to complete their transit trip. Since no fixed-route transit system can provide direct, origin-to-destination service for all its passengers, a certain proportion of transit trips require a traveler to transfer between two or more routes. However, the act of transferring involves a number of actions which can make the overall transit trip more onerous (deboarding one vehicle, waiting for another vehicle to arrive, walking to the other vehicle, reboarding, and, sometimes, paying an additional

fare). Therefore, transfer policies can play a major role in determining how attractive and convenient a transit system is perceived to be.

The SMD Program recently completed a study of current transfer practices employed by transit properties throughout the United States. Data for this study were collected from a series of discussions with transit operators on 39 different U.S. transit properties. The properties varied with respect to size, service objectives and constraints, and types of policies. Bus-to-rail, and rail-to-rail transfers were examined in addition to the more common bus-to-bus transfer.

Eleven specific transfer policy components were identified and discussed in the study. These components included: (1) reducing the physical separation between routes at transfer points; (2) through-routing and route consolidation; (3) schedule coordination; (4) dynamic control of vehicle departures at transfer points; (5) timed transfers; (6) schedule adherence on connecting routes; (7) service frequency on connecting routes; (8) transfer charges; (9) use of transfer slips; (10) improved schedule information; and (11) marketing initiatives. The effects of each component on operator costs, user satisfaction, ridership, and revenues were analyzed with respect to such site-specific factors as historical and current ridership patterns, route structures, service frequency, size and shape of the service area, and degree of schedule adherence. Based on these analyses, the study identified specific situations and settings within which each component could appropriately be applied.

In addition to the general study of transfer policies, the SMD Program is also conducting a comparative study of U.S. transit properties that have instituted timed transfers between some of their routes. Timed transfers are designed to minimize the wait times of transferring passengers by synchronizing the arrivals at transfer points of buses from different routes. The study is examining four multi-focal-point timed transfer systems in detail. These systems are located in Ann Arbor, Michigan, Boulder, Colorado, Portland, Oregon, and Tacoma, Washington. Operating and cost information, as well as passenger survey data, will be analyzed to gain insight into the mechanics and workability of timed transfers and the reactions of passengers riding the timed-transfer routes.

## Computerized Rider Information Systems

The SMD Program is sponsoring a demonstration in Erie, Pennsylvania, to test the operational feasibility, cost-effectiveness, and passenger acceptance of a computerized rider information system (CRIS) which will enable passengers to obtain by telephone real-time estimates of the arrival time of the next bus at their stop. The objective of such a system is to reduce the uncertainty and the amount of time transit users spend waiting for a bus.

The key elements of the proposed system, which is modeled after an operational system in Mississauga, Ontario, include an automatic vehicle monitoring (AVM) system, a central computerized management information system (MIS), and an electronic automatic voice response (AVR) system. Passengers will request information by dialing a special seven-digit phone number with unique digits for the bus route and stop for which information is desired.

The AVR system will obtain the estimated bus arrival time from the computer, synthesize that into a voice response, and play that response back to the person dialing.

A central issue to be addressed in the evaluation is whether the high capital cost of such a system (estimated at $1 million) can be justified by the expected increases in ridership and by the availability of detailed system performance data.

Articulated Bus

In searching for ways to increase productivity and reduce operating costs, transit operators have taken renewed interest in the use of higher-capacity articulated buses as replacements for conventional transit coaches. Under the proper conditions, articulated buses could reduce the number of buses needed to satisfy demand levels on a given route and thereby reduce system operating costs. Alternatively, articulated buses could possibly attract additional ridership on high-patronage routes by increasing the likelihood of getting a seat.

In order to provide the transit industry with information helpful in making decisions about articulated bus investment and utilization, the SMD Program conducted a study of recent articulated bus experience in the United States. The study used data collected from 11 U.S. transit properties which have recently deployed articulated buses in revenue service. Service and operating characteristics, maintenance experience, and costs were documented and contrasted with those of conventional bus deployments.

The extra length and unique design of the articulated buses currently in service cause them to handle differently than conventional buses and necessitate additional training for drivers. The most noteworthy differences include a tendency for the rear of the bus to swing out during turns, and the potential for major turntable damage if the bus is backed up improperly.

Operating data collected in two cities indicate that articulated buses tend to experience longer dwell times at stops than conventional buses, due principally to slower door operations and the higher passenger loads associated with appropriate articulated bus deployment. These differences will have a greater impact on the run times for buses used on local, multiple-stop routes than for buses used on express routes.

The study also considered alternative substitution rates of replacement of articulated buses for conventional buses. From strictly a cost standpoint, it appears that cost savings will accrue when articulated buses are substituted for conventional buses at ratios of 1-for-2 or 2-for-3. At ratios of 3-for-4 or higher, reductions in driver labor costs are more than offset by the higher purchase price and other operating costs of articulated buses. However, where articulated buses are substituted for conventional buses at ratios of less than 1-for-1, small declines in service levels -- particularly, longer headways and longer in-vehicle travel times -- are likely to occur. These service impacts could result in some decline in ridership and fare revenue.

Considering both operator costs and service impacts, the study found articulated buses to be very cost-effective when used to replace conventional buses operating as "double headers" (i.e., two buses running in tandem along the same route). Articulated buses may also be cost-effective in express service when substituted for conventional buses at a ratio of approximately 2-for-3. However, articulated buses were not found to be cost-effective in any of the local service scenarios considered. Of course, no general study of this nature can draw conclusions on the desirability of articulated bus utilization on a particular route or in a specific local setting. However, based on these findings, the decision to employ articulated buses on local routes should be made cautiously and only after careful consideration of conventional bus deployment alternatives.

## Innovative Transit Services

The SMD Program occasionally evaluates innovative applications of existing transportation equipment, facilities, or services to increase or improve bus service to specific travel markets. Two such applications which are currently under investigation include the provision of high-quality fixed-route bus service between downtown Washington, D.C., and its airports, and a feasibility study of using school buses for nonpupil transportation services.

The Washington, D.C., improved airport access demonstration will attempt to increase the use of public ground transportation services between downtown Washington and Dulles International Airport, located 25 miles southwest of the city. Strategies will be employed to improve service reliability, to provide better access to Metrorail transit service, and to increase public awareness of the airport access system through various marketing strategies.

A recently completed SMD study assessed the potential for school buses to carry other persons during periods when the buses would otherwise be idle, as well as the potential for public transit to carry pupils along with other passengers as part of their regular service plan. The study identified three major barriers to the consolidation of pupil and nonpupil transportation: (1) differences in travel patterns, (2) coincident demand peaks in the morning, and (3) different vehicle requirements. Despite these problems, the study discovered several instances of successful coordination of pupil and nonpupil transportation. Most of these occurred in rural areas, where school buses are often the only form of public transportation available. The most common applications of nonpupil school bus transportation involved senior citizen lunch programs or other activities for the elderly that did not conflict with school transportation times.

## Priority Treatment for High-Occupancy Vehicles

Traditional traffic engineering techniques are designed to maximize the flow of vehicles through a highway network. Unfortunately, this methodology fails to account for the fact that different vehicles carry vastly different numbers of pasengers. Strategies involving priority treatment for high-occupancy vehicles (HOV) expand upon traditional traffic engineering techniques by substituting person flows for vehicle flows as the principal criterion for measuring system productivity.


A recent study of articulated buses examined their costs and operating characteristics and looked at alternative deployment strategies.

Boston's "Downtown Crossing" is one of four auto-restricted zone demonstrations being evaluated by the SMD Program.

The SMD Program has had a long history of experimentation with HOV priority treatment strategies. Early SMD evaluations focused on projects begun under the Urban Corridor Demonstration Program and included bus bypass lanes on metered freeway ramps in Minneapolis and Los Angeles, the Shirley Highway and El Monte Busway dedicated bus lanes, contraflow bus lanes on the approaches to the Lincoln Tunnel in New Jersey and the Golden Gate Bridge in California, and concurrent-flow bus and carpool lanes on the Santa Monica Freeway and Interstate 95 in Miami, Florida. The findings from these projects have provided considerable insight into the costs, impacts and implementation issues surrounding these strategies. Moreover, many of these strategies are now basic elements in local transportation system management (TSM) plans.

Recent SMD efforts have focused on extending HOV priority treatment strategies to downtown arterial streets, principally to improve the travel times and schedule reliability of transit vehicles. In a recently completed demonstration in San Francisco, improvements were made in the signs and lane markings delineating concurrent-flow bus lanes on three downtown streets. The improvements were found to have little impact on reducing lane violations, and indications are that for such improvements to be effective, they must be complemented by increased enforcement efforts.

Two other downtown street priority treatment demonstrations are just getting underway. In New York City, the right-most two lanes of Madison Avenue have been reserved for buses-only from 42nd Street to 59th Street, and right turns are prohibited over this 17-block stretch. These changes have improved bus speed and flow along the route by eliminating conflicts which occur as buses weave in and out of the congested curb lane to board and discharge passengers. In Philadelphia, a signal preemption system will be installed along a 6-mile trackless trolley route. The preemption system will be able to detect trolley vehicles as they approach an intersection and extend the green phase of traffic signal to allow the vehicle to get through.

The SMD Program is also continuing its evaluation of HOV lanes on urban freeways, particularly those which extend preferential treatment to carpools and vanpools. One such project involves a contraflow HOV lane on Interstate 45, north of Houston, Texas. The project is unusual in that it is the first and, to date, the only contraflow lane in the United States to allow registered vanpools as well as buses to operate on it. Vanpool drivers are required to take a special safety training course before they can use the lanes. The safety record of the lane has been excellent, with only four accidents in 22 months of operation. The presence of the lane has contributed significantly to increased transit and vanpool use in the corridor. Since its opening in August 1979, bus and vanpool modal split jumped from 7 to 25 percent, and total daily contraflow lane use currently averages over 11,000 person-trips. The SMD Program is continuing to analyze data from this project to more precisely measure its impacts on travel behavior and mode choice.

Special case study evaluations are also being conducted on two locally initiated, freeway HOV lane projects in New Jersey. In one project, a 12-mile segment of the Garden State Parkway has been widened, and the innermost lanes in each direction have been designated as concurrent-flow priority lanes for vehicles with three or more occupants. In the other project, an existing bus lane on the New Jersey approach to the George Washington Bridge has been lengthened and opened to any vehicle with three or more occupants. Carpools

will enjoy the dual benefits of being able to bypass the queues of vehicles at the toll booths and of not having to pay the $1.50 toll.

Downtown Traffic Restraint and Transit/Pedestrian Improvements

The SMD Program has been examining two concepts -- auto restricted zones (ARZs) and transit malls -- which have as their objective the physical restraint of automobile traffic and the encouragement of transit use and pedestrian activities in downtown areas. A transit mall is a street on which transit vehicles are given exclusive or near-exclusive use, sidewalks are widened, and amentities are added for pedestrians and waiting transit patrons. Automobile access is prohibited or strictly limited, except for cross-street traffic. An ARZ expands upon the transit mall concept in terms of both physical size and intended impacts. The focal point of an ARZ is a pedestrian enhancement zone, extending one or more city blocks in all directions, within which automobiles are prohibited or severely restricted. ARZs generally incorporate additional elements such as new or rerouted transit service, reserved bus lanes, transit and taxi facilities, peripheral parking facilities, and ring roads for the rerouting of through-traffic. ARZs may also serve as catalysts for urban revitalization efforts, prompting new building construction and renovation of existing buildings within the pedestrian enhancement zone.

SMD evaluation efforts have followed different lines of approach in studying transit malls versus ARZs. Since the transit mall concept had already been implemented in several locations across the United States, a comparative case study evaluation was initiated to obtain transferable findings and increase public awareness about the concept. The study was done in two phases: (1) a cursory investigation of the characteristics and histories of six transit malls in various stages of implementation, and (2) a more detailed analysis of three of the six projects in Minneapolis, Philadelphia, and Portland, Oregon.

The study of ARZs began in 1975 with a comprehensive study to assess the feasibility of the concept, identify potential demonstration sites, and develop detailed demonstration designs in several prospective sites. The study led to the eventual selection of four SMD demonstration sites -- Memphis, Tennessee, Boston, Massachusetts, New York City, and Providence, Rhode Island. Two of these demonstrations, those in New York City and Providence, are still in their engineering design phases and have no evaluation findings to report. Preliminary findings are available from Boston and Memphis regarding project implementation and early operational impacts.

Boston's "Downtown Crossing" has had significant impacts on travel within and to the downtown area. Pedestrian volumes within the zone have increased by 10 percent or more, with most of the increase coming from downtown employees. Auto use has declined as an access mode to the area, with corresponding increases among transit and walk trips. The street closings and changes in traffic circulation have had little or no effect on peripheral traffic congestion, and provisions for emergency access and goods deliveries have proved workable. Overall, the project has been well received by merchants and the general public, providing encouraging evidence as to the feasibility of this concept.

In Memphis, a shuttle bus service was instituted to connect the existing Mid-America Mall pedestrian area with a major employment area, the Memphis Medical Center. The shuttle service is currently averaging over 60,000 passenger-trips per month, with most of the ridership occurring during the midday. The shuttle bus has greatly increased the use of the Mall by Medical Center employees and has drawn a significant number of trips that were formerly made by automobile.

Although the favorable evidence regarding the economic impacts of auto restrictive measures in downtown areas is currently drawn from only a few project sites, it seems clear that both transit malls and ARZs can contribute substantially to broader urban revitalization efforts.

## PRICING AND SERVICE INNOVATIONS

There is strong evidence that the relative price of a transportation service has a significant influence on the level, pattern, and composition of demand for that service. Similarly, travel choices are also influenced by the relative quality of service offered by alternative transportation modes. Therefore, by effectively manipulating transportation prices and service levels, planners and policymakers can influence travel choices so as to improve the utilization of existing transportation systems and help alleviate transportation problems such as traffic congestion.

SMD activities in the area of pricing and service innovations all have the general goal of developing information to aid local areas in setting transportation pricing policies which are efficient, equitable, and consistent with specific transportation service objectives. Central to this goal is a better understanding of the impacts of pricing policies on travel behavior. The program is also investigating appropriate mechanisms for implementing transit pricing policies, and has recently begun testing strategies for increasing private sector involvement in the financing of transit services.

### Transit Fare and Service Variations

In order to develop effective transit pricing policies, transit operators must first be able to predict what impact, if any, a proposed fare or service change will have on ridership and revenues. The SMD Program has been studying traveler responses to changes in transit fares and service levels as an ongoing activity in its pricing research efforts. Specific questions involve not only the overall impacts of the fare and service changes on ridership and revenues, but also differences in the responses to fare and service changes according to differences in the initial fare levels, the magnitude of the fare increase, the level of service provided, and the size and characteristics of the city served.

As part of this ongoing effort, the SMD Program is currently conducting a series of case study evaluations of locally initiated transit fare increases. Studies have recently been completed for Erie, Pennsylvania, Jacksonville, Florida, Fort Worth, Texas, and the Kentucky suburbs of Cincinnati. The studies reveal a low aggregate demand response to increases in fare. This suggests that transit riders largely absorb the costs of higher fares, and

that fare increases do provide operators an avenue for increasing revenues. It was also observed that demand adjustments to fare increases occur very rapidly, with most of the change occurring in the first month. Finally, the studies noted that changes in transit service levels (measured as changes in route-miles of bus service) invoked substantially greater changes in ridership than did fare changes.

The SMD Program is also currently sponsoring a demonstration in Vancouver, Washington, to study the effects of a sequence of service improvements and fare increases on transit ridership. Another demonstration just getting underway in Bridgeport, Connecticut, will explore the role of a transit pricing manager in coordinating transit fare policies and service changes as part of a comprehensive regional transportation improvement program. A variety of fare and service changes are expected to be implemented within this project, and certain changes will be evaluated in detail to gain insight into the complex relationships between fare and service policies.

## Free-Fare Transit

Closely related to its evaluations of fare increases and service improvements are the investigations of free-fare transit service recently completed by the SMD Program. Responding to a Congressional mandate to determine the feasibility of free-fare transit, the SMD Program sponsored two demonstrations of systemwide off-peak, free-fare transit service in Denver, Colorado, and Trenton, New Jersey, during 1978. A more focused application of free-fare transit service -- the central business district (CBD) free-fare zone -- was investigated in two case study evaluations in Portland, Oregon, and Seattle, Washington, and expanded with two demonstrations in Albany, New York, and Knoxville, Tennessee.

In the two systemwide free-fare demonstrations, off-peak transit ridership increased by about 50 percent in response to fare elimination, and remained at this level throughout the year-long demonstration period. When off-peak fares were reinstituted, however, ridership reverted back to pre-free-fare levels within a period of 6 months.

Despite the substantial ridership increases, no particular sociodemographic group could be identified as an overwhelming beneficiary of the free-fare service. Looking specifically at the changes in travel behavior of poor people, the elderly, and those who are transit dependent, it was found that free-fare transit did not significantly improve the overall mobility of these groups relative to that of other transit travelers. Similarly, off-peak free-fare transit had no significant impact on reducing regional auto vehicle-miles of travel. Nor was there any evidence that systemwide free-fare transit improved CBD commercial activity relative to other shopping locations in the region.

The cost of systemwide, off-peak free-fare transit service was substantial. At both sites, the combination of lost revenues and increased operating costs attributable to free-fare would have required an 11-percent increase in transit operating subsidies. Moreover, the sharp increases in off-peak transit ridership had adverse effects on at least three aspects of

transit service quality: on-board crowding, schedule adherence, and the perceived level of on-board security.

In contrast to the broad-based but nonfocused impacts arising from a systemwide free-fare policy, a CBD free-fare zone is characterized by more localized impacts and substantially lower costs of operation. The primary objective of a CBD free-fare zone is to provide downtown shoppers, employees, and residents with an internal circulation system on the assumption that this added amenity will make the area more attractive and lead to increased commercial activity and revitalization.

Free-fare zones have been shown to substantially increase transit ridership in the area of the zone. In Seattle, Knoxville, and Albany, transit ridership within the zone tripled over pre-implementation levels; in Portland, it increased ninefold. Most of this increase came from trips diverted from other travel modes, particularly walking.

In the Albany demonstration, a concentrated effort was made to measure the impact of the increased transit ridership on retail sales activity. Based on an analysis of retail sales tax data, there does appear to have been an increase in CBD retail activity coincident with free-fare zone implementation. Moreover, stores which were closer to the CBD bus routes showed the greatest gain in retail sales. As an additional indication of the benefits perceived by CBD merchants, the downtown merchants' association has helped subsidize the free-fare service following the expiration of SMD funding.

## Fare Payment Strategies

Historically, the predominant method of fare payment on American transit systems has been the deposit of exact cash fares in a farebox upon boarding. In recent years, however, attention has focused on the potential of alternative payment strategies to improve operating efficiency and to make transit more convenient for riders. The SMD Program has studied the impacts of temporary discounts of monthly transit passes on transit pass sales, ridership, and operator revenues. It has also investigated the merits of marketing fare prepayment instruments to specific target groups such as employees or students, and using the private sector (employers, banks, and merchants) in the sale and distribution of fare prepayment instruments. In addition to testing ways to promote the use of prepayment as an alternative to cash fare, the SMD Program is also working to determine the best application of self-service fare collection equipment in a U.S. transit system. Finally, plans are underway to implement an automated fare postpayment program in Santa Cruz, California.

Findings from the demonstrations involving temporary reduced-fare promotions of transit fare prepayment (TFP) instruments in Austin, Texas, and Phoenix, Arizona, suggest that this marketing strategy is not particularly effective in attracting new transit riders or inducing cash-paying riders to switch to TFP permanently. Although both projects experienced dramatic increases in the level of TFP sales during the discount periods, virtually all of this increase came from existing riders who realized a small cost savings due to the effective price difference between TFP and cash fares. Although some of the new TFP buyers exhibited small increases in their transit trip


SMD transit payment demonstrations are exploring various alternatives to cash fares and their impacts on ridership, operational efficiency, and revenue generation.

frequencies during the promotion, most of them quickly returned to their former payment methods and trip frequencies when the promotions ended. Temporary reduced-price promotions should therefore be viewed as short-term marketing techniques to spotlight the introduction of a new TFP instrument, and not as long-term strategies to induce new transit ridership.

Another TFP strategy which was significantly more successful involved the marketing of TFP instruments to employers who would then sell them to their employees. Two demonstrations in Sacramento, California, and Jacksonville, Florida, revealed that many employers are willing to assume the responsibility and administrative costs of distributing transit passes to their employees, and that some will even subsidize a portion of the cost as an employee benefit. This enables the transit operator to realize the increased patronage resulting from an effective fare discount to subsidized employees without having to absorb any revenue losses itself. The demonstrations also found that overall employer participation was very dependent on how effectively the program was presented to them, and on what benefits they perceived would accrue to them.

Two other demonstrations which are still in progress are exploring the merits of marketing TFP instruments to special target groups. In Tucson, Arizona, a TFP promotion program is aimed specifically at students attending two local colleges. In Duluth, Minnesota, a special reduced-price monthly pass is being marketed to downtown employees who commute outside of the short, half-hour period when the transit system is most congested. Evaluations of these projects are examining the cost-effectiveness of more focused promotion efforts.

Self-service fare collection, although widely used on European transit systems, was not implemented in the United States until very recently. In July 1981, the first example of a self-service fare collection system was instituted in San Diego, California, on its new light rail transit line. Although the fare collection system was developed and will operate entirely with local funding, the SMD Program is conducting a special evaluation of this innovative concept. The evaluation will document implementation and operating issues and will examine the impacts of the new system on users and transit revenues. In June 1982, the SMD Program will sponsor the first systemwide demonstration of self-service fare collection in Portland, Oregon. This system is to be implemented in conjunction with the introduction of articulated buses and light rail transit service to help offset the anticipated delays in boarding times associated with these higher-capacity vehicles.

Another innovative fare technique scheduled to be tested on a systemwide level in the near future is credit card postpayment. Two earlier experiments with this concept, conducted in conjunction with specialized door-to-door transit services for elderly and handicapped people, were plagued with severe problems involving the hardware of the automated farebox recording systems. It is believed that many of these problems have now been overcome, and a demonstration of credit card postpayment used in general transit service will begin in Santa Cruz, California, in 1982.

## Transit Fare Integration

Transit fare integration involves the adjustment of fare levels and fare structures in such a way that the resulting transit system appears to the passenger as a single, unified network rather than a disjointed collection of routes and services. Two key elements of transit fare integration are the elimination of transfer charges and the adoption of a rational fare policy, based on such criteria as distance traveled and level of service.

The SMD Program is currently evaluating a transit fare integration program in Atlanta, Georgia, and plans to monitor two other fare integration efforts in San Francisco, and in Bridgeport, Connecticut. In all of these evaluations, special attention will be paid to the institutional difficulties of trying to integrate fares when different modes and, sometimes, different transit properties are involved.

## Transit Fare Promotions

Temporary fare reductions or elimination of transit fares may be used to induce nonriders to experiment with transit and encourage existing riders to increase their use of transit. The SMD Program is currently conducting three demonstrations involving transit fare promotions in an effort to determine whether people can be drawn to transit using short-term promotions and whether those drawn can be retained as fare-paying passengers.

The three demonstrations are located in Scranton, Pennsylvania, Spokane, Washington, and Minneapolis-St. Paul, Minnesota. In Scranton, three successive, 1-month fare promotions will be implemented. The promotions will reduce fares systemwide from a 45¢ base fare to 20¢, 5¢, and free, respectively. Each promotion will be followed by a 5-month period in which the base fare is restored to test the long-term ridership retention of each promotional discount. In Minneapolis-St. Paul, coupons valid for free transit trips will be issued using various distribution procedures and validity periods in an attempt to determine the most cost-effective marketing techniques for transit promotion. Finally, in Spokane, an indirect form of transit marketing will be tested in which bus patrons will be issued coupons entitling them to discounts at downtown retail establishments. Since the nature and magnitude of the discounts rest with the individual merchants, the Spokane experiment will, in effect, be utilizing the private sector to subsidize transit promotion costs.

## Parking Pricing Strategies

Just as lowered transit fares can serve as an incentive to attract people to transit, increased auto user charges such as parking fees or road tolls can lead to more efficient use of automobiles at certain times of the day or in certain areas. The SMD Program is currently evaluating the effectiveness of parking pricing as a parking management tool in downtown commercial areas and in residential neighborhoods bordering a major trip attractor.

In Madison, Wisconsin, a parking surcharge will be collected from all vehicles entering any of four city-owned parking lots during the morning peak

period. This surcharge is expected to discourage commuters from parking downtown and monopolizing spaces which could otherwise be used by a larger number of shoppers arriving later in the morning. Three new peripheral park-and-ride lots, connected to the downtown by shuttle bus service, have been opened to provide commuters with an alternative to parking downtown.

Two other demonstrations, in Hermosa Beach and Santa Cruz, California, are exploring the merits of combining residential parking permits with parking pricing to alleviate the congestion problems caused by nonresident beach goers who monopolize all available parking spaces during nice weather. In both sites, residential parking stickers and guest passes are available to all residents in the affected areas. Nonresidents may buy a temporary day pass which allows them to park near the beach, or they may drive to peripheral parking lots and take a shuttle bus to the beach.

## PARATRANSIT SERVICES

Paratransit is a generic term for a broad range of transportation modes that lie between the single-occupant automobile and fixed-route, fixed-schedule public transit services. Common paratransit modes include taxis, jitneys, demand-responsive transit (DRT) or dial-a-ride (DAR), carpools, vanpools, and subscription buses.

In many situations, paratransit services can offer attractive alternatives to both the single-occupant automobile and conventional transit services. For commuters, ridesharing arrangements provide transportation at a fraction of the cost of driving alone. Taxis and publicly operated DRT services can provide transportation in low-density areas that could not be served productively using conventional, fixed-route buses. Furthermore, by using paratransit services as feeders to existing transit routes, a transit operator can substantially increase coverage without major investments for new equipment.

The SMD Program has made major contributions in the development and testing of innovative approaches to providing paratransit services. Operational features, cost-effectiveness, and public acceptance and use are issues considered critical in the evaluation of these services within the specific SMD projects. More recently, the SMD Program has focused considerable attention on the institutional barriers which may hamper the adoption of innovative paratransit services, and is working to develop new institutional frameworks in which a variety of transportation services may be offered to the public. An important concept which has emerged is that of transportation brokerage. Brokers help to implement a range of paratransit or transit services by matching those wishing a service with providers of that service, and actively work to remove barriers to the more efficient use of available transportation resources.

### Demand-Responsive Transit Services

Demand-responsive transit (DRT) refers to a class of paratransit services in which vehicles pick up and transport riders within an area at times and places specified by the riders themselves. DRT services enable passengers to

schedule trips at their convenience instead of having to adjust their schedules to coincide with transit headways. Moreover, the ability to dynamically dispatch and route vehicles in response to known demand means that DRT services have the potential to be more productive and cost-effective than conventional transit services in areas with low demand densities.

Over the years, the SMD Program has tested and evaluated the DRT service concept under a variety of operating configurations, provider arrangements, and institutional settings. In Rochester, New York, publicly operated, areawide (many-to-many) dial-a-ride (DAR) service was demonstrated in two suburban communities. During later phases of the project, two other communities were added, with service provided by a private operator under contract to the transit authority and using transit authority vehicles. Privately operated, shared-ride taxi (SRT) feeder service to a rural fixed-route bus system was studied in a demonstration in St. Bernard Parish, Louisiana. Finally, in Westport, Connecticut, an integrated transit system consisting of a publicly operated fixed-route bus service and an SRT service using transit district vehicles but operated under a private management contract was tested. Evaluations of these demonstrations have been completed, and the findings provide substantial insight concerning the appropriate applications for DRT, as well as organizational and operational approaches which produce the most satisfactory results.

A principal concern regarding DRT service is cost. None of the publicly operated, areawide DRT services studied were able to sustain high enough demand levels to achieve acceptable levels of vehicle productivity or cost per passenger. High operating costs, combined with typically modest fares, produced revenue-to-cost ratios of 0.20 or less. Privately operated SRT services were typically less costly than DAR, due, in part, to their use of lower cost, nonunion drivers.

Legal and institutional barriers to the integration of publicly and privately operated services were shown to be surmountable, and several landmark legal precedents were set because of court decisions arising from demonstration activities. The demonstrations also provided insights regarding the factors that influence service performance and operating costs, and identified alternative strategies for improving DRT operations.

One issue which was not fully resolved in the completed demonstrations concerns the relative efficiencies and productivities of computerized versus manual dispatching. Although computerized dispatching was instituted in Rochester, the low demand levels and limited service area did not provide a sufficient test of the concept's capabilities. A more rigorous test of computerized dispatching is currently underway in Orange County, California. Evaluation of this demonstration will focus on the workability of implementing, operating, and administering an automated DRT control system, and the impacts such a system has on level of service, vehicle productivity and system operating costs.

### Taxicab Regulatory Revisions

The taxicab is currently a relatively underutilized mode of public transportation in the United States, but one which has the potential to

complement and, in some cases, provide a cost-effective alternative to existing transit services. Modifications to many of the regulations governing taxicabs can significantly enhance their ability to serve the public. Moreover, there is a need to understand the institutional processes by which taxicab regulatory revisions can be successfully implemented.

Although it has sponsored no specific demonstration of taxicab regulatory revision, the SMD Program is currently conducting case study evaluations in five western cities -- San Diego, Berkeley, and Oakland, California, Portland, Oregon, and Seattle, Washington. Each city adopted new taxicab ordinances during 1979 or 1980. In addition, a retrospective study was completed in FY 1980 concerning regulatory revisions which had taken place in Indianapolis, Indiana, in 1973.

Regulatory revisions in the six cities generally consisted of relaxing entry restrictions to new taxicabs and/or allowing taxicabs greater flexibility in setting fare rates. Entry relaxation was often motivated by a perceived shortage of taxicab service, a desire to introduce new competition to force service improvements or more reasonable rates, to decrease the city's vulnerability to a taxi strike or company shutdown, or to encourage taxi companies to branch out and offer new innovative services. Open ratesetting was usually instituted because of by a desire to de-politicize the ratesetting process, or because city councils lacked the necessary data or administrative support to determine what an appropriate taxi fare rate should be.

Open entry has had mixed results in the cities where it has been implemented. Where the taxi industry was healthy or growing, taxi supply has grown without adversely affecting existing operators. In other cities, open entry has resulted in a rather unstable equilibrium with numerous operators entering and leaving the industry because they cannot make a profit.

Open ratesetting has typically resulted in moderate fare increases within the city, but has created problems at airports where taxis often charge exhorbitantly high rates to incoming visitors who may be unaware of their alternatives.

As yet, the regulatory revisions have not spurred operators to adopt innovative fares or services, and there is no evidence that overall taxi service levels have changed significantly. Nor have the regulatory changes significantly reduced the time spent by city administrative staffs in dealing with taxi industry matters.

Future efforts by the SMD Program in the area of taxicab regulatory revisions include further analysis of the long-term impacts of these changes on taxi service levels and industry profitability. In addition, a detailed evaluation will be conducted of the proposed reorganization and consolidation of taxicab ordinances in Dade County, Florida, to be implemented in conjunction with an SMD paratransit brokerage demonstration.

## Ridesharing

The term ridesharing is used to describe any of several arrangements whereby individuals voluntarily agree to travel together, typically for the

commute trip to work or school. The most common forms of ridesharing are carpools and vanpools. More recently, buspooling and organized hitchhiking or casual carpooling have been included as legitimate ridesharing arrangements.

Ridesharing offers a simple, low-cost alternative to new highway construction or increased transit capacity for serving peak-period travel demand. It can also help reduce energy consumption and air pollution by reducing the number of single-occupant auto commute trips. For these reasons, the SMD Program has been actively investigating alternative ridesharing arrangements and methods of promoting ridesharing within urban areas.

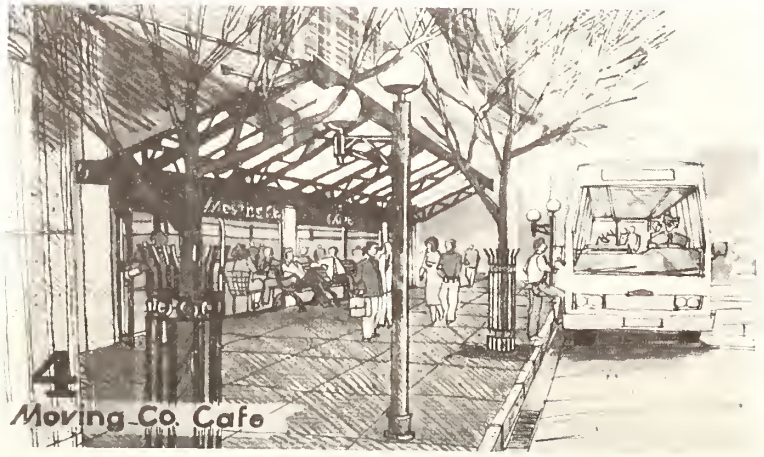
A major portion of SMD ridesharing efforts has been devoted to the development and evaluation of third-party vanpool programs, in which an independent "transportation broker" promotes the idea of vanpooling to local employers and their employees, helps to arrange vanpools by matching potential vanpoolers together, and in some cases, may even lease vans to newly organized vanpools. Five SMD-sponsored demonstrations involving third-party vanpool programs were implemented in Knoxville, Tennessee, Norfolk, Virginia, San Francisco, California, Minneapolis, Minnesota, and Newport News, Virginia. The projects experimented with a variety of operational, organizational, and financial approaches. Furthermore, they were seen as a means to assess the market potential for vanpooling, nationwide, by providing empirical information about the demographic and travel characteristics, attitudes, and behavioral responses of vanpoolers versus nonvanpoolers.

A crosscutting study was recently conducted on data from four of the vanpool demonstrations. The study found that vanpooling is both workable and effective over a range of settings and commuter markets. There appears to be a sizeable market of commuters for whom vanpooling is a viable and attractive mode. The typical vanpooler can be characterized as a "choice" rider who does not need a car during the day, rarely works overtime, and has a relatively long commute distance (over 50 miles, round trip). For these individuals, the benefits of vanpooling (lower commuting costs, less driving, and the possibility of eliminating a household automobile) more than compensate for the added travel time to pick up passengers and reduced schedule flexibility. Vanpool drivers exhibit considerable entrepreneurship in adapting vanpool operating policies to passenger preferences and in setting fares to reflect individual passenger circuity and van occupancy levels.

It was also found that successful promotion of vanpooling to private employers depends heavily on securing top management's support at the outset, and is influenced by such factors as parking availability at the employment site. The concept of leasing "seed vans" to newly formed vanpools appears to be an effective means of encouraging individuals to try out vanpooling without having to make a major commitment to purchase a van. While the costs of operating the third-party vanpool programs were high during the demonstration periods, there is evidence of substantial declines in unit costs with increasing program size and maturity.

Findings from the Newport News demonstration and from evaluations of several vanpool projects currently being funded as part of the National Ridesharing Demonstration Program will provide further insight into characteristics of vanpoolers and the operational aspects of effective vanpool programs. In Newport News, particularly, an effort is being made to more






The Bridgeport transportation brokerage demonstration is expanding brokerage activities to include fixed-route and paratransit services, coordination of social service agency transportation, and community and economic development.

accurately measure the fuel savings that can be attributed to vanpool formation.

Another ridesharing concept which has been explored by the SMD Program is subscription bus service. This concept was first investigated early on in the program with the case study evaluations of locally initiated services in Reston, Virginia, and in Southern California. More recently, and SMD-sponsored demonstration of subscription bus service to the El Segundo industrial park in Southern California was evaluated. This service, operated by the Southern California Rapid Transit District (SCRTD), provided limited-stop service along routes which were typically shorter than those found in other subscription bus operations. The shorter routes allowed the buses to make multiple runs during a peak period, thereby increasing vehicle productivities.

The findings from the El Segundo demonstration indicate that multiple-run subscription bus service can attract commuters in the intermediate trip distances of 7 to 25 miles, one way. However, the service must be perceived as reliable, convenient, and reasonably competitive with the automobile in terms of overall travel time in order to maintain a clientele of choice riders.

During FY 1979 and 1980, the SMD Program tested an innovative ridesharing concept known as casual carpooling, in which drivers could pick up potential passengers at designated locations, but no commitment was required of either rider or driver to participate from one day to the next. The demonstration was implemented in Marin and Sonoma Counties, north of San Francisco. Drivers with two or more passengers could use a high-occupancy vehicle lane and avoid paying a toll on the Golden Gate Bridge.

Overall participation in the program was low, and it was not continued beyond the demonstration period. Major deterrents to more widespread participatation among riders included the uncertainty of getting a ride and difficulty of traveling to designated match points. From the perspective of a publicly sponsored ridesharing program, casual carpool appears to have limited application at this time.

### Transportation Brokerage

Unlike other SMD concepts which represent innovative transportation services or service improvements, transportation brokerage refers to a particular institutional structure within which innovative services can be implemented. A transportation broker may be defined as a third party who tries to efficiently match transportation supply with the specific transportation needs of one or more segments of the population.

Transportation brokerage projects sponsored by the SMD Program span a broad range of potential target groups and service options available to the broker. Principal target groups served by SMD brokerage projects include elderly and handicapped people, commuters, and the general public.

The primary goal of an elderly and handicapped (E & H) transportation broker is to satisfy the mobility needs of its clients group through the

provision of low-cost, accessible transportation service. The first E & H brokerage project was instituted in Mountain View, California. Since then, a much more comprehensive demonstration has been initiated in Pittsburgh, Pennsylvania, and E & H brokerage has appeared as a component of other brokerage projects in Knoxville, Tennessee, Newport News, Virginia, and Bridgeport, Connecticut.

Commuter brokerage projects in Knoxville, Newport News, and Minneapolis, Minnesota, have already been discussed under ridesharing. In all of these projects, the principal goal of the broker was to increase the efficiency of peak-period transportation by decreasing the number of trips made by single-occupant autos.

General public brokers represent the latest expansion in the scope of brokerage activities. The goal of the general public broker is to integrate those transportation modes over which the broker has some influence or control into an effective and efficient transportation system responsive to the needs of the people in the urban area. Current SMD projects involving general public brokers are located in Dade County, Florida, and Bridgeport, Connecticut.

A variation on general public transportation brokerage, known as decentralized brokerage, is being demonstrated in northeastern Illinois. Here, the typical broker functions are divided between the Regional Transportation Authority (RTA) and local communities interested in developing innovative paratransit services to meet their local public transportation needs.

Although many of the brokerage demonstrations are still in progress, evaluation findings from the earlier commuter broker projects provide some general insight concerning the role and value of a transportation broker.

The transportation broker appears to play a major role in the planning, coordination, and implementation of a new transportation service such as vanpool promotion. The duties and responsibilities associated with this role require substantial amounts of time and effort which, in the absence of a broker, could not be easily assigned to any other local organization.

An effective brokerage program is likely to be expensive. Brokerage cannot be done well as a part-time activity. Current findings point to the need for full-time staff, with effective leadership, dedicated to specific program objectives, and with sufficient resources to achieve them. Thus, the principal benefits of transportation brokerage relate not to its efficiency, but rather to its ability to implement a program that would not otherwise exist.

The concept of decentralized brokerage seems to have merit as a mechanism by which a large regional transportation authority can identify and respond to the needs of its constituent communities in a cost-effective manner. In the northeastern Illinois demonstration, there seemed to be little or no serious overlap in the division of responsibilities between the RTA and local project staffs and, aside from some early start-up difficulties, the program has operated smoothly and satisfactorily.

Current brokerage demonstrations in Pittsburgh and Bridgeport are aimed at investigating expanded roles for the transportation broker. Bridgeport, especially, represents the most comprehensive and ambitious application of transportation brokerage yet attempted. As a general public transportation broker, the Greater Bridgeport Transit District will have an almost unlimited variety of transportation service options at its disposal and an equally large number of competing transportation needs which must be met. This demonstration should provide valuable insight into the ultimate role and limitations, as well as the costs and benefits, of the brokerage concept.

### Innovative Service Concepts

Occasionally, the SMD Program sponsors demonstrations of innovative vehicle designs or other transit equipment in order to encourage growth of an undeveloped travel market or to tap an underutilized transportation resource. Two such demonstrations which have recently been completed by the SMD Program involved a special case study of high-speed waterborne commuter transit service in Boston Harbor, Massachusetts, and a study of bicycle-transit integration in Santa Barbara, California.

The South Shore Over-the-Water Commuter Service, initiated in December 1978, tested the potential for transporting commuters across Boston Harbor by supplementing existing ferry service with high-speed hovercraft service. The hovercraft service was significantly faster than the conventional boat and proved to be very popular with many commuters in that travel corridor. However, the hovercraft vessel was much smaller than the conventional boat, and its size seriously limited its passenger-carrying capacity and its ability to travel safely in rough seas. Moreover, the hovercraft experienced a number of mechanical problems, and the absence of a back-up high-speed vessel meant that service had to be discontinued whenever the hovercraft was being repaired. Although the service was found not to be economically viable in this application, it appears that many of the problems could be overcome with a larger vessel and the availability of a back-up boat.

The Santa Barbara Bicycle Transit Demonstration examined the feasibility of integrating fixed-route transit service with bicycle transportation. Bicycle trailers were attached behind minibuses on three bus routes that served areas with heavy bicycle usage, such as colleges. The service has been generally well received, and enjoys high patronage levels on at least one of these routes. Although the potential applications of this service concept are probably limited to specific routes and geographic locations, the Santa Barbara demonstration has shown that bike/bus service is operationally practical.

## TRANSPORTATION SERVICES FOR SPECIAL USER GROUPS

The term "special user" refers to those persons who, because of age, income, or disability, do not have use of an automobile, and are therefore dependent on public transportation or special arrangements to meet their mobility needs. The SMD Program has been instrumental in the development and testing of various approaches to serving the transportation needs of these special user groups. Concepts currently under evaluation include wheelchair-

accessible fixed-route bus service, specialized door-to-door transit services for elderly and handicapped persons, user-side subsidies for taxis and fixed-route bus services, coordination of social service agency transportation services, transportation services for disadvantaged, inner-city residents, and public transportation services in rural areas. The evaluations are examining the costs and operational feasibility of these services, institutional issues and barriers to implementation, and the impacts of these services on the mobility of their intended target groups.

Accessible Fixed-Route Bus Services

In recent years, there has been considerable and heated debate about the merits of making fixed-route transit services fully accessible to all handicapped people, including those confined to wheelchairs. Transit operators and many transportation professionals have argued that the installation of wheelchair lifts on all public transit buses would be prohibitively expensive and would still not adequately serve the transportation needs of many handicapped persons. On the other hand, Federal policymakers and spokespersons from various groups representing the handicapped have claimed that accessible public transportation is essential in order for severely handicapped persons to be able to rejoin the mainstream of society. For the most part, however, there has been little or no empirical evidence to support the claims made by either side.

In order to provide both policymakers and transit operators with objective, quantitative information about this highly controversial transportation service option, the SMD Program has conducted several case study evaluations of locally implemented accessible fixed-route bus operations throughout the United States. In addition, it is currently sponsoring two demonstrations of fully accessible fixed-route bus operations in Champaign-Urbana, Illinois, and Palm Beach County, Florida.

Most of the accessible fixed-route bus services currently in operation are experiencing low levels of lift use. Many wheelchair users at the project sites have claimed that they don't need the fixed-route bus service. Others have claimed that they are not able to use the service because of difficulty in getting to the bus stop or because their wheelchairs do not fit safely on the lifts. Lifts have rarely been used by anyone other than wheelchair users.

Because of the low utilization rates, none of the sites have experienced any significant impacts on overall schedule adherence due to the institution of accessible service. On the other hand, lift malfunctions have occurred with great frequency, resulting in denied boardings for lift users and/or delays for other bus passengers.

The major impacts resulting from the provision of accessible fixed-route bus service have been substantial increases in bus maintenance costs due to equipment malfunctions and damage caused by accidents or operator error, increased costs for driver and mechanic training, and increased capital costs for the lift equipment and extra back-up buses. The total incremental cost of providing accessible service has been estimated at $1500 to $2000 per year per accessible bus. With the increased likelihood of substantial cutbacks in



Two methods of providing door-to-door transportation for elderly and handicapped people which have been investigated by the SMD Program are publicly operated dial-a-ride services and user-side subsidies for shared-ride taxi services.

Federal operating subsidies for public transportation by the mid 1980s, these costs will probably have to be paid out of local transit funds.

## Door-to-Door Transit Services for Special Users

Findings from the accessible fixed-route bus evaluations confirm that fixed-route transit cannot be used by a large number of elderly and handicapped persons. Many of these people find it difficult or impossible to get to a bus stop, regardless of whether the vehicle itself is accessible. The only practical way of providing transportation to such individuals is with door-to-door transit service.

The SMD Program has recently completed evaluations in seven demonstration sites involving door-to-door transit services for elderly and handicapped people. The projects were located in Portland, Oregon, Westport and the lower Naugatuck Valley, Connecticut, Rochester and New York City, New York, and Proviso Township and Will County, Illinois. Most of these services offered low fares but required that travelers call in advance (usually a day ahead) to request a ride.

The specialized door-to-door transit services were generally not heavily utilized by their target markets. Project registration rates ranged from 16 to 30 percent of the estimated eligible population, and average trip rates for those who did register ranged from less than one to about three round trips per week. Many project registrants viewed the services principally as a back-up mode of transportation. However, at each site, a small but significant group of frequent users claimed that specialized door-to-door transit services increased their mobility by allowing them to make trips they would otherwise not have taken. Largely because of low overall demand levels, specialized door-to-door transit services also experienced low levels of vehicle productivity. Furthermore, the costs of operating these services were high, ranging from $5.00 to nearly $11.00 per passenger-trip. Higher productivities and lower per-passenger costs were achieved in several sites by opening the service up to the general public. It has generally been concluded, however, that specialized door-to-door transit services operated by a public transit authority cannot compete, in terms of cost, with taxis or other services provided by local private transportation providers.

## User-Side Subsidies

The user-side subsidy is a technique for delivering low-cost transportation service to selected groups of individuals using private providers. Under a user-side subsidy program, certain "target groups" are permitted to purchase trips from a transportation provider at fares which are below those charged to the general public. For each subsidizing trip delivered, the provider receives a voucher, scrip, or a ticket from the user which can be redeemed at the subsidized agency for an agreed-upon value -- usually the full-fare value of the trip.

User-side subsidies offer a way for local areas to provide low-cost door-to-door transportation service to their elderly and handicapped citizens by using taxis and other private transportation providers. It has been shown

that, on a per-trip basis, private operators can deliver these services more efficiently and at lower cost than can a dedicated fleet of publicly operated vehicles. The SMD Program has played a major role in the development and refinement of the user-side subsidy concept. Four demonstration projects in Danville, Illinois, Kinston, North Carolina, Montgomery, Alabama, and Lawrence, Massachusetts, have recently been completed. In addition, case study evaluations of locally initiated user-side subsidy programs have been conducted in Kansas City, Missouri, Milwaukee, Seattle, Los Angeles, and the San Francisco Bay Area. Finally, the SMD Program has examined user-side subsidy programs which were elements of larger demonstrations in Pittsburgh, Milton Township, Illinois, and the State of West Virginia.

Overall, the evaluations have shown user-side subsidies to be not only feasible, but very attractive methods of delivering special needs transportation services through private providers. The programs were implemented with relatively little difficulty in a variety of settings having considerably different demographic characteristics, regulatory policies, and taxi operating practices. Moreover, the implemented programs have been generally well received by subsidized users, transportation providers, and the general public. The cost to the public to subsidize a trip through a user-side subsidy was found to be substantially less than the average per-trip cost of publicly operated specialized transportation services. Administrative costs were found to be relatively modest and largely independent of total project demand. This suggests the existence of scale economies and indicates that user-side subsidy programs may be financially viable even in larger urban areas. Moreover, private transportation providers seemed willing to absorb some of the administrative costs themselves in return for the expectation of increased business.

Subsidy costs are largely a function of local policy, and were effectively controlled in the demonstrations through such mechanisms as limits on per-trip subsidy payments, eligibility restrictions, and limits on total subsidized travel. There was little or no evidence of subsidy fraud or abuse by either project users or transportation providers.

The subsidy programs seemed to attract those in the target population who were most transit dependent and most in need of subsidized transportation. Eligible individuals with other means of transportation took few, if any, subsidized trips. The principal benefits which accrued to subsidized users were a decrease in their travel costs for those taxi trips which would otherwise have been made at full-fare, and a change from less attractive transportation alternatives.

The user-side subsidy concept has also been successfully applied as a way to maintain low fares for certain target groups on fixed-route bus service. In three of the demonstrations sites -- Danville, Montgomery, and Lawrence -- elderly and handicapped persons could purchase discounted bus tickets, and thereby enjoy reduced transportation costs. In future evaluation efforts, the SMD Program plans to investigate the feasibility of employing user-side subsidies for low-income transit users to offset the adverse effects of a systemwide fare increase.

Coordination of Social Service Agency Transportation

Many social service agencies operate or subsidize transportation services to take their clients to and from agency programs. Very often, however, agencies lack the resources and technical expertise to adequately run their own transportation program. Moreover, there is typically little or no voluntary cooperation between agencies with respect to transportation service delivery. Consequently, the resulting network of individual agency transportation programs is often fragmented, duplicative, and highly inefficient.

The SMD Program is currently testing a variety of approaches to promote and facilitate coordinatation of social service agency transportation programs in a region. In Chico, California, and in Pittsburgh, social service agencies coordinate monetary resources and, in some cases, lease their vehicles to an operating agency which provides transportation services to agency clients. Under this cooperative arrangement, the participating agencies maintain substantial control over how their resources are utilized.

Another approach, known as consolidation, is being tested in demonstrations in Mercer County, New Jersey, Will County, Illinois, and Sacramento, California. With consolidation, agencies contribute their available transportation resources to an independent transportation provider. The provider agrees to deliver transportation services for the participating agencies, but is more or less autonomous with respect to overall administrative and operational decisions. Thus, under consolidation, individual agencies must relinquish control over how their resources are spent.

Many of the social service agency transportation demonstrations are still underway, with only preliminary findings currently available. However, the projects have provided some insights on the barriers to coordination, and on strategies which seem to be most effective in gaining agency support, participation, and cooperation.

The most serious barriers to developing, implementing, and expanding coordinated transportation have been operational and attitudinal rather than statutory. Many agencies have been fearful that any relaxation of control over their transportation services would result in a deterioration of service quality. This fear has usually been compounded by the absence of any history of successful service provision on the part of the coordinating agency. As a result, most of the coordinated systems have taken much longer to implement than had been anticipated. Agencies have generally agreed to participate only after being convinced that their specific transportation service needs are understood and addressed by the coordinated system. The more successful coordination efforts have been those whose director seemed to have good intrapersonal skills and a special sensitivity to the needs and concerns of human service agencies.

There is, as yet, no evidence that significant cost savings have been realized as a result of coordination efforts, although detailed analyses of project costs are still in progress for several of the demonstrations. There are, however, some indications that productivity increases rather than actual

cost savings are likely to be the principal benefits arising from the coordination of social service agency transportation services.

## Transportation Services for Other Special User Groups

During FY 1979, the SMD Program broadened the scope of its special user group program by sponsoring a demonstration to provide seasonal transit service for groups of low-income, transit-dependent, inner-city residents of Los Angeles to recreation areas in the nearby Santa Monica Mountains. The service proved to be very popular among the target population, with over 270 groups and more than 13,000 riders using the service in its first 2 years of operation. The service provided its patrons, many of whom had limited access to outdoor recreation other than local playgrounds or beaches, the opportunity to view a variety of wildlife and rugged natural terrain, and to hike, fish, swim, picnic, or participate in organized games.

The costs of providing recreational bus service were relatively high, averaging $6.77 per passenger in the second year. Since the target population would probably not be able to afford fares to cover these costs, a substantial public subsidy would be required to support such a service. In the current economic and political climate, such subsidies seem unlikely.

## Rural Public Transportation

Rural public transportation systems operate within a substantially different context from urban transit systems. Low population densities result in demand levels for public transportation that are often insufficient to support a conventional fixed-route bus system. What limited public transportation does exist is often inaccessible to those elderly or handicapped people who need the more costly door-to-door service. The basic requirements for effective rural public transportation therefore fall into three categories: availability, affordability, and accessibility.

The SMD Program recently completed a special evaluation of 11 rural bus services located on Indian reservations, and has been monitoring the West Virginia Transit Renumeration and Incentive Program (TRIP). Both of these projects were initiated in order to examine alternative approaches to providing effective public transportation in rural areas, especially for individuals without access to automobiles.

The projects demonstrated four basic approaches aimed at making public transportation available, affordable, and accessible, in rural areas. Multipurpose bus systems, characterized by low fares and limited door-to-door service did not prove to be cost-effective in the low-density rural areas. By contrast, single-purpose bus systems, which provided low-cost, door-to-door services for specific activities at specific times, could concentrate demand and thereby achieve higher levels of productivity. The use of either single of multipurpose bus systems for contract or subscription services also appeared to increase productivity. Finally, the application of user-side subsidies to reduce financial barriers to travel was limited by the availability of public transportation and funding restrictions.


Future activities by the SMD Program will focus on improving the operating efficiency and productivity of conventional fixed-route transit services and exploring how private transportation providers can be utilized more effectively to deliver new services.

The use of door-to-door transit service seemed to be an essential element in nearly all of the successful rural public transportation projects. The door-to-door service is needed to overcome the long distances between many rural residences and the nearest state or county road. In West Virginia, taxis effectively provided such service through the mechanism of user-side subsidies.

Rural public transportation systems are also subject to special operational problems. Rough terrain and large service areas make centralized maintenance, supervision, and fueling impractical. While inexpensive driver labor may be available, experienced management personnel are generally difficult to find. In many of the projects, this resulted in lengthy and disruptive initial adjustment periods that alienated potential riders due to poor service reliability.

## SUMMARY AND FUTURE DIRECTIONS OF THE SMD PROGRAM

Throughout its history, the Service and Methods Demonstration Program has continually shown its ability to anticipate and respond to contemporary problems in urban transportation management. Innovative priority treatment strategies, initially demonstrated through the SMD Program, are now familiar elements in the transportation improvement plans of most urban areas. Similarly, many communities have instituted specialized door-to-door transportation services for their elderly and handicapped citizens, based on findings and recommendations from early SMD projects. Another SMD concept which has been widely adopted is the user-side subsidy. In a recent inventory, over 100 locally operated user-side subsidy programs were identified nationwide.

The SMD Program has also demonstrated its value in providing timely responses to critical questions involving national urban transportation policy. Most recent examples of this role include SMD evaluations of free-fare transit service in response to a Congressional mandate, and evaluations of the costs and impacts of accessible fixed-route bus service, which have contributed significantly to the Department of Transportation's re-evaluation of the merits of Section 504 transit accessibility guidelines.

Over the next few years, however, the SMD Program faces what may be its greatest challenge yet -- to develop, test, and disseminate information about innovative strategies and management techniques to reduce the operating deficits of public transportation in response to growing economic and political pressures. Many of the demonstrations currently being evaluated by the SMD Program already reflect an increased emphasis on transit productivity and efficiency. Future efforts, described briefly below, will be directed principally toward these goals.

In the area of conventional transit service innovations, demonstration activities will focus on improvements in transit service attributes such as reliability, transfer coordination, and passenger information systems. The central theme of these projects will be to improve transit service and make it more attractive to choice riders at little or no increase in operating costs. The passenger information system demonstrations will also be exploring other uses for passenger information data, such as in transit operations management

and service planning. A demonstration involving coordination of public transit and school transportation services is also planned, with a primary objective being to increase overall transit efficiency by reducing or eliminating redundant services.

The future directions for SMD pricing and service innovations have come largely from the recommendations set forth in an SMD-sponsored conference on transit pricing, held in September 1980. The principal theme emerging from the conference was that transit must adopt a more businesslike approach to pricing policy in order to survive through the 1980s. Specific recommendations included: (1) a shift toward cost-based pricing (i.e., charging higher fares for higher cost services), (2) more attention to service improvements as mechanisms for attracting ridership, (3) a greater separation of the transportation and public assistance functions in public transit, and (4) greater utilization of the private sector in financing public transportation.

Proposed SMD pricing demonstrations involving graduated, distance-based fare structures and the application of user-side subsidies to low-income groups directly respond to the conference recommendations. In addition, ongoing demonstrations in transit pricing management will provide a laboratory for testing a variety of transit fare and service policies and cost management techniques. Finally, demonstrations of innovative fare collection mechanisms will explore the feasibility of implementing more complex fare structures such as third-party billing or monthly payment schemes.

Paratransit demonstrations will also reflect the theme of public transportation cost savings by exploring innovative applications of private providers to deliver transportation services in areas or to target groups that cannot be efficiently served with conventional fixed-route transit. Specific demonstrations include: (1) the use of shared-ride taxi services to supplement transit in low-density neighborhoods or during evenings and weekends, (2) an application of the citizen cooperative concept to neighborhood transportation services, and (3) strategies to facilitate ridesharing, both at employment sites and in residential neighborhoods. Also, the SMD Program will be evaluating the cost-effectiveness of check-point dial-a-ride as an alternative to fixed-route bus service in low-density areas.

For the near future, at least, the SMD Program will continue to explore alternative transportation services for elderly and handicapped people in order to aid local decisionmakers in developing cost-effective, accessible public transportation for their areas. Further exploration of the user-side subsidy concept is anticipated, with a demonstration involving its application in a large city. Another proposed demonstration will look at accessible feeder service to accessible fixed-route bus service as one means to increase transit use by handicapped people.

Of course, the ultimate goal of the SMD Program is to provide useful, objective information in a timely fashion, which can be used by transportation decisionmakers to formulate more rational, effective and equitable transportation policies. The findings summarized in this report and in other SMD publications are all directed toward that goal.

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