A Directory
of Research
Development
and Demonstration
Programs

innovation in public transportation

Fiscal Year 1980

U.S. Department
of Transportation

**Urban Mass
Transportation
Administration**

April 1981

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

Report Number: UMTA-MA-06-0086-81-1

A DIRECTORY of RESERACH, DEVELOPMENT and DEMONSTRATION PROJECTS

innovation

IN PUBLIC TRANSPORTATION

Fiscal Year 1980

U.S. Department of Transportation
Urban Mass Transportation Administration
Washington, D.C. 20590

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

Table of Contents

Introduction

This annual directory contains descriptions of current research, development, and demonstration (RD&D) projects sponsored and funded by the U.S. Department of Transportation's Urban Mass Transportation Administration (UMTA). One of UMTA's major objectives is to make public information regarding its RD&D activities readily available, and this publication is one of the principal vehicles for reporting such information.

This directory focuses on activity that took place in fiscal year 1980, which began on October 1, 1979 and ended September 30, 1980. All of the projects described in this volume are funded under Sections 6, 8, or 11 of the Urban Mass Transportation Act of 1964, as amended.

Section 6 of the Act has authorized the Secretary of Transportation "to undertake research, development and demonstration projects in all phases of urban mass transportation . . . which he determines will assist in the reduction of urban transportation needs, the improvement of mass transportation service, or the contribution of such service toward meeting total urban transportation needs at minimum costs." The Act also authorizes "the development, testing, and demonstration of new facilities, equipment, techniques, and methods."

Under Section 8 of the Act, funds are authorized each year to conduct local transportation planning studies, otherwise known as Technical Studies. A portion of these Technical Studies funds are also used annually for Special Studies to help local planning agencies and UMTA improve the quality of information used for local transportation planning.

Section 11 authorizes a program of University Research and Training Grants These grants are designed to contribute to UMTA's research and to stimulate professional growth in fields relating to transportation. Summaries of the University Research and Training Grant projects appear in Chapter 16 of this report, along with listings of available publications.

UMTA's organizational structure is illustrated on page 3. The offices responsible for administering research, development, and demonstrations are shaded. The projects described in Section One of this document are administered by the six offices listed under the Office of Technology Development and Deployment. The projects described in Section Two are administered by the Office of Service and Methods and Demonstrations. The Offices of Planning Assistance, Planning Methods and Support, and Transportation Management are responsible for the projects included in Section Three, and the projects described in Section Four are administered by the offices listed under Policy and Program Development.

The accompanying table shows funding for major RD&D program areas. Tables summarizing funding and other important information about individual UMTA projects follow the descriptive material in each chapter.

In these project summary tables, a schedule is listed for each project indicating the time at which the project was approved by UMTA to the expected completion date. Except where otherwise indicated, dollar amounts presented for each project represent federal funds provided by UMTA and do not include funds from other federal, state, local, or private sources. Funding figures are provided to give an indication of the scope of individual tasks and, in most cases, unless indicated otherwise, these figures are cumulative. Small support tasks and contracts under $10,000 are not always calculated into the project totals. The figures in this volume, therefore, should not be used for budget analysis.

The project tables also identify other federal organizations which support and complement UMTA's RD&D in the field of urban mass transportation. The Federal Highway Administration (FHWA) funds or performs projects jointly with UMTA, generally in the areas of transportation planning and traffic management. The Federal Railroad Administration (FRA) manages the DOT Transportation Test Center (TTC) at Pueblo, Colo., which includes urban rail test facilities and the rail dynamics laboratory. The Transportation Systems Center (TSC) at Cambridge, Mass., supports UMTA by conducting in-house research, analysis, and development, and by managing related RD&D contracts. TSC is a major component of the DOT Research and Special Programs Administration, and performs technological and socioeconomic research in all modes of transportation.

Technical documents describing the results of most of the completed projects have either been issued or are currently under preparation. Published reports are listed in a bibliography following each chapter, and usually may be obtained from the National Technical Information Service (NTIS) of the U.S. Department of Commerce. In addition, UMTA periodically publishes collections of report abstracts. Details on how to obtain these

and other technical reports are provided in Appendix A. Forms for ordering publications from NTIS are also included at the end of this document.

Appendix B provides information for potential contractors and grantees on participation in UMTA's RD&D programs, including details on the submission of proposals, proposal evaluation criteria, and university research grants.

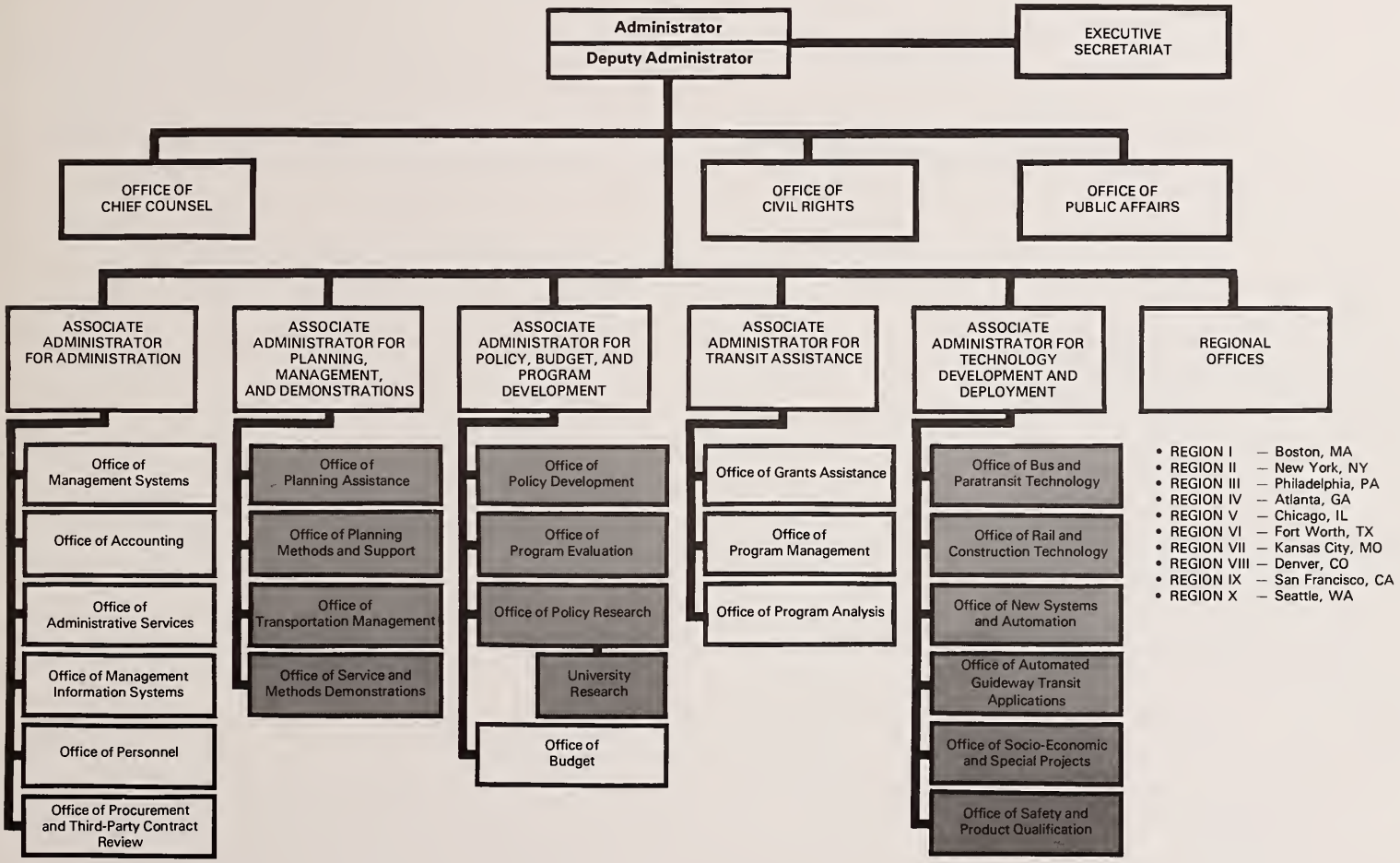
An index of agencies and contractors, a project index, and a subject index are also included.

This document was prepared by the Office of Technology Sharing at the U.S. Department of Transportation's Transportation Systems Center in Cambridge, Mass. Copies may be obtained by contacting this office, or ordered directly from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Urban Mass Transportation Administration
Summary of RD&D and Related Funding

	FY 1979 Actual	FY 1980 Estimate	FY 1981 Requested
	(Dollars in thousands)		
Technology Development and Deployment			
Bus and Paratransit Technology	$10,679	$ 7,950	$10,100
Rail and Construction Technology	12,175	12,595	12,500
New Systems	22,329	17,050	13,450
Safety and Product Qualification	1,626	3,025	2,800
Systems Studies, Support and Development	575	1,260	1,250
National Cooperative Transit R&D Program	208	1,000	1,000
Subtotal	$47,592	$42,880	$41,100
Service and Methods Demonstrations	6,289	14,000	16,000
Planning Methods and Support	4,917	3,800	4,450
Special Studies (Section 8 Funds)	3,000	3,000	3,000
Transit Management Techniques and Methods	2,279	3,750	5,000
Policy and Program Development	1,058	2,700	3,800
University Research (Section 11 Funds)	1,999	2,000	2,000
Total	$67,134	$72,130	$75,350

TABLE OF ORGANIZATION
URBAN MASS TRANSPORTATION ADMINISTRATION



SECTION I

Technology Development and Deployment


6
9A
8
7706

Technology Development and Deployment

The following seven chapters are devoted to projects which are administered by the Office of Technology Development and Deployment. In exploring and testing new transportation technologies, the office has attempted to adhere to the following three objectives.

In conventional bus and rail transit design, equipment manufacture, or construction, the office has attempted to obtain either a substantial reduction in life-cycle costs without sacrificing performance, safety, or service capability, or substantial improvements in safety, performance and service capability achieved in a cost-effective manner.

As a second objective, a special effort has been made to support selected, high-risk, high-technology research and development initiatives which could potentially result in significant increases of productivity of transit operations, such as through the introduction of automation.

Finally, a strong effort has been made to support national priorities, such as energy conservation, central city revitalization, transit accessibility for the elderly and handicapped, safety, and environmental protection.

In order to meet its objectives, the Technology Development and Deployment Office sponsors research, development, testing, evaluation, and demonstrations of selected new technologies to prepare for their deployment in actual transit service.

In addition, the office participates actively in developing and reviewing equipment specifications, in promoting standardization of transit vehicles and equipment, and in qualification of new and improved transit products. It also has a strong program for planning and conducting projects on safety and system assurance. UMTA conducts evaluations and assessments of existing technology, publishes state-of-the-art summaries, cooperates with agencies such as the Environmental Protection Agency, the Department of Energy, the National Science Foundation, and the National Bureau of Standards in carrying out programs of national importance.

UMTA's delivery system for new or improved transit technologies depends, ultimately, on the purchase of new products with UMTA capital grant assistance. The fundamental strategy for improving the deployment process for new transit technology is to coordinate the efforts of UMTA's Office of Technology Development and Deployment with its Office of Transit Assistance in such a way as to foster the timely introduction of new products, and to conduct the field demonstrations in revenue service which are necessary to prove their effectiveness.

A notable enhancement to the transit technology delivery system is the implementation of Section 3(a)(1)(c) of the UMTA Act for introduction of new transit products. This new portion of the UMTA capital assistance program allows transit properties to purchase limited production runs of products which have progressed through the research and development phase but which have not yet been used routinely in transit. This program, under the sponsorship of the Office of Technology Development and Deployment, bridges the gap between innovative product development and use of new products in revenue service.

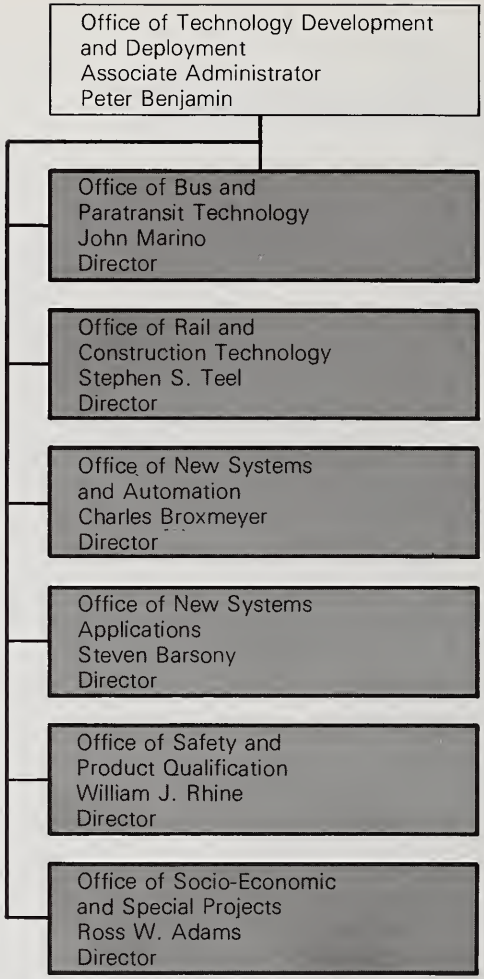
The need for technical information among client groups is met by UMTA through conferences, seminars, workshops, technical papers, project reports, and special reports targted at particular groups of users. The needs of the client

groups are ascertained, and the results of Technology Development and Deployment efforts are communicated by conferring and cooperating directly with representatives of these groups, including transit operators, transit equipment suppliers and developers, consulting firms, state and local government agencies, public interest groups, universities, foreign governments, and foreign industrial firms.

Increasingly, the office is consolidating technology sharing functions into an organized program of activites administered by the Transportation Systems Center (TSC). These include the development of publications and conferences to convey information, as well as the development of ways to determine user needs and provide information on projects and programs in the most effective way.

To further encourage user participation in the R&D process, this office has also initiated a National Cooperative Transit Research and Development Program (NCTRP), in which the transit industry is encouraged to establish its own agenda and priorities for a limited number of R&D projects. This program is administered by the Transportation Research Board (TRB) of the National Academy of Sciences and is modeled after a successful counterpart established by the Federal Highway Administration (FHWA).

The organization of the Office of Technology Development and Deployment is shown below. The projects described in this section are funded and administered through the program offices indicated in the shaded boxes.



CHAPTER 1

Bus and Paratransit Vehicle Technology

Trends and Highlights

One of UMTA's major challenges is to stimulate the development of new technologies for buses and paratransit vehicles as well as operational technology in order to promote more efficient use of energy, accommodate environmental concerns, and respond to the needs of the elderly and handicapped for access to public transportation. Such technological development is a long-term process and results cannot always be reported annually.

The major issues of fuel efficiency, accessibility, life cycle cost and passenger comfort commanded a deal of attention during FY 80. A large number of new Advanced Design Buses have been purchased by transit operators and put into revenue service. Data from these buses have provided needed input for the preparation of future R&D programs.

Mockups of two paratransit vehicles have been exhibited and evaluated by paratransit providers and users. There is a strong continuing need to develop multipurpose paratransit vehicles accessible to the elderly and handicapped. However, these vehicles must also be producible at a price operators can afford. During FY 80, UMTA selected two of the initial three contractors to continue vehicle development and to build prototypes to test and evaluate.

In an effort to comply with Section 504 of the Rehabilitation Act of 1973, the Department of Transportation issued a final rule, effective July 2, 1979, which mandates phased-in accessibility for all DOT-funded facilities and vehicles. The specific regulations contained in the final rule will crucially affect bus and paratransit technological development.

Bus Development

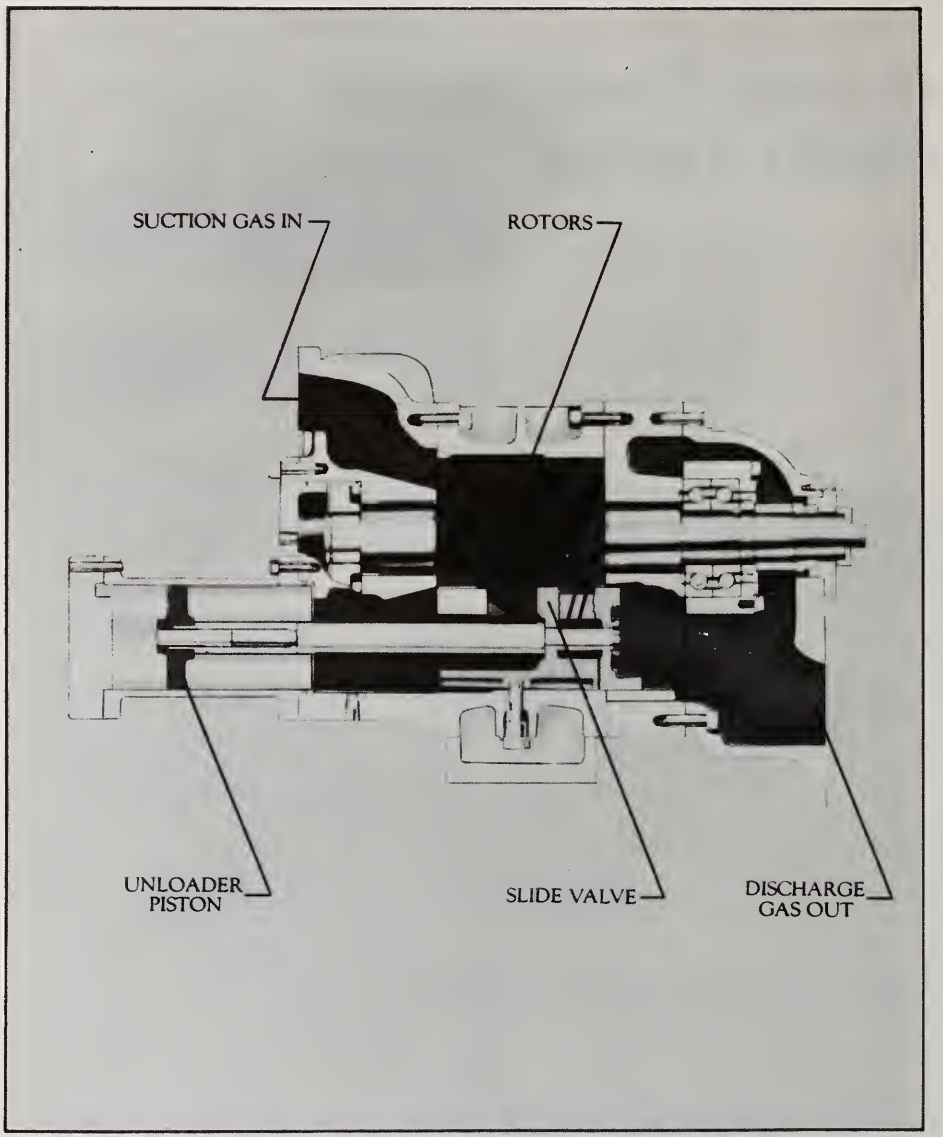
Specifications for the Advanced Design Bus, completed under project MD-06-0024, have undergone revisions to insure a more reliable and cost-effective bus.

In 1978, a program to improve the reliability of bus air conditioning systems was initiated. The contractor was selected in early 1979. The Phase I program, which resulted in the design of a more efficient system using a screw compressor, was completed in FY 80. A contract for the installation and test of a screw compressor in a transit bus has been initiated.

A contract with the Michigan DOT for the test and evaluation of brake retarders for transit buses is currently being negotiated. In addition, Booz, Allen and Hamilton is investigating corrosion problems in the buses and developing wheelwell strength test procedures. Tests and evaluations of windows that open and improved ventilation schemes are being conducted with properties and manufacturers.

A Section 6 grant with Norwalk, Conn. for the lease of three standard sized Scania buses for one year is being completed. The buses will be operated in revenue service and the fuel efficiency, reliability, performance, and public acceptance of the buses in the Norwalk transit environment will be evaluated.

The Wheelchair Access Evaluation project (CA-06-0103) has been completed for the installation of four different configurations of passive lifts in existing transit buses, in an effort to develop information upon which transit properties can base planning, purchasing, and retrofitting



The rotary screw compressor is a simple machine which provides more efficient bus air conditioning while conserving energy.

of wheelchair lifts. This project demonstrated the feasibility of retrofitting existing buses with passive wheelchair lifts.

New Bus Introduction Program (NBEI)

Preliminary plans have been completed for a New Bus Equipment Introduction Program (NBEI). This program will provide for the purchase of up to 200 buses with innovative features. These buses will be located at a limited number of sites throughout the nation and evaluated to determine the extent to which they provide for improved fuel economy, low life cycle cost, accessibility, and user amenities.

Paratransit Vehicle Development

The overall goal of the Paratransit Vehicle Program (IT-06-0204, CA-06-0133) is to stimulate the automotive industry to manufacture vehicles which meet the needs of paratransit service and to provide these vehicles at an affordable cost. An objective of the program is to promote the design and development of vehicles to be used for a wide range of paratransit services, such as shared-ride taxicab service, dial-a-ride, transportation for the elderly and handicapped, and other transportation services that do not require the capacity of vans or small buses.

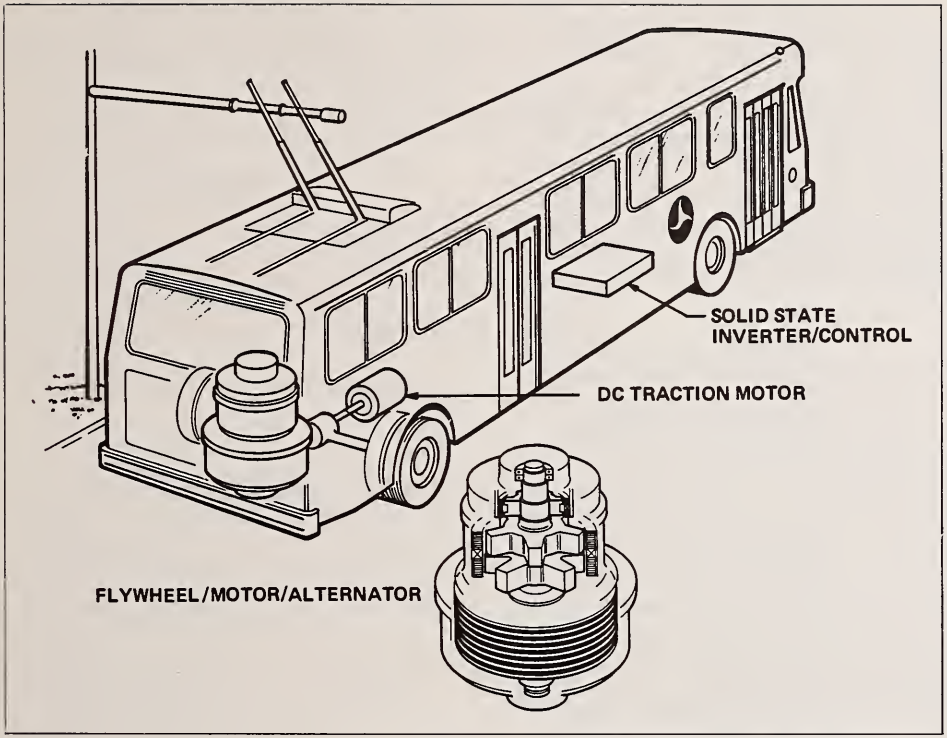
UMTA is evaluating a number of innovations in bus design, such as the Omnibus by Chance, the Gillig Phantom, and articulated buses like the one shown here.

Three contracts had been awarded in open competition for the vehicle design and construction of a mockup vehicle (Task 1). These designs and mockups were evaluated by paratransit and transit operators, handicapped representatives, and UMTA. Two of these contractors were selected to proceed with Task 2 which is the manufacture of three driveable prototypes. These vehicles will then be subjected to testing by an independent contractor to determine their performance characteristics. They will also be evaluated by paratransit operators, as well as by representatives from the handicapped community. The vehicles developed under this program may be similar to the earlier prototype vehicles, but the contractors will be required to emphasize low initial cost and low maintenance costs.

In 1980, two prototype paratransit vehicles, accessible to the handicapped, were developed.

Energy Conservation and Environmental Projects

While the reduction of energy consumption in general is a worthwhile objective, the real problem is the consumption of petroleum and petroleum products. In the transportation area, the long-term solution to the petroleum problem lies in the widespread availability of vehicles which do not depend on petroleum based fuels. Independence from petroleum could be achieved through either or both of the following: utilization of alternate fuels, and vehicles powered by electricity. Electricity is a major option because, in the U.S., only 16 percent of the source energy used in the



UMTA has been conducting research on the energy-saving capabilities of flywheel technology.

generation of electricity comes from petroleum.

In support of more efficient diesel propulsion systems, simple calculations will prove that a 10 percent improvement in the propulsion system efficiency can save the U.S. transit operators in excess of $40 million per year at $1.20 per gallon.

UMTA has a three-pronged approach to the transit energy problem, namely:

- stimulating greater and more efficient use of electricity;
- promoting alternative fuel capability in existing bus systems; and
- promoting more efficient use of petroleum in existing bus systems.

Electricity

The flywheel energy storage system, more efficient operation of electric trolley buses (ETB), and evaluation of battery buses are the prime projects in promoting electric propulsion.

In 1977, two contractors completed a Phase I study for UMTA which analyzed various conceptual flywheel designs and determined their impact on several bus transit vehicle systems. The study showed a clear advantage when substituting flywheel on-board storage with intermediate charging stations for a continuous overhead electrification system. In addition, the study results showed a major improvement when adding the flywheel to an all-battery system; at current diesel oil prices, the all-flywheel bus was determined to be in the competitive range of a diesel bus system.

During the second phase of the program (MA-06-0093), contractors will be testing and evaluating their system concepts in a laboratory demonstration to be completed early in FY 1983.

Seattle (Wash.) Metro has requested funding to demonstrate, for up to two months, a hybrid trolley bus with off-wire capability provided by a diesel engine. The vehicle will be on loan from Esslingen, West Germany, where several similar vehicles are in operation.

An actual test of battery bus performance will be conducted when the Roosevelt Island Development Corporation, in New York City, acquires three battery buses with the help of a capital grant from UMTA. A contract for monitoring and evaluating the vehicles will be awarded in the Battery Bus Test and Evaluation project (IT-06-0206).

Alternative Fuels

Several alternative fuel projects are being conducted in cooperation with the Department of Energy.

The gas turbine engine has many distinct advantages over the diesel engine, the prime one being its capability to use a range of alternative fuels. Other advantages include lower exhaust emissions, a quieter and smoother ride, and it also has many maintenance advantages, such as proven cold weather starting capabilities.

Baltimore, Md., has been selected to be the first city to demonstrate the gas turbine bus in revenue service (MD-06-0059). Five buses will be equipped with gas turbines for this demonstration which will last approximately 18 months. Other cities will be selected to test and evaluate a more mature gas turbine in subsequent phases of the program. The program is jointly funded and managed with the Department of Energy (DOE) (DC-06-0204) under an interagency agreement. The program is scheduled for completion in 1985-1986.

The outlook for continued use of diesel fuel in transit buses is not promising due to current trends in the world oil situation. In order to be ready for a decreasing supply of this fuel, UMTA has contracted with the Port Authority of Allegheny County (PA-06-0060) to study the applicability of various alternative fuels to an entire bus transit system. It is the intent of the study to identify and recommend a development plan for the most promising of the fuels taking into account availability, operating requirements, cost, and minimum alteration to the current transit infrastructure.

The Florida Department of Transportation (FL-06-0022) will examine the means and feasibility of converting a diesel transit bus engine to methanol use. UMTA has approved Phase I of this project, which includes the selection of a consultant to perform the feasibility and means of conversion study. Depending upon the outcome of this initial phase, development installation and test of a modified engine could be completed in 1983.

More Efficient Use of Petroleum

The first phase of the Stored Hydraulic Energy Propulsion System (SHEPS) (OR-06-0007) is under way with assistance to the Tri-County Metropolitan Transit District of Oregon (TRI-MET). In this phase, TRI-MET will select a hardware contractor to do the development, installation, and testing in later phases. The overall project will involve the development of a system to store excess engine and braking energy in pressurized fluid. The stored energy will then be available to assist the engine in high power demand (acceleration) situations. The expected benefits are improved fuel economy (up to 30 percent improvement) and lower emissions.

Another project being conducted jointly by the Environmental Protection Agency (EPA), UMTA, and the National Highway Traffic Safety Administration (NHTSA) of DOT, involves Bus Noise Reduction (OR-06-0005). The program intends to demonstrate the effect a well designed bus noise reduction kit will have on a representative bus configuration.

A retrofit kit for a Flxible "New Look" bus was completed in November 1979. The Tri-County Metropolitan Transportation District of Oregon is currently working on a kit for a GMC "New Look" bus.

Bus and Paratransit Vehicle Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
BUS DEVELOPMENT					
General Bus Procurement Specifications	MD-06-0024	$95,000	July 1976-Dec. 1980	Booz, Allen and Hamilton	D. Symes (202) 426-4035
Wheelchair Access Evaluation	CA-06-0103	$292,000	Feb. 1977-July 1979	CALTRANS	T. Norman (202) 426-4035
NBEI Test Plan	MD-06-0063	$95,000	Sept. 1980-Mar. 1981	Acumenics	E. Bers (202) 426-8483
PARATRANSIT VEHICLE DEVELOPMENT					
Paratransit Vehicle Prototype Procurement	IT-06-0204	$1,030,000	July 1979-May 1981	McFarland Design	John E. Ridgley (202) 426-8483
Paratransit Vehicle Prototype Procurement	CA-06-0132	$970,000	July 1979-May 1981	Minicars, Inc.	John E. Ridgley (202) 426-8483
Paratransit Vehicle Technical Support and Testing	IT-06-0213	$730,000	Aug. 1979-Aug. 1981	Dynatrend, Inc.	John E. Ridgley (202) 426-8483
ENERGY AND THE ENVIRONMENT					
Gas Turbine Urban Bus	DC-06-0204 MD-06-0059	$2,800,000 (DOT) $11,200,000 (DOE)	May 1978-Sept. 1985	To be selected	J. F. Campbell (202) 426-4035
Flywheel Energy Storage	MA-06-0093	$15,000,000	Dec. 1978-June 1981	TSC	J. F. Campbell (202) 426-4035
Flywheel Energy Storage: Management Systems Evaluation	WI-06-0005	$15,000	March 1978-June 1978	University of Wisconsin	J. F. Campbell (202) 426-4035

Bus and Paratransit Vehicle Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
ENERGY AND THE ENVIRONMENT					
Stored Hydraulic Energy Propulsion System	OR-06-0007	$3,000,000 (estimated)	Oct. 1980- Oct. 1983	Tri-County Metropolitan Transportation District of Oregon	P. J. Sullivan (202) 426-4036
Alternative Fuels Study for Urban Mass Transit Buses	PA-06-0060	$125,000	Oct. 1980- July 1981	Port Authority of Allegheny County, Pa.	P. J. Sullivan (202) 426-4035
Use of Methanol as an Alternative Fuel for Transit Buses	FL-06-0022	$3,000,000 (estimated)	Oct. 1980- Aug. 1983 (Projected)	Florida Department of Transportation	P. J. Sullivan (202) 426-4035
Battery Bus Test and Evaluation	IT-06-0206	$264,000	Oct. 1980- Oct. 1982	Roosevelt Island Development Corp.	John E. Ridgley (202) 426-8483
Bus Noise Reduction	OR-06-0005	$155,000 (UMTA) $65,000 (EPA)	July 1978- Jan. 1981	Tri-County Metropolitan Transportation District of Oregon	P. J. Sullivan (202) 426-4035
Advanced Bus Air Conditioning	IT-06-0145	$245,000	April 1979- April 1980	Garrett AiResearch	J. F. Campbell (202) 426-4035

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

Study of Flywheel Energy Storage
Proj. CA-06-0106
L. J. Lawson, A. K. Smith, and G. D. Davis
1977, PB 282-652
5 vols.

Study of Flywheel Energy Storage
Proj. NY-06-0062
E. Lustenader, General Electric Corporate Research
1977, PB 282-929

Project Definition for Evaluation of Battery Buses: Final Report
Proj. DC-06-0205
Transportation Assistance, Inc.
April 1978

Gas Turbine Engine Application in Transit Coaches
Proj. IT-06-0025
March 1977, PB 272-608

Transit Bus Propulsion Systems, Alternate Power Plant Installations
Proj. IT-06-0025
Booz, Allen and Hamilton, Inc.
September 1977, PB 276-612

Impact of Fare Collection on Bus Design
Proj. IT-06-0132
Booz, Allen and Hamilton, Inc.
April 30, 1979, PB 300-633

Bus Interior Design for Improved Safety
Proj. IT-06-0025
Booz, Allen Applied Research
April 1976, PB 252-253

Boarding Ramps for Transit Buses: Final Report
Proj. MD-06-0025
Booz, Allen and Hamilton, Inc.
May 1977, PB 269-290

Forecast of Urban 40-Foot Coach Demand: 1972-1990
Proj. IT-06-0025
Booz, Allen Research and Simpson and Curtin
December 1972, PB 222-684

Transit Bus Propulsion Systems State-of-the-Art
Proj. IT-06-0025
Booz, Allen Research, Inc., Development Inc.
August 1972, PB 222-871

Baseline Bus Ride and Handling Test Methodology and Data Presentation
February 1976

Transit Bus Propulsion Requirements
January 1978

Small Transit Bus Requirements Study: Final Report [Summary]
Proj. IT-06-0074
RRC International, Inc.
March 1977, PB 269-398
PB 269-392

Operations of Small Buses In Urban Transit Service in the United States
Proj. IT-06-0072
RRC International, Inc.
July 1975, PB 269-393

Operating Profiles and Small Bus Peformance Requirements in Urban Transit Service
Proj. IT-06-0074
RRC International, Inc.
December 1976, PB 269-395

General and Performance Specifications for a Small Urban Transit Bus
Proj. IT-06-0074
RRC International, Inc.
December 1976, PB 269-397

Guidelines for the Design of Future Small Transit Buses and Bus Stops to Accommodate the Elderly and Handicapped
Proj. IT-06-0074
RRC International, Inc.
March 1977, PB 269-396

Bus Characteristics Needed for Elderly and Handicapped in Urban Travel
Proj. IT-06-0074
RRC International, Inc.
March 1976, PB 269-394

Assessment of Battery Buses: Final Report
Proj. VA-06-0044
Trans Systems Corporation
July 1977, PB 271-321

Study of Future Paratransit Requirements: Scenario Report
Proj. IT-06-0104
Alan M. Voorhees and Associates, Inc.
November 1976, PB 262-629

Study of Future Paratransit Requirements: Final Report
Proj. IT-06-0104
Alan M. Voorhees and Associates, Inc.
January 1977, PB 264-082

Study of Future Paratransit Requirements: Executive Summary
Proj. IT-06-0104
February 1977, PB 265-821

Assessment of Service Requirements and Design Characteristics of Present and Future Paratransit Vehicles
Proj. NY-06-0058
Ronald Adams
April 1977, PB 267-574

Technology Delivery for a New Paratransit Vehicle: Final Report
Proj. PA-06-0039
Gellman Research Associates, Inc.
July 1977, PB 272-128

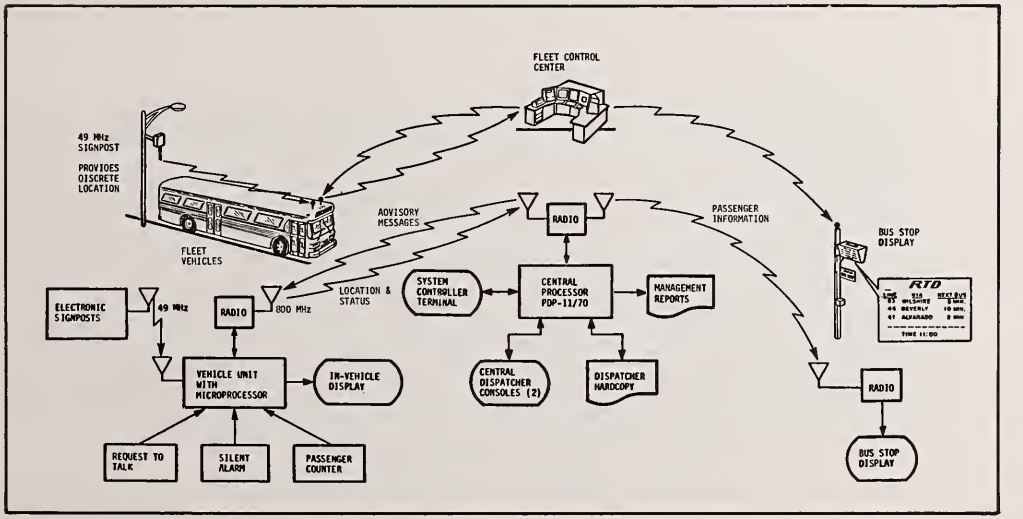
A Study of Wheelchair Access to the Current Transit Bus Design: Final Report
Proj. MI-06-0017
AM General Corporation
April 1977, PB 270-101

Advanced Bus Air Conditioning System
Proj. CA-06-0145
Airesearch MFG. Co. of California
June 1980, PB 80-215-502

CHAPTER 2

Bus and Paratransit Operational Technology

Trends and Highlights



UMTA's Bus and Paratransit Operational Technology consists of two major program areas: Paratransit Integration and Automated Vehicle Monitoring (AVM).

Paratransit technology recognizes that, in many cases, conventional, fixed-route ground transportation does not satisfy the needs of the general public or special groups (the elderly, handicapped, and people otherwise disadvantaged) from the viewpoints of transportation availability and desired levels of service. However, paratransit services have the potential of providing economical solutions to various transportation problems of the general public as well as special group needs by supplementing conventional transit with paratransit and integrating it into areawide public transportation systems. Overall objectives are not only to significantly improve transportation availability and levels-of-service, but also to provide viable alternatives to the private automobile.

Even though such paratransit services as dial-a-ride, shared-ride taxi, car and van pooling, subscription services, and special paratransit services for the elderly and handicapped have been and continue to be implemented throughout the country, the pace of growth has been rather slow. Some of the major barriers impeding use of paratransit services have been the lack of knowledge, experience, and the operational technology necessary to properly plan, implement, operate, and manage such services. In its Paratransit Integration program, UMTA is directly concerned with overcoming this need for operational technology and planning. UMTA sponsors research, development,

and deployment of computer technology which has the potential for making operational improvements, reducing costs, improving levels of service, improving management, and coordinating and integrating paratransit and conventional transit in order to improve public transportation availability at reasonable costs. Work is contracted directly by UNTA and through the Transportation Systems Center (TSC), which also performs some program research.

Prior to FY 79, the Paratransit Integration program was primarily concerned with developing a knowledge base, performing cost/benefit analyses, developing planning models, and developing and implementing such computer systems as the low cost Knoxville, Tenn., Ride Sharing (Brokerage) System, and the Rochester, N.Y., Dial-a-Ride. The latter system is rather sophisticated and may well represent the state-of-the-art in computer control of dial-a-ride type services.

Current efforts emphasize low cost, highly transferable systems and applications for providing computer assistance to dispatching, routing, and scheduling; for coordinating and managing paratransit for social service agencies; and for integrating paratransit with conventional fixed route transit into areawide transportation systems. Areawide service integration may be best accomplished through a "brokerage concept," and R&D for computer technology in support of that concept is also being conducted.

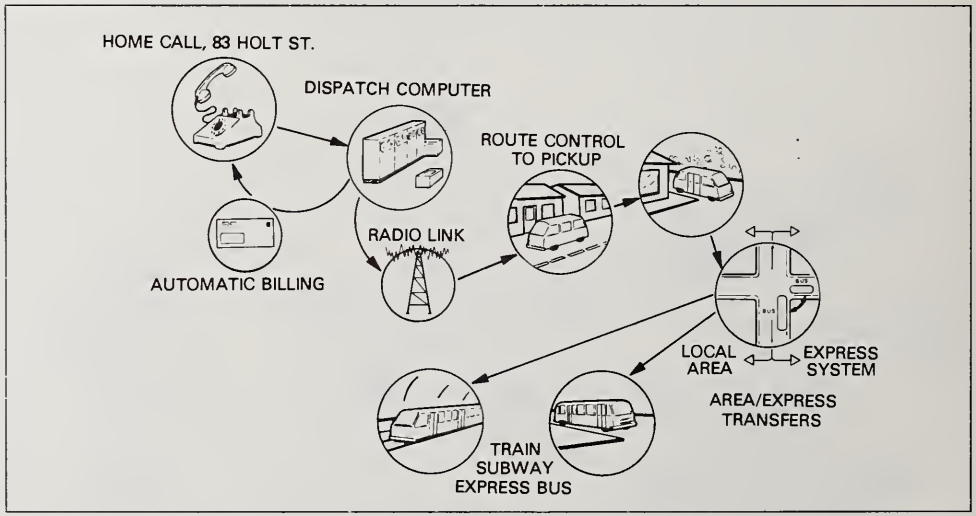
The second area of study in the operational technology program, Automatic Vehicle Monitoring (AVM), involves the development of a system to continually monitor, track, and communicate with transit vehicles on city streets. This two-way digital communications, command and control system helps to insure that schedules are maintained and that efficient and timely responses can be made to emergency situations. The AVM system could have other applications as well, such as in the taxi industry or police departments.

Paratransit Integration

Through research and development in the field of computer technology, the Bus and Paratransit Operational Technology Program is attempting to find solutions to transportation analysis, management and operating problems. Under the program, computer techniques and software are being developed to provide the needed tools for successful management, operation, and planning of flexible paratransit services and for the coordination of those services with conventional fixed-route, fixed-schedule mass transit systems.

UMTA has supported research in computerized dial-a-ride systems since the mid-1970's when a successful pilot project was carried out in Haddonfield, N.J. Since that time, paratransit programs in other cities have been planned and put into operation. One of the most widely studied is in Rochester, N.Y. Rochester's

A schematic of how a computer-dispatched dial-a-ride system works.



integrated dial-a-ride system, supported by UMTA since 1975, has included the development of computer software for scheduling and dispatching dial-a-ride vehicles. In FY 79, UMTA's Office of Service and Methods Demonstrations sponsored the transfer of the Rochester system to Orange County, Calif., and this effort will continue into early 1981.

The program has studied the role that shared-ride taxi systems can play in an integrated paratransit network. In a study entitled Shared-Ride Taxi Requirements (MA-06-0054), the conditions under which the shared-ride taxi could operate at a reasonable profit were examined, as well as the computer support which the system would need for efficient operation. In a related study, Shared-Ride Taxi Fare Calculation System (PA-06-0040), a method was developed to electronically calculate fares, thereby resolving many of the inequities of current fare calculator systems. Both projects were completed in FY 79 and provide important information for a new project for Dade County, Fla. which began in FY 80.

One study, Paratransit Cost Benefit Analysis (MA-06-0054), investigated the benefits and costs associated with the use of integrated paratransit in urban and suburban areas. The study also analyzed and compared the conventional fixed-route bus and exclusive-ride taxi to determine the circumstances under which these conventional modes would be superior to paratransit and vice versa. This study was completed in FY 79. It indicated that checkpoint dial-a-ride services have high cost/benefit potential. Two R&D projects for checkpoint which benefit from the results of this project will begin in FY 81.

Another study, Paratransit Large Regional Analysis (IT-06-0150 and MA-06-0084), is developing parametric tools for analysis of the financial, level-of-service, environmental, and energy factors involved in developing areawide, integrated, demand-responsive systems. Two different computer programs, one using the traditional Urban Transportation Planning System computer package, and another model requiring less data and fewer technical skills to apply are being developed. Validation began on both models in FY 79, and the models will be completed in early 1981.

A Low Cost Ride-Sharing Computer System for Knoxville, Tenn., (DC-06-0160 and DC-06-0199) was undertaken in FY 78 to develop a low-cost microcomputer system to support Knoxville's ride-sharing programs. The computer system will serve to assist a transportation "broker," or coordinator, by matching transportation services with market demand. While the system is currently operational, in FY 79 enhancements were initiated to improve its functional capabilities and restructure its documentation in order to facilitate system transferability, and the completed system will be available in early FY 1981.

In AVM systems, display panels mounted on the bus dashboard can provide bus operators with up to fourteen common instructions to improve service during the run.

In the Baltimore area, a study, Computer Algorithm for Subscription Bus Scheduling (MD-06-0027), has been designed to investigate an advanced reservation dial-a-ride problem. The project was expanded to field test the scheduling algorithm using information on handicapped services for its data base, and also to design an algorithm for scheduling subscription bus services to multiple job sites. The subscription algorithm was tested on real data and compared to the normal, manually derived results in FY 79. The computer results yielded significantly improved vehicle utilization and travel times for service patrons. Further work in this advanced/subscription reservation area is under way and should be of significant benefit especially for social service agency transportation.

The Paratransit Technical Support and Independent Studies Project (DC-06-0175) also supports the program. This project is developing a comprehensive catalogue with abstracts of demand-responsive and integrated paratransit services and equipment for distribution to the public.

The National Bureau of Standards has been analyzing and developing highly transferable software packages which can be taken "off-the-shelf" and used to build systems on site to serve different users' needs. Work is also underway in the R&D of the application of low cost, computer-assisted graphical systems to the solution of dispatching and scheduling problems. These efforts are expected to facilitate relatively low cost improvements in level-of-service operation and management of paratransit services. Finally, work is beginning on the development of simplistic, easy to use planning tools and techniques, and on a simplified approach to fully automated computer scheduling for use on low cost microprocessors.

Advanced Area-Coverage Automatic Vehicle Monitoring

Automatic Vehicle Monitoring (AVM) is an electronic system of monitoring the location and status of transit vehicles operating on city streets. All vehicles are monitored by a computer and their location is shown in real-time on display panels in a control center. The display automatically indicates whether the bus is on schedule. If a bus is not on schedule, the computer issues instructions for the driver to follow to get the bus back on schedule. The system is applicable to a wide variety of vehicles, including police, fire, postal, taxi and delivery vehicles.

Dispatchers in Los Angeles using the AVM display console.

An AVM system is made up of three subsystems: location, communications, and data processing. The location subsystem locates vehicles to within 300 feet in the urban environment. The communications subsystem transmits location and passenger count information from the vehicle to the control center. The data processing subsystem compares vehicle location information to schedule information and automatically determines the optimum strategy to maintain scheduled service and sends the appropriate command to the bus via the communications link.

The AVM system is expected to result in better service to passengers and reduced operating costs. Buses will adhere more closely to schedules and headways, and this may result in fewer buses being required to maintain a given level of service. Data needed for management purposes can be collected automatically. AVM promotes greater passenger and operator security because a driver can instantly notify the control center of an emergency so the police can be alerted and given the exact location of the vehicle.

The AVM system is a long-term research, development, and evaluation program which began as Phase I in 1974.

During the initial phase, four contractors competed in feasibility tests of their location-monitoring systems. Based on the results in the light of each contractor's system proposal, one contractor was selected to develop the Phase II system.

Phase II began in 1977. Los Angeles was selected as the project site because the transit operator expressed a strong willingness to participate in the project. During Phase II, a fully functional AVM system was developed and will be operated and evaluated. The system will be installed on four bus routes for transit operations. For random-route operations, 15 vehicles will be tracked throughout a 30 square mile area. Up to 200 fixed-route transit buses and 15 random-route vehicles will be equipped.

During a one-year period starting in FY 80, the automatic vehicle monitoring system will be tested and evaluated for its effect on transit system performance and operations. Detailed analysis will quantify the results and this analysis may qualify the AVM system for UMTA capital assistance funding.

An AVM console at a control center is shown above.

Bus and Paratransit Operational Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
PARATRANSIT INTEGRATION					
Paratransit: Large Regional Analysis	IT-06-0150	$300,000	Nov. 1977-Dec. 1980	SYSTAN, Inc.	Edward Neigut (202) 426-8483
Paratransit: Large Regional Analysis	MA-06-0084	$284,000	Nov. 1977-Dec. 1980	Multisystems, Inc.	Edward Neigut (202) 426-8483
Low Cost Ride-Sharing Computer System for Knoxville, Tenn.	DC-06-0199 TN-06-0010	$280,000	Dec. 1976-Feb. 1981	International Management Resources, Inc.; University of Tennessee	Edward Neigut (202) 426-8483
Paratransit Catalog	DC-06-0175	$120,000	March 1977-Feb. 1981	Transportation Assistance, Inc.	Edward Neigut (202) 426-8483
Paratransit Handbook and Other Support	MA-06-0054	$464,000	June 1977-Sept. 1981	TSC; SYSTAN Inc.	B. P. Bushueff (617) 494-2406
Micro Model Simulation Validation	MA-06-0054	$70,000	Oct. 1978-Dec. 1980	TSC	Ron Digregorio (617) 494-2733
Operational Software Packages and Support	DC-06-0261	$1,177,000	July 1979-July 1983	National Bureau of Standards	Edward Neigut (202) 426-8483
Computer-Assisted Shared-Ride Taxi and Social Services Coordination System	FL-06-0018	$800,000	Oct. 1979-July 1982	Dade County, Florida	Edward Neigut (202) 426-8483
Graphics Research and Support	MA-06-0054	$65,000	Oct. 1979-Oct. 1980	TSC; Wilson-Hill Associates, Inc.	Paul Connolly (617) 494-2205
Checkpoint Passenger/ Systems Interface and German Checkpoint Assessment	MA-06-0054	$120,000	Sept. 1979-July 1981	TSC; Cambridge Systematics, Inc.	Paul Bushueff (617) 494-2406
Product Transferability Analysis	MA-06-0054	$75,000	Oct. 1979-Oct. 1980	TSC; Raytheon Service Co.	Tom Carberry (617) 494-2369
Computer-Assisted Graphics Research	MA-06-0054	$318,000	April 1980-Continuing	TSC; Stanford Research Institute	Tom Carberry (617) 494-2369
Simplistic Planning and Scheduling Tools	MA-06-0071	$66,000	Oct. 1980-Oct. 1981	Massachusetts Institute of Technology	Edward Neigut (202) 426-8483

Bus and Paratransit Operational Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
ADVANCED AREA-COVERAGE AUTOMATIC VEHICLE MONITORING PROGRAM					
Phase II, Systems Management of Multi-User AVM Demonstration Project	MA-06-0041	$9,541,000	Sept. 1974-April 1981	TSC; Gould Information Identification, Inc.	Denis Symes (202) 426-4035
Technical Support for Phase II AVM System	VA-06-0026 CA-06-0119	(Included in above total)	Sept. 1974-April 1981	MITRE Corp.; Southern California Rapid Transit District (SCRTD)	Denis Symes (202) 426-4035
Study of Loran-C Land Reception and Stability	DC-06-0211	(Included in above total)	Sept. 1974-April 1981	Office of the Secretary of Transportation	Denis Symes (202) 426-4035

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

PARATRANSIT INTEGRATION

Paratransit Pilot System Software Design and Functional Description
Proj. MA-06-0054
First Data Corporation
1978, DOT-TSC-1447

Paratransit Pilot System Software Operator Handbook
Proj. MA-06-0054
First Data Corporation
1978, DOT-TSC-1447

Paratransit Pilot System Software Installation Guide
Proj. MA-06-0054
First Data Corporation
1978, DOT-TSC-1447

Paratransit Pilot System Software Dial-A-Ride Street Name File System
Proj. MA-06-0054
First Data Corporation
1978, DOT-TSC-1447

Paratransit Pilot System Software Terminal Handling System
Proj. MA-06-0054
First Data Corporation
1978, DOT-TSC-1447

Paratransit Integration Symposium Proceedings
Proj. MA-06-0054
Systems Architects, Inc.
June 1978, UMTA-MA-06-0054-78-2

Benefit-Cost Analysis of Integrated Paratransit Systems
Vol. I, **Executive Summary**
Vol. II, **Introduction and Framework for Analysis**
Vol. III, **Scenario Analyses**
Vol. IV, **Issues in Community Acceptance and Integrated Paratransit Implementation**
Vol. V, **The Impacts of Technological Innovation**
Vol. VI, **Technical Appendices**
Proj. MA-06-0054
Multisystems, Inc.
September 1978, UMTA-MA-06-0054-78

Paratransit Integration, Model Review and Requirements
Proj. MA-06-0054
Systan, Inc.
July 1978, DOT-TSC-1392

Paratransit Integration, State-of-the-Art Report
Proj. MA-06-0054
Systan, Inc.
December 1978, DOT-TSC-1392

Paratransit Integration Workshop Proceedings
Proj. MA-06-0054
Systems Architects, Inc.
August 1978, UMTA-MA-06-0054-78-18

Integrated Dial-A-Ride and Fixed Route Transit in Ann Arbor, Michigan
Proj. MA-06-1083
Cambridge Systematics, Inc. and Multisystems, Inc.
March 1977, PB 267-942

The Shared-Ride Taxi System Requirement Study: Final Report
Proj. MA-06-0054
Dave Systems
August 1977, PB 299-231

Haddonfield Dial-A-Ride Demonstration, Third Household Survey
Proj. VA-06-0024
MITRE Corporation
March 1976, PB 257-033

Data Base Design for Demand-Responsive Transit
Proj. VA-06-0024
MITRE Corporation
July 1976, PB 256-820

Dial-A-Ride Software Installation Guide
Proj. VA-06-0024
MITRE Corporation
September 1976, PB 258-333

Demand Responsive Transportation Planning Guidelines [1976]
Proj. VA-06-0024
MITRE Corporation
October 1976, PB 261-314

Paratransit Handbook, Volumes I & II
Proj. MA-06-0054
Systan, Incorporated
February 1979
UMTA-MA-06-0054-79-2, II

AUTOMATIC VEHICLE MONITORING

A Study of the Costs and Benefits Associated with AVM
Proj. MA-06-0041
Transportation Systems Center
February 1977, PB 266-293

A Comprehensive Field Test and Evaluation of an Electronic Signpost AVM System Final Report/Phase I
Proj. MA-06-0041
Hoffman Information Identification, Inc.
August 1977
Vol. I. **Test Results,** PB 272-907
Vol. II, **Appendix,** PB 273-436

Loran Automatic Vehicle Monitoring System: Phase I
Proj. MA-06-0041
Teledyne Systems Company
August 1977
Vol. I, **Test Results,** PB 274-955
Vol. II, **Appendices,** PB 274-956

Report on Phase One Tests of Fairchild Automatic Vehicle Monitoring [AVM] System: Final Report
Proj. MA-06-0041
Fairchild Space and Electronics Company
August 1977, PB 273-816

Experiments on Four Different Techniques for Automatically Locating Land Vehicles: A Summary of Results
Proj. MA-06-0041
Transportation Systems Center
November 1977, PB 270-951

Field Testing of a Pulse Trilateration Automatic Vehicle Monitoring System in Philadelphia
Proj. MA-06-0041
Hazeltine Corporation
August 1978
Vol. I, **Executive Summary,** PB 295-610
Vol. II, **Test Results and Data,** PB 295-611

Evaluation of Passenger Counter System for an AVM Experiment:
Vol. I, **Technical Report,** PB 294-199
Vol. II, **Test Data,** PB 294-200
Proj. MA-06-0041
Gould Information Identification, Inc.
February 1979

Vibration Tests on Transit Buses
Proj. MA-06-0041
Gould Information Identification, Inc.
March 1979, PB 295-091

800 MHz Communications Survey of the Los Angeles Area
Proj. MA-06-0041
Gould Information Identification, Inc.
March 1979, PB 295-043

CHAPTER 3

Rail and Construction Technology

Trends and Highlights

The need for improved productivity and better use in the future of existing capital-intensive facilities is emphasized by current high inflation and resource shortages. Research and development efforts under the Rail and Construction Technology Program provide a substantial foundation for addressing these issues in the 80's. The focus in the new decade will be on the introduction of products with proven technology into the transit market place to achieve projected gains.

The inherent characteristics of rail transit require primary attention to basic technical problems that are encountered in normal operations. UMTA's program is structured to apply short-term solutions to these problems in order to stabilize conditions and create an environment that will be receptive to longer-range, higher technology advances.

The successful development of a technology does not insure its ultimate deployment. In addition to the traditional considerations of cost and technical feasibility, all aspects of the transit system that impact on the introduction of new technology are to be evaluated. Items such as training needs and adequacy of maintenance pose potential barriers to the success of technology, and must be addressed.

The program seeks to promote the following benefits for operators and passengers of urban rail transportation systems: lower initial and life-cycle operating costs of rail vehicles and facilities; improvements in the reliability, maintainability, and availability of vehicles and systems; improved operations; and a safe environment for passengers and system personnel.

The Rail and Construction Technology Program is organized into four program elements. Requirements, Analysis, and Evaluation includes evaluation of urban rail transit experience in order to guide research and development to best meet UMTA goals. Systems Integration and Deployment emphasizes technology improvements and deployment in the areas of standardization, elderly and handicapped accessibility, noise abatement, rail transit vehicle testing, and wheel/rail interaction. Vehicle and Equipment Technology includes subsystem technology assessments and development activities to promote short-term solutions to current problems. Construction Technology involves research and development to reduce the capital requirements and improve construction methods necessary for new systems and rehabilitation of existing systems.

People in wheelchairs have trouble adjusting to the vertical and horizontal gaps between rapid rail station platforms and the cars. The Veteran's Administration is trying to establish the maximum distance which can be negotiated safely.

Requirements, Analysis, and Evaluation

This program element is directed toward guiding the Rail and Construction Technology Program to meet the UMTA objectives of reduced life-cycle costs, improved performance, reliability and safety, energy conservation and elderly and handicapped accessibility. It provides a link between the experience and problems of existing urban rail systems and the research and development required to improve these systems and develop new ones. Under this effort, the urban rail transit market will be continually evaluated from supply and demand viewpoints, providing a basis for directing research and development efforts toward those areas with the highest potential for timely impact and greatest payoff from research and development dollars.

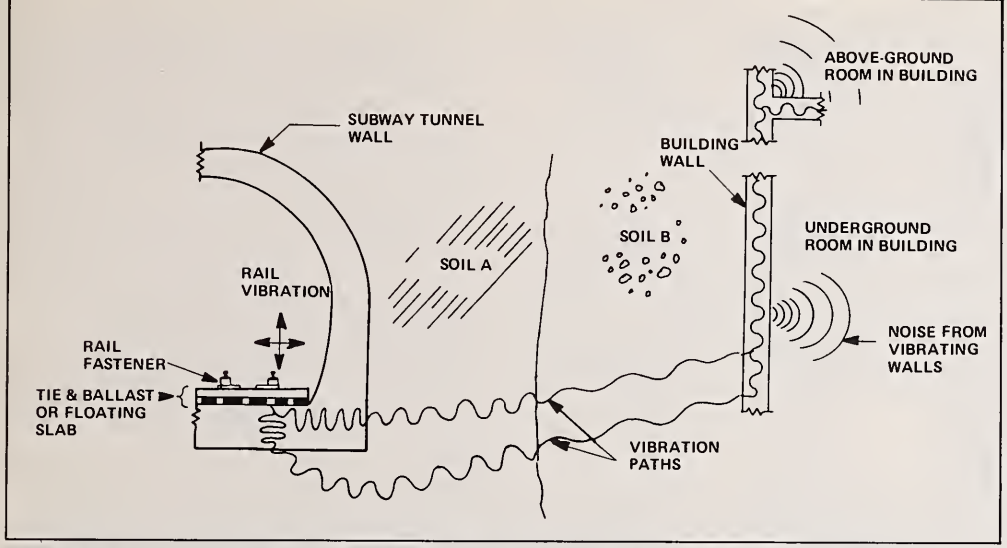
Under a grant to the Bay Area Rapid Transit (BART) authority in San Francisco, an evaluation of central train control approaches and their impact on system availability and performance has been completed (CA-06-0124). Various control algorithms were assessed for several transit systems, including BART, NYCTA (New York), CTA (Chicago), and WMATA.

An analysis of rail transit vehicle refurbishment is being conducted to develop criteria for assessing the trade-off of new vehicle purchase versus rehabilitation of existing equipment. The results of this work will be based on examination of recent transit industry refurbishment projects (MA-06-0025). In a related area, a contract was awarded to investigate the feasibility of rail transit vehicle life-cycle cost procurements and to develop a methodology for use by transit authorities (MD-06-0074). This work is being done in support of new legislation requiring grantees to consider life-cycle costing in equipment procurements.

A transit system operational model was developed to assess critical factors in system availability and cost and the influence of individual technology improvements on these factors (MN-06-0010). The model was used to examine the operation of the PATCO Lindenwold Line in Philadelphia.

Systems Integration and Deployment

The Systems Integration and Deployment (SID) program is directed toward concurrent cost reduction, improved safety, noise abatement and accessibility for the elderly and handicapped. The program consists of the following subelements: standardization, elderly and handicapped accessibility, the Transportation Test Center (TTC) construction and operation, urban rail noise abatement, and wheel/rail dynamics. Standardization is needed because of rapidly escalating system costs, decreased reliability of newly delivered equipment, and divergent



A schematic of how noise from vibrating rails travels through the soil and into buildings.

designs of recently built rapid and light rail systems. The program to promote elderly and handicapped accessibility is in response to recent Congressional policy decisions. The Transportation Test Center facilities provide a means of testing vehicles in a safe and controlled situation. Noise abatement is needed to improve the quality of life in and around urban rail transit systems. The wheel/rail dynamics program will identify interactive relationships between vehicle and track systems to improve ride quality, track wear, safety, and noise conditions.

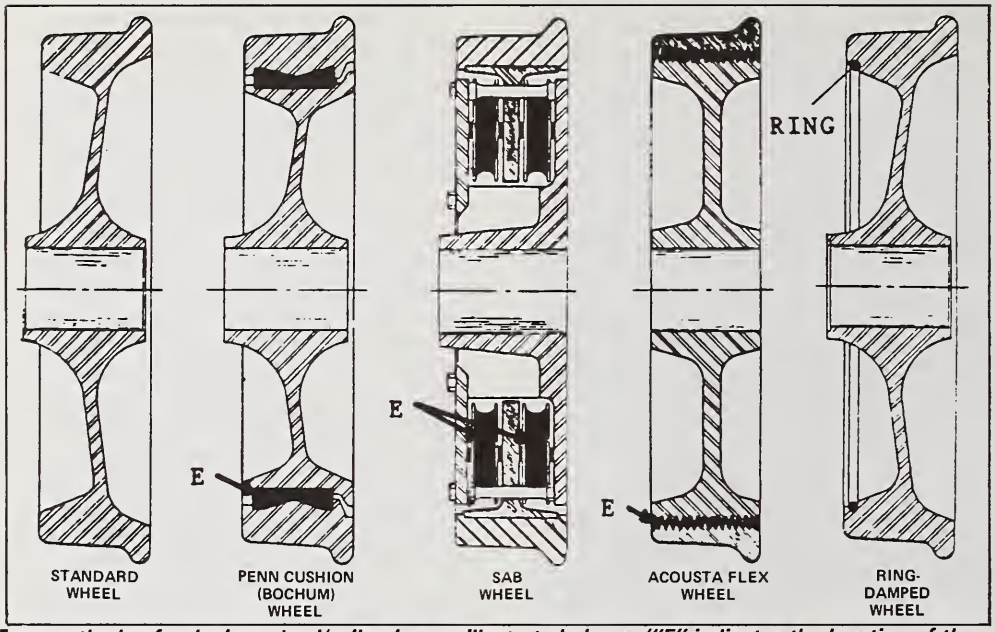
Standardization

The rail transit equipment industry historically has responded to specifications developed by individual operators, resulting in a proliferation of customized designs. This approach is in contrast to the locomotive and bus industries, which offer a range of standardized sizes and types of vehicles. The vehicles share common components, and the designs benefit from the manufacturer's ability to improve the total product line in an evolutionary fashion without making previous models obsolete.

The street railway industry first used standardization with the development of the "PCC" car in the 1930's. Variations in such factors as length, width, and door placement were accommodated in a car with standard performance and subsystem interfaces. Thousands of such vehicles are now operating on systems in the United States and around the world.

During the last decade, the U.S. transit railcar market has been characterized by uncertainty and instability. The rising cost of railcars, the demise of established passenger carbuilders (St. Louis Car and Pullman), the entry and relatively quick exit of new carbuilders after incurring large losses (Rohr and Boeing Vertol), the increasing railcar complexity accompanied by lower reliability, a seemingly greater occurrence of major component failures, the penetration of foreign carbuilders into the U.S. market, and more frequent resort to litigation to resolve disputes between the buyer and supplier clearly exemplify the market's difficulties. The problems associated with the railcar market have been debated with no universal agreement between the affected constituencies as to the courses of action required to rectify the situation. It is apparent that no single approach, e.g., standardization, is the answer to assuring a stable market because the basic issues are so intermingled with all facets of the rail transit industry—procurement practices and methods, maintenance, training, product improvement, product innovation, management planning, financial constraints, etc. However, standardization of specifications can bring important benefits to all sectors of the transit industry. As a result of these and other factors, UMTA has been working with operators, suppliers, and consultants to develop and refine standardized light and rapid railcar specifications.

UMTA first dealt with standardization when, in cooperation with the rail transit operators, it developed the *Guideline Specification for Urban Railcars*. These



Four methods of reducing wheel/rail noise are illustrated above. ("E" indicates the location of the elastomeric material on the wheels.)

guidelines attempted to standardize the format for a technical railcar specification.

Subsequently, UMTA began a two-phase project on rapid railcar standardization (IT-06-0131, IT-06-0175, DC-06-0121). The first phase involved a study of the feasibility of standardization. The second phase, now under way, is primarily concerned with the development of a standardized, or baseline, rapid transit car specification. Subtasks in the project include a study on car body materials, a service-evaluated products list, uniform acceptance test procedures, and a propulsion system life-cycle cost selection methodology.

The American Public Transit Association (APTA) is assisting UMTA in reviewing technical materials, along with the Standardization Committee of the Railway Progress Institute, representing the supply industry.

A study of the feasibility of joint procurement by five potential rapid transit properties was added to the Phase II tasks. Car procurements, scheduled for 1978-1979, were to be undertaken by Washington, D.C., Baltimore, Md., Miami, Fla., Cleveland, Ohio, Chicago, Ill., and Philadelphia, Pa. The project contractor found that pairings were feasible for Baltimore and Miami, and Cleveland and Philadelphia. On the basis of this study, UMTA later recommended that the two paired groups proceed with joint specification development and joint purchase, although only Baltimore and Miami actually completed a joint procurement for 206 cars.

Specifications for a new light rail vehicle (LRV) were developed in 1972 by transit operators with consulting assistance. In 1973 the Boeing Vertol Company was awarded a contract to design and manufacture LRVs for the San Francisco Municipal Railway and the Massachusetts Bay Transportation Authority. Because of a concern with the apparent high operating cost of the new car and the potentially higher cost for a new LRV bid to the "standard specification," an UMTA consultant critically reviewed the specifications for the purpose of recommending viable cost reduction changes which would not adversely affect performance.

A final report has been issued on this study (MA-06-0025), and the specification was revised to incorporate results of the study and other changes (i.e., four- or six-axle option). The revised version, *A General Specification for Procurement of Light Rail Vehicles,* was completed in 1980 by N. D. Lea and Associates under contract to TSC in cooperation with the transit industry. Public comments were solicited by UMTA on the specification in the *Federal Register,* and a final version of the specification will be published after analysis of the comments.

Under a related project (DC-06-0186), a series of National Design Practices Manuals are being developed. These manuals will assist UMTA, transit plan-

ners, engineers, and other transit professionals in developing new rapid rail transit systems or expanding and modernizing existing systems. The manuals will address issues of construction planning, safety, environmental acceptability, aesthetics, cost-effectiveness, operating efficiency, maintainability, reliability, accessibility and standardization of system elements.

A detailed outline for the scope and content of the manuals was developed by APTA under the project's first phase. In the project's second phase UMTA has selected a contractor (IT-06-0242) to develop the manuals. APTA will assist UMTA in reviewing draft technical materials in Phase II.

The scope of the manuals will include best practices for railcar equipment, power, signals and communication, safety, ways and structures, operations, and construction, including preliminary engineering and final design. The project involves detailed analysis into the many various existing standards, guidelines, codes, regulations, and other documents used by the industry for the planning, design, construction, and operation of an urban rail transit system.

The new urban transit building at the Transportation Test Center (TTC) in Pueblo, Colo.

Elderly and Handicapped Accessibility

The Rail Elderly and Handicapped Accessibility Program has been focused on two major areas: rail vehicle lifts, and a Congressionally mandated study of commuter and light rail system accessibility. Work on lifts began with a project at Boeing Vertol to develop a pivoting lift for light rail vehicles. The concept proved to be overly complex, and work was terminated. Subsequently, a more detailed lift feasibility study was undertaken by the Technology Research and Analysis Corporation under contract to TSC (MA-06-0025). A comprehensive report, *The Feasibility of Retrofitting Lifts on Commuter and Light Rail Vehicles* describes on which particular type of railcar it is feasible to retrofit a lift. A contract has been awarded to the Budd Company to undertake actual lift retrofit on a Boeing LRV after a period of analysis and design has been completed.

The Congressionally mandated Section 321(b) study required a comprehensive station and vehicle inventory of all UMTA-funded commuter and light rail systems to produce long-term cost estimates of making systems accessible to the handicapped. Although specified as a transit operators' study, a consultant (Crain and Associates) was used at the request of APTA because of the magnitude of effort involved (CA-06-0125). Over 1400 commuter and light rail stations and 5200 railcars were studied, and costed if accessibility retrofit was necessary. The 321 (b) report was reviewed by transit agencies and representatives from the handicapped community. A final 321 report combining rapid, commuter and light rail is being prepared by UMTA for

submission to Congress in the fall of 1980 with estimates of the total capital and operating costs of accessibility for a 30-year period.

Additional related work is being conducted by the Veterans Administration's Rehabilitation Engineering Center to study the ability of people in wheelchairs to traverse various horizontal and vertical gaps found commonly in high platform rapid rail systems. The study was engendered by the potential high costs of installing gap filler devices as hypothesized in the 321(a) rapid rail systems accessibility cost study.

Noise Abatement Technology

The purpose of the Urban Rail Noise Abatement Program is to reduce the environmental impact of noise caused by existing transit systems and to reduce the cost of noise control through the development and deployment of new and improved data methods and hardware. Under the sponsorship and direction of UMTA, TSC plans and technically directs the urban rail noise abatement program.

A previous TSC effort resulted in the development of a national assessment of urban rail noise which summarizes and compares the noise exposure of patrons and community residents caused by rail rapid transit operations in the United States. Another prior effort involved the inservice testing of four noise abatement techniques—resilient wheels, ring-damped wheels, wheel truing, and rail grinding—on the Southeastern Pennsylvania Transportation Authority (SEPTA). A follow-up inservice test is planned on NYCTA to further evaluate ring-damped wheels and three other techniques. These tests will develop data on the long-term costs and performance.

Previous UMTA research investigated how wheel and rail interact to produce noise and vibration. A current research effort is using this knowledge to improve the effectiveness of wheel/rail noise abatement techniques. Previously developed mathematical models of wheel/rail interaction have been refined based on the collection of new data and on field tests performed at the Pullman Standard test track and the DOT Pueblo test track, as well as on several transit systems, including NYCTA, MBTA (Boston), and CTA, Chicago.

For selected wheel/rail noise abatement treatments, the improved models were used to predict which design changes for treatments produced maximum reductions in noise levels. One application of the model has been the design and manufacture of a resilient treaded wheel which will undergo testing. Other treatments evaluated in this study were wheel truing, wheel flat prevention, rail grinding, hardfaced rail, and rail lubrication.

Another significant finding of the SEPTA study was that the propulsion system is a major source of noise at higher operating speeds. UMTA is spon-

Each rapid rail train has two trucks. A model of a steerable truck, which allows more flexibility in individual wheels, thus reducing the wheel/rail screech while the train is rounding curves, is shown above.

soring research on the origins of and possible treatments for propulsion system noise. In addition, UMTA has investigated the use of vehicle skirts as a way to control this noise.

Urban rail elevated structures have the greatest environmental noise impact of all parts of the urban rail system. A project is under way to assess this impact and design ways to control it. A survey of elevated structures in the United States has been completed, and an analytical model developed to predict noise from elevated structures. Based on this work, design guidelines for control of noise from existing structures are being developed, inservice tests of selected treatments will be performed as a final step. Treatments being studied include barriers, rail welding, wheel truing, rail grinding, resilient fasteners, and structural damping.

Groundborne noise and vibration from transit tunnels are other sources of community disturbance. Research is being carried out to find ways to ameliorate this problem. Groundborne noise and vibration control technologies in the United States and Europe have been surveyed and evaluated. Techniques studied include floating slab trackbed, truck design parameters, ballast mats, trenches, and resilient fasteners. A model has been developed to predict groundborne vibrations for track types, tunnel structures, surrounding earth, and building structures. Using the prediction model, design modifications will be made to optimize vibration control. Installation and maintenance costs, and the safety of the techniques will also be assessed. Finally, recommendations for inservice testing of the selected techniques will be made.

Winter blizzards in Chicago are common. The CTA must use special snow trains to clear the tracks.

A Bay Area Rapid Transit train at one of the stations.

Besides publication in technical reports, results are presented at meetings held jointly by UMTA and APTA. The results of the SEPTA inservice testing of wheel/rail noise abatement techniques were presented in Atlanta, Ga. in December 1979. A slide tape show on the inservice testing was part of the presentation. Attending this seminar were APTA advisory board members, equipment suppliers, public officials, and consultant.

An Urban Rail Noise Abatement Information Center has been established at TSC. Information on urban rail noise abatement has been collected from a variety of sources and is available to all who wish to see it.

UMTA is concerned with the implementation of noise control technologies on transit systems, as well as with technology development activities. The profusion of recent literature makes it difficult for transit authorities to select and implement available technology for noise and vibration control. *A Handbook of Urban Rail Noise and Vibration Control* is being developed to summarize the literature in a form usable by transit authorities, as well as by suppliers and consultants. Topics covered include fundamentals of sound and vibration, measurement techniques, acceptability criteria, noise control actions required for new and old systems, techniques recommended for control of vehicle, station, wayside, elevated structure, and groundborne noise and vibration.

In addition to the handbook, a *Compendium of Acoustical Materials* for use in rail transit systems is planned as an aid to transit operators responsible for the implementation of noise control. The compendium will provide an index of suppliers of materials, products, and services related to noise control and noise measurement.

Radiated interference measurement and analysis techniques are carried out on the MARTA chopper-controlled vehicle at TTC in Pueblo, Colo.

Transportation Test Center

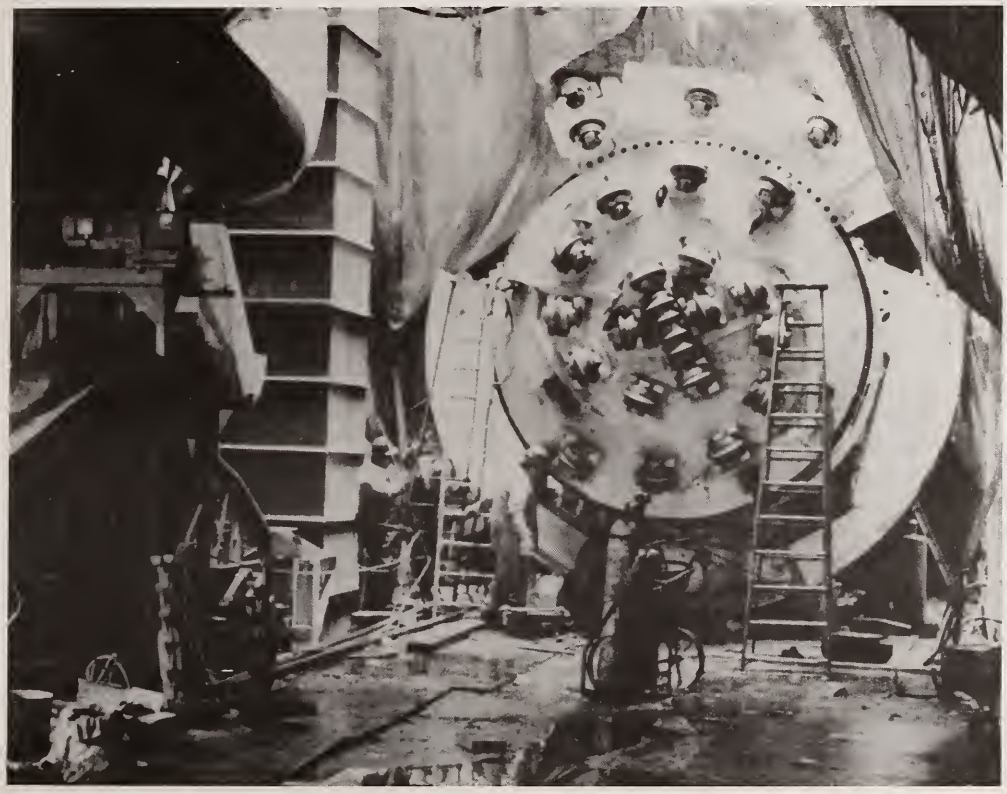
The Transportation Test Center (TTC), managed by the Federal Railroad Administration, operates and administers an intermodal center for comprehensive testing, evaluation, and associated development of ground transportation systems and their components by DOT organizations, other government agencies, and private industry (CO-06-0009).

The urban rail test facilities at the TTC consist of a 9.1 mile oval, electrified rail transit test track, and a power system for energizing the track, repair, maintenance and support facilities. The rail transit test track is designed for the test and evaluation of urban rail vehicles—light, rapid, and commuter rail. A second purpose of the track is the development, test, and evaluation of state-of-the-art track structures.

In addition to the conventional contact rail electrification, about two miles of simple overhead power wires have been constructed over part of the track to permit test and evaluation of urban rail vehicles using overhead power collection systems, such as light rail vehicles and commuter cars.

The installation of a solid state permanent power station to supply electricity to the transit test track has been completed. Two substations and a software control system will provide the system capability to automatically maintain desired third rail voltage levels at the vehicle and to accept power regenerated from vehicles. Manual operation of the system was accomplished this year with automatic control scheduled for completion in FY 80.

Assembly of one of the four tunnel boring machines to be evaluated during construction of the new subway tunnel at the Niagara Frontier Transportation Authority in Buffalo, N.Y.



The first use of the power station was the conduct of a fault clearing test of the Atlanta MARTA railcars. A surge of voltage was applied and the operation of protective devices, such as circuit breakers, was observed.

In FY 80 a new Urban Rail Building (URB) was completed within the transit track oval. This 20,000-square foot building provided convenient access to and from the main test area without interrupting other test programs.

Special capabilities of the URB include: two 190-foot service tracks through the building, one over a service pit; floor loading designed for 50-ton power jacking; office space including accommodations reserved for visiting test representatives; and a 600-volt DC power system.

Located also at TTC is a Rail Dynamics Laboratory (RDL), designed to simulate rail dynamics for the purpose of studying the periodic and random oscillations of rail vehicles. Evaluation of RDL capabilities for transit vehicles was begun in late 1980 with testing of the State-of-the-Art Car (SOAC) in that facility.

Recently completed at TTC is a tight turn loop, a 150-foot radius curve track which has enabled the validation of wheel/rail noise phenomena using the SOAC vehicle.

During FY 80, production transit car testing was completed on the new Blue Line cars for the Massachusetts Bay Transportation Authority (MBTA). Two of the cars, built by Hawker-Siddeley Canada Ltd., underwent testing at TTC on the Transit Test Track, accumulating 11,000 miles. Testing was conducted in the areas of vehicle performance, ride quality, and noise. In addition, special

testing was conducted on experimental, environmentally safe (free from lead and asbestos) brake shoes, coupler wear, and energy conservation. The cars displayed high reliability, with no major technical or operational problems encountered. Ninety-nine percent of the scheduled track time was used during their stay at TTC. The results of this testing were published.

Testing was also initiated on a pair of transit cars from the Metropolitan Atlanta Rapid Transit Authority (MARTA). Planned testing was essentially completed during this fiscal year, but requests by MARTA for continued special testing in areas of brake performance and truck dynamics will probably result in an extension into the next fiscal year.

Wheel/Rail Dynamics

Radial steering trucks will be evaluated as possible noise abatement and wear reduction techniques. It is anticipated that a steerable truck will reduce noise and wheel/rail wear by reducing the wheel/rail lateral forces and the angle of attack. Under a competitive contract, a design feasibility phase was conducted in FY 80, and will be followed by a test on evaluation phase. Ultimately, a product introduction phase will follow if the results of the evaluation demonstrate the cost effectiveness of this approach. A project plan has been developed and procurements for design feasibility studies have been initiated.

In FY 79, two contracts (MA-06-0025) were awarded for the preliminary design and analysis of steerable trucks for rapid rail transit vehicles. One of these awards was made to the Budd Company; the other to a team comprising the Urban Transportation Development Corporation, Boeing Vertol, and the Chicago Transit Authority. Although CTA is no longer interested, the UTDC steerable trucks are now being considered by WMATA as a project.

UMTA is also exploring the technical and economic feasibility of retrofitting some PCC streetcars in Pittsburgh with a steerable truck configuration.

Vehicle and Equipment Technology

The era of oil shortages and environmental concerns has focused attention on the nation's rail transit systems and their key role in alleviating these domestic problems. Currently, there are ten U.S. cities that have rail rapid transit systems in operation, under construction, or in final engineering: San Francisco, Chicago, Cleveland, Philadelphia, New York, Boston, Washington, Baltimore, Atlanta, and Miami.

In addition, ten cities have light rail systems planned, in operation, or under construction—Philadelphia, Boston, Pittsburgh, Newark, New Orelans, San Francisco, Cleveland, Buffalo, San Diego, and Portland, Ore. (New Orleans and Detroit have unique historic trolleys which serve mass transit functions). Together with commuter railroads, rail transit systems carry more than two billion passengers annually, or one-third of all mass transit riders.

Rail transit has experienced significant growth in ridership during the last three years. Projections are for this trend to continue. The availability and reliability of equipment is critical to meeting the new demands and to insuring patron acceptance. The application of technology improvements to essential components of the transit system will support these purposes.

Vehicle Prototypes and Subsystems

Through the mid-1970's, UMTA's Rail and Construction Technology Program focused on the development of total vehicle designs and advanced vehicle subsystem development. Two prototype rapid transit vehicles were developed and tested: the State-of-the-Art-Car (SOAC) and the Advanced Train (ACT-1).

Under the Advanced Subsystems Development Program (ASDP) (IT-06-0026), a number of promising subsystems designed for applicability to either existing or planned rapid transit vehicles have been developed. The objective of this program has been to develop subsystems that offered potential improvements over existing equipment. Subsystems developed under this program include an AC synchronous propulsion system (VA-06-0053), and a monomotor truck and a synchronous brake system (PA-06-0046). Testing of the ASDP truck and brake systems retrofitted into the SOAC vehicles was completed at the Transportation Test Center (TTC) in June 1980. Development of the synchronous propulsion system was terminated due to technical difficulties.

Subsystem Technology Applications to Rail Systems (STARS)

The ASDP program was supplanted by a program of subsystem development

which places more emphasis on providing solutions to the day-to-day problems of operating and maintaining a rapid rail transit system. This program, known as Subsystem Technology Applications to Rail Systems (STARS), will identify operational problems, apply existing technology to their solution and deploy these solutions in the near term.

During its first full year, the STARS program has already achieved major accomplishments. In addition, hardware development activities were initiated in the areas of fare collection, winterization equipment, AC propulsion, static auxiliary power supplies, improved air conditioning, and door improvements; technology assessments were conducted to quantify rail transit problems and identify future STARS opportunities in advanced propulsion systems, electromagnetic interference (EMI), energy optimization, and escalators.

An investigation (VA-06-0053) of advanced propulsion systems included a survey of domestic and foreign development activities and identified critical technology items. This effort culminated in the UMTA-sponsored International Conference on Advanced Propulsion Systems for Urban Rail Vehicles, held in Washington, D.C. in February 1980. An outcome of this work has been the preparation of a specification for the development of an AC induction motor propulsion system. Multiple contracts for this project are scheduled for award in early 1981.

Other major subsystem development contracts are also scheduled for award in 1981, following the preparation of development specifications. These projects will include development of improved door designs, static auxiliary power supplies and improved air conditioning.

This year UMTA initiated a project under the direction of TSC to improve the reliability and availability of rail transit fare collection equipment. The project involves equipment suppliers and is supported strongly by the rail transit authorities through direct involvement in periodic workshops and research and development grants. Grants have been awarded to PATCO (Philadelphia) (NJ-06-0012) for designing and testing a high reliability ticket vendor, and to CTA (Chicago) (IL-06-0049) for evaluating various pass reader systems.

The fare collection project is multifaceted, involving requirements analyses, product development, tests, and evaluations. Reports have been completed describing specific issues and problems and assessing equipment reliability conditions at BART and WMATA. This work will be extended to other properties in order to provide a broad and uniform assessment of fare collection equipment. A workshop was held in March 1980 to prioritize future hardware development efforts. Future workshops will seve as a means to provide continued coordination among the authorities and suppliers. Other project activities include model development for system tradeoff studies, hardware development evaluations at various properties, the preparation of an equipment catalog, a policy impact study to aid properties in the selection of equipment, and an evaluation of the operational effectiveness of foreign fare collection equipment.

In recent years several U.S. rail properties operating escalators have had problems with frequent breakdowns and low availability. In order to more clearly define and understand the issues and problems, a technology assessment was initiated by UMTA. During this study, the state-of-the-art of escalator technology was reviewed, a brief analysis of operational data was conducted, and institutional factors and recommendations for future research and development were developed. An Escalator Maintenance Reduction Advisory Board was also set up to voice the needs of transit operators. Based on Board recommendations, an investigation of the cost/safety/performance tradeoffs of escalator special design features is currently being undertaken (MA-06-0025).

The major snow storms of the winters of 1977-78 and 1978-79 that paralyzed many transit systems alerted the industry to the special measures required to maintain operations during severe winter weather. In response to this problem, an APTA Task Force on Rail Transit Snow and Ice Emergencies was formed, which identified the need for a high-capacity special purpose snow removal vehicle.

In support of this activity, a contract previously awarded for a Winterization Technology and Systems Operation Study was amended to develop a specification for a universal rail-mounted snow removal vehicle. The Chicago Transit Authority (CTA) has utilized this specification for the procurement of a prototype vehicle to be delivered in March 1981. CTA was awarded an UMTA R&D grant (IL-06-0048) to test and modify the

vehicle with technical support to be provided from the Transportation Systems Center (MA-06-0025).

A computer model was developed by Carnegie-Mellon University (DC-06-0280) to assess tractive energy conservation strategies. The model features two major modules, a train performance simulator and an electrical network simulator. A separate module was also designed to optimize results on the basis of cost. Model validation experiments of the regeneration strategy are scheduled to be conducted. An industry user workshop is planned for April 1981. Other activities in energy conservation include a grant to WMATA (DC-065-0315) to develop a methodology for auditing energy use and a study (PA-06-0059) of energy utility rate structures to provide transit industry criteria.

Because of potential advantages in reliable operation, maintenance, and energy efficiency, solid state propulsion control is being increasingly applied to rail transit. Unfortunately, one negative side effect in introducing this new technology has been its electromagnetic incompatibility with existing train control systems at certain U.S. transit properties.

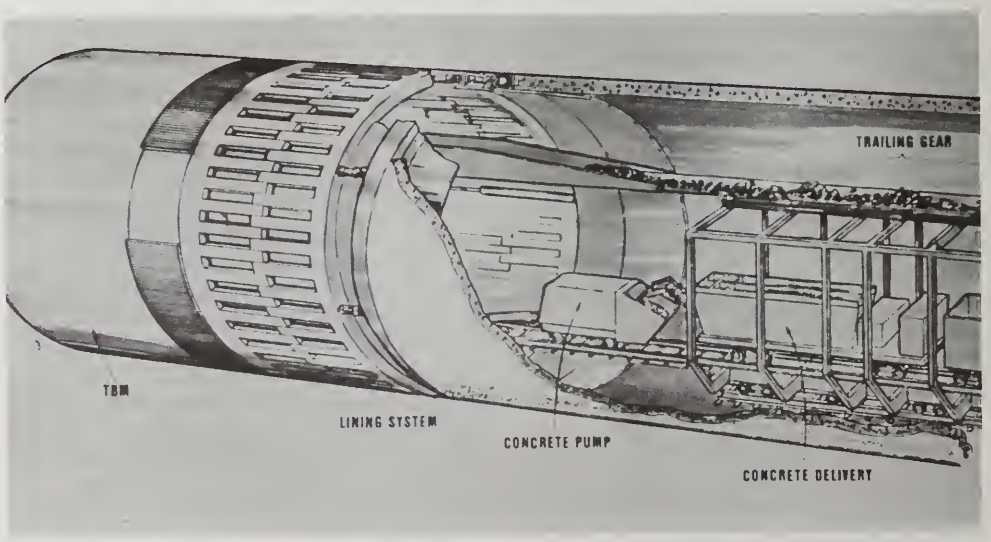
Since early 1979, UMTA, with technical support from TSC has been working in a cooperative effort with transit operators and their suppliers to develop standardized methods of analysis and testing to quantify and resolve issues of electromagnetic compatibility (EMC) in rail transit operation. A technical working group and an APTA advisory board have been established. Significant progress has been made toward solving this problem.

A draft standards document for intrasystem EMI between rail transit vehicular electrical power and track circuit signalling subsystems was developed and has been issued for public comment with a notice in the *Federal Register*.

Section 6 R&D grants were awarded to Baltimore (MD-06-0072) and Atlanta (GA-06-0013) to develop cost-effective hardware designs to guarantee electromagnetic compatibility between propulsion and signalling equipment. Based on these grants, new hardware designs and configurations have been developed and tested, and are being introduced into revenue service.

Cost-effective alternatives for electromagnetic compatibility between chopper propulsion and signalling equipment for both new and existing systems have been developed. A property-specific alternatives assessment has been completed in support of the introduction of new chopper-controlled vehicles at WMATA scheduled for next year. In addition, a preliminary assessment of EMC for AC

Schematic drawing of the extruded tunnel lining system which continuously places a concrete support lining immediately behind the tunnel boring machine as it moves forward.



propulsion system development was conducted.

Planned program activities include completing the standards development process, developing general vehicle EMC tests for Pueblo TTC, continuing EMC analysis of advanced propulsion systems, and extending the EMC program to include other major transit subsystems.

Construction Technology

The Urban Rail Construction Technology program deals with the problems of rapidly increasing construction costs and deteriorating transit facilities. The increasing construction costs of new or expanding transit systems are largely related to institutional factors which limit the use of new technologies, contracting practices, and management procedures to reduce cost.

The cost of constructing new rail systems depends on the effectiveness of research and development in reducing capital requirements and improving construction procedures and management. The need for modernization, rehabilitation, and reconstruction will increase rapidly in the future. It is projected that U.S. transit agencies will request nearly $15 billion in federal aid over the next ten years for rehabilitation and modernization. The enhancement of the structural integrity and reliability of these deteriorating facilities is of increasing importance.

This concrete slab trackbed, used in conjunction with resilient rail fasteners on the Madrid-Barcelona line, was one of several installations evaluated for possible use in the United States.

Contracting and Management

Studies by UMTA and others indicated that traditional institutional practices are a serious barrier to the deployment of innovative technology, and are indeed a contributing factor to the spiraling costs in recent years. In response to these findings, R&D projects are directed to the development of contracting and management criteria and guidelines for use by transit authorities. The inherent risks and complexities of underground construction are appreciated and taken into account in the formulation and allocation (assignment) of these criteria and guidelines. For contracting, the risks for all parties are to be clearly defined, understood, and accepted; and, in management, clear lines of authority and accountability are to be established.

A study of allocation of risks in urban underground construction (MA-06-0097) is under way to develop a quan-

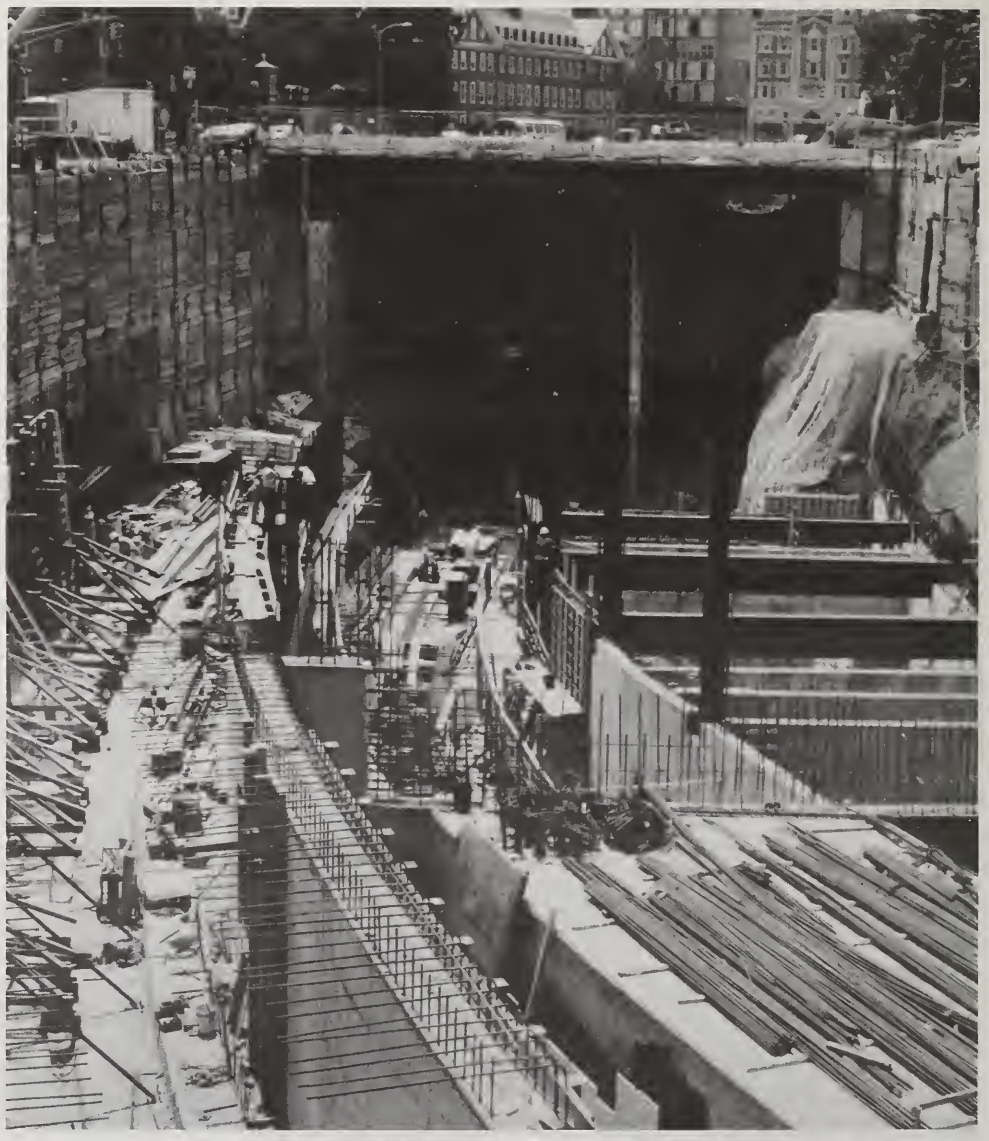
titative technique to analyze the effect on owner's and designer's cost of alternative risk allocation schemes. Results of this study were used to analyze the NFTA's wrap-up insurance program to provide recommendations for the best type of insurance coverage for construction (NY-06-0071).

Another related study, Cost Estimating Methodology for Underground Construction (MA-06-0100) is under way. This model is based on labor and materials used for different types of construction, and will develop cost estimates based on a broad range of assumptions from conceptual planning to final design.

A study entitled Management of Urban Construction Programs (MA-06-0100) is being conducted by the Building Research Advisory Board (BRAB) of the National Academy of Sciences. The principal objective of this study is to develop criteria which can be used as a guide by local government authorities in developing sound management plans for the execution of federally funded urban construction programs. It will identify decision-making roles at all levels, and develop criteria and procedures for assigning responsibility, authority, and control. A series of seminars will be conducted in six major cities to disseminate the plan and discuss the program.

Elevated Structures

Research into elevated structures is directed toward developing new or improved design and construction procedures. These new methods and materials will provide more aesthetically appealing structures while improving construction tolerances, increasing the rate of construction, minimizing costs, and



Cut and cover construction in progress on the MBTA Red Line extension in Harvard Square in Cambridge, Mass.

simultaneously producing low-maintenance structures. Consequently, local disruption and environmental interference will be minimal.

A project (MA-06-0096) to evaluate concrete double tee and box girder designs through mathematical models is under way to predict the performance of these designs under a variety of conditions. A related study (GA-06-0010) is under way to assess the overall criteria used in designing U.S. rail transit elevated structures.

Also under way is the development of a design practices handbook (MA-06-0076) for steel box girders. This handbook will provide design methodology using rail transit criteria for designing elevated structures.

Track and Wayside Technology

The objective of the Track and Wayside Technology Program is to achieve UMTA's goals of increased track performance, reliability, safety, reduced overall costs, and the optimum use of rapid transit track. Every effort is being made to coordinate activities with the various sectors of the U.S. transit industry. This will insure that research efforts are directed toward solving real problems and that results are implemented. Through these cooperative efforts, the UMTA track research program will result in track design standards, construction standards, and maintenance guidelines.

A project to investigate and analyze the use of restraining rail in U.S. rapid transit track systems is under way (MA-06-0100). Its objective is to develop guidelines to optimize the design and installation. This study is also examining rail lubrication for transit.

Another study (MA-06-0100) is investigating the applicability, justification, and economic feasibility of at-grade concrete slab track for use in U.S. rapid transit systems. Preliminary information from England, Germany, and elsewhere indicates that the relatively high initial cost associated with concrete slab track may be offset by maintenance savings. Other important advantages are reduced traffic disruption, long life, ability to maintain track geometry, and suitability for high speeds and heavy axleloads.

The development of a standard rapid transit concrete tie has been an ongoing effort in the past few years. To date, two types of concrete ties (monoblock and duoblock) have been designed, fabricated, and laboratory tested. A plan for deploying the standard concrete ties will be developed (MA-06-0100) in cooperation with the transit industry.

In a related effort (MA-06-0100), the effect of vehicle-induced forces on the rails, ties, and fastenings of rapid rail tracks will be determined. Experimental data is being generated using the TTC test loop and will be used to validate analysis tools developed under previous studies.

A test section to evaluate the noise characteristics of three different types of track structures in subway stations is under way in Chicago (IL-06-0042). CUTD, in cooperation with CTA, is evaluating concrete tie and ballast, direct fixation, and STEDEF ties. Noise and ground vibration measurements will be taken in both railcars and station areas.

A project (MA-06-0100) to assess the U.S. rail transit rehabilitation and modernization needs and to develop a R&D program directed at cost-effective technological improvements in rehabilitating fixed facilities has been begun.

Improvements in industrial engineering procedures in rail transit has been identified in a recent study as an area which has great potential for reducing costs of maintaining ways and structures. A project (DC-06-0333) has been initiated to develop a training program which will assist in the introduction of new techniques in maintenance practices. Maintenance scheduling algorithms will also be developed.

A Track Geometry Measurement System (TGMS) is a device which can be attached to any transit car and which identifies those portions of the track in need of improvement. A prototype TGMS was developed at TSC and tested on the Toronto Transit Commission property for several months with successful results (MA-06-0025). NYCTA is currently conducting a two-year evaluation of the prototype. Concurrently, specifications for an improved system are being developed jointly by the industry and government.

Tunneling Technology

The tunneling program was initiated in FY 73 to reduce the costs of urban underground construction, accelerate the rate of construction, educate planners in the proper use of tunnels, and optimize the use of tunnels in urban transportation systems. The types of research conducted within the program include ground control and stabilization, design and construction standards, and transit system environment criteria.

Several tunneling studies are being conducted in the area of ground control

and stabilization. Evaluations of soil and construction parameters affecting ground movements around tunnels are being performed, and recommendations for procedures to predict and control these movements are being developed.

During site explorations for the extension of a Massachusetts Bay Transportation Authority (MBTA) line, innovative geotechnical methods have been used to predict subsurface conditions in "critical" construction zones (MA-06-0100). Resulting predictions will be compared with actual conditions encountered in excavation. In addition, ground movements will be monitored as tunnel excavation proceeds.

For the past several years, instrumentation data from the BART Berkeley Hills Tunnels have been collected. An analysis of that study is being conducted to determine the state of the instrumentation and to determine the extent of any ground movement surrounding the tunnels. A new instrumentation program will be developed for continued long-term monitoring (CA-06-0120).

The performance of the MBTA Porter Square station rock chamber and lining will be monitored during construction through the use of construction control instrumentation. This evaluation (MA-06-0127) will examine the validity of the design approach compared with other designs.

The Niagara Frontier Transportation Authority (NFTA) project is using four tunnel boring machines (TBM) to construct its rock tunnels. Two of the machines are new, the others rebuilt. A study (MA-06-0100) is under way to evaluate the performance of all four machines in order to develop a data base on TBM performance in rail transit construction.

A study is under way to analyze the effect of dipped guideways on the operation of rapid rail transit systems constructed underground. This study will investigate energy consumption during operation as well as maintenance and operational impacts (CA-06-0144).

Guidelines for the structural design of tunnels based on the ultimate strength concepts of concrete behavior are being developed (MA-06-0100).

The development of an extruded tunnel lining system is in progress. It has three major phases: 1) resolution of major technological problems, 2) hardware design, and 3) system fabrication and field test and demonstration. Phase 3 has been initiated. UMTA is now planning for the deployment of this lining system. When completed, the system will be capable of continuously placing the final tunnel support directly behind a tunnel boring machine, thus eliminating the need for primary tunnel support, and reducing construction time and cost.

UMTA sponsored a rock chamber study in connection with the construction of the Peachtree Center Station of the MARTA system (GA-06-0007). The study evaluated various configurations of rock anchors and shotcrete as final support systems for station caverns and line tunnels. As a result of this project, steel-fiber shotcrete will be used for tunnel support in a section of the MARTA system.

Problems encountered in the removal of rock and earth from tunnel excavation sites have been addressed by a project undertaken by WMATA. It involves development of a plan for use of the muck excavated from sections of WMATA's Glenmont Route (DC-06-0209). The basis for this study will be the *Muck Utilization Handbook* developed under a previous UMTA-sponsored study. The WMATA project included investigation of alternatives, evaluation of public and private land development uses, and development of a cost-effective plan for use of the excavated material.

The socioeconomic impacts of tunnel construction in urban areas are also being studied (MA-06-0100). A behavioral model will be developed and tested which will measure the disruptive effects of tunnel construction.

A grant to the Port Authority Trans-Hudson (PATH), in cooperation with the New York City Transit Authority (NYCTA) involves a comprehensive investigation of existing and new technology applicable or adaptable to testing tunnel structural integrity (NY-06-0077). A reliable "nondestructive" method of testing is to be developed. Such a method will be invaluable to old subway systems. It will also be useful in determining the condition of structures other than tunnels.

Another grant to WMATA (DC-06-0267) is intended to validate specific portions of the subway Environmental Simulation (SES) program, and to provide information for the Subway Environmental Design Handbook. The data obtained will be used in predicting temperature distribution patterns during peak operating periods, safety ventilation operations, equipment operation costs, effectiveness of dome reliefs, and temperature stratification patterns in large stations typical of the WMATA system.

Fire safety in urban transit tunnels is also being studied (MA-06-0025). This

project is actually a continuation of the prior Subway Environmental Simulation Program, which developed a model to evaluate fire safety at any point in the subway by simulating a fire. This model permits emergency evacuation plans and gives information on control of the ventilation system. This current project will increase the model's predictive capabilities and will make the program less costly and easier to run. The model will be modified to run on TSC facilities, where it will be readily available to all transit properties.

The Port Authority of Allegheny County (PAAC), Pittsburgh, Pa., is preparing, under an UMTA grant, an alternative design for the construction of Mount Lebanon Transit Tunnel, using the New Austrian Tunneling Method (NATM) technology (PA-06-0052). The purpose of the project is to offer NATM as an option to bidders for the construction of the tunnel.

The University of Illinois is analyzing data obtained during construction of WMATA tunnels (MA-06-0100). The primary objective of the study is to develop more economical and safer guidelines for the planning, design and construction of rock chambers and tunnels.

Instrumentation and Evaluation of Slurry Wall Construction (MA-06-0100) is being conducted on the Red Line Extension of the Massachusetts Bay Transportation Authority (MBTA). The purpose of the study is to evaluate the performance of slurry walls as an integral part of permanent underground transportation structures. Such an application could reduce the total cost of the project by combining the costly temporary construction with the permanent structure.

Rail and Construction Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
REQUIREMENTS, ANALYSIS AND EVALUATION					
Central Control Algorithm Assessment	CA-06-0124	$150,000	Sept. 1979-Sept. 1981	BART/Stanford Research Institute	Stephen Teel (202) 426-0090
Life Cycle Cost Model	MN-06-0010	$30,000	July 1978-July 1980	University of Minnesota	Stephen Teel (202) 426-0090
Rail Vehicle Refurbishment Study	MA-06-0025	$120,000	Jan. 1980-Dec. 1980	Input/Output Computer Services	Stephen Teel (202) 426-0090
SYSTEMS INTEGRATION AND DEPLOYMENT					
Standardization					
Railcar Standardization	MA-06-0025 IT-06-0131 IT-06-0175 DC-06-0121 IT-06-0229	$1,500,000	May 1976-Feb. 1981	Decision Group: American Public Transit Association (APTA); N.D. Lea and Assocites	Jeffrey Mora (202) 426-0090
National Design Practices Manuals	DC-06-0186	$100,000	Aug. 1978-June 1982	American Public Transit Association	Jeffrey Mora (202) 426-0090
Elderly and Handicapped Rail Accessibility					
Elderly and Handicapped Accessibility	MA-06-0025 PA-06-0034 CA-06-0125	$2,300,000	Sept. 1977-Dec. 1982	TSC; Boeing Vertol Co.; Crain and Associates; TRAAC Associates; Budd Co.	Jeffrey Mora (202) 426-0090
Noise Abatement					
Handbook of Urban Rail Noise and Vibration Control	MA-06-0025	$110,000	Sept. 1978-Dec. 1980	TSC; Wilson, Ihrig and Associates	Michael Dinning (617) 494-2119

Rail and Construction Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
Noise Abatement					
In-Service Test and Evaluation of Wheel/Rail Noise Control Treatments on SEPTA	MA-06-0025	$470,000	July 1975-April 1979	TSC; DeLeuw Cather and Co.; Wilson, Ihrig and Associates	Paul Spencer (202) 426-0090
Wheel/Rail Technology	MA-06-0099	$370,000	July 1979-Sept. 1981	TSC; Bolt, Beranek and Newman, Inc.	Robert Hinckley (617) 494-2185
Vehicle Skirt Cost Effectiveness	MA-06-0099	$10,000	Jan. 1979-March 1979	TSC; Bolt, Beranek and Newman, Inc.	Robert Hinckley (617) 494-2185
Elevated Structures	MA-06-0025	$350,000	June 1978-Dec. 1980	TSC; Bolt, Beranek and Newman, Inc.	Robert Hinckley (617) 494-2185
Reduction of Groundborne Noise and Vibration	MA-06-0099	$330,000	Aug. 1979-Sept. 1981	TSC; Wilson, Ihrig and Associates	Michael Dinning (617) 494-2119
Noise Abatement Workshops	MA-06-0099	$10,000	Aug. 1979-April 1981	TSC; Pacific Consultants	Michael Dinning (617) 494-2119
Procedure for Evaluation of Abatement Cost Effectiveness (PEACE)	MA-06-0099	$90,000	April 1979-June 1981	TSC; Polytechnic Institute of New York	Michael Dinning (617) 494-2119
WMATA Wheel/Rail Wear Reduction	MA-06-0099	$80,000	Feb. 1979-Nov. 1979	TSC; Battelle Columbus Laboratory; WMATA	Charles Phillips (617) 494-2493
Resilient Fastener Evaluation	MA-06-0099	$10,000	March 1979-March 1981	TSC; Chicago Urban Transit District	Gilbert Butler (202) 426-0090
Damped Wheel In-Service Test	MA-06-0094	$240,000	Feb. 1981-Oct. 1982	To be selected	Robert Hinckley (617) 494-2185
Propulsion System Noise Control	MA-06-0094	$270,000	Jan. 1981-Oct. 1982	To be selected	Michael Dinning (617) 494-2119
Acoustical Materials Compendium	MA-06-0094	$75,000	Nov. 1980-Jan. 1982	To be selected	Michael Dinning (617) 494-2119
Transportation Test Center	CO-06-0009	$900,000	Oct. 1980-Oct. 1981	FRA	Paul Spencer (202) 426-0090

Rail and Construction Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
Wheel/Rail Dynamics					
Steerable Truck	MA-06-0025	$850,000	Aug. 1977-Oct. 1981	TSC; Budd Co.; Urban Transportation Development Corporation	Paul Spencer (202) 426-0090
VEHICLE AND EQUIPMENT TECHNOLOGY					
ASDP Unpowered Testing	PA-06-0046	$425,000	Nov. 1978-May 1980	Budd Co.	Stephen Teel (202) 426-0090
Subsystem Technology Application to Rail Systems (STARS)					
Fare Collection Ticket Dispenser Development	NJ-06-0012	$100,000	Oct. 1980-Oct. 1981	PATCO	Joseph Koziol (617) 494-2014
Fare Collection Pass Reader Evaluation	IL-06-0049	$250,000	Oct. 1980-Oct. 1982	CTA	Joseph Koziol (617) 494-2014
Escalator Assessment	MA-06-0025	$60,000	April 1980-Dec. 1981	Jet Propulsion Laboratory	Joseph Koziol (617) 494-2014
Winterization Technology Investigation	MA-06-0025	$100,000	June 1979-July 1980	Kusko, Inc.	Jason Baker (617) 494-2493
Snow Removal Equipment	IL-06-0048	$100,000	Oct. 1980-Oct. 1982	CTA	Jason Baker (617) 494-2493
Axle Stress Investigation	MA-06-0117	$80,000	March 1980-Dec. 1980	MBTA	Paul Spencer (202) 426-0090
Energy Optimization Model	DC-06-0280	$45,000	Oct. 1979-Oct. 1980	Carnegie-Mellon University	Steve Teel (202) 426-0090
Energy Rate Analysis	PA-06-0059	$80,000	June 1980-June 1981	Carnegie-Mellon University	Steve Teel (202) 426-0090
Energy Asessment	DC-06-0315	$110,000	May 1980-May 1981	WMATA	Steve Teel (202) 426-0090
Electromagnetic Interference (EMI), Specification Development	MA-06-0059	$500,000	Jan. 1980-Dec. 1981	TSC; Pacific Consultants; Radiation Sciences	Lou Frasco (617) 494-2464

Rail and Construction Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
VEHICLE AND EQUIPMENT TECHNOLOGY					
Subsystem Technology Application to Rail Systems (STARS)					
EMI Countermeasures	MD-06-0072	$225,000	Feb. 1980-Oct. 1980	MTA/Baltimore, Md.	Lou Frasco (617) 494-2464
EMI Countermeasures	GA-06-0013	$195,000	June 1980-April 1981	MARTA	Lou Frasco (617) 494-2464
CONSTRUCTION TECHNOLOGY					
Allocation of Risk in Construction	MA-06-0097	$142,000	July 1979-Dec. 1980	Massachusetts Institute of Technology	Gilbert Butler (202) 426-0090
Project Management Plan Criteria	MA-06-0100	$68,000	May 1979-Oct. 1980	TSC; National Academy of Sciences	Paul Witkiewicz (617) 494-2006
Construction Cost Estimating Methodology	MA-06-0100	$150,000	Jan. 1980-Jan. 1981	TSC; Multisystems, Inc.	Anna Snyder (617) 494-2247
Design Practices for Steel Box Girders	MA-06-0076	$90,000	May 1980-May 1982	University of Maryland	Paul Spencer (202) 426-0090
Design Analysis of Elevated Structures	MA-06-0096	$90,000	Sept. 1979-March 1981	Massachusetts Institute of Technology	Paul Spencer (202) 426-0090
Assessment of Design Criteria for Aerial Structures	GA-06-0010	$50,000	Dec. 1978-Jan. 1981	Harrington, George and Dunn, Inc.	Paul Spencer (202) 426-0090
Restraining Rail Design Guidelines	MA-06-0100	$136,000	Sept. 1979-Dec. 1980	TSC; Ensco, Inc.	Gerald Saulnier (617) 494-2006
Concrete Slab Track Assessment	MA-06-0100	$120,000	Sept. 1979-Feb. 1981	TSC; Portland Cement Association	Paul Witkiewicz (617) 494-2006
Transit Track/Noise Test Section	IL-06-0042	$650,000	Nov. 1978-April 1981	Chicago Urban Transportation District	Gilbert Butler (202) 426-0090
Vehicle-Induced Forces	MA-06-0100	$339,000	Oct. 1978-Nov. 1980	TSC; Kaman Avidyne	John Patukian (617) 494-2206

Rail and Construction Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
CONSTRUCTION TECHNOLOGY					
Rehabilitation Research Needs Study	MA-06-0100	$238,000	Dec. 1979-March 1981	TSC: UTD Corp.	Gerald Saulnier (617) 494-2006
Industrial Engineering and Track Maintenance	DC-06-0333	$300,000	Oct. 1980-Oct. 1982	WMATA	Mahmood Fateh (202) 426-0090
Track Structure Shear Test	MA-06-0100	$75,000	Aug. 1980-Aug. 1981	TSC; Virginia Polytechnic Institute and State University	John Putukian (617) 494-2206
Concrete Tie Deployment Analysis	MA-06-0100	$20,000	Oct. 1980	TSC; Delon Hampton Associates	Gerald Saulnier (617) 494-2006
MBTA Site Exploration	MA-06-0100	$456,750	Oct. 1978-June 1980	TSC; Bechtel Corp; Haley and Aldrich, Inc.	Phillip Mattson (617) 494-2431
Precast Concrete Liners Test Section	MD-06-0029 MD-06-0039	$470,000	Oct. 1978-Nov. 1980	MTA	Gilbert Butler (202) 426-0090
Tunneling Technology Workshops and Seminars	MA-06-0100	$50,000	Oct. 1980-Oct. 1981	TSC; Pacific Consultants	Santo Gozzo (617) 267-6622
Rock Station and Tunnel Test Section	GA-06-0007	$480,000	Aug. 1977-Nov. 1980	MARTA	Gilbert Butler (202) 426-0090
Design Recommendations for Concrete Tunnel Liners	MA-06-0100	$350,000	April 1978-July 1981	TSC; University of Illinois at Champaign-Urbana	Gerald Saulnier (617) 494-2006
Muck Utilization	DC-06-0209	$81,000	Nov. 1978-Nov. 1980	WMATA	Gilbert Butler (202) 426-0090
Socioeconomic Impacts	MA-06-0100	$341,000	Sept. 1977-March 1981	TSC/FHWA; Abt Associates, Inc.	Gilbert Butler (202) 426-0090
Nondestructive Testing (NDT) Tunnel Inspection	NY-06-0077	$800,000	April 1980-April 1983	PATH	Gilbert Butler (202) 426-0090
Validation of WMATA Ventilation Design	DC-06-0267	$469,000	Aug. 1979-Sept. 1981	WMATA	Gilbert Butler (202) 426-0090

Rail and Construction Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
CONSTRUCTION TECHNOLOGY					
Subway Environmental Simulation: Emergency Ventilation	MA-06-0100	$210,000	Nov. 1978-April 1981	TSC; Parsons, Brinkerhoff, Quade and Douglas	Anna Snyder (617) 494-2247
New Austrian Tunneling Method (NATM) Test Section	PA-06-0052	$509,000	June 1979-Oct. 1982	PAAC	Gilbert Butler (202) 426-0090
Analysis of WMATA Construction Monitoring Data	MA-06-0100	$40,000	March 1979-Dec. 1980	TSC/FHWA; WMATA Washington, D.C.	Phillip Mattson (617) 494-2431
Monitoring of MBTA Slurry Wall Construction	MA-06-0100	$50,000	March 1979-April 1981	TSC/FHWA; MBTA	Phillip Mattson (617) 494-2431
Design of Soft Ground Tunnels	MA-06-0100	$155,000	Aug. 1979-Feb. 1981	TSC; Stanford University	Phillip Mattson (617) 494-2431
Compaction Grouting Test Section	MD-06-0036	$51,000	Aug. 1977-Dec. 1979	MTA	Gilbert Butler (202) 426-0090
Development of an Extruded Tunnel Lining System (ETLS)	MA-06-0100	$2,051,000	Jan. 1978-July 1981	TSC; Foster Miller Associates, Inc.	Gerald Saulnier (617) 494-2006
ETLS Deployment Analysis	MA-06-0100	$30,000	Oct. 1980-Oct. 1981	TSC, Delon Hampton Associates	Gerald Saulnier (617) 494-2006
Berkeley Hills Tunnel Instrumentation Analysis	CA-06-0120	$100,000	Dec. 1978-April 1981	BART	Gilbert Butler (202) 426-0090
Porter Square Design Evaluation	MA-06-0127	$220,000	Oct. 1980-Dec. 1981	MBTA	Gilbert Butler (202) 426-0090
In Situ Stress Measurements in Tunnels	DC-06-0312	$23,000	Aug. 1980-Sept. 1981	National Science Foundation; University of California, Berkeley	Gilbert Butler (202) 426-0090
Tunnel Boring Machine Evaluation	MA-06-0100	$164,000	July 1980-July 1982	TSC; Goldberg, Zoino and Associates	Paul Witkiewicz (617) 494-2006
Analysis of Dipped Guideways for Rail	CA-06-0144	$150,000	July 1980-Dec. 1981	Jet Propulsion Laboratory	Gilbert Butler (202) 426-0090

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate ofice.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

REQUIREMENTS ANALYSIS AND EVALUATION

Urban Rail Supporting Technology: A Five Year Progress Summary 1971-1976
Proj. MA-06-0025
Transportation Systems Center
June 1976, PB 259-090

Rail Transit System Cost Study, Revision I: Final Report
Proj. MA-06-0025
Thomas K. Dyer, Inc.
March 1977, PB 266-918

Assessment of Washington Metropolitan Area Rail Rapid Transit System
Proj. MA-06-0060
Transportation Systems Center

Roster of North American Rapid Transit Cars 1945-1980 (2nd Edition)
Proj. DC-06-0121
American Public Transit Association
July 1980, PB 80-213-564

SYSTEMS INTEGRATION AND DEPLOYMENT

Standardization

Determination of the Optimal Approach to Rail Rapid Transit Car Standardization
Proj. IT-06-0131
International Research and Technology Corp.
August 1976, PB 259-363

Cost Savings Potential of Modification to the Standard Light Rail Vehicle Specification
Proj. MA-06-0025
N. D. Lea and Associates
June 1979, PB 295-070

An Investigation of Rail Rapid Transit Carbody Materials
Proj. IT-06-0175
Decision Group
March 1980, PB 80-170-970

A General Specification for Procurement of Light Rail Vehicles (Review Draft)
Proj. MA-06-0125
N. D. Lea and Associates
May 1980

Proposed Analysis Methodology for Rail Car Propulsion System Selection
Proj. IT-06-0229
N. D. Lea and Associates
May 1980

Noise Abatement

Urban Rail Noise Abatement Program: A Description
Proj. MA-06-0099
Transportation Systems Center
March 1979

Noise Rating Criteria for Elevated Rapid Transit Structures
Proj. MA-06-0099
Bolt, Beranek and Newman, Inc.
May 1979

In-Service Performance and Costs of Methods for Control of Urban Rail System Noise: Experimental Design
Proj. MA-06-0025
DeLeuw Cather and Co. and Wilson, Ihrig and Associates
May 1976, PB 257-200

In-Service Performance and Costs of Methods for Control of Urban Rail System Noise: Test and Evaluation Plan
Proj. MA-06-0025
DeLeuw Cather and Co. and Wilson, Ihrig and Associates
April 1977, PB 272-521

In-Service Performance and Costs of Methods for Control of Urban Rail System Noise: Initial Test Series Report
Proj. MA-06-0025
DeLeuw Cather and Co. and Wilson, Ihrig and Associates
August 1978, UMTA-MA-06-0025-78-7

Prediction and Control of Noise and Vibration in Rail Transit Systems
Proj. MA-06-0025
L. G. Kurzweil and R. Lotz
September 1978, UMTA-MA-06-0025-78-8

Noise Assessment of the Bay Area Rapid Transit System
Proj. MA-06-0025
Wilson, Ihrig and Associates
October 1978, UMTA-MA-06-0025-78-10

Noise Assessment of the Greater Cleveland Regional Transit Authority Heavy Rail Transit System
Proj. MA-06-0025
Boeing Vertol Co.
October 1978, UMTA-MA-06-0025-78-12

Noise Assessment of the Port Authority Transit Corporation, Lindenwold Rail Transit Line
Proj. MA-06-0025
Boeing Vertol Co.
October 1978, UMTA-MA-06-0025-78-9

Noise Assessment of the Southeastern Pennsylvania Transportation Authority Heavy Rail Transit System
Proj. MA-06-0025
Boeing Vertol Co.
October 1978, UMTA-MA-06-0025-78-11

Noise Assessment of the New York City Rail Rapid Transit System
Proj. MA-06-0025
Polytechnic Institute of New York
January 1979, UMTA-MA-06-0025-79-7

Noise Assessment of the Chicago Transit Authority Rail Rapid Transit System
Proj. MA-06-0025
University of Illinois
January 1979, UMTA-MA-06-0025-79-8

Noise Abatement in Rail Rapid Transit: Effect of Some Variations
Proj. NY-11-0002
Polytechnic Institute of New York
December 1978. UMTA-NY-11-0002-79-1

Noise Degradation Over Time of Rail Rapid Transit Cars
Proj. NY-11-0002
Polytechnic Institute of New York
December 1978, UMTA-NY-11-0002-79-2

In-Service Performance and Costs of Methods to Control Urban Rail System Noise: Final Report
Wilson, Ihrig and Associates and Deleuw Cather and Co.
December 1979, UMTA-MA-06-0099-80-2

Urban Rail Noise Abatement Program: A Description
L. C. Kurzweil, W. Cobb, M. G. Dinning
March 1980, UMTA-MA-06-0099-80-2

Noise Impact Inventory of Elevated Structures in U.S. Urban Rail Rapid Transit Systems
D. A. Towers
September 1980, UMTA-MA-06-0099-80-5

Noise Control for Rapid Transit Cars on Elevated Structures: Preliminary Investigation of Vehicle Skirts, Urdercar Absorption, and Noise Barriers
C. E. Hanson, et al.
April 1980, UMTA-MA-06-0099-80-4

Urban Rail Noise Abatement Program Digest
May 1980, UMTA-MA-06-0099-80-3

Noise Rating Criteria for Elevated Rapid Transit Structures (Reprint)
T. J. Schultz
March 1980, UMTA-MA-06-0099-79-3

Wayside Noise of Elevated Rail Transit Structures: Analysis of Published Data and Supplementary Measurements
E. Ungar and L. Wittig
September 1980, UMTA-MA-06-0099-80

Transportation Test Center

General Vehicle Test Instrumentation Evaluation: Final Report
Proj. MA-06-0025
Transportation Systems Center
March 1977, PB 269-598

General Vehicle Test Instrumentation Manual: Operational Handbook
Proj. MA-06-0025
Transportation Systems Center
September 1977, PB 274-543

WMATA Rapid Transit Vehicle Engineering Tests
Proj. MA-06-0025
K. J. Simmonds and F. H. Henderson
May 1979, PB 298-978

SLRV Engineering Tests at Department of Transportation, Transportation Test Center—Final Test Report,
Volumes I-IV
Proj. MA-06-0025
June 1979, UMTA-MA-06-0025-79-5

Massachusetts Bay Transportation Authority Blue Line Vehicle Evaluation: Final Report
August 1980, FRA-TTC-80/01

Wheel/Rail Dynamics

Measurement of Wheel/Rail Forces at the Washington Metropolitan Area Transit Authority
Vol. I, **Analysis Report; Interim Report**
C. Phillips, H. Weinstock, R. Greif, and W. Thompson
July 1980, UMTA-MA-06-0025-80-6

Measurement of Wheel/Rail Forces at the Washington Metropolitan Area Transit Authority
Vol. II, **Test Report; Interim Report**
D. R. Ahlbeck, H. D. Harrison, and J. M. Tuten
July 1968, UMTA-MA-06-0025-80-7

Analysis of Wheel/Rail Force and Flange Force During Steady State Curving of Rigid Trucks: Interim Report
H. Weinstock and R. Greif
September 1980, UMTA-MA—06-0025-80

Crashworthiness

Increased Rail Transit Vehicle Crashworthiness in Head-On Collisions
Vol. I, **Initial Impact: Final Report**
E. Hahn
June 1980, UMTA-MA-06-0025-80-1

Increased Rail Transit Crashworthiness in Head-On Collisions
Vol. II, **Primary Collision: Final Report**
E. Hahn, S. Walgrave, and T. Liber
June 1980, UMTA-MA-06-0025-80-2

Increased Rail Transit Vehicle Crashworthiness in Head-On Collisions
Vol. III, **Guidelines for Evaluation and Development of New Railcar Designs: Final Report**
A., Wiedermann, A. Longinew, and E. Hahn
June 1980, UMTA-MA-06-0025-80-3

Increased Rail Transit Vehicle Crashworthiness in Head-On Collisions
Vol. IV, **Train User's Manual: Final Report**
E. Hahn
June 1980, UMTA-MA-06-0025-80-4

VEHICLE AND EQUIPMENT TECHNOLOGY

Propulsion Systems

Energy Storage Propulsion System for Rapid Transit Cars: System Design and Equipment Description
Proj. NY-06-0006
Metropolitan Transportation Authority
September 1975, PB 249-063

Flywheel Propulsion Simulation: Final Report
Proj. MA-06-0044
Alexander Kusko, Inc.
May 1977, PB 272-259

Engineering Tests for Energy Storage Cars at the Transportation Test Center
Proj. MA-06-0025
May 1977, Vols. I-IV, PB 269-399
Vol. I. **Program Description and Test Summary,** PB 269-400
Vol. II, **Performance Power Consumption and Radio Frequency Interference Tests,** 269-401
Vol. III, **Noise Tests,** PB 269-402
Vol. IV, **Ride Roughness Tests,** PB 269-403

Urban Rail Vehicle and Systems Program: Annual Report
Proj. IT-06-0023
Boeing Vertol Company
October 1977, PB 295-124

Urban Rapid Rail Vehicle and Systems Program: Annual Report
Proj. IT-06-0026
October 1978, PB 301-168

Energy Storage Propulsion System for Rapid Transit Cars: Test Results and System Evaluation
Proj. NY-06-0006
Metropolitan Transportation Authority
October 1978, PB 300-918

The Advanced Subsystems Development Program (ASDP) Self-Synchronous Propulsion for Rapid Transit Cars
Vol. I, **Program Synopsis**
Vol. II, **Detailed Technical Discussion**
Vol, III, **Appendices**
Proj. IT-06-0026
Delco Electronics
December 1978, PB 298-770, PB 298-771
PB 298-772

The Act-1 Advanced Concept Train Development Program: Design, Fabrication and Tests
Proj. IT-06-0026
Boeing Vertol Company
April 1979, UMTA-IT-06-0026-79-2

The Act-1 Advanced Concept Train Engineering Test Program at the Transportation Test Center
Proj. IT-06-0026
May 1979. PB 80-155286

The Status of Advanced Propulsion Systems for Urban Rail Vehicles
Proj. VA-06-0053
MITRE Corporation
May 1979, PB 298-770

The Advanced Subsystems Development Program (ASDP): Final Project Report
Proj. IT-06-0026
Boeing Vertol Company
August 1979

Proceedings of the International Conference on Advanced Propulsion Systems for Urban Rail Vehicles
Proj. VA-06-0053
MITRE Corporation
February 1980, PB 80-149-099

Chopper Induced Interference in Audio-Frequency Automatic Train Control Systems
Proj. MA-06-0025
University of Lowell
March 1980

Rail Transit Fare Collection Overview
Proj. CA-06-0116
Jet Propulsion Laboratory
April 1980

An Analysis of Urban Rail and Construction Technology Development and Deployment Projects
Proj. CA-06-0116
Jet Propulsion Laboratory
May 1980

Automatic Fare Collection Equipment, Reliability and Maintainability Assessment Plan for Urban Rail Transit Properties
Proj. MA-06-0026
Automated Services, Inc.
June 1980

Assessment of WMATA's Automatic Fare Collection Equipment Performance
Proj. MA-06-0026
Input/Output Computer Services, Inc.
July 1980

Rail Transit Winterization Technology and Systems Operations Study
Proj. MA-06-0025
Alexander Kusko, Inc.
July 1980

Effects of the Metropolitan Dade County Rapid Transit System on the Electromagnetic Environment
Proj. MA-06-0025
Radiation Sciences, Inc.
August 1980

CONSTRUCTION TECHNOLOGY

Contracting and Management

Insurance for Urban Transportation Construction
Proj. MA-06-0025
Cresheim Co., Inc.
June 1977, PB 272-108

Development of Economic Factors in Tunnel Construction
Proj. MA-06-0025
Bechtel Corporation
December 1977, PB 280-878

Economic Factors in Tunnel Construction
Proj. MA-06-0025
E. Foster, et al.
February 1979, PB 294-726

Exploratory Study on Responsibility, Liability and Accountability for Risks in Construction
Committee on Responsibility, Liability, and Accountability, National Research Council, National Academy of Sciences
1978

Recommendations for Better Management of Major Underground Construction Projects
Subcommittee on Management of Major Underground Construction Projects.
National Committee on Tunneling Technology, National Academy of Sciences
1978, PB 236-973

A Quantitative Method for Analyzing the Allocation of Risks in Transportation Construction
Proj. MA-06-0100
R. E. Levitt, et al.
April 1979, PB 295-099

Management of Urban Construction Programs
Vol. I, **Guidelines for Development of Project Management Plans.**
Vol. II, **Supplemental Information**
Committee on Management of Urban Construction.
Building Research Advisory Board
National Research Council
1980

Elevated Structures

Static and Dynamic Tests of Full-Scale Double-Tee Girders for Dade County Rapid Transit System
Proj. FL-06-0017
Metropolitan Dade County
October 1979, UMTA-FL-06-0017-80-1

Track and Wayside

Track Geometry System Software Manual
Proj. MA-06-0025
Transportation Systems Center
April 1978, PB 285-558

Laboratory Evaluation of Concrete Ties and Fastenings for Transit Use
Proj. MA-06-0100
Amir N. Hanna
March 1979, PB 297-533

Measurement Program for Evaluation of Concrete Ties and Fastenings in Transit Track
Proj. MA-06-0100
Amir N. Hanna
March 1979, PB 297-570

Preliminary Specifications for Standard Concrete Ties and Fastenings for Transit Track
Proj. MA-06-0100
Amir N. Hanna
March 1979, PB 297-850

U.S. Transit Track Assessment and Research Needs
Proj. MA-06-0100
E. G. Cunney, et al.
December 1979, PB 80-196-892

Tunneling Technology

Pneumatic-Hydraulic Material Transport System for Rapid Excavation of Tunnels
Proj. MA-06-0025
R. R. Faddick and J. W. Martin
August 1974, PB 295-619

Construction Monitoring of Soft Ground Rapid Transit Tunnels: A Definition of Needs and Potential Developments
Proj. MA-06-0025
B. Schmidt, et al.
November 1974, PB 241-536

A Computer Model for Sizing Rapid Transit Tunnel Diameters
Proj. MA-06-0025
January 1976

Subway Environmental Design Handbook: Volume I, Principles and Applications: Second Edition
Proj. DC-06-0010
Transit Development Corporation, Inc.
March 1976, PB 254-788

Subsurface Exploration Methods for Soft Ground Rapid Transit Tunnels
Proj. MA-06-0025
Parsons, Brinckerhoff, Quade and Douglas, Inc. and Soil and Rock Instrumentation, Inc.
Vol. I, **Sections 1-6 and References**
Vol. II, **Appendices A-F**
April 1976, PB 258-342/AS-SET

Assessment of Disruptive Effects Associated With Urban Transportation Tunnel Construction
Proj. MA-06-0025
ABT Associates, Inc.
June 1976, PB 256-848

Proceedings: Seminar on Underground Construction Problems, Techniques and Solutions, Chicago, Illinois, October 20-22, 1975
Proj. MA-06-0025
Chicago Urban Transportation District
December 1976, PB 264-027

Guidelines for Improved Rapid Transit Tunneling Safety and Environmental Impact
Proj. MA-06-0025
A. A. Mathews, Inc.
January 1977
Vol. I, **Safety,** PB 271-047
Vol. II, **Environmental Impact,** PB 271-048

Construction Monitoring of Soft Ground Tunnels: A Rational Handbook of Practices for Rapid Transit System Planners and Managers
Proj. MA-06-0025
Parsons, Brinckerhoff, Quade and Douglas, Inc.
January 1977, PB 264-361

Study of Subway Station Design and Construction: Final Report
Proj. MA-06-0025
DeLeuw Cather and Company and Skidmore, Owings and Merrill
March 1977, PB 268-894

Muck Utilization Planning, Urban Transportation Tunneling: A Handbook of Rational Practices for Planners and Designers
Proj. MA-06-0025
Haley and Aldrich, Inc.
May 1977, PB 272-139

Development of Design Procedures for Stabilized Soil Support Systems for Soft Ground Tunneling
Proj. DC-06-0158
G. W. Clough
Vol. I, **A Report on the Practice of Chemical Stabilization Around Soft Ground Tunnels in England, France and Germany,**
June 1977, PB 272-771
Vol. II, **Preliminary Results,**
August 1977, PB 273-064
Vol. III, **Analysis and Design Method**
Vol. IV, **WMATA Case Studies,**
October 1978, PB 295-757

MARTA Tunnel Construction in Decatur, Georgia: A Case Study of Impacts
Proj. MA-06-0025
July 1977, PB 271-366

Proceedings: Workshop on Materials Handling for Tunnel Construction
Proj. MA-06-0025
Colorado School of Mines
August 1977, PB 276-602

Muck Utilization in Urban Transportation Tunneling Process: Final Report
Proj. MA-06-0025
Haley and Aldrich, Inc.
December 1977, PB 278-066

The Transportation of Tunnel Muck by Pipeline
Proj. MA-06-0025
Colorado School of Mines
January 1978, PB 281-103

Rapid Transit Subways: Maintenance and Engineering Report
Proj. MA-06-0025
James Birkmyer
January 1978, PB 279-691

Rapid Transit Subways: Guidelines for Engineering New Installations for Reduced Maintenance
Proj. MA-06-0025
James Birkmyer
January 1978, PB 279-453

Rapid Transit Subways: Maintenance Guidelines
Proj. MA-06-0025
James Birkmyer
January 1978, PB 279-692

Settlements Around Tunnels in Soils: Three Case Studies
H. H. MacPherson, et al.
Proj. IL-06-0043
March 1978, PB 290-856

Tunneling for Urban Transportation: A Review of European Construction Practice
Proj. IL-06-0041
T. D. O'Rourke
August 1978, PB 292-462

Analysis of Ground-Liner Interaction for Tunnels
Proj. IL-06-0043
R. E. Rankin, et al.
October 1978, PB 294-818

Proceedings: Seminar on the Use of Composite Third Rail in Electrified Transit and Commuter Rail Systems
Proj. MA-06-0025
H. D. Decker, Editor
November 1978, PB 293-317

Experimental Verification of a Pneumatic Transport System for the Rapid Excavation of Tunnels Part II—Test Program
Proj. MA-06-0025
J. W. Martin and R. R. Faddick
December 1978, PB 295-032

Experimental Verification of a Pneumatic Transport System for the Rapid Excavation of Tunnels Part I—Installation of the Test Facility
Proj. MA-06-0025
J. W. Martin and K. R. Faddick
March 1979, PB 295-456

Materials Handling for Urban Tunneling in Rock
Proj. MA-06-0025
J. M. Duncan, et al.
May 1979, PB 299-117

The Atlanta Research Chamber: Applied Research for Tunnels (Monographs)
Proj. GA-06-0017
Don C. Rose, et al.
June 1979, PB 297-574

Potential for Standardization in Rail Transit Tunnel Construction
Proj. DC-06-0182
Delon Hampton
August 1979, UMTA-DC-06-0182-79-1

Factors Influencing the Performance of Full Face Hard Rock Tunnel Boring Machines
Proj. CA-06-0122
G. Korbin
September 1979, UMTA-CA-06-0122-79-1

Mechanical Tunneling in Solid Rock: Final Translation
Werner Rutschmann
May 1980, PB-221-013

Extruded Tunnel Lining System: Phase I, Conceptual Design and Feasibility Testing
Proj. MA-06-0100
Brian J. Doherty, et al.
September 1979, PB 80-118-011

Field Evaluation of Fracture Control in Tunnel Blasting
Proj. MA-06-0100
D. E. Thompson, et al.
December 1979, PB 80-149-297

Proceedings: Workshops on Tunnel Lining Design
Proj. MA-06-0100
Gary S. Brierly, Editor
December 1979, PB 80-171-366

Field Evaluation of Advanced Methods of Subsurface Exploration for Transit Tunneling
Proj. MA-06-0100
D. E. Thompson, et al.
June 1980, PB 80-200-496

Shotcrete for Underground Support
Robin Mason, Conference Chairman
Engineering Foundation Conference
April 1978

Urban Tunneling Technology Program Digest
Proj. MA-06-0100
Transportation Systems Center
April 1980, UMTA-MA-06-0100-80-3

Improved Design of Tunnel Supports
Proj. MA-06-0100
H. H. Einstein
Executive Summary
December 1979, PB 80-134-547
Vol. I, **Simplified Analysis of Ground-Structure Interaction in Tunneling**
June 1980, UMTA-MA-06-0100-80-4
Vol. II, **Aspects of Yielding in Ground-Structure Interaction**
June 1980, UMTA-MA-06-0100-80-5
Vol. III, **Finite Element Analysis of the Peachtree Center Station in Atlanta**
June 1980, UMTA-MA-06-0100-80-6
Vol. IV, **Tunneling Practices in Austria and Germany**
June 1980, UMTA-MA-06-0100-80-7
Vol. V, **Empirical Methods in Rock/Tunneling: Review and Recommendations**
June 1980, UMTA-MA-06-0100-80-8

CHAPTER 4

New Systems and Automation

Trends and Highlights

Transit systems in which automatic vehicles are designed to travel along their own separate guideways are classified as automated guideway transit (AGT) systems. A number of such systems are currently in operation at activity centers across the country, including airports, shopping centers, college campuses, and amusement parks. The Urban Mass Transportation Administration has major programs to develop and also to install automated guideway transit systems.

Automated transit systems provide a means for reducing labor costs while providing performance and safety. Studies of automated system performance and service indicate that such systems have a very high potential for affecting the movement of people within cities. When installed in suitable configurations, such systems will provide a level of service significantly superior to that provided by current bus and rail transit.

Guideway configurations covering significant areas, using automobile or other feeders, and providing trips with short travel times and few intermediate stops between origin and destination stations, are an important potential resource for serving the transit needs of cities.

UMTA's overall program in AGT includes these major elements: Automated Guideway Supporting Technology; New Systems Alternatives; Advanced Group Rapid Transit Systems (AGRT); and the Downtown People Mover (DPM). Work in these areas, reported in this chapter and Chapter 5 and 7, is highly interrelated. For example, the new systems alternatives research includes performing assessments of existing foreign and domestic systems, providing supporting

data for the DPM program and providing performance criteria for more advanced systems and technologies.

A significant milestone in the UMTA AGT program was the award, in June 1979, of contracts to Boeing Aerospace Company and Otis Elevator Company for development of AGRT engineering test facilities. The facilities, which will be installed at the Boeing plant in Seattle, Wash., and the Otis plant in Denver, Col., are scheduled for completion at the end of 1985.

Advanced Group Rapid Transit

The goal of the AGRT is the development and installation of engineering verification test facilities which embody the system specifications. The specifications for the AGRT system include achievement of a peak capacity of 14,000 seats per lane per hour using 12-seat vehicles. The use of small vehicles will allow the system to provide a high level of service to dispersed origins and destinations over various urban areas. The system will also be suitable for collection and distribution in central business districts. Trips will be characterized by short waiting and travel times and few intermediate stops.

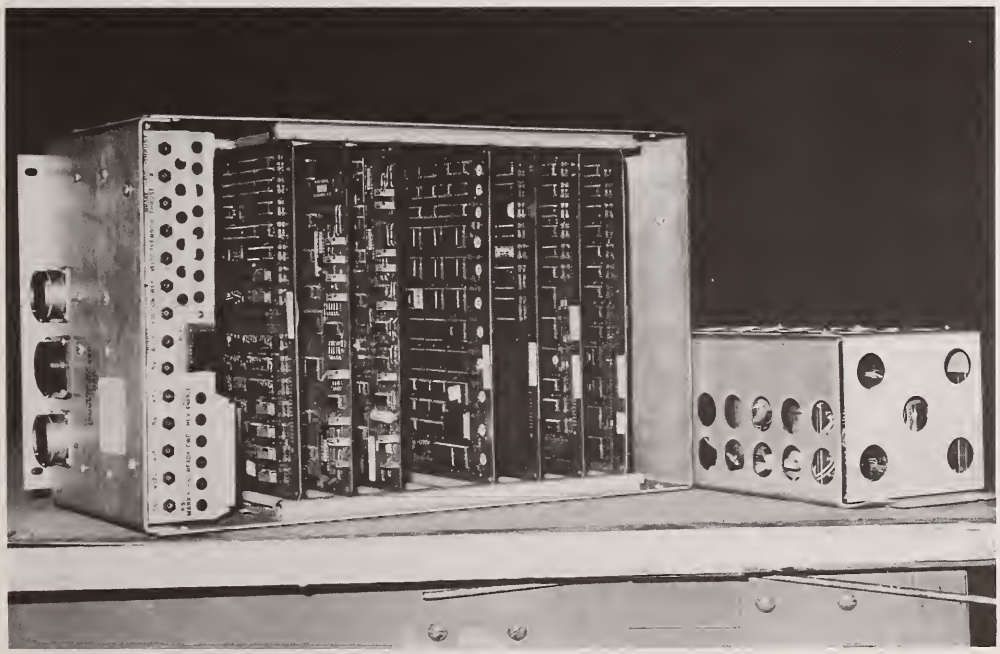
Phase I, the concept definition phase, was completed in August 1975. During Phase I, three contractors, Boeing, Otis and Rohr, produced competing preliminary designs. Phase IIA (VA-06-0023, OH-06-0023, MD-06-0025, DC-06-0140, CA-06-0094, CO-06-0008, WA-06-0008, IT-06-0169), which began in June 1976 and was completed in December 1977, continued the Phase I design competition. The three contractors further developed their designs, conducted development of critical subsystems, and performed extensive simulation studies of the behavior of their systems on a test network provided by UMTA.

The system designed by Boeing utilizes a rubber-tired vehicle steered along a guideway by side-mounted steering wheels which guide both the front and rear axles.

The guideway is U-shaped and is fabricated of reinforced concrete. The vehicles are equipped with a unique radar collision avoidance system. The Boeing version of AGRT is an outgrowth of the Morgantown design.

The Otis Elevator Company system uses a vehicle with an air-cushion suspension system and a single-sided linear induction motor (LIM) propulsion system. The LIM primary is on board the vehicle and the LIM secondary is embedded in the center of the guideway.

Microprocessors permit the evaluation of a variety of strategies used to control the AGT vehicle as it moves along the guideway.



Here too, the guideway is an open U-shaped design. The vehicle emergency braking system uses a skid-type brake pad which contacts the guideway surface under emergency conditions.

The test facilities, which will be installed at the Otis and Boeing plants under Phase IIB of the AGRT program, will enable the contractors to test the critical vehicle control technologies for their systems. Each facility will consist of about 5500 feet of guideway, two vehicles, a station, and a central control facility. Phase IIB is scheduled for completion at the end of 1985.

The development of Romag technology is also being continued, with concentration on subsystem and component development. The development will be carried out by Boeing (WA-06-0014), which acquired rights to Romag under license from Rohr, after Rohr elected to withdraw from the AGRT program. Romag is a vehicle magnetic suspension concept using magnetic forces between the primary and secondary of a linear induction motor to suspend as well as to propel and brake the vehicle. Magnetic suspension offers significant advantages in the areas of noise reduction, guideway wear, and weather resistance.

The proposed magnetic levitation (maglev) system development will be performed in three phases. In Phase I, Boeing will develop concepts for both supported and suspended maglev vehicles. In Phase II, a suspended or supported design will be developed and tested. Phase III will involve the incorporation of design improvements and the extension of the test track facility.

Integrated magnetic levitation and propulsion system concepts have been demonstrated for both suspended and supported AGT vehicles.

Automated Guideway Transit Supporting Technology

The Automated Guideway Transit Supporting Technology program is directed toward the development of technologies that permit the successful deployment of automated guideway transportation systems. Existing elements of this program are directed toward development of analysis, software, subsystems,and components that may be used for a variety of advanced urban transportation systems. New elements will include system-oriented activities.

The Transette system, which propels small vehicles by a moving belt, is being evaluated at the Georgia Institute of Technology.

A major goal of the program is to provide information to system designers and developers. Further goals are to provide information to planners that will assist them in the evaluation of applications and in the reduction of the risk involved in the deployment of new systems.

Previous non-system oriented activities addressed to new systems of transportation included a variety of subsystem development projects (Development Engineering program) and command and control studies (Applied Physics Laboratory). The Automated Guideway Transit Supporting Technology program has expanded the scope of these earlier programs and is focused on three areas: system technology, subsystem and component technology, and wayside technology.

At the system technology level, the major thrusts were in the area of system simulations and operational analyses, and the identification of methods to improve passenger safety and security. The performance of system-level operational analyses provides the needed technical and cost data. Use of analytical tools, such as computer simulations, will generate data that permit local urban planners and government officials to evaluate expected performance characteristics and to identify and project various cost elements of a proposed automated ground transportation system.

The System Operations Studies program (MA-06-0048) addressed a wide spectrum of different technologies ranging from large vehicle shuttles to Personal Rapid Transit (PRT) systems. Both single and multiple vehicle configurations were considered.

A complete set of AGT system planning models in the form of computer simulation programs was developed which permit the user to develop detailed cost and service information for a proposed AGT deployment starting from zone-to-zone trip demand data, feeder characteristics, station locations and configurations, and network geometry. Analysis fidelity ranges from average traffic flow to detailed representations of individual passengers and vehicles. The models are applicable to all classes of AGT technology and useful to planners in all facets of system operations.

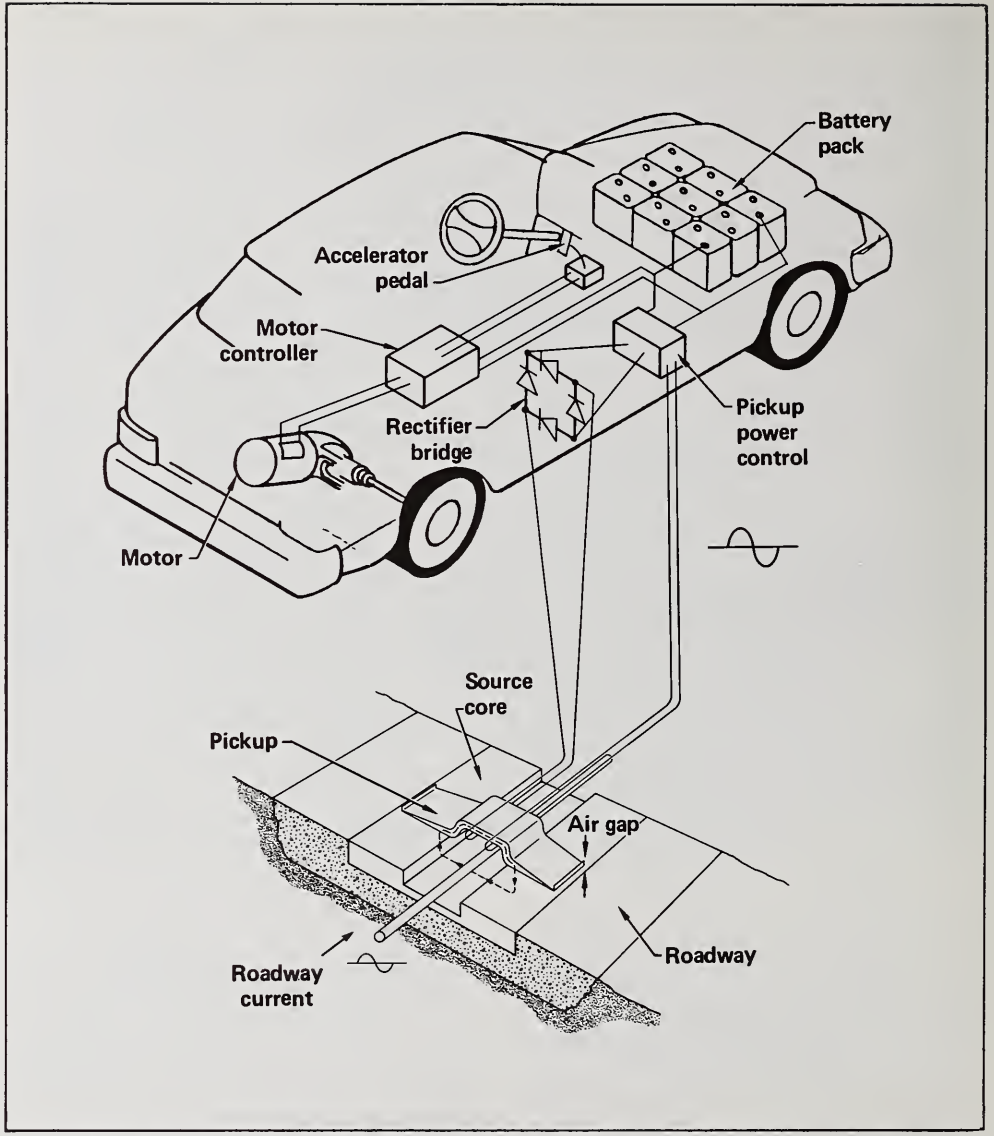
The System Safety and Passenger Security Studies program (MA-06-0048) evaluated various methods of minimizing vandalism and enhancing passenger security and safety in automated systems.

Studies were conducted to determine design guidelines and requirements for automated systems. Particular emphasis was placed on user and nonuser impacts, and on passenger safety and comfort.

Security and safety enhancement techniques currently employed by transit authorities were identified and evaluated. Specific emphasis was given to architectural design, police methods, surveillance techniques, evacuation, rescue, and the values passengers place on security features. A highlight of this project was evaluation of a television surveillance experiment which was carried out in an at-grade station on a New York subway line. In addition, experiments were conducted to establish relations between design and permissible emergency braking levels.

The Subsystem and Component Technology area treated two key technical topics that are common to all AGT systems: vehicle longitudinal control and reliability, and vehicle lateral control and switching.

The Vehicle Longitudinal Control and Reliability project (IT-06-0148) was concerned with the improvement of performance, reliability, and maintenance of longitudinal systems, with fail-operational design concepts receiving particular attention. Redundant implementation provides the key to operation that permits vehicles suffering single failures to continue to the nearest maintenance area, station, or siding. Fail-operational design approaches using microprocessors will significantly improve the mean time between failures which might lead to vehicle breakdowns on the guideway. The longitudinal control studies also explored the potential of a variety of control approaches including



Non-contact inductive power collection is being evaluated for application to battery powered transit vehicles which use roads as well as separate guideways.

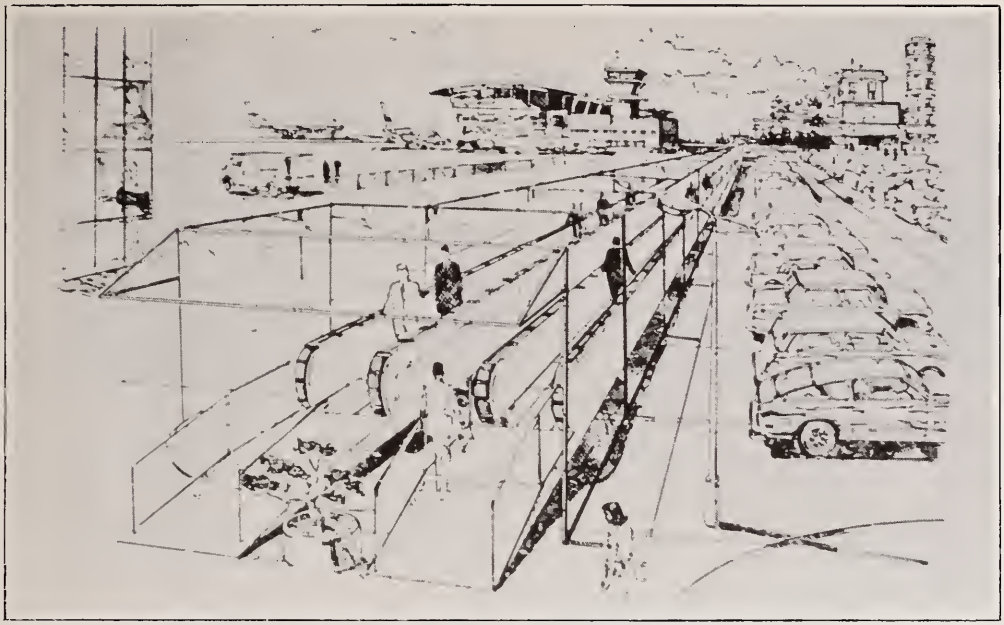


Illustration of a possible application of a high-speed moving walkway.

vehicle-follower and point-follower strategies. The longitudinal control system project included analyses, evaluation, design, and experimental investigations. Extensive testing included operations at headways in the five second range.

The Vehicle Lateral Control and Switching project (IT-06-0156) explored techniques to improve reliability, reduce costs and improve performance of vehicle electronic wire-follower and mechanical wall-follower lateral control and switching systems. Reducing the guideway length required to execute switching maneuvers and improving ride comfort were two major objectives of this program that included lateral control and switching system design analyses, computer simulations, and vehicle tests at the contractor's facility. A test vehicle was built and testing was carried out at the contractor's test track and at Lowry Air Force Base.

All the investigations in the longitudinal and lateral control areas have been related to cost and performance goals to assure that they reflect practical objectives. The work in this area included review of the status of existing technology, detailed mathematical modeling, analyses and simulation, development of design concepts, and experimental validation of those designs.

The Wayside Technology area was addressed through the Guideway and Station Technology project (IT-06-0152). This project included studies of implementation technologies for guideways, stations, power distribution systems, and weather protection concepts. Reduction of cost, implementation time, and environmental impact of guideways and stations were emphasized.

In addition to the major projects discussed above, a number of smaller projects are being pursued. A study has been performed to identify measures of service availability as used by operators, manufacturers, and researchers (MA-06-0048). Projects also include work in a number of related areas, such as the development of a hydrostatic drive for AGT vehicles (CA-06-0108); the development of an instrumented vehicle to detect malfunctions and thus minimize downtime (WA-06-0009); evaluations of a single-sided linear induction motor for both suspension and propulsion (VA-06-0035); and automated mixed traffic transit (AMTT) technology development (CA-06-0088) concentrating on a system using vehicles having sophisticated sensors that permit operation at 2 to 5 kph (1.2 to 3 mph) speeds in pedestrian areas, or at higher speeds on semiprotected rights of way.

Transette, an innovative moving belt transport system has been installed at the Georgia Institute of Technology (GA-06-0009) to transport students. A detailed assessment of its characteristics has been carried out. A grant was awarded

for upgrading future development of the Transette system. An inductive power transfer concept to allow for the transfer of electric energy from the surface of a road to a vehicle without direct electrical contact is being evaluated by Lawrence Livermore Laboratory (CA-06-0143) to determine its applicability to transit systems.

A number of independent study contracts were also awarded to assist the UMTA staff in evaluating technical approaches, performing cost analyses, developing new hardware system concepts, and evaluating environmental impacts of AGT systems, (VA-06-0056, MD-06-0038, MD-06-0050).

The data and analytical tools obtained from each program are being documented. As progress is made in the development of supporting technology, workshops will be conducted, where appropriate, to disseminate the data to system designers and urban planners. Data evolving from the program will also be applied to a broad spectrum of automated guideway technologies ranging from simple shuttles to network applications.

Ongoing work involves further development and application of the System Operations Studies models; a detailed study of AGT station operations; and further technology development for innovative transit systems sucha s AMTT and Transette.

The technical results of the AGTST program will be an important factor in decreasing the technical and economic risks associated with the development and installation of AGT systems. Developments in the supporting technology program have already been utilized in planning the AGRT and the Downtown People Mover Systems.

Accelerating Walkways

Accelerating Walkways (IT-06-0126) are novel pedestrian-assist devices capable of transporting large numbers of travelers over short distances. A typical accelerating walkway moves at something less than normal walking speed for boarding and unloading but increases to more than twice the normal walking speed for the main portion of the trip. Accelerating walkways can provide service within and near activity centers such as transit terminals. Such systems hold promise of improving ridership on subways and commuter rail lines through provision of improved access, short trip times, and reduced congestion. Accelerating walkways compare favorably in both cost and travel time with vehicular travel.

Several prototype systems have been developed, but none provide service to the public. UMTA tentatively plans to install, and demonstrate in public service, an accelerating walkway in the Conrail-PATH station in Hoboken, N.J. The walkway will be approximately 300 feet in length and will connect Conrail commuter trains to the Port Authority Trans Hudson line to New York.

The program has five phases. The first phase, Feasibility Study, has been completed. The study provided a comprehensive overview of accelerating walkway technology, identified potential applications and associated cost benefits, and provided an independent safety assessment. Phase II study contracts of approximately $100,000 each have been completed by four contractors—Ateliers et Chantiers de Bretagne, Boeing Aerospace, Dean Research, and Dunlop. The contracts covered design documentation, analytical studies, and preliminary demonstration studies.

Phase III will involve fabrication and test of up to two accelerating walkways at the manufacturers' plants. Phase IV, Public Demonstration, provides for system implementation, testing, public demonstration, and evaluation. Phase V provides for introduction of design improvements based on the data obtained from the demonstration.

New Systems and Automation

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
ADVANCED GROUP RAPID TRANSIT SYSTEMS					
Phase IIB AGRT Development	WA-06-0011 CO-06-0011	$27,000,000 $25,000,000	Sept. 1978- Sept. 1985	Boeing Aerospace Co.; Otis Elevator Co.	Aldo DeSimone (202) 426-9264
Technical Studies in Guideway and Vehicle Systems	VA-06-0186	$800,000	Sept. 1978- Sept. 1982	MITRE Corporation	James Hamm (202) 426-9264
Technical Studies in Safety and Dependability	OH-06-0190	$500,000	July 1979- Oct. 1982	Battelle Columbus Laboratory	Raymond Brunson (202) 426-9264
Technical Studies in Command and Control	MD-06-0047	$975,000	Aug. 1979- Dec. 1982	Johns Hopkins University Applied Physics Laboratory	Duncan MacKinnon (202) 426-4047
AUTOMATED GUIDEWAY TRANSIT SUPPORTING TECHNOLOGY					
Operation Studies	MA-06-0048	$350,000	Sept. 1979- Sept. 1981	TSC; General Motors Corporation	Arthur Priver (617) 494-2357
Passenger Interface	MA-06-0048	$175,000	Feb. 1979- Feb. 1981	TSC; Dunlap and Associates	E. D. Sussman (617) 494-2041
AGT Vehicle Longitudinal Control and Reliability	IT-06-0148	$2,561,000	March 1977- March 1980	Otis Elevator Co.	Robert Hoyler (202) 426-4047
AGT Vehicle Lateral Control and Switching	IT-06-0156	$869,000	Aug. 1977- March 1980	Otis Elevator Co.	George Izumi (202) 426-4047
Inductive Power for Transit Application	CA-06-0143	$150,000	Aug. 1980- Feb. 1982	Lawrence Livermore Laboratory	George Izumi (202) 424-4047
AMTT Technical Development	CA-06-0088	$645,000	Feb. 1976- Dec. 1981	California Institute of Technology	Robert Hoyler (202) 426-4047
Engineering Modifications and Test of Transette	GA-06-0009	$248,000	July 1980- Sept. 1981	Georgia Institute of Technology	George Anagnostopolous (617) 494-2758

New Systems and Automation

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
AUTOMATED GUIDEWAY TRANSIT SUPPORTING TECHNOLOGY					
AGTST Independent Technical Evaluation	VA-06-0056	$350,000	Nov. 1979-Nov. 1982	MITRE Corporation	George Izumi (202) 426-4047
Independent Control Analysis	MD-06-0050	$250,000	Sept 1980-Jan. 1982	Johns Hopkins University Applied Physics Laboratory	Robert Hoyler (202) 426-4047
Safety and Reliability of AGT Systems	OH-06-0028	$150,000	Oct. 1979-Dec. 1980	Battelle Columbus Laboratory	Robert Hoyler (202) 426-4047
Independent Safety Analysis	OH-06-0030	$50,000	Oct. 1980-Oct. 1981	Battelle Columbus Laboratory	Robert Hoyler (202) 426-4047
Passive Vehicle Studies	TX-06-0030	$25,000	Oct. 1979-July 1980	Vought Corp.	Robert Hoyler (202) 426-4047
Inductive Power Transfer	CA-06-0143	$150,000	Aug. 1980-Feb. 1982	Lawrence Livermore Laboratory	George Izumi (202) 426-4047
ACCELERATING WALKWAY PROGRAM					
Accelerating Walkways	IT-06-0126	$5,748,000	Aug. 1976-Sept. 1983	Tri-State Regional Planning Commission; Port Authority of New York and New Jersey	George Izumi (202) 426-4047

Bibliography

This list of reports contains those published from January 1977 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

Advanced Group Rapid Transit System Development Program, Phase IIA: Executive Summary
Proj. CA-06-0094
Rohr Industries, Inc.

Advanced Group Rapid Transit System Development Program, Phase IIA: Executive Summary
Proj. CO-06-0008
Otis Elevator Company

Advanced Group Rapid Transit System Development Program, Phase IIA: Executive Summary
Proj. WA-06-0008
Boeing Aerospace Company

Automated Mixed Traffic Vehicle [AMTV] Technology and Safety Study: Final Report
Proj. CA-06-0088
California Institute of Technology, Jet Propulsion Laboratory
February 1978, N78-25257

AMTV Headway Sensor and Safety Design
Proj. CA-06-0088
California Institute of Technology, Jet Propulsion Laboratory
January 1980, PB 80-179-039

Automated Mixed Traffic Vehicle Study at Washington National Airport
Proj. VA-06-0056
The MITRE Corporation
November 1979, PB 80-121-148

Costs and Energy Efficiency of a Dual-Mode System
Proj. CA-06-0088
California Institute of Technology, Jet Propulsion Laboratory
April 1977, PB 272-714

Point-Follower Automatic Vehicle Control: A Generic Analysis
Proj. MD-06-0022
Johns Hopkins University, Applied Physics Laboratory
May 1977, PB 270-354

A State-Constrained Approach to Vehicle-Follower Control for Short-Headway AGT Systems: Final Report
Proj. MD-06-0022
Johns Hopkins University, Applied Physics Laboratory
August 1977, PB 272-239

Guidelines for Ride-Quality Specifications Based on Transpo '72 Data: Final Report
Proj. MD-06-0022
Johns Hopkins University, Applied Physics Laboratory
October 1977, PB 273-272

Advanced Group Rapid Transit System Development Program, Phase I, Executive Summary
Proj. PA-06-0032
Boeing Vertol Company

Analysis of Short Ramps for Dual Mode and PRT Stations: Final Report
Proj. MA-06-0048
Alden Self-Transit Systems Corporation and Transportation Systems Center
July 1977, PB 272-351

Proceedings of Workshop on Methodology for Evaluating the Effectiveness of Crime Reduction Measures in Automated Guideway Transit Systems: Final Report
Proj. MA-06-0048
Transportation Systems Center
July 1977, PB 273-695

Effects of Deceleration and Rate of Deceleration on Live Seated Human Subjects
Proj. MA-06-0048
Transportation Systems Center
October 1977, PB 284-653

Factors Contributing to the Retention of Seated Passengers During Emergency Stops
Proj. MA-06-0048
Dunlap and Associates
March 1980, PB 80-195-134

Evacuation and Rescue in Automated Guideway Transit
Vol. I. **Data Collection, Scenarios, and Evaluation**
Proj. MA-06-0048
Vought Corporation
December 1979, PB 80-195-761

Evacuation and Rescue in Automated Guideway Transit
Vol. I. **Guidebook**
Proj. MA-06-0048
Vought Corporation
December 1979, PB 80-195-779

Passenger Safety and Convenience Services in Automated Guideway Transit
Vol. I. **Data Collection, Scenarios, and Evaluation**
Proj. MA-06-0048
Vought Corporation
December 1979, PB 80-167-059

Passenger Safety and Convenience and Services in Automated Guideway Transit
Vol. 2. **Guidebook**
Proj. MA-06-0048
Vought Corporation
December 1979, PB 80-167-067

Predicting Automated Guideway Transit System Station Security Requirements
Proj. MA-06-0048
W. V. Rouse and Company
March 1980, PB 80-194-244

Automated Guideway Transit System Passenger Security Guidebook
Proj. MA-06-0048
Dunlap and Associates
March 1980, UMTA-MA-06-0048-79-7

A Quantitative Evaluation of Service: Dependability Modeling Approaches for Automated Guideway Transit
Proj. MD-06-0022
Johns Hopkins University, Applied Physics Laboratory
May 1979, PB 299-584

Operational Concepts and Implementation Techniques for Vehicle-Follower Control of AGT Systems
Proj. MD-06-0038
Johns Hopkins University, Applied Physics Laboratory
August 1979, PB 80-120-207

Control Law Implementation for Short Headway Vehicle-Follower AGT Systems
Proj. MD-06-0038
Johns Hopkins University, Applied Physics Laboratory
October 1979, PB 80-181-019

The Development of Measures of Service Availability,
Volume I: Summary Report
Proj. MA-06-0048
Battelle Columbus Laboratory
UMTA-MA-06-0048-78-2

The Development of Measures of Service Availability,
Volume II: Task Technical Reports
Proj. MA-06-0048
Battelle Columbus Laboratory
UMTA-MA-06-0048-78-3

The Development of Measures of Service Availability,
Volume III: Application Guidelines
Proj. MA-06-0048
Battelle Columbus Laboratory
UMTA-MA-06-0048-78

Automated Guideway Transit Service Availability Workshop
Proj. MA-06-0048
C. W. Watt (editor)
Transportation Systems Center
February 1978, PB 282-295

Vehicle Lateral Control and Switching: Cost and Weight Models
Proj. IT-06-0156
Otis Elevator Company
April 1978, PB 286-551

Vehicle Lateral Control and Switching:
Vol. 1, **Project Summary**
Proj. IT-06-0156
Otis Elevator Company
March 1980, PB 80-199-722

Vehicle Lateral Control and Switching:
Vol. 2, Part A, Design and Analysis Report
Proj. IT-0156
Otis Elevator Company
March 1980, PB 80-199-730

Vehicle Lateral Control and Switching:
Vol. 2, Part B, **Design and Analysis Report**
Proj. IT-06-0156
Otis Elevator Company
March 1980, PB 80-199-748

Vehicle Lateral Control and Switching:
Vol. 3, **Detailed Hardware Studies**
Proj. IT-06-0156
March 1980, PB 80-199-755

Vehicle Lateral Control and Switching:
Vol. 4, **Experimental Program**
Proj. IT-06-0156
Otis Elevator Company
March 1980, PB 80-199-763

Vehicle Lateral Control and Switching:
Vol. 5, **Data Base**
Proj. IT-06-0156
Otis Elevator Company
March 1980, PB 80-199-763

Vehicle Lateral Control and Switching:
Vol. 6, **Software Manual**
Proj. IT-06-0156
Otis Elevator Company
March 1980, PB 80-199-789

Vehicle Lateral Control and Switching: Technology Review
Proj. IT-06-0156
Otis Elevator Company
March 1978, PB 284-799

Life-Cycle Costs and Application Analysis for New Systems
Proj. VA-06-0041
MITRE Corp.
May 1978, PB 229-586

Reliability Study of Operating AGT Systems
Proj. OH-06-0023
H. H. Hunter, R. D. King and D. J. Ochner
December 1977

Safety Performance Criteria
Proj. OH-06-0023
H. H. Hunter, et al.
January, 1978

Accelerating Moving Walkway Systems [AMWS]: Technology Assessment
Proj. IT-06-0126
Port Authority of New York and New Jersey
March 1978, PB 287-082

Accelerating Moving Walkway System: Executive Summary
Proj. IT-06-0126
Port Authority of New York and New Jersey
November 1978, PB 290-682

Accelerating Moving Walkway Systems [AMWS]: Market Attributes, Applications and Benefits
Proj. IT-06-0126
Port Authority of New York and New Jersey
March 1978, PB 287-083

Accelerating Moving Walkway Systems [AMWS]: Safety and Human Factors
Proj. IT-06-0126
Port Authority of New York and New Jersey
March 1978, PB 286-831

Accelerating Moving Walkway Systems [AMWS]: Safety Seminar Proceedings
Proj. IT-06-0126
Port Authority of New York and New Jersey
March 1978, PB 287-084

Accelerating Walkway System Times Square-Grand Central Station Analysis
Proj. VA-06-0041
MITRE Corp.
Dec. 1978, PB 80-181-795

Accelerating Walkway System Analysis at Washington National Airport
Proj. VA-06-0041
MITRE Corp.
June 1979, PB 80-183-841

AGT Guideway and Station Technology,
Vol. 2, **Weather Protection Review**
DeLeuw, Cather and Co.
Proj. IT-06-0152
March 1978, PB 287-522

Independent Study of Personal Rapid Transit
Proj. CA-06-0090
C. L. Olson
December 1977, PB 287-869

AGT Technology Development
Proj. VA-06-0056
MITRE Corp.
March 1980

AGT Conference Proceedings
Proj. MA-06-0048
August 1978, UMTA-MA-06-0048-78-1

Review of Dual Mode Case Studies
Proj. VA-06-0041
MITRE Corp.
April 1979, PB 205-442

Life Cycle Costs and Application Analysis for New Systems
Proj. VA-06-0041
MITRE Corp.
May 1978, PB 299-586

Automated Guideway Transit Technical Data
Proj. VA-06-0041
MITRE Corp.
April 1979, PB 295-095

Vehicle Longitudinal Control and Reliability Projects: A Review of AGT Longitudinal Control and Measurement Technology
Proj. IT-06-0148
Otis Transportation Technology Division
June 1979, PB 80-114-036

Vehicle Longitudinal Control and Reliability Project: A Review of AGT Communication System Technology
Proj. IT-06-0148
Otis Transportation Technology Division
July 1979, PB 80-138-148

Vehicle Longitudinal Control and Reliability Project
Vol. II, **Part A, Review of AGT Propulsion Conditioning, Braking and Power Distribution Technology**
Proj. IT-06-0148
Otis Transportation Technology Division
June 1979, PB 300-373

Vehicle Longitudinal Control and Reliability Project: A Review of Entrainment Technology
Proj. IT-06-0148
Otis Transportation Technology Division
February 1979, PB 300-372

Vehicle Longitudinal Control and Reliability Project, Longitudinal Control Analysis and Design, Part A—SLT and GRT Systems
Proj. IT-06-0148
Otis Transportation Technology Division
May 1979, PB 298-766

Vehicle Longitudinal Control and Reliability Project, Longitudinal Control Analysis and Design, Part B—PRT Systems
Proj. IT-06-0148
Otis Transportation Technology Division
May 1979, PB 298-767

Vehicle Longitudinal Control and Reliability Project: Reliability Enhancement Analysis and Design Test Report
Proj. IT-06-0148
Otis Transportation Technology Division
May 1979, PB 299-525

Vehicle Longitudinal Control and Reliability Project: Longitudinal and Control Cost and Weight Model
Proj. IT-06-0148
Otis Transportation Technology Division
June 1979, PB 299-526

Vehicle Longitudinal Control and Reliability Project: VLCR Entrainment and Platooning Analysis and Design, Parts A and B
Proj. IT-06-0148
Otis Transportation Technology Division
February 1979, PB 299-798

Vehicle Longitudinal Control and Reliability Project: VLCR Entrainment and Platooning Analysis and Design
Appendix B. **TRAINSIM Simulation Program User's Guide**
Proj. IT-06-0148
Otis Transportation Technology Division
February 1979, PB 297-129

Vehicle Longitudinal Control and Reliability Project: VLCR Data Base
Proj. IT-06-0148
Otis Transportation Technology Division
September 1979, PB 80-132-541

Study on Hydrostatic Drives for Small AGT Vehicles
Proj. CA-06-0089
Mobility Systems and Equipment Co.
October 1978, PB 298-805

AGT Guideway and Station Technology
Vol. 1, **Executive Summary**
Proj. IT-06-0152
DeLeuw, Cather and Co.
August 1979, PB 299-553

AGT Guideway and Station Technology
Vol. 2. **Weather Protection Review**
Proj. IT-06-0152
DeLeuw Cather and Co.
March 1978, PB 287-522

AGT Guideway and Station Technology
Vol. 3. **Technology Review**
Proj. IT-06-0152
DeLeuw Cather and Co.
September 1978, PB 287-632

AGT Guideway and Station Technology
Vol. 4, **Design Guidelines**
Proj. IT-06-0152
DeLeuw, Cather and Co.
March 1979, PB 295-613

AGT Guideway and Station Technology
Vol. 5, **Evaluation Models**
Proj. IT-06-0152
DeLeuw, Cather and Co.
June 1979, PB 299-034

AGT Guideway and Station Technology
Vol. 6. **Dynamic Model**
Proj. IT-06-0152
DeLeuw, Cather and Co.
July 1979, PB 299-153

AGT Guideway and Station Technology
Vol. 7. **Guideway and Station Concepts**
Proj. IT-06-0152
DeLeuw, Cather and Co.
July 1979, PB 299-411

AGT Guideway and Station Technology
Vol. 8. **Weather Protection Concepts**
Proj. IT-06-0152
August 1979, PB 299-746

Guidelines for Design and Evaluation of Human Factors Aspects of AGT Systems
Proj. MA-06-0081
Transportation Systems Center
March 1979, PB 294-817

Vehicle Follower Longitudinal Control for Automated Guideway Transit Vehicles
Proj. MN-11-0002
University of Minnesota
February 1977, PB 264-554

Automated Guideway Transit Service Availability Workshop
Proj. MA-06-0048
Transportation Systems Center
February 1978, PB 282-295

Operation of Automated Guideway Transit Vehicles in Dynamically Reconfigured Trains and Platoons:
Vol. 1. **Extended Summary**
Proj. MA-06-0085
Massachusetts Institute of Technology
April 1979, PB 300-513

Operation of Automated Guideway Transit Vehicles in Dynamically Reconfigured Trains and Platoons: Vol. II.
Proj. MA-06-0085
Massachusetts Institute of Technology
July 1979, PB 80-142-862

Operation of Automated Guideway Transit Vehicles in Dynamically Reconfigured Trains and Platoons: Vol. III.
Proj. MA-06-0085
Massachusetts Institute of Technology
October 1979, PB 80-198-856

Morgantown People Mover Inductive Communication System Design Summary
Proj. MA-06-0048
Transportation Systems Center
September 1978, PB 295-750

Systems Operation Studies for Automated Guideway Transit Systems: Summary Report
Proj. MA-06-0048
General Motors Transportation Systems Division
February 1980, UMTA-MA-06-0048-80-1

Systems Operation Studies for Automated Guideway Transit Systems: Classification and Definition of AGT Systems
Proj. MA-06-0048
General Motors Transportation System Division
February 1980, UMTA-MA-06-0048-80-3

Artist's model of Jacksonville Downtown People Mover.

CHAPTER 5

New Systems Applications

Trends and Highlights

People movers, or automated guideway transit (AGT) systems and other new systems of transportation are being considered as promising alternatives to conventional transit systems in urban areas. Fully automated transit systems are being developed to provide safe, efficient, and economical transportation in our central cities in response to a number of concerns. Among these are the trend toward the revitalization of our central cities; the need for improvements in transit productivity and service levels; the need for energy conservation; and the need for reductions in traffic congestion and air pollution.

Although people movers are presently carrying millions of passengers at airports, universities, recreational parks, and shopping centers, their application in more complex urban settings poses special environmental, economic, technical, and institutional problems.

The Office of New Systems Applications was established as the focal point within UMTA to coordinate the introduction of people mover systems into the urban environment. The office has three major objectives: 1) to develop and implement projects that can demonstrate the application of new transit systems in urban areas; 2) to provide a "delivery system" for the deployment of federal and privately developed advanced technology systems that have demonstrated promise in providing improved transit service; and 3) to provide the necessary planning, technical, and managerial support to local, state, and other offices involved with the implementation of new transit systems in urban applications.

Downtown People Mover (DPM) Program

Through the Downtown People Mover (DPM) program, the Office of new Systems Applications is attempting to show that unmanned (fully automated), relatively simple people mover systems, operating in urban environments, can provide an adequate level of reliable service at reasonable costs.

In April 1976, candidate sites for DPM demonstrations were solicited. Of the 65 cities that responded with letters of interest, only 38 were able to submit proposals, for various reasons. Four of these —Cleveland, Ohio; Houston, Tex.; Los Angeles, Calif.; and St. Paul, Minn.—were selected as demonstration sites. In addition, DOT advised the cities of Miami and Detroit that their DPM proposals were of sufficient merit to permit them to reprogram funds from their existing federal transit commitments to their proposed DPM projects, if the cities so desired.

Subsequently, in June 1977, Congress directed UMTA to consider funding additional DPM projects in the cities of Jacksonville, Fla.; St. Louis, Mo.; Baltimore, Md.; and Indianapolis, Ind. Upon further review of the merits of these proposals, DOT determined that Baltimore, Indianapolis, Jacksonville, Norfolk (Va.), and St. Louis could be awarded technical study grants to perform feasibility studies to further refine their proposed projects. Subsequently, Cleveland and Houston elected not to continue with the people mover demonstration program.

Further refinement of the program has resulted in the establishment of a two-tiered effort. The status of these DPM projects and the DOT policy with regard to present and future DPM investments follow.

Three of the four first-tier cities (Los Angeles, Detroit, and Miami) have completed their preliminary engineering phase for their DPM system and have released Requests For Proposals (RFP's) for DPM system suppliers. The remaining city, St. Paul, is completing its preliminary engineering efforts and expects to request proposals by mid-1981. The award of Section 3 capital grants to each of these first-tier cities for Phase II, project construction, will depend on the following factors: 1) the availability of federal funds, acceptable cost, and results from the preliminary engineering studies; 2) successful completion of all statutory grant requirements, including securing the 20 percent local share funds, and obtaining all of the required environmental clearances; and 3) meeting any specific conditions required by UMTA as a prerequisite to participation in the DPM program. Los Angeles has completed these requirements and has been awarded initial funding for the final design and construction phase of its DPM project.

The second-tier cities of Baltimore, Indianapolis, Jacksonville, Norfolk, and St. Louis have been awarded technical study grants for feasibility studies and refinement of their DPM projects. Based on Congressional direction to UMTA, these second-tier cities may proceed with preliminary engineering studies when their feasibility studies have been successfully completed with favorable results.

Any other city seeking federal funding of a DPM system is required by UMTA to conduct an analysis of transportation alternatives prior to submission of an application for capital grant assistance.

Los Angeles

In Los Angeles, plans are being made to revitalize the Central Business District (CBD), reinforce downtown growth trends, and stimulate the local economy by initiating the following actions: 1) implementation of coordinated land use and transportation programs; 2) provision of joint development and redevelopment opportunities surrounding DPM stations; 3) improvement of CBD circulation with connections to the elevated pedestrian PEDWAY network; 4) provision of intercepts to reduce CBD auto use; 5) improvement of air quality; and 6) improvement of services and accessibility to downtown for transit users.

Los Angeles was awarded preliminary engineering grants (CA-03-0131, CA-06-0112, CA-09-7002, CA-09-7003, and CA-09-7005) and initiated work on its DPM project in January 1978. The DPM system consists of three route miles of double-lane guideway and thirteen stations, and is estimated to cost around $175 million, including $45.2 million for terminal intercept parking facilities at the Convention Center and Union Station. The preliminary engineering and environmental impact statement procedures have been completed. Los Angeles released its RFP in April 1980, and received four proposals in August 1980. Selection of a system supplier is expected to be made before the end of the 1980 calendar year.

St. Paul

The main objectives of St. Paul's proposed DPM system are to improve acces-

Maps of downtown Miami (left), Los Angeles (top right) and Detroit (bottom right), showing how the DPM will circulate through the central business districts.

sibility to the CBD, improve the internal circulation system, discourage the use of automobiles in the CBD, complement the existing elevated pedestrian SKYWAY network, encourage fringe parking, and improve air quality.

St.Paul was awarded its preliminary engineering grants (MN-03-0017, MN-06-0009, MN-09-0024), and initiated work in September 1977. Base patronage forecasts were completed in March 1978, and preliminary route alignments and station locations were determined by April 1978. Parking plans, station layouts, AGT supplier liaison, cost estimates, joint development studies, preparation of a draft procurement bid package, and environmental impact studies were among the tasks being pursued during this phase.

Preliminary system specifications and capital cost estimates for the DPM system have been completed. The Minnesota Legislature has authorized the city to proceed with the project if it can provide all of the local share for matching UMTA grant funds. The financial plan developed by the city has been revised accordingly. The environmental review is being completed and a bid procurement package is being developed. Award of a Phase II UMTA grant for implementation is expected in mid-1981.

Detroit

The specific local objective of Detroit's DPM system is to revitalize the CBD by linking the modern centers of the city (the expanding Renaissance Center, Cobo Hall, the River Front Arena, the Kern Block proposal, and Woodward Mall) with declining office and retail establishments in the CBD core.

Detroit was awarded its preliminary engineering grants (MI-03-0063, MI-06-0024, MI-09-0038, and MI-09-0039), and preliminary engineering and environmental impact studies began in September 1978.

Circulation of the Draft Environmental Impact Statement was completed in May 1980. A Memorandum of Agreement for the mitigation of project impacts on historic sites has been drafted and signed by the Southeastern Michigan Transportation Authority (SEMTA), the Michigan State Historic Preservation Office, and UMTA. This document was sent to the Advisory Council on Historic Preservation for approval. The preliminary engineering efforts for the project have been completed.

Photomontages show how the new DPM systems will be integrated into the landscape in downtown Los Angeles (left) and Detroit (right).

The bid package for Phase II was released in September 1980, and completion of the project is anticipated in late 1984.

Miami

The City of Miami hopes to maintain and strengthen its downtown area as the principal activity center of the region, to stimulate CBD development and mass transit use, to reduce traffic congestion, and to increase accessibility to downtown facilities. Dade County hopes that the proposed DPM will further act as a catalyst to the economic development of the downtown Miami area. The Miami DPM will be coordinated with the rapid transit system to provide circulation of passengers within the downtown area.

UMTA awarded DPM preliminary engineering grants to Dade County, Fla., (FL-03-0050 and FL-09-7002) in May 1978. Preliminary engineering began in November 1978. In March 1979, the county and city approved a four-mile, double-lane guideway alignment for the full DPM system, and selected a two-mile, double loop segment for the first stage. Dade County completed the preliminary engineering on the first stage system in September 1980, and circulated a RFP for a system supplier. Dade County expects to select a supplier and begin implementation January 1981.

Jacksonville

The City of Jacksonville seeks to improve accessibility into its downtown area, provide greater urban mobility, and promote economic revitalization within the central business district through its proposed DPM system. The DPM would link the two major downtown activity centers located on opposite sides of the St. John's river. Each of these areas contains office, retail, hotel, and entertainment centers with peripheral automobile parking lots. Enclosed walkway systems connecting offices and business centers may also be coordinated with the proposed DPM. A major factor in implementation will be the timely completion of the Acosta Bridge across the St. John's river, since the bridge will also carry the DPM.

UMTA awarded a preliminary engineering grant (FL-03-0061) to the Jacksonville Transportation Authority in April 1980. Preparation of administrative and management procedures, a program of public involvement, refinement of the route alignment, and the environmental impact evaluation process have been initiated by Jacksonville.

Downtown People Mover Technical Support

The Downtown People Mover Technical Support Program is designed to assist the Office of New Systems Applications in

AGT vehicles are evaluated under winter conditions at the U.S. DOT Test Track in Pueblo, Colo.

reviewing documentation prepared by the grantees during the preliminary engineering phase. The major objective of these technical support projects has been to provide independent review and recommendations to UMTA about each city's DPM activities. These efforts have included review of performance specifications, capital costs, operation and maintenance costs, project schedules, safety plans, elderly and handicapped provisions, and procurement bid packages. Evaluations of proposed operating strategies, operating and maintenance plans, and plans for testing the systems have also been performed.

Operators controlling the DPM system at Morgantown can tell where every vehicle is at any moment.

As the first-tier cities move into Phase II activities, the technical support tasks and activities will change to include review and recommendations to UMTA on the construction bid packages, final engineering documentation, safety assurance, acceptance test plans, and system design.

The Transportation Systems Center (TSC) provides overall DPM program support by reviewing and evaluating assigned elements of the cities' preliminary engineering efforts, assessing the technological status of potential suppliers, and developing DPM guidelines and evaluation criteria. Dynatrend, Inc. is providing technical support for the cities of St. Paul (IT-06-0182) and Detroit (IT-06-0183); and PRC Harris is providing support for Los Angeles (IT-06-0181) and Miami (IT-06-0214).

Downtown People Mover Technical Feasibility Studies

Funds for technical feasibility studies were provided to the second-tier cities of Baltimore (MD-09-0014), Indianapolis (IN-09-0017), Jacksonville (FL-09-7001), Norfolk (VA-09-0035), and St. Louis (MO-09-0014). Jacksonville and Norfolk have completed their feasibility studies while the studies in Baltimore, Indianapolis, and St. Louis are still being conducted.

The major objective of these studies is to determine whether or not a DPM would be suitable and practical for these cities. Each study includes determination of route, estimation of patronage, capital and operations and maintenance costs, impact analysis, preliminary environmental study, and other tasks in order to determine the feasibility of a DPM.

Other Projects Relating to Downtown People Mover Systems

As the DPM program has progressed, the need for proven winter operating capability has been identified as a common requirement of DPM systems in northern cities. Government-funded efforts on the Morgantown and AIRTRANS systems have helped to overcome deficiencies in this area. (The DEMAG/MBB Cabinlift system's design inherently provides for winter operating capability.)

To provide an adequate data base to support DPM planning and decision-making, UMTA has undertaken the Winterization Testing Program (MA-06-0081) with TSC and three suppliers of technologically differing AGT systems. The three suppliers involved—Otis, Westinghouse, and Universal Mobility—have performed winter operational testing on their respective systems to demonstrate performance during severe weather. Various winterization approaches have been tested to determine their efficiency in alleviating operating problems associated with severe weather. In addition to providing UMTA with the necessary data base, these tests will permit the suppliers to independently develop or modify their systems to effectively combat winter weather problems.

The Downtown People Mover Communications project (IT-06-0216) will produce two 16mm color films with sound to document the preliminary engineering and implementation phases of UMTA's DPM program. The Office of New Systems Applications will act as technical advisor, and the Office of the Secretary will act as production supervisor for these films. William Greaves Productions is under contract to produce these two films. Production of the preliminary engineering film is underway, and completion is expected in early 1981.

The objective of the DPM Impact Analysis (IT-06-0177) is to determine the social and economic effects of DPM. This study will be conducted concurrently with the implementation of the systems. Data will be collected at each demonstration site before and after implementation. Analysis of these data will determine the changes that the DPM makes in these cities, as well as to examine how this technology may affect conditions in other cities.

Morgantown People Mover (MPM) Demonstration Project

The Morgantown, W. Va., people mover system is an automated, self-service transit system consisting of a fleet of electrically powered vehicles which operate on a guideway at 15-second intervals, either scheduled or on demand. The system, which has five stations, provides a safe, comfortable, and reliable means of transportation, while alleviating congestion, noise and air pollution. The system is capable of transporting 1,100 passengers in 20 minutes between two stations 1.5 miles apart. It can operate 24 hours a day and provides nonstop origin-to-destination service by the use of off-line stations. The vehicles were designed to provide economical service during both peak and low demand periods.

The Morgantown vehicles are small by mass transit standards, each carrying up to 21 passengers, with eight seated and 13 standing. The vehicle is 15.5 feet long and six feet wide and weighs 8400 pounds when empty. Speeds of up to 30 miles per hour are provided by a DC motor powered by a three-phase, 575-volt AC distribution system. Rubber tires and an air-bag suspension system provide a quiet and comfortable ride. Unique features include a heated guideway for operation during icy conditions, onboard switching and steering, a synchronous point-follower control system, and computers to manage all system operations. Fail-safe design and redundant safety-critical systems enhance reliability and insure passenger safety.

Compared with conventional transit systems, the Morgantown system provides increased frequency of service and demand-responsive flexibility. The transportation technology that has been developed for Morgantown will also be applicable to the transportation problems of urban core areas. In addition, such systems are also capable of being integrated with existing transit systems.

The Morgantown system has been regarded as a success since its opening for regular revenue service for West Virginia University students, faculty, and others in October 1975. It has demonstrated its reliability and its acceptability as a modern transit alternative to increasing automobile use in a high density urban corridor. During its first year of operation with three stations, the MPM registered a total of almost 600,000 vehicle-miles and almost 800,000 passengers.

Improvements made during the first year of operation resulted in significantly greater reliability and ridership. During its second year of operation, the MPM carried more than 1.85 million passengers and operated almost 600,000 vehicle miles. In September 1977, the system carried 308,000 passengers; average system availability was 97.9 percent. Perhaps most importantly, there have been no serious passenger injuries associated with the system's operation during the three years since it opened.

Since the system had demonstrated compliance with its specifications and had been accepted by the university, UMTA approved a grant to the West Virginia Board of Regents for the Phase II expansion (WV-03-0006). Phase II extended the system another 1.1 miles, expanded one station, and added two new stations, 26 cars, and a small maintenance facility. The Phase I vehicle fleet was refurbished, and a new heated power rail was installed to complement the heated guideway for better winter operations. Construction was completed in late 1978. System operations, which were halted in July 1978 in order to combine the system extension with the existing system, resumed in July 1979. Revenue operations resumed in September. Since then, ridership has increased by more than 50 percent over previous levels and system reliability has exceeded 97 percent. Availability is expected to improve further as operating and maintenance personnel gain experience.

The knowledge gained from building and operating the MPM system will be of great help in making future automated guideway transit systems more reliable. The MPM has paved the way for things to come, demonstrating the technological feasibility, operational practicality, and transportation benefits of AGT concepts for the future.

AIRTRANS Urban Technology Program

At the Dallas/Ft. Worth (DFW) Airport, the AIRTRANS AGT system transports passengers and employees between parking lots and airline terminals. The fully automatic system operates a fleet of 68 vehicles, 24 hours a day, serving 53 stations connected by 13 miles of single-lane guideway. AIRTRANS also operates utility vehicles for baggage, supplies, mail, and refuse between utility stations.

Since its opening in January 1974, AIRTRANS' operational performance has steadily improved. During its first five years of operation, it has carried over 22 million riders and travelled 16 million vehicle miles without any passenger fatalities.

In 1975, an intensive assessment study of AIRTRANS was sponsored by UMTA and performed by the Transportation Systems Center. The study identified a number of areas where further technical development would be necessary to make AIRTRANS suitable for urban application.

In 1976, Congress also expressed a growing interest in applying AGT systems to urban areas in order to help solve urban transportation problems. Since airports represent a different environment from that of urban areas, the AIRTRANS Urban Technology Program (AUTP) was designed to improve the technology of AIRTRANS to be more suitable for urban use. The principal objectives of AUTP included development and demonstration of higher speeds for increased productivity, higher subsystem reliability, and lower capital and operating costs. The project involved two phases.

Phase I of the program covered the period from December 1976 through December 1977. During this phase, an AIRTRANS utility vehicle was converted to a test vehicle and instrumented for test purposes. Measurements were made and tests performed on a portion of the AIRTRANS guideway at speeds of up to 30 miles per hour to characterize the present vehicle and other subsystems in such areas as ride quality, jerk and vibration levels, and noise. The analysis of the data was used to support the design of upgraded subsystems including vehicle control electronics, mechanical and servo-actuated steering, and collectors for wayside power and control signals.

A vehicle propulsion system providing speeds of up to 45 miles per hour and a propulsion control system with regenerative braking to reduce energy consumption and extend brake lining life have been developed. Under Phase I, improved propulsion, steering, power and signal collectors, and control electronics were developed. These improved subsystems were installed in a test vehicle for evaluation, and demonstrated on the AIRTRANS system in November 1977.

The Phase II program (TX-06-0020) was a 24-month effort building on the results of Phase I. During Phase II, severe winter weather testing of the propulsion and driveline, suspension, steering, pneumatic system, and electrical system has been conducted using an environmental chamber. Testing also included spraying water at very low temperatures

on the power collector/power rail system installed on the rotating 18-foot test wheel to evaluate its performance under icing and freezing conditions. The vehicle control electronics and software have been revised to give smoother acceleration and to use regeneration for normal braking. In addition, automatic reversing of the vehicle's direction has been developed and demonstrated.

All of the improved elements and subsystems have been installed in a modified AIRTRANS utility vehicle to constitute a prototype urban vehicle, including an automatic coupler system. The performance of the improved features was evaluated during the fall of 1979. It is hoped that these improvements in the AIRTRANS system will provide better technology for future urban systems.

Cold Weather Transit Technology Program

In the aftermath of the major operational difficulties experienced by transit systems during the winter of 1978, the Congress became increasingly concerned with the inability to operate transit systems efficiently under conditions of cold, snow, and ice. Nearly one-third of the nation's transit systems suffer from interruption and limited or cancelled operations due to winter weather.

Recognizing the need for broad-based, fundamental research and development activity to address these winter problems, the Congress provided $5.5 million in FY 1980 for initiation of research to advance cold weather transit technology.

The Congress directed that the program be conducted by the University of Notre Dame in Indiana and indicated support for the program proposed by the Vought Corporation in Texas. This Cold Weather Transit Technology Program (IN-06-0009) involves testing and evaluation of the abilities of laser beams, ultrasonic and microwave radiation, and other methods to disrupt the bonding of ice and snow to facilitate its removal from critical traction surfaces and from power and signal transmission rails.

The hardware to be developed will be applicable to a variety of transit vehicles and, for full-scale testing purposes, will be designed to be attached to the AIRTRANS prototype urban vehicle, developed under the AIRTRANS Urban Technology Program.

Under this cold weather technology program, the University of Notre Dame

A variety of methods—such as laser beams and ultrasonic and microwave radiation—for removing snow and ice from traction areas are being evaluated at the University of Notre Dame in South Bend, Ind.

will establish a data bank of the technology and proven techniques for combating winter problems and will make this information available to designers, planners, and operators of transit systems for inclusion in their systems to assure year-round, all-weather capability. The university will also investigate the physics of ice and snow at the interface between tires and pavement, or wheels and rails.

Initial planning and preliminary design will also define requirements for the establishment of a National Test Center for Ice Control and Snow Removal. Such a facility would provide full-scale testing capabilities of ice and snow counter-measures in conjunction with a variety of different transit systems including light rail, rapid rail, commuter rail, and automated guideway transit systems.

Aerial Suspended Transit Demonstration Project

UMTA has awarded grants (LA-9-0053 and LA-06-0003) to the City of New Orleans to study an Aerial Suspended Transit System to serve the new Orleans Central Business District.

The system would use a driver-operated transit vehicle suspended from overhead rails or cables to provide service between three major sites at the 1984 World's Fair: the Riverfront (adjacent to the Hilton Hotel), the Superdome Stadium, and Louis Armstrong Park. The system would subsequently become a permanent and integral part of a circulation system in the CBD linking major activity centers and peripheral parking areas.

The major objectives of this study are to determine the economic and technical feasibility of an aerial suspended transit system, to identify the route alignment, to determine the patronage and service level requirements, to prepare an environmental impact analysis and to perform some preliminary engineering activities including a preliminary capital cost estimate.

The award of further capital grant funding to New Orleans for system implementation will depend on the following factors: 1) the availability of federal funds; 2) satisfactory cost estimates and results from the feasibility study and preliminary engineering efforts; and 3) the successful completion of all statutory grant requirements including securing the 20 percent local share and obtaining all of the required environmental clearances.

The results of this demonstration project will provide practical data which would enable an evaluation of the advantages offered by this type of aerial-suspended system. Expected advantages include low capital cost, low level of visual impact at the street level, and a minimal amount of disruption required during construction.

New Systems Applications

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
DOWNTOWN PEOPLE MOVER (DPM) PROGRAM					
Downtown People Mover Preliminary Engineering Grants	CA-06-0131 CA-06-0112 CA-09-7002 CA-09-7003 CA-09-7005	$1,478,000 $651,000 $20,000 $365,000 $548,000	Jan. 1978- June 1980	Charles River Associates	Vincent R. Demarco (202) 426-2896
	MN-03-0017 MN-06-0009 MN-09-0024	$1,068,000 $265,000 $359,000	Sept. 1977- June 1981	MTC	Philip H. Morgan (202) 426-2896
	MI-03-0063 MI-09-0038 MI-09-0039 MI-06-0024	$950,000 $224,975 $33,694 $115,000	June 1978- April 1980	SEMTA	Steve Asatoorian (202) 426-2896
	FL-03-0050 FL-09-7002	$964,000 $210,000	May 1978- April 1980	Dade County, Fla.	William Murray (202) 426-2896
	FL-03-0061	$1,500,000	June 1980- Dec. 1981	Jacksonville Transportation Authority	Fred L. Sing (202) 426-2896
Downtown People Mover Technical Support	MA-06-0081	$2,155,000	June 1977- Sept. 1980	TSC	Ron Kangas (202) 426-2896
	VA-06-0073	$150,000	Nov. 1979- Nov. 1980	MITRE Corp.	William Murray (202) 426-2896
	IT-06-0182	$339,000	Jan. 1978- Dec. 1978	Dynatrend, Inc.	Philip H. Morgan (202) 426-2896
	IT-06-0183	$285,000	Sept. 1978- April 1980	Dynatrend, Inc.	Steve Asatoorian (202) 426-2896
	IT-06-0181	$465,000	Jan. 1978- June 1980	PRC Harris	Vincent R. Demarco (202) 426-2896
	IT-06-0214	$253,000	Nov. 1978- Dec. 1979	PRC Harris	William Murray (202) 426-2896

New Systems Applications

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
DOWNTOWN PEOPLE MOVER (DPM) PROGRAM					
Downtown People Mover Technical Feasibility Studies	MD-09-0014	$241,000	Sept. 1978-March 1980	City of Baltimore, Md.	Fred L. Sing (202) 426-2896
	IN-09-0017	$303,000	March 1978-March 1980	City of Indianapolis, Ind.	Philip H. Morgan (202) 426-2896
	FL-09-7001	$368,000	May 1978-Sept. 1979	City of Jacksonville, Fla.	Fred L. Sing (202) 426-2896
	VA-09-0035	$100,000	July 1978-June 1980	City of Norfolk, Va.	Fred L. Sing (202) 426-2896
	MO-09-0014	$185,000	July 1978-April 1980	City of St. Louis, Mo.	Fred L. Sing (202) 426-2896
OTHER PROJECTS RELATING TO DOWNTOWN PEOPLE MOVER SYSTEMS					
DPM Winterization Program	MA-06-0081	$1,180,000	Sept. 1978-May 1980	TSC	Philip H. Morgan (202) 426-2896
Downtown People Mover Communications	IT-06-0216	$310,000	Sept. 1978-Dec. 1984	William Greaves Productions	Fred L. Sing (202) 426-2896
DPM Impact Analysis	IT-06-0177	$606,000	Sept. 1979-Sept. 1980	Cambridge Systematics, Inc.	John Durham (202) 426-4022
MORGANTOWN PEOPLE MOVER (MPM) DEMONSTRATION PROJECT					
Morgantown People Mover System: Phase II	WV-03-0006	$63,600,000	Oct. 1976-April 1980	West Virginia Board of Regents	Philip H. Morgan (202) 426-2896
AIRTRANS URBAN TECHNOLOGY PROGRAM					
AIRTRANS Upgrading	TX-06-0020	$7,000,000	Dec. 1976-Dec. 1979	Dallas-Fort Worth Airport, Tex.	Philip H. Morgan (202) 426-2896

New Systems Applications

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
COLD WEATHER TRANSIT TECHNOLOGY PROGRAM					
Cold Weather Countermeasures	IN-06-0009	$5,500,000	Jan. 1980-April 1981	University of Notre Dame	Philip H. Morgan (202) 426-2896
AERIAL SUSPENDED TRANSIT DEMONSTRATION PROJECT					
Feasibility Study	LA-09-0053 LA-06-0003	$200,000 $100,000	Sept. 1980-Sept. 1981	City of New Orleans	Ronald D. Kangas (202) 426-2896

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

AIRTRANS Urban Technology Program, Phase I: Final Report
Proj. TX-06-0020
Vought Corporation
January 1978, PB 291-128

AIRTRANS Urban Technology Program, Phase II: Final Reports (Series of 8) **Executive Summary,**
UMTA-TX-06-0020-79-8
Vol. I, **Control System Improvements,**
UMTA-TX-06-0020-79-2
Vol. II, **Passenger Communications,**
UMTA-TX-06-0020-79-3
Vol. III, **Vehicle and Wayside Systems,**
UMTA-TX-06-0020-79-4
Vol. IV, **Vehicle Fabrication, Tests and Demonstration,** UMTA-TX-06-0020-79-5
Vol. V, **Systems Operation,**
UMTA-TX-06-0020-79-6
Vol. VI, **Severe Weather,**
UMTA-TX-06-0020-79-7

Inspect and Repair as Necessary (IRAN)
UMTA-TX-06-0020-79-1
Proj. TX-06-0020-01
Vought Corporation
November 1979

Impact Evaluation of Morgantown PRT 1975-1976 Ridership, Interim Analysis
Proj. MA-06-0026
Transportation Systems Center
June 1977, PB 270-916

MPRT O & M Phase Operating, Availability and Maintenance History
Proj. WV-06-0005
Boeing Aerospace Company
Surface Transportation Systems
January 1977, PB 266-994

Morgantown People Mover Redundant Computing Systems Design Summary
Proj. MA-06-0048
Boeing Aerospace Company
September 1980

Morgantown People Mover Electromagnetic Compatibility Program
Proj. MA-06-0048
Boeing Aerospace Company
September 1980

Morgantown People Mover Collision Avoidance System Design Summary
Proj. MA-06-0048
Boeing Aerospace Company
September 1980

MPM Operating, Availability and Maintenance History October 1979-June 1979
Proj. MA-06-0081
Transportation System Center
October 1979

People Mover Profile
Proj. MA-06-0081
Urban Mass Transportation Administration
May 1977, PB 268-335

PRT Impact Study, Pre-PRT Phase
Proj. MA-06-0026
West Virginia University
March 1976
Vol. I, **Travel Analysis,** PB-254-481
Vol. II, **Data Collection Procedure and Coding Manual,** PB 254-482
Vol. III, **Frequency Tabulations from Four Transportation-Related Surveys,** PB 254-83

PRT Impact Study, Operational Phase
Proj. MA-06-0026
West Virginia University
July 1979

Impact on Morgantown Travel, Traffic, and Associated Activities
Vol. I, **Travel Analysis**
Vol. II, **Data Collection Procedures and Coding Manual,** PB 300-341 (3 vols.)

Proceedings of the First DPM Workshop, "Project Management Control," April 30-May 2, 1978
UMTA and West Virginia University

Proceedings of the Second DPM Workshop "Vehicle Design," July 27-28, 1978
UMTA and West Virginia University

Proceedings of the Third DPM Workshop "System Operation and Maintenance, November 8-10, 1978
UMTA and West Virginia University

DPM GUIDELINE DOCUMENTS

DPM Program Plan
UTD Document Control Number 76-08
Revision 03
May 21, 1976

DPM Program Implementation Guidelines
UTD Document Control Number 77-10
Revision 03
January 30, 1979

Guidelines for Design and Evaluation of Human Factors Aspects of AGT Systems
Proj. MA-06-0048
Transportation Systems Center
September 1979

Fire Safety Guidelines of Vehicles in a Downtown People Mover System
Proj. MD-06-0035
National Bureau of Standards
January 1979

Guidelines for the Maintenance of DPM Systems
Proj. VA-06-0055
Technology Research and Analysis Corporation
July 1979

St. Paul DPM Final Report
Proj. MN-03-0017, MN-06-0009, MN-09-0024
Metropolitan Transit Commission, City of St. Paul
March 1979

CHAPTER 6

Safety and Product Qualification

Trends and Highlights

In 1976 UMTA established the Office of Safety and Product Qualification to insure increased emphasis on the safety, quality, operational suitability, and reliability of UMTA funded transit systems. The activities of the office are divided into two major program areas: safety and product qualification.

The safety program has to date emphasized voluntary initiatives on the part of new transit systems in implementing safety and system assurance programs. Close monitoring of these programs is carried out by UMTA with the support of other organizations, such as the Transportation Systems Center (TSC), the Federal Railroad Administration (FRA) and the American Public Transit Association (APTA). The office sponsors educational programs in safety and systems assurance, as well as research on safety and reliability problems, with the aim of increasing general knowledge among transit operators and other transit professionals.

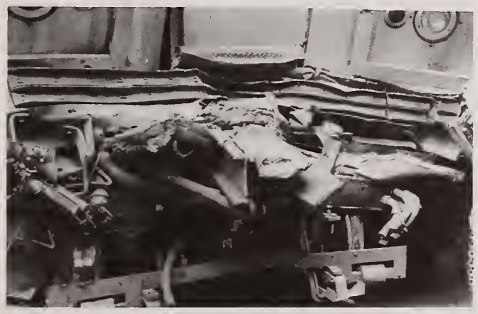
A significant change occurred in UMTA's safety program in 1978. As the result of a DOT study, UMTA was given complete responsibility for rapid rail and light rail transit system safety. The responsibility for rapid rail systems had formerly resided with the FRA, while no administration had specific responsibility for light rail transit safety.

The UMTA rail transit safety program plan consists of three major elements: Safety Information; System Safety; and Safety Research and Development. All of these elements are interdependent; and this structure enables a better assessment of individual elements and resources.

The product qualification program is also structured in three elements: New Technology Deployment; Transit Tech-

nology Information; and Assessment and Qualification.

New Technology Deployment contains projects directed toward the introduction and use of new or innovative procedures, techniques, products or processes to improve transit effectiveness. Two new major efforts were incorporated this year. The first is the coordination and consolidation of Life Cycle Costing (LCC) efforts in response to the rolling stock acquisition provision in the FY 80 UMTA Appropriations Act. The second new effort is the coordination responsibility for the use of capital funding of Section 3(a)(1)(C) to assist in the initial transit deployment of products embodying significant technical innovations.



With the cooperation of the rail transit industry, UMTA's Office of Safety and Product Qualification has developed an improved system for reporting rail transit accidents such as the one above.

The second, Transit Technology Information, includes those projects which provide transit product performance information. These projects include reduction of the fire threat in transit systems by proper material selection and the Transit Reliability Information Program (TRIP), which established an experimental data bank put in operation this year.

Assessment and Qualification examines specific evaluative projects or individual products for transit application.

During FY 80, significant activities within the UMTA Rail Transit Safety Program included the expansion of the safety and system assurance reviews, an extensive unsafe conditions investigation, initiating the development of emergency preparedness guidelines, and the issuance of annual rail safety reports for 1978 and 1979. During the past year, UMTA has held a number of workshops with American Public Transit Association (APTA), Transportation Safety Institute (TSI), and the transit industry to identify and develop new training courses and update the transit safety training program.

Safety Information

Safety Information Reporting and Analysis System

Part of the responsibility for rapid rail and light rail transit system safety given to UMTA was to develop a new rapid rail transit (RRT) accident/incident reporting system. The RRT systems are to continue to report into the existing FRA system until the new UMTA system is deployed. The Office of Safety and Product Qualification, while developing the rail Safety Information Reporting and Analysis System (SIRAS), has published reports of the RRT accident/incident data gathered by FRA for 1978 and 1979. Plans have been made to publish the 1980 FRA-gathered data in the same manner. The office also conducted two workshops in FY 80 with the rail transit industry for review and comment on the final development of SIRAS. Reporting forms, procedures and thresholds necessary for transit authorities to collect information related to accidents/incidents, have been developed. SIRAS is expected to be operational in April 1981. System deployment will follow approval by the Office of Management and Budget, publication in the *Federal Register,* and the training of the users at transit properties. Both rapid rail and light rail transit systems will be re-

UMTA provides teams of experts to review transit operators' safety program plans and to investigate potential problems. This picture shows measurements being taken to verify automatic train control system performance.

porting their accident/incident data to UMTA. Program support for SIRAS is provided under an agreement (MA-06-0098) with TSC.

UMTA currently has no mechanism in place for collecting and analyzing safety data on transit bus operations. Furthermore, no national data base of transit bus accidents/injuries suitable to meet UMTA safety needs exists. Accident and casualty information is gathered by various sources (local jurisdictions, state police, National Highway Traffic Safety Administration, and others), but not in a uniform manner. Even definitions of accidents and casualties differ among the various information collection sources. A feasibility and utility study is currently underway to characterize the state of transit bus safety, evaluate safety information gathering systems currently collecting data on transit bus accidents and injuries, and to assess the feasibility of an UMTA transit bus reporting system. This study is being conducted with technical support through a contract (VA-06-0080) with the University of Southern California.

System Safety

System safety, the most significant element of the UMTA Rail Transit Safety program, involves developing and conducting programs and activities focused on the elimination and control of hazards and the prevention of events that could cause accidents. These programs and activities have systems life-cycle application for the purpose of continually achieving and verifying the highest practical levels of safety by means other than the reaction to the experience of accidents.

The system safety program plans development is an on-going activity involving the development of system safety program plans by new and existing rail transit authorities. These plans provide the rail transit authorities with a medium for documenting their safety program and displaying their commitment to safety. They also provide a medium for the conduct of audits, reviews, and evaluations of the property's safety program.

Safety and system assurance reviews of new rail transit system development programs have been a primary safety activity within UMTA. The purpose of these reviews is to review and evaluate the decision-making capabilities, processes, and procedures that are applied by a property during the planning, design, development, and operation of a rail transit system; and to make a constructive contribution to a transit property's efforts to provide safe, secure, and dependable service. Within the past year this activity has been expanded to include the review of safety and system assurance programs at existing rail transit properties.

During FY 80, safety and system assurance reviews were held at the Niagara Frontier Transportation Authority (NFTA) in Buffalo and at the Port Authority of Allegheny County (PAT) in Pittsburgh. In addition, a review of the safety program and practices were made at the Southeastern Pennsylvania Transportation Authority (SEPTA) in Philadelphia.

The investigation of unsafe conditions at transit properties receiving financial assistance from UMTA are carried out under the authority of Section 107 of the National Mass Transportation Assistance Act of 1974. The most recent of these has been the investigation of the New York City Transit Authority R-46 cars which have experienced safety problems with their trucks, handbrakes, and DC power cables. The R-46 investigation was carried out by various DOT agencies with different areas of expertise. A report to the UMTA Administrator presented the findings and conclusions on the R-46 car safety problems and recommendations concerning alternatives that could be employed to resolve the problems was completed in April, 1980.

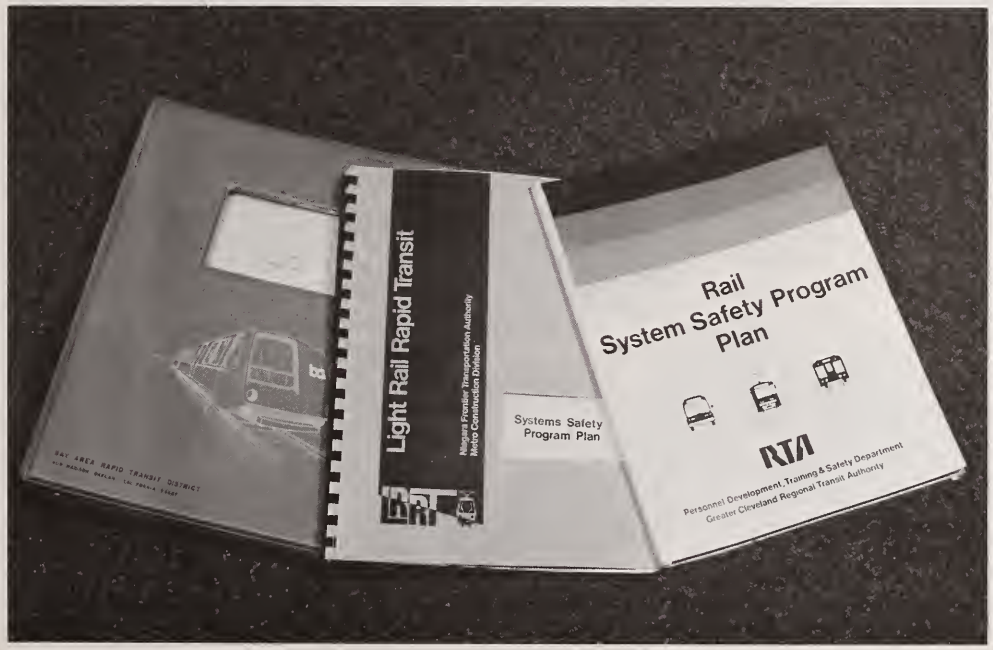
System safety and security education and training for the transit community is another program activity. Since 1976, UMTA has funded the development and conduct of several safety, security, and system assurance courses that have been held at the Transportation Safety Institute (TSI) in Oklahoma City. These courses were identified, developed, and conducted through the cooperative efforts of UMTA, TSI, the American Public Transit Association (APTA), and representatives from the transit industry. To promote attendance at the courses and make the training available to as many transit employees as possible, UMTA has funded the tuition and per diem expenses of qualified attendees. Beginning in FY 80, UMTA increased this funding to cover travel expenses as well. During the past year, courses on mass transit security were held at TSI and seminars on explosives management were presented in various U.S. cities. In addition, UMTA held a number of workshops with APTA, TSI, and the industry to identify and develop new courses needed, e.g., bus system safety, bus and rail accident investigation, system safety analysis, and human factors.

UMTA also responds to safety inquiries from the public, local officials, and the Congress. Examples of inquiries received in FY 80 include public concern with unsafe operating practices and equipment, improper maintenance and control of safety related equipment, and malicious damage to transit equipment and facilities. Each of the inquiries was acted upon to ensure that legitimate safety problems were being properly resolved by the affected transit property.

Program support for the UMTA system safety activities is provided under continuing reimbursable agreements with two DOT offices. One of these agreements (DC-06-0215) is with TSI at Oklahoma City under which TSI provides support to UMTA in terms of personnel and facilities for the system safety and security education and training activity. The other agreement (MA-06-0098) is with TSC in Cambridge, Mass. During FY 80, TSC provided support to UMTA on a number of system safety activities including safety and system assurance reviews and unsafe condition investigations.

Technical support to the UMTA system safety activities is provided under two separate contracts. Under a continuing contract (DC-06-0123), APTA gathers information and provides technical expertise on transit safety issues. Program support also is being provided (IT-06-0239) by Booz, Allen, and Hamilton, in the development of implementation documentation in such areas as unsafe conditions investigations, program reviews and evaluations, system safety analysis, and system safety plans content.

System safety program plans are prepared and implemented by transit operators to make sure that attention to safety is continuous and thorough.



Safety Research and Development

The UMTA safety research and development program is aimed at significant and critical safety problems of a generic nature. Site-specific problems are of concern also, but the particular property involved is expected to remedy this class of safety problem. At present, the highest priority safety research project for UMTA and the industry is the development of rail transit emergency preparedness guidelines. Because of the similarity of problems in emergencies, UMTA and FRA have agreed to include commuter rail systems in the emergency preparedness study.

During FY 80 two workshops on this project have been held which established the purpose of the guidelines, outlined the expected document, and named transit industry committees to prepare the individual sections of the document. A follow-up workshop determined the scope, content and schedule for the document.

Other potential UMTA safety research projects included in the UMTA Rail Transit Program Plan for Safety Research and Development (completed in FY 79) are rail car crashworthiness design standards, human factor causes for collisions and accidents, and slips and falls in stations and on platforms. Program support for both the emergency preparedness guidelines development and the program plan was provided by TSC (MA-06-0098).

A bus safety research project has been initiated to study the bus driver's effect on bus safety. This study will investigate bus operator characteristics that enhance safety. TSC, under agreement MA-06-0098, furnishes support to this project.

New Technology Deployment

During FY 80, projects were continued on developing Life Cycle Cost (LCC) procurement techniques and validation projects, and projects to use these techniques in actual vehicle procurements were initiated. Projects VA-06-0045 and CA-06-0046 are examples. Plans were made for conducting seminars at the Regional Offices early in FY 81. Detailed process planning was begun for the new provision in Section 3 capital assistance (Section 3(a)(1)(C)) permitting use of that funding for the initial acquisition by transit properties of new technology products. Although the first such funding will not occur until FY 81, the methods for project identification, selection, implementation, and control were initiated.

Two separate projects were initiated to assess barriers in bringing new innovations into production transit stock (MA-06-0060). One project, to assist 16(b)(2) participants in selecting good quality small vehicles, was completed with a media package of operational experience and information, including a sample procurement specification and acceptance checklist. A second project assessing a transit bus communications and control system was continued at TSC.

Transit Technology Information

Major progress was made on TRIP (Transit Reliability Information Program) Phase I, with the rail experimental data bank operating on selected car components at five properties. The feasibility of expanding the program to cover transit

Information about maintenance for vans and small buses is included in a new manual designed to help operators of light-weight accessible buses.

buses was evaluated during this year. A project was initiated to assist a rail transit property in establishing an automated reliability information monitoring and analysis system. As part of the continuing effort with TSC on reducing the threat of transit system fires, the materials data bank on flammability and smoke emission characteristics was expanded, progress was made on formalizing existing flammability guidelines into a requirement for grant funding assistance, and a second phase of transit cable electrical insulation fire characteristics was initiated. Two reports, one on the materials data bank, and the second on the identification of transit vehicle fire threat, were published this year as a result of this effort.

Assessment and Qualification

A project (MA-06-0060) to assess current bus lift operational performance was initiated, and projects to assess two small bus configurations were continued at TSC. The joint NHTSA/UMTA program to assess transit bus brake antilock system performance (WI-06-0007) was continued with the participation of a transit property, with the buses equipped with system operation recorders to operate in revenue service throughout most of the year. A project was started with the Bay Area Rapid Transit District (CA-06-0052) to conduct full-scale fire testing on a length of transit car after major fire hardening efforts have been accomplished. Testing of the new Massachusetts Bay Transit Authority Blue Line cars at TTC was completed, and testing was begun on the Metropolitan Atlanta Rapid Transit Authority cars.

Safety and Product Qualification

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
SAFETY INFORMATION					
Rail Transit Safety Information Reporting and Analysis System	MA-06-0098	$716,000	Sept. 1978- Continuing	TSC	Llyod G. Murphy (202) 426-6588
Transit Bus Safety Information Reporting Feasibility Study	VA-06-0080	$104,000	Oct. 1980- Nov. 1981	University of Southern California	Lloyd G. Murphy (202) 426-6588
SYSTEM SAFETY					
Program Support	DC-06-0215	$795,400	Sept. 1975- Continuing	Transportation Safety Institute	Gwendolyn R. Cooper (202) 426-6588
	MA-06-0098	$360,000	Sept. 1978- Continuing	TSC	Edward J. Boyle (202) 426-9545
Technical Support	DC-06-0123	$532,000	Dec. 1976- Continuing	American Public Transit Association	Thomas F. Prendergast (202) 426-6588
	IT-06-0239	$175,000	Mar. 1980- March 1981	Booz, Allen and Hamilton	Edward J. Boyle (202) 426-9545
SAFETY RESEARCH AND DEVELOPMENT					
Rail Safety R&D	MA-06-0098	$260,000	Nov. 1978- Continuing	TSC	Roy Field (202) 426-9545
Bus Safety R&D	MA-06-0098	$120,000	Aug. 1980- Sept. 1981	TSC	Roy Field (202) 426-9545

Safety and Product Qualification

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
ASSESSMENT AND QUALIFICATION					
Bus Brake Anti-lock Assessment	WI-06-0007	$62,000	Nov. 1979-Nov. 1981	Milwaukee County Transit Authority	Robert Haught (202) 426-9545
BART Full-Scale Fire Testing	CA-06-0052	$250,000	Aug. 1980-July 1981	BART	Robert Haught (202) 426-9545
Product Qualification	MA-06-0060	$275,000 (FY 80)	Oct. 1979-Sept. 1980	TSC	Robert Haught (202) 426-9545
NEW TECHNOLOGY DEPLOYMENT					
Life Cycle Costing	VA-06-0045	$302,589	Sept. 1977-Continuing	Advanced Management Systems	Robert Haught (202) 426-9545
Life Cycle Costing	CA-06-0046	$300,000	July 1980-June 1985	Santa Clara County Transportation Administration	Robert Haught (202) 426-9545
Barriers to Rolling Stock Innovations	OH-06-0032	$65,000	Aug. 1980-Aug. 1981	Miami University of Ohio	Robert Haught (202) 426-9545
Product Qualification	MA-06-0060	$48,000 (FY 80)	Oct. 1979-Sept. 1980	TSC	Robert Haught (202) 426-9545
TRANSIT TECHNOLOGY INFORMATION					
WMATA Reliability Information System	DC-06-0260	$120,000	Nov. 1979-Nov. 1980	WMATA	Robert Haught (202) 426-9545
Product Qualification	MA-06-0060	$935,000 (FY 80)	Oct. 1979-Sept. 1980	TSC	Robert Haught (202) 426-9545
Fire Safety Standards	MA-06-0051	$350,000 (FY 80)	Oct. 1979-Sept. 1980	TSC	Robert Haught (202) 426-9545
Evaluation of ADB Introduction	MD-06-0024	$148,000	Oct. 1979-Dec. 1980	OAO Corporation	Robert Haught (202) 426-9545

Tests on "perturbed" track show the outer limits of stability at various speeds of locomotives as they run over track geometry irregularities.

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reorts and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

A Final Report of the Safety and System Assurance Contract
Proj. DC-06-0123
American Public Transit Association
November 1978

Development of a Safety Program Plan for the Office of Safety and Product Qualification, Volume I
Proj. CA-06-0105
G.P. Jones, et al.
September 1977, PB 279-331

Development of a Safety Program Plan for the Office of Safety and Product Qualification, Volume II
Proj. CA-06-0105
G.P. Jones, et al.
September 1977, PB 279-332

Safety in Urban Mass Transportation: Research Report
Proj. RI-06-0005
Battelle Columbus Laboratory
March 1976, PB 245-413

Safety in Urban Mass Transportation: Guidelines Manual
Proj. RI-06-0005
Battelle Columbus Laboratory
May 1975, PB 245-413

Rail Transit Safety Annual Report, 1978
Proj. MA-06-0098
Transportation Systems Center
July 1979

Rail Transit Safety Annual Report, 1979
Proj. MA-06-0098
Transportation Systems Center
DOT-TSC-UMTA-80-24
June 1980

Assessment of Current Fire Safety Efforts
Proj. MA-06-0051
W. Hathaway, Transportation Systems Center
PB 299-110

Electric Insulation Fire Characteristics, Volume I and II
Proj. MA-06-0025
Boeing/CAMI
December 1978
Vol I. PB 294-840
Vol II. PB 294-841

Assessment of Washington Metropolitan Area Rail Rapid Transit System
Proj. MA-06-0060
Transportation Systems Center
December 1978,
DOT-TSC-UM-929-PM-79-4

Evaluation of the Cincinnati Transit Information System (TIS)
Proj. MA-06-0060
Transportation Systems Center
August 1979, UMTA-MA-06-0060-79-1

Fire Safety Guidelines for Vehicles in a Downtown People Mover System
National Bureau of Standards/
Center for Fire Research
January 1979, NBSIR 78-1586

Life Cycle Cost Procurement Procedures for Advanced Design Buses: Development and Test Application
Proj. VA-06-0045
Advanced Management Systems
May 1980, PB 80-209-026

Identification of the Fire Threat in Urban Transit Vehicles
Proj. MA-06-0051
TSC
June 1980, UMTA-MA-06-0051-80-1

Equipment and Maintenance Requirements for Light-Weight Accessible Bus Operations
Proj. MA-06-0060
TSC
May 1980, DOT-TSC-1604

Identification and Evaluation of Operational Alternatives for Materials Data Bank
Proj. MA-06-0051
TSC
July 1980, UMTA-MA-0051-80-2

CHAPTER 7

Socio-Economic Research and Special Projects

Trends and Highlights

The Office of Socio-Economic Special Projects encompasses a wide range of research, development, and information-dissemination programs. The office also has responsibility for carrying out projects that support UMTA's accessibility policies for the handicapped, which have been developed in accordance with Section 504 of the Rehabilitation Act of 1973.

During FY 80, the Automated Guideway Transit (AGT) Socio-Economic Research Program was expanded to include evaluations of new systems such as Accelerating Walkways, Automated Mixed Traffic Transit, and Cable Technology Transit as well as AGT. The revised program, New Systems Alternatives, continues to encompass a wide range of topics relevant to implementation of new transit systems in the urban environment: assessments of the technology and performance of existing systems, economic feasibility studies, market analyses, and urban impact studies such as energy analyses, aesthetics, and security requirements. In addition, a new effort to identify and develop long-range advanced transit systems research programs was initiated.

A second area of study is the Automated Transit Information System (ATIS). The ATIS is a computer-aided system that can automatically respond to consumer questions on bus and other transit services, including specific information on routes, schedules, fares, and related inquiries.

A third major activity is an Air Cushion Vehicle (ACV) demonstration in southwestern Alaska. This demonstration, which was expected to become operational in October, 1980, will result in

the first scheduled service of an ACV in the United States. Two vehicles will be used, an 110-ton hoverbarge for goods service and a small, more conventional ACV for people.

In FY 80, implementation of a five-year program plan to improve transit's accessibility to the elderly and handicapped was begun. Projects to learn more about the capabilities of people with specific handicaps were initiated to help in designing solutions to reducing barriers in the transit environment. A program to match the results of research that would help reduce barriers with specific interests of transit operators was started.

A search for a means of transporting people from one floor to another in transit stations at lower cost was begun. Installation of elevators in older stations has been found to represent 98 percent of the cost of making rail transit accessible. The escalator, the inclined elevator, and special, unconventional elevators were reviewed. Design of a kit to modify the escalator, in order to carry wheelchair-users and better accommodate other types of handicapped people, was completed. Fabricating and testing the design will take place during FY 81.

The Impact Assessment Program (IAP) is another important activity of this office. Within the IAP, independent evaluations of new transit technology demonstrations sponsored throughout the Office of Technology Development and Deployment, with particular emphasis on the socio-economic impacts of the demonstrated technology are conducted. These assessments are managed apart from the demonstration projects themselves to increase the objectivity and credibility of the assessment results.

Several other special projects were initiated by this office including work on decision analysis procedures, commercialization techniques, and requirements analyses to aid in the assessment and future direction of UMTA R&D projects.

Work has also included projects in cooperation with the support staff of UMTA's Office of Technology Development and Deployment to maintain and improve UMTA's technology sharing and communication efforts. This work involves a variety of strategies to encourage the exchange of information and to share UMTA's research and development projects with the entire transportation community and the general public.

Socio-Economic Research/New Systems Alternatives

Projects included in the New Systems Alternatives program are aimed at identifying suitable conditions for developing and implementing new technologies for urban public transportation. Issues examined in this program include:

A 50-ton capacity air cushion vehicle barge operating in Alaskan waters.

- performance, operational, and economic characteristics of deployed new sysems;
- cost-effectiveness comparisons of new systems with conventional modes;
- potential national market for new systems;
- urban impacts and public acceptability of new systems;
- financing, delivery system, and policy options related to new system implementation;
- future research, development, and demonstration requirements; and
- improved information-dissemination on new transit system characteristics.

Program objectives are pursued through five activity areas: assessment, markets, costs, impacts, and program support.

Assessments

The data base of operational AGT systems, documented by previous assessments, was supplemented with additional assessments of AGT systems and other new operational transit technologies. These assessment reports include: 1) descriptive economic, system peformance, and human factors information; 2) factual operating and engineering data; and 3) a chronology and review of the system development experience. All assessments include extensive coordination with system manufacturers and operators.

Further domestic AGT system assessments (IT-06-0188) completed in FY 80 describe systems at Busch Gardens, Williamsburg, Va.; Duke University Hospital, Durham, N.C.; and the Miami, Fla. International Airport. The Morgantown Independent Assessment (IT-06-0157) evaluated Phase I (September 1975 to July 1978) operational and performance characteristics of the automated people mover system at the University of West Virginia. Planning activities for a Phase II assessment of the Morgantown system were initiated under the Domestic New Systems Assessment project (IT-06-0248).

The Aerobus Assessment (IT-06-0189) established a data base on cable technology transit for planners who might be considering its potential for U.S. urban transportation deployment.

Better information about complex routes and schedules can be provided when operators have access to Automated Transit Information System (ATIS). Here, a pilot system is being evaluated by SCRTD in Los Angeles.

Two cable systems were assessed: the Aerobus System which is operated in Mannheim, West Germany, and the Roosevelt Island Tramway in New York City.

Additional foreign AGT systems were studied in project MA-06-0069, in order to expand the AGT data base to include international developments. These assessments were performed under cooperative agreements between the United States and other nations. They include assessments of the VAL System in Little, France; the H-Bahn system developed in West Germany; and the Canadian ICTS, a steel wheel-on-rail AGT system. Safety and security analyses of AIRTRANS (Phase II) were conducted under a cooperative U.S./French agreement. Another study completed in this project was a status report on the Osaka and Kobe urban AGT systems under construction in Japan.

An assessment of the Transette system, located in Atlanta, Ga., was also made. This study documents the state-of-the-art for moving belt transit systems (MA-06-0069).

Markets

Market research studies completed in FY 80 evaluated the capabilities of new transit technologies to meet the travel demands and mobility requirements of urban areas and the estimates of the potential market. The influence of current or alternative UMTA policies on market size was also assessed.

The Generic Alternatives Analyses Project (IT-06-0168) will provide local planners with a framework for transit system alternatives analyses and preliminary mode selection. The relative cost effectiveness of AGT and conventional transit modes was examined in numerous generalized urban applications. The sensitivity of AGT effectiveness measures to travel demand, cost, urban development, social, environmental, and institutional factors was investigated.

The potential market for AGT systems was determined in the Preliminary AGT Markets Project (IT-06-0165). This study involved site-specific evaluations of AGT system performance, costs, and impacts, and included interviews and simulated alternatives analyses in Chicago, Ill.; Atlanta, Ga.; and Dallas, Tex. These case studies also incorporated evaluations of site-specific impacts (e.g. visual intrusion) and modal preference surveys not possible in hypothetical studies.

The AMTT Markets Study (DC-06-0197) identified potential applications for Automated Mixed Traffic Transit and examined the estimated cost for each application type. Planning for additional new systems market studies was initiated in FY 80.

Costs

Capital, and operating and maintenance (O&M) costs of new systems were compiled and analyzed to aid planners in evaluating their economic feasibility. Analyses included consideration of potential cost reductions through system maturation, product improvements, operational changes, and market increases. A second supplementary cost update (MA-06-0069), documenting and analyzing capital cost data on 12 AGT systems and AGT O&M cost trends from 1976-1979, was published.

Impacts

Potential urban impacts of new systems were identified and analyzed in this project area. The Aesthetics Handbook (IT-06-0165) was designed to assist AGT planners in understanding aesthetic impacts and alternative design solutions to lessen adverse impacts. Data on AGT system energy usage were developed in the AGT Energy Analysis (IT-06-0220). On-site energy assessments are currently being conducted and potential energy reductions will be identified.

Program Support

A major program support effort in FY 80 was the preparation of the AGT Socio-Economic Research Program Summary Report (IT-06-0176) which integrated project data and results for the period 1976 through 1979 for widespread public dissemination. The Advanced Transit Requirements and Applications Planning Project (MA-06-0069) was initiated to assist in developing long-range advanced systems RD&D programs. This study will identify user, operator, and community requirements; identify service concepts to meet these requirements; and analyze the relative capabilities of existing and innovative transit technologies in providing the necessary system and subsystem hardware and performance requirements.

System Studies, Support, and Development

Automated Transit Information System (ATIS)

In FY 80, the Office of Socio-Economic and Special Projects continued several activities which supported the development and demonstration of an Automated Transit Information System (ATIS). Key to the system, currently being tested in Washington, D.C., and Los Angeles, Calif., is that computer programs locate and supply information in response to consumer questions about bus and rail transit service. The ATIS is expected to increase accuracy and reduce response time to questions about schedules, routes, and fares while cutting the time and cost needed to train information operators.

The ATIS Demonstration Project (DC-06-0154) has developed a prototype ATIS for trial operation in the Washington Metropolitan Area Transit Authority (WMATA). As a demonstration, the project was designed to determine the technical, operational, and economic feasibility of the ATIS. To insure that WMATA will meet with operational and technical success, the project, ATIS Technical Support (MD-06-0037), was developed. The support project reviewed proposed work plans, evaluated progress, and conducted independent studies to aid in the ATIS demonstration. At the present time, the geographic data base for the WMATA service area is complete and the WMATA ATIS is expected to be fully operational in early FY 81.

A project entitled ATIS Data Base Integration (VA-06-0052) is developing a report on recent innovations in information systems for scheduling, routing, and monitoring vehicle movement, as well as providing customer information. A workshop was conducted in November, 1979 on the analysis of system design and evaluation. The project has also identified ways in which ATIS algorithms and data base can be used in other transit operations to help spread the costs and benefits of ATIS among several functional areas.

Another project, ATIS Voice Response (VA-06-0054), was undertaken to determine if computerized voice response could be used to improve the operational performance of ATIS. Included in this study was a systems requirement analysis and a feasibility study for using computerized voice response (CVR) as part of an ATIS. A brief overview of computer technology was made to determine if CVR might be used either now or in the near future.

The Port Authority of New York and New Jersey received a grant to determine the feasibility of implementing a regional ATIS to use a common data base shared by several propeties in the metropolitan area (NY-06-0077). An interagency agreement among TSC, UMTA, and FAA was initiated to determine the design and utility of ATIS in high-density transit terminals, particularly major airports. An operational prototype was developed and 12 to 15 console units will be installed within Logan Airport, in Boston, Mass., during FY 81. A new project was initiated to conceptualize the technical, operational, and cost considerations of using the nine-digit zip code planned by the U.S. Post Office within the ATIS geographic data base.

Finally, in the area of nonmodal systems development, the office funded a grant to the State of Alaska (AK-06-0002) to demonstrate an air cushion vehicle (ACV) to meet the unique transportation needs of remote Alaskan communities. In FY 80 two ACV's, one an 110-ton hoverbarge, were built and shipped to Alaska. The demonstration was scheduled to begin in October, 1980.

Accommodation of Elderly and Handicapped Travellers

Section 504 of the Rehabilitation Act of 1973 requires that" . . . no otherwise qualified handicapped individual in the United States . . . shall solely by reason of his handicap, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance."

On May 31, 1979 UMTA issued final regulations describing minimum accessibility requirements that must be met in all transit facilities and vehicles in order to qualify for the use of federal funds (49 CFR, Part 27, Subpart E). Additional and continued planning and coordination of programs to achieve the designs needed to make transit accessible is well under way and is the responsibility of the Office of Socio-Economic and Special Projects.

During FY 80 the office initiated the first three programs of a five-year Elderly and Handicapped Program Plan (VA-06-0061) to improve transit accessiblity for elderly and handicapped travellers. The plan identified nine problem areas in transit systems which need to be addressed by the research community. Example problem areas are communications (with the deaf and the blind and those who have difficulty speaking), fare collection and fare boxes (particularly for those with problems of manual dexterity), and discontinuity between the platform

and rail vehicle (particularly for the wheelchair user).

The problem areas were determined to be of high importance to handicapped people, and therefore areas in which design solutions through research, development, or demonstration should be sought.

The Program Plan contains eight elements, as follows:

1) analysis of the handicapped, by handicap category;
2) analysis of barriers to the handicapped, by transit mode;
3) transit accessibility technology transfer;
4) evaluation of safety and technology;
5) rapid rail transit accessibility improvements;
6) bus transit accessibility improvements;
7) light rail transit accessibility improvements; and
8) commuter rail transit accessibility improvements.

The first element (IT-06-0243) will obtain baseline information by handicap category (deaf, blind, etc.) in order to establish the requirements a design solution must meet to successfully reduce a barrier to people in that category of handicap. The second element (MD-06-0057) will take a census of handicapped, by transit mode, to set priorities for future research. In the third element, information transfer (MA-06-0122), the output of research will be matched with specific research needs which individual transit operators have identified.

In addition to the plan's broad programs involving several modes, projects focusing on individual modes were also begun. A grant was awarded to the Boston College School of Special Education to develop guidelines for improved communication with the visually impaired in rail rapid transit systems (MA-11-0036). Validation of the guidelines is planned in future research.

The problem that handicapped people experience in moving from one floor level to another in transit stations was addressed in several projects in FY 80. Work was completed on the design phase of the Escalator Modification Kit (IT-06-0164). This project will design, build, and test a prototype "modification kit" to make the escalator more accommodating to the semi-ambulatory and wheelchair users. During FY 81, laboratory testing of the design will take place on an unused escalator at Malden Center, one of the stations operated by Boston's Massachusetts Bay Transportation Authority.

The transit system in Stockholm, Sweden, has had very successful experience with 36 inclined elevators installed in 20 stations, making the stations accessible to all citizens. These inclined elevators travel alongside the escalators at the same angel (30°), giving people who have difficulty with escalators a way to change floor levels that allows them to remain in the pedestrian mainstream. An earlier assessment of the Stockholm inclined elevators (IT-06-0162) concluded that with some minor changes, this type of elevator could be used in the United States, and it recommended that an inclined elevator demonstration project be undertaken.

With the aid of a research grant from UMTA, the Washington Metropolitan Area Transit Authority (WMATA) will develop specifications for operation of an inclined elevator in the Washington Metro and, after the elevator's installation, will perform an evaluation of it. WMATA plans to install an inclined elevator in its Huntington, Va., Metro station. This will be the first inclined elevator to operate in a U.S. transit system.

The Code Committee for Elevators, Escalators, and Moving Walks of the American National Standards Institute (ANSI) used the UMTA assessment report during FY 80 in preparing proposed safety specifications for inclined elevators in the United States. The new code, when approved, will form Part XX of the ANSI A17 Elevator Code.

Because installation of elevators in older stations is very costly, the office initiated research to study types of special elevators in operation in Europe that do not require the large amount of excavation or safety crawl space needed for conventional elevators. Whether they can be used in transit stations, and what design changes may be needed, will be determined (MA-06-0125).

Every city with a Downtown People Mover program develops a plan describing the actions it will take and designs it will employ to make these new automated transit systems free from barriers to the handicapped. During FY 80, the office worked with the Office of New Systems Applications and the cities of Detroit, Los Angeles, and Miami to develop their plans. Moreover, Los Angeles undertook research to develop guidelines for making DPM systems accessible (CA-06-0122 and CA-09-7003).

Unimobile at Hershey Park, Penn.

Vought Airtrans at Dallas/Fort Worth Regional Airport, Tex.

UMTA has completed technical assessments and is continuing to monitor reliability and costs on the people mover vehicles illustrated on these pages.

VSL System at Roosevelt Island, N.Y.

Westinghouse People Mover at Busch Gardens, Va.

Mueller Aerobus in West Germany

Cabintaxi in West Germany

Ford ACT System at Fairlane, Mich.

Westinghouse People Mover at Tampa, Fla. International Airport

Otis System at Duke University, N.C.

Wedway System at Disneyworld, Fla.

Cabinlift in West Germany

Boeing People Mover at Morgantown, W.Va.

ICTS in Canada

VAL System in France

Rohr System at Houston, Tex. Intercontinental Airport

Impact Assessment

The office serves as the focal point for independent evaluation activities within the Office of Technology Development and Deployment (UTD). Working within the Impact Assessment Program (IAP), efforts are devoted to developing experimental design plans, conducting evaluations of new technology demonstrations, and providing expert evaluation assistance to UTD and local project managers.

The largest evaluation under way during FY 80 was the socio-economic impact assessment of Downtown People Movers (DPM) planned for Detroit, Los Angeles, Miami, and St. Paul (IT-06-0177). Support has been provided to the demonstration cities to insure that final results are comparable, and a revised assessment plan was completed to provide a guide for local elevators. In a related effort, work was initiated to document characteristics and costs of minibus systems, and to specify evaluation measures to compare different modes of transit (IT-06-0236).

In another project, baseline data has been collected for demonstration of advanced Automatic Vehicle Monitoring (AVM) at the Southern California Rapid Transit District (CA-06-0121); "after" data collection and analysis will proceed in FY 81 (IT-06-0263). Work began in FY 80 on an assessment of Automatic Transit Information Systems (ATIS). This project includes support of local ATIS evaluations in the District of Columbia and Los Angeles, plus the preparation of a national level assessment (DC-06-0256). Other ongoing evaluations during FY 80 include the Alaska Air Cushion Vehicle Evaluation (MD-06-0058) and the Phase II Morgantown People Mover Impact Assessment (IT-06-0203 and WV-06-0012).

In order to provide general evaluation guidance to UTD project managers and others, an "Evaluation Handbook for Transportation Impact Assessment" was drafted in FY 80 (IT-06-0203). The handbook will be published in FY 81.

Special Projects

Several projects conducted by the office do not readily fit into any distinct project grouping. For example, a project entitled UTD Special Reports and Discussion Papers (MD-06-0032) studied possible federal incentives to stimulate greater innovations in mass transit technology and options for overcoming barriers to the introduction of new transit products into commercial service. Preliminary efforts of this project included consultation with selected transit industry officials representing the points of view of both operating properties and equipment suppliers.

A study entitled AMTV Market Estimates (DC-06-0196) to assess the potential national market for Automated Mixed Traffic Vehicles (AMTV) was completed in FY 80. AMTV is an automated vehicle capable of moving in a mixed traffic environment without a driver aboard, whicle automatically avoiding obstacles and pedestrians. The study was undertaken jointly by UMTA and NASA, and included a review of potential sites for the AMTV, such as pedestrian malls, airports, and college campuses. Other assessments were made of special applications for the elderly and handicapped, and of possible locations for demonstration projects.

The Life Cycle Costing General Feasibility Study (RI-06-0007), which surveyed current life cycle costing procedures and determined how these procedures might be applied by UMTA and transit operators in the procurement of transit equipment, was completed. A pilot experiment (IT-06-0240) was planned at a transit property to test the methodology developed. Several small buses from up to three manufacturers will be purchased by negotiated procurement and operated under similar and controlled conditions in regular transit service. Cost data will be collected and compared over an 18-month period. Life cycle costs will be projected for an extended period. In a second procurement, the vehicle with the lowest expected total cost of ownership will be selected. During 1980, the life-cycle costing program, including the pilot experiment, was assumed by the Office of Safety and Product Qualification.

Two pre-program studies were initiated in FY 80: 1) Decision Analysis, for establishing selected criteria for UMTA RD&D projects (MD-06-0061), and 2) Commercialization Study of developed prototypes and products. These two studies will coordinate with the Impact Assessment Program (IAP) to develop a uniform procedure for assessing the need for an UMTA RD&D project, continuously monitoring selected projects, and determining methods for commercializing the resulting products or prototypes.

Finally, the National Cooperative Transit Research and Development Program (NCTRP) initiated in FY 79 will be

continued. NCTRP (MD-06-0053, DC-06-0230, DC-06-0231, DC-06-0232) was developed to provide UMTA's primary constituents, the transit industry and cities, counties and states, through the American Public Transit Association and the Urban Consortium, an opportunity to participate collectively in identifying and resolving near-term transit research and development problems. The NCTRP operates through a technical steering group which reviews research requests and assigns a priority ranking for those selected in the annual program of projects. The Transportation Research Board of the National Academy of Sciences serves as coordinator for NCTRP by monitoring the various research projects and awarding all subcontracts. The pragmatic objective of NCTRP is to establish a closer working relationship between government agencies and transit operators and suppliers in order to expedite UMTA's efforts to make the results of research available to the users.

Communications and Technology Sharing

A major effort of the Office of Technology Development and Deployment is to share the results of UMTA's research and development activities with planners, transit officials, elected officials, the public, and other interested groups. Three communications and technology sharing projects were developed for this program.

The largest project, Technology Sharing and Support (MA-06-0086), is funded through the Transportation Systems Center in Cambridge, Mass., and provides technical and analytical support to the Office of Technology Development and Deployment in an effort to share information with UMTA's client groups. In its information sharing effort, the TSC Office of Technology Sharing organizes and conducts conferences and disseminates a variety of documents both on UMTA's technology development and deployment activities and on specific interest areas.

During FY 80, the Office of Technology Sharing began a cooperative program with research and developmnt officials from state departments of transportation. The program is designed to accelerate the dissemination of results from state-initiated programs which might be useful to other states. In addition, the program will provide systems for coordinating state and federally funded research, and for informing UMTA of current technological problems experienced by state DOT's.

Two new kinds of Technology Sharing documents were developed during FY 80. The first, a "program digest" was designed to communicate introductory technical information to both technical and nontechnical people, fulfilling the need for information on specific subjects to a great majority of the interested public. The prototype digests on urban tunneling technology and urban rail noise abatement were each based on over 5000 pages of technical reports.

The second new type of publication is a "program fact sheet", a four-to six-page illustrated description of work in progress which complements other Technology Sharing documents by providing a technical overview and a discussion of future plans for individual programs. Both of these approaches are being evaluated for potential application to a wide range of UMTA-sponsored RD&D programs.

The Office of Technology Sharing also produced the 1979 edition of the UMTA RD&D Directory, *Innovation in Public Transportation.* (A list of other publications issued from this office appears in Appendix A.) Finally, the office completed the development of an automated direct mail system to be used to identify and reach specific target audiences.

Socio-Economic Research and Special Projects

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
SOCIO-ECONOMIC RESEARCH/NEW SYSTEMS ALTERNATIVES					
Morgantown Independent Assessment (Phase I)	IT-06-0157	$196,000	Jan. 1977-Oct. 1979	N. D. Lea and Associates	Ron Nawrocki (202) 426-4022
Further Domestic Assessments	IT-06-0188	$100,000	Apr. 1978-Nov. 1979	N. D. Lea and Associates	Ron Nawrocki (202) 426-4022
Aerobus Assessment	IT-06-0189	$100,000	Oct. 1978-Oct. 1979	N. D. Lea and Associates	Ron Nawrocki (202) 426-4022
Domestic New Systems Assessments	IT-06-0248	To Be Determined	Jan. 1981-Jan. 1984	To Be Selected	Ron Nawrocki (202) 426-4022
Foreign Assessments	MA-06-0069	$352,000	Aug. 1977-Oct. 1981	TSC	Ron Nawrocki (202) 426-4022
Preliminary AGT Markets	IT-06-0165	$294,000	Oct. 1977-Oct. 1980	Cambridge Systematics, Inc.	Ron Nawrocki (202) 426-4022
Generic Alternatives Analyses	IT-06-0168	$402,000	Aug. 1977-Oct. 1980	W. V. Rouse and Associates	Ron Nawrocki (202) 426-4022
AMTT Markets Study	DC-06-0197 VA-06-0056	$50,000 $10,000	Oct. 1977-Sept. 1980	SRI International; MITRE Corporation	Ron Nawrocki (202) 426-4022
Summary of Capital and O&M Costs Experiences of AGT Systems, Supplement II, 1976-1979	MA-06-0069	$80,000	Oct. 1979-Mar. 1980	TSC	Ron Nawrocki (202) 426-4022
Aesthetics Handbook	IT-06-0165	$40,000	Aug. 1978-Feb. 1980	Skidmore, Owings and Merrill	Ron Nawrocki (202) 426-4022
AGT Energy Analysis	IT-06-0220	$184,000	July 1979-Oct. 1980	AMS, Inc.	Ron Nawrocki (202) 426-4022
AGT Socio-Economic Research Summary Report	IT-06-0176	$20,000	Dec. 1978-Oct. 1979	MITRE Corporation	Ron Nawrocki (202) 426-4022

Socio-Economic Research and Special Projects

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
SOCIO-ECONOMIC RESEARCH/NEW SYSTEMS ALTERNATIVES					
Technical Program Support	IT-06-0197	$220,000	Feb. 1979-Oct. 1981	SYSTAN, Inc.	Ron Nawrocki (202) 426-4022
Advanced Transit Requirements and Applications	MA-06-0069	$250,000	Aug. 1980-Oct. 1981	TSC	Ron Nawrocki (202) 426-4022
SYSTEMS STUDIES, SUPPORT, AND DEVELOPMENT **Automated Transit Information System (ATIS)**					
ATIS Prototype Demonstration	DC-06-0154	$435,000	Sept. 1976-July 1980	WMATA	John Durham (202) 426-4022
ATIS Data Base Integration	VA-06-0052	$100,000	Nov. 1978-Dec. 1980	MITRE Corporation	John Durham (202) 426-4022
ATIS Voice Response	VA-06-0054	$50,000	Nov. 1978-Sept. 1979	Input/Output Computer Services	John Durham (202) 426-4022
Regional ATIS	NY-06-0077	$150,000	Oct. 1979-Oct. 1980	Port Authority of New York and New Jersey	John Durham (202) 426-4022
Airport ATIS	MA-06-0108	$75,000	Oct. 1979-Oct. 1980	TSC	John Durham (202) 426-4022
ACV Demonstration	AK-06-0002	$1,020,000	Oct. 1979-Oct. 1981	State of Alaska	John Durham (202) 426-4022
ATIS Zip Code Data Base	DC-06-0295	$10,000	June 1980-Oct. 1981	National Capital Systems	John Durham (202) 426-4022
ATIS Prototype Remote Entry	Unassigned	$90,000	Planned 1981	To Be Selected	John Durham (202) 426-4022

Socio-Economic Research and Special Projects

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
SYSTEMS STUDIES, SUPPORT, AND DEVELOPMENT					
Accommodation of Elderly and Handicapped Travellers					
Analysis of Handicapped, to Ascertain Design Requirements	IT-06-0243	$530,000	Oct. 1980-Oct. 1981	Wilson-Hill Associates, Inc.	P. Simpich (202) 426-4023
Analysis of Transportation Barriers, by Transit Mode	MD-06-0057	$200,000	Oct. 1980-Aug. 1981	OAO Corporation	P. Simpich (202) 426-4023
Transit Accessibility Technology Transfer	MA-06-0122	$180,000	Aug. 1980-Aug. 1982	TSC	P. Simpich (202) 426-4023
Improved Communication with the Visually Impaired in Rail Rapid Transit	MA-11-0036	$80,000	July 1980-June 1981	Boston College	P. Simpich (202) 426-4023
Special Barriers Study: Wheelchair-Fastening Systems, and Special Elevators	MA-06-0125	$200,000	Sept. 1980-May 1981	TSC	P. Simpich (202) 426-4023
IMPACT ASSESSMENT					
DPM Impact Assessment	IT-06-0177	$606,000	Oct. 1979-Oct. 1984	Cambridge Systematics, Inc.	John Durham (202) 426-4022
Alaska ACV Evaluation	MD-06-0058	$110,000	May 1979-Dec. 1981	Omar McCall and Associates	John Durham (202) 426-4022
Morgantown Phase II Impact Assessment	IT-06-0203	115,000	Oct. 1979-Jan. 1981	SYSTAN, Inc.	John Durham (202) 426-4022
Morgantown Phase II Travel Assessment	WV-06-0012	$188,000	Dec. 1978-Dec. 1980	West Virginia University	John Durham (202) 426-4022
ATIS Evaluation	DC-06-0256	$120,000	April 1980-Sept. 1981	Wilson-Hill Associates, Inc.	John Durham (202) 426-4022

Socio-Economic Research and Special Projects

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
IMPACT ASSESSMENT					
AVM Baseline Assessment	CA-06-0121	$85,000	April 1979-Dec. 1980	Juarez and Associates	John Durham (202) 426-4022
AVM Project Assessment	IT-06-0263	$160,000	Oct. 1980-Dec. 1981	SYSTAN, Inc.	John Durham (202) 426-4022
Minibus Performance Measures	IT-06-0236	$25,000	Aug. 1980-Oct. 1980	S G Associates	John Durham (202) 426-4022
Project Evaluation Technical Support	IT-06-0203	$145,000	Jan. 1979-Jan. 1981	SYSTAN, Inc.	John Durham (202) 426-4022
SPECIAL PROJECTS					
UTD Special Reports and Discussion Papers	MD-06-0032	$165,430	March 1978-March 1980	Onyx Corporation	Henry Nejako (202) 426-4052
Life-Cycle Costing: General Feasibility Study	RI-06-0007	$139,000	March 1975-Nov. 1980	Naval Underwater Systems Center; Dudley W. Gill and Associates	P. Simpich (202) 426-4023
Decision Analysis Methodology for Planning UMTA Technology Projects	MD-06-0061	$20,000	April 1979-June 1981	Automated Management Systems	John Durham (202) 426-4022

Socio-Economic Research and Special Projects

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
COMMUNICATIONS AND TECHNOLOGY SHARING					
Technology Sharing Support	MA-06-0086	$410,000	Oct. 1977- Continuing	TSC	Henry Nejako (202) 426-4052
International Transit Compendium	AL-06-0006	$50,000	April 1978- Dec. 1980	N. D. Lea Transportation Research Corp.	Edith Rodano (202) 426-9261
Analysis of the 1978 ATRA Conference	DC-06-0252	$35,000	March 1979- Feb. 1980	Advanced Transit Association	Edith Rodano (202) 426-9261
National Cooperative Transit Research and Development Program	MD-06-0053 DC-06-0230 DC-06-0231 DC-06-0232	$1,000,000	March 1979- Continuing	Transportation Research Board; American Public Transit Association; Public Technology, Inc.; Onyx Corp.	John Durham (202) 426-4022

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, they may be obtained by writing to the person listed as the technical contact in the project summary chart.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

SOCIO-ECONOMIC RESEARCH/ NEW SYSTEMS ALTERNATIVES

AGT Aesthetics: A Handbook for Planning and Design of Automated Guideway Transit (AGT) Systems
Proj. IT-06-0165
Skidmore, Owings and Merrill
February 1980, PB-80-173-594

Automated Guideway Transit Socio-Economic Research Program: Findings, 1976-1979
Proj. IT-06-0176
MITRE Corp.
February 1980, PB-80-184-633

Automated Mixed Traffic Transit (AMTT) Market Analysis
Proj. VA-06-0056/DC-06-0197
MITRE Corp. and SRI International
September 1980

Assessment of Operational Automated Guideway Systems: Airtrans (Phase I)
Proj. MA-06-0067
Transportation Systems Center
September 1976, PB 261-339

Assessment of Operational Automatic Guideway Systems: Airtrans (Phase II)
Proj. MA-06-0069
Transportation Systems Center and Institut de Recherche de Transports, France
January 1980, PB-80-182-538

Assessment of Operational Automated Guideway Systems: Jetrail
Proj. MA-06-0067
Transportation Systems Center
December 1977, PB 278-521

Assessment of the Automatically Controlled Transportation (ACT) System at Fairlane Town Center
Proj. IT-06-0135
SRI International
December 1977, PB 268-524

Assessment of the Busch Gardens Automated Anheuser-Busch Shuttle System
Proj. IT-06-0188
N. D. Lea & Associates
November 1979, PB-80-127-384

Assessment of the Mueller Aerobus System
Proj. IT-06-0189
N. D. Lea & Associates
September 1979, PB-80-130-636

Assessment of the Passenger Shuttle System (PSS) at Tampa International Airport
Proj. IT-06-0135
SRI International
December 1977, PB 285-597

Assessment of the Phase I Morgantown People Mover System
Proj. IT-06-0157
N. D. Lea & Associates and SNV Studiengesellschaft Nahvenkehr mbH
October 1979, PB-80-177-926

Assessment of the Satellite Transit System (STS) at the Seattle-Tacoma International Airport
Proj. IT-06-0135
SRI International
December 1977, PB 281-820

Assessment of the Tunnel Train System at the Houston Intercontinental Airport
Proj. IT-06-0135
SRI International
December 1977, UMTA-IT-06-0135-77-3

Assessment of the UMI Type II Tourister AGT Systems at King's Dominion
Proj. IT-06-0135
SRI International
December 1977, PB 286-513

Assessment of the WEDway People-Mover System at Walt Disney World
Proj. IT-06-0135
SRI International
November 1977, PB 268-935

Description and Technical Review of Duke University Automated People/Cargo Transportation System
Proj. IT-06-0188
N. D. Lea & Associates
August 1979

Description and Technical Review of the Miami International Airport Satellite Transit Shuttle System
Proj. IT-06-0188
N. D. Lea & Associates
September 1979, PB-80-158-892

Development/Deployment Investigation of Cabintaxi/Cabinlift Systems: Final Report
Proj. MA-06-0067
Transportation Systems Center and SNV Studiengesellschaft Nahverkehr mbH
December 1977, PB 277-184

Life Cycle Cost Model for Comparing AGT and Conventional Transit Alternatives
Proj. CA-06-0090
General Research Corp.
February 1976, PB 259-529

Review of Downtown People Mover Proposals: Preliminary Market Implications for Downtown Application of Automated Guideway Transit
Proj. IT-06-0176
MITRE Corp.
December 1977, PB 281-068

Review of Local Alternatives Analyses Involving Automated Guideway Transit
Proj. NY-06-0057
Urbitran Associates
February 1978, PB 291-334

Roosevelt Island Tramway System Assessment
Proj. IT-06-0189
N. D. Lea & Associates
August 1979, PB 80-129-224

Summary of Capital and Operations and Maintenance Cost Experience of Automated Guideway Transit Systems
Proj. IT-06-0157
N. D. Lea and Associates
April 1978, UMTA-IT-06-0157-78-2
Supplement 1. **Summary of Capital and Operations and Maintenance Cost Experience of Automated Guideway Transit Systems: Costs and Trends for the Period 1976-1978**
Proj. IT-06-0188
N. D. Lea & Associates and Transportation Systems Center
October 1979, PB-80-146-483

Supplement 2. **Summary of Capital and Operations and Maintenance Cost Experience of Automated Guideway Transit Systems: Costs and Trends for the Period 1976-1979**
Proj. MA-06-0069
Transportation Systems Center
March 1980, PB-80-204-878

SYSTEMS STUDIES, SUPPORT AND DEVELOPMENT

Automated Transit Information Systems (ATIS)

An Automated Information Directory System [AIDS]: Review and Specifications
Proj. VA-06-0038
MITRE Corporation
July 1977, PB 272-253

Comparison of the Performance of Three Algorithms for Use in an Automated Transit Information System
Proj. MD-06-0013, MD-06-0037
National Bureau of Standards
August 1977

Cost/Benefit Analysis of Automated Transit Information Systems
Proj. MD-06-0013, MD-06-0037
National Bureau of Standards
February 1977, NBSIR 77-1235

Elderly and Handicapped Accessibility

A Requirements Analysis Document for Transit Vehicle Wheelchair Lift Devices
Proj. CA-06-0101
Canyon Research Group, Inc.
June 1978, UMTA CA-06-0101-79-1

Assessment of the Inclined Elevator and Its Use in Stockholm
Proj. IT-06-0172
DeLeuw Cather and Co.
September 1978, PB 294-854

Escalator Modification for the Handicapped: Phase I, Final Report
Proj. IT-06-0164
Foster-Miller Associates, Inc.
July 1980, UMTA-IT-06-0164-80-01

Los Angeles Downtown People Mover Handbook of Guidelines for Accessibility to Elderly and Handicapped People
Proj. CA-06-0112, CA-09-7003
Community Redevelopment Agency, City of Los Angeles, Kaiser Engineers, DMJM and Synergy Consulting Services
September 1980, UMTA-CA-09-7003

Safety During Special Transportation Service Trips: Part I, Transportation in Vehicles Designed for the Handicapped
Proj. CA-06-0098
California Department of Transportation
December 1978 (English Edition), UMTA-CA-06-0098-78-2

Safety During Special Transportation Service Trips: Part II, Movement In and Out of Special Transportation Service Vehicles
Proj. CA-06-0098
California Department of Transportation
December 1977 (English Edition), UMTA-CA-06-0098-78-1

Safety Guidelines for Wheelchair Lifts on Public Transit Vehicles
Proj. CA-06-0098
California Department of Transportation
July 1980, UMTA-CA-06-0098

Transit Station Use by the Handicapped: Vertical Movement Technology
Contract No. DOT-UT-80040
Transportation Research Board
April 1980, DOT-UT-80040

Life Cycle Costing

Life-Cycle Costing for Current Rohr and AM General Buses and General Motors RTS-II Bus
Proj. VA-06-0039
Advanced Management Systems, Inc.
July 1976, PB 255-091

Life-Cycle Costing Guidelines for Procurement of Small Buses
Proj. RI-06-0007
Naval Underwater Systems Center, Dudley Gill Associates and Reed Winslow
August 1980, UMTA-RI-06-0007

Use of Life-Cycle Costing for Transit Equipment Procurement
Proj. RI-06-0007
Naval Underwater Systems Center, Dudley Gill Associates and Reed Winslow
July 1980, UMTA-RI-06-0007

Impact Assessment

Downtown People Mover Demonstration Program: Impact Assessment Guide to Local Evaluations
Proj. IT-06-0177
Cambridge Systematics, Inc.
September 1980, UMTA-IT-06-0177-80-1

Experimental Design Plan for the Downtown People Mover Demonstration Projects: Final Report
Proj. DC-06-0162
Peat, Marwick, Mitchell and Co.
April 1977, PB 270-614

Communications, Technology Sharing and Other Projects

Development of a Time-Calibrated Self-Cancelling Ticket: Initial Feasibility Determination
Proj. IT-06-0125
A. D. Little, Inc.
July 1977, UMTA-IT-06-0125-77-1

Development of a Time-Calibrated Self-Cancelling Ticket, Final Report
Proj. IT-06-0125
A. D. Little, Inc.
May 1979, UMTA IT-06-0125-79-1

Innovation In Public Transportation: Fiscal Year 1977: A Directory of Research, Development and Demonstration Projects
Proj. MA-06-0086
Transportation Systems Center
1978

Innovation in Public Transportation Fiscal Year 1978: A Directory of Research, Development and Demonstration Projects
Proj. MA-06-0086
Transportation Systems Center
1979

Innovation in Public Transportation Fiscal Year 1979: A Directory of Research, Development, and Demonstration Projects
Proj. MA-06-0086
Transportation Systems Center
1980

Proceedings of the Urban Mass Transportation Administration/ American Public Transit Association Research and Development Priorities Conference
Proj. DC-06-0136
American Public Transit Association
May 1976, PB-255-898

Review of Possible Effects of Some Selected Federal Actions on New Transit Product Introduction
Proj. MD-06-0032
The Onyx Corporation
July 1979, UMTA-MD-06-0032-79-1

SECTION II

Service and Methods Demonstrations


metro

Service and Methods Demonstrations

The purpose of the Service and Methods Demonstrations (SMD) Program is to improve the quality and efficiency of urban transportation by sponsoring the implementation of new transportation management techniques and innovative transit services throughout the United States. The program focuses on strategies that utilize existing transportation technology to provide improvements which require relatively low levels of capital investment and can be implemented in short time frame. Some of these strategies have already been successfully employed in other parts of the world. Others are based on recent conceptual or technological developments by UMTA or by local transit properties in the United States. The program is designed to perform the final critical experimental tests and development steps, where required, and to bring these innovative strategies into full operational application.

Service and methods demonstrations reflect the philosophy that the travel needs of urban areas are best served by a balanced transportation system. In most cases, this requires a combination of travel modes (automobile, paratransit, bus, etc.) to provide a variety of services for various users, trip purposes, and travel patterns. Many demonstrations specifically address the technical and institutional issues of integrating a mix of transportation services provided by both public and private operators to serve a community's travel needs.

The SMD program places emphasis on the use of minor physical changes and operational policies to expand the capacity and increase the productivity of existing systems. This emphasis is consistent with, and provides technical support for, the Transportation Systems Management (TSM) element of the joint planning and programming regulations issued by UMTA and the Federal Highway Adminstration (FHWA). Many of the techniques which have been proven feasible through SMD demonstrations have subsequently been incorporated in Transportation Improvement Plans (TIP) of urban areas.

Innovative services and methods which have been demonstrated in the SMD program also support such important national goals as improved environmental quality and energy conservation. Moreover, these improvements will have more immediate impacts than activities with long lead times, such as the development of a new technology or the construction of major new facilities.

Demonstration activities have been divided into four major program areas. These areas are described briefly below.

Transportation Service for Special User Groups

This area seeks to develop and test specialized services that will provide for the travel needs of transit dependent people, particularly the elderly, the handicapped, and the poor. Projects in this area have included testing of specialized equipment to make public transportation more accessible to handicapped travelers, specialized demand-responsive, door-to-door services, user-side subsidies, and coordination of social service agency transportation programs.

Fare and Pricing Policies

This area focuses on the application of innovative pricing policies and transit service improvements to provide incentives for the use of public transportation and more efficient utilization of existing highway and parking facilities. The emphasis in this area is evolving from sys-

temwide fare policies to pricing specific travel markets in order to distribute benefits more equitably, attract new riders, and improve the productivity of underutilized vehicles. Projects in this area include alternative methods of fare payment, fare-free transit, fare incentive promotions, transit service improvements, and congestion pricing for automobiles.

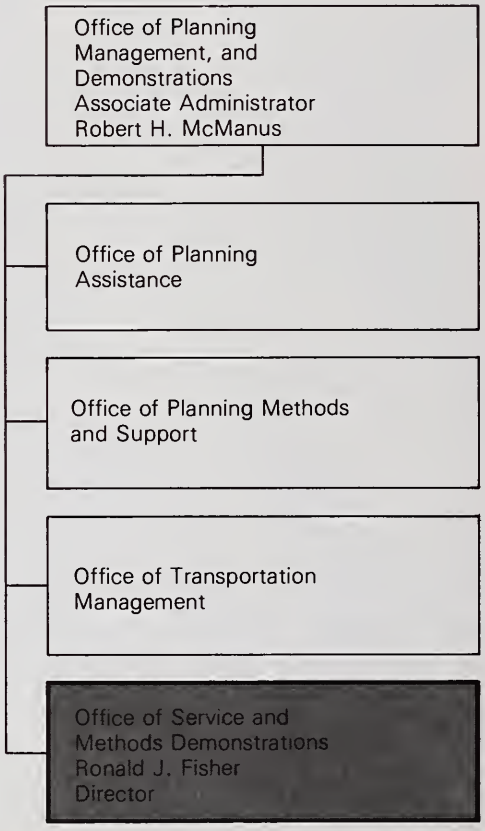
Conventional Transit Service Innovations

Demonstrations in this area include the innovative use of traffic engineering techniques and transit service policies aimed at improving conventional fixed-route transit systems and more effective utilization of existing transportation and urban resources. Emphasis has been placed on expediting peak period movements of passengers on surface transit vehicles (bus, light rail, and trolley bus). However, many of the strategies can and have encouraged greater use of other multiple-occupant vehicles such as carpools and vanpools. Projects in this area have included exclusive busways; reserved lanes on freeways, arterials, and local streets; signal preemption; transit malls; auto restricted zones; and vehicle innovations.

Paratransit

This area includes a broad range of services lying between conventional fixed route transit and the private automobile (e.g., demand responsive transit, jitneys, taxis, vanpools and carpools). The primary focus is on the use of these alternative travel modes to provide more efficient use of transportation facilities in those situations where conventional transit service is uneconomical to operate or simply ineffective.

The organization of the Office of Planning, Management and Demonstrations is shown below. The projects described in this section are funded and administered through the Office of Service and Methods Demonstrations, indicated in the shaded box on the accompanying chart.



CHAPTER 8

Transportation Services for Special User Groups

Trends and Highlights

The term "special users" refers to those members of the population who, because of age, income, or disability, are dependent upon public transportation or other special arrangements to meet their transportation needs. One of the objectives of the UMTA Service and Methods Demonstrations Program is to improve the mobility of the estimated 7.5 million urban Americans who are transportation handicapped.

The principle of full accessibility is being tested in a number of cities. Transit buses equipped with lifts to enable wheelchair users and others who cannot use steps to board the vehicle are in use in fixed-route service in selected areas. Mechanical difficulties related to the lift equipment have caused delays in implementing these services; however, there is steady improvement in lift reliability. These setbacks are counteracted by the many successful paratransit programs being conducted. A variety of special transportation services are being tested throughout the country, ranging from user subsidy programs to transportation brokerage systems.

Successful testing of the user subsidy concept has been demonstrated in projects in Montgomery, Ala., Lawrence, Mass., and Kinston, N.C., as well as in Danville, Ill., where an additional grant allowed the expansion of an experimental subsidy program to include the entire city's transportation system. Results of these projects show that the taxi-ticket program is easy to implement at low cost, and has the potential for widespread adoption. Current efforts in this area focus on coordinating multiple funding sources for the user subsidy and on implementing the concept in large urban

areas, where institutional and administrative complexities are much greater.

One problem has become evident in the investigation of transportation to special groups: human service agencies experience many difficulties in providing transportation for their clients. A proliferation of small, single-purpose services within the same area, operating independently of one another, often results. Programs to promote the coordination of these services are being funded by UMTA in cooperation with the Department of Health and Human Services (formerly HEW). The programs are demonstrating a variety of solutions, such as common referral of transportation information among agencies, or joint purchasing arrangements, or conslidation of all equipment and transportation services. Some agencies now can purchase transportation from other providers to serve their clients. In other projects, the local transit authority acts as a broker, matching the demand for special services with available supply from both public vehicles and private companies.

Identifying and Reaching Transportation Handicapped People

Through a $1.9 million research contract, the Service and Methods Demonstrations Office conducted a national survey (NY-06-0054) to determine the number of transportation handicapped people over five years of age and living in urban areas. The survey also at-

Full-size buses with lifts like the one shown above are accessible to people in wheelchairs. These buses are being used in Seattle, Wash., Washington, D.C., Hartford, Stamford, and New Haven, Conn., and other cities.

tempted to determine their demographic characteristics, their current transportation behavior, and the perceived barriers preventing their use of public transportation. This information, as well as an assessment of alternative solutions, was published in two reports, *Summary Report of Data from a National Survey of Transportation Handicapped People* and *Technical Report of National Survey of Transportation Handicapped Persons.* Subsequent reports from the project are

The EASYRIDE service uses fully-accessible vans to provide door-to-door transportation to elderly and disabled people in New York.

A Manual for Estimating the Incidence and Trip Rates for Transportation Handicapped People; A Cost/Effectiveness Model for the Analysis of Transportation Options for the Handicapped; and *A National Perspective for Providing Transportation to Handicapped Persons.*

In addition, four surveys have been conducted in areas where there is a special service for handicapped people as well as a fixed-route transit system. These surveys interviewed both users and nonusers and were designed to provide an insight into future demonstrations for the transportation of handicapped people.

A study is being done of the costs and ridership of specialized transportation services as well as accessible fixed-route services. While this study will not generate any new data, it will bring together all existing data on the subject. In four cities, a range of services will be modeled under a variety of conditions. This will assist UMTA in evaluating planned services to meet current and future regulations and legislation.

Accessibility Programs

Accessible Full-Size Bus Services

The 504 regulations, published in 1979 by DOT, outline program requirements to insure system accessibility to handicapped people. The regulations require that one-half of the peak-hour bus service must be accessible within ten years. Accessibility demonstrations which became operational in FY 80 have revealed a number of practical problems which must be overcome in deploying standard buses which accommodate wheelchairs.

In an attempt to evaluate fixed-route service using accessible buses, research is being conducted. One set of projects (MA-06-0049) involves locally sponsored efforts in major urban areas to introduce a number of accessible buses into their standard bus fleets. In these projects, federal capital grants were used to purchase new standard-size transit buses which are lift-equipped. In some cases, existing buses were retrofitted. Some of the earliest experiments to test accessible service in St. Louis, Mo., Atlanta, Ga., and San Diego, Calif., are documented in reports. In addition, accessible fleets ranging from 100 to 200 buses are now in passenger service in Seattle, Wash., Washington, D.C., and Hartford, Stamford, and New Haven, Conn.

These projects represent the first large-scale use of wheelchair-accessible, full-size buses. The information gained in such areas as service reliability, handicapped ridership, costs, labor implications, etc., is expected to be of interest to many other transit systems planning similar programs.

The use of fully accessible buses will improve the mobility of handicapped people, but, due to the limitations of transit area coverage, it is obvious that a fully accessible, fixed-route system will not meet all of their travel needs. The evaluations of these projects will identify that segment of the transportation handicapped population who can use the system, as well as which travel needs are not met by such service.

Initial ridership on the accessible bus services to date has been low, with the exception of Seattle, where ridership has been significantly higher than at any other site. However, the level of service has also been low. A major question is how much wheelchair-handicapped ridership will increase as more accessible service is provided and as time passes to allow for adjustments in travel patterns and travel modes. While the full use of accessible transit is contingent on a more accessible environment generally (i.e., jobs, streets, and buildings), the accessi-

ble bus evaluations will help answer this question. Final reports on Seattle, Hartford, Stamford, and New Haven will be available in 1981.

Total Accessibility Demonstrations, Champaign-Urbana, Ill., and Palm Beach County, Fla.

These two demonstrations (IL-06-0039 and FL-06-0015) were designed to evaluate the effectiveness of a fully accessible fleet of buses, rather than a partially accessible fleet or paratransit services, as an alternative for meeting the needs of the transportation handicapped. Fifteen buses in Illinois and 30 buses in Florida have been retrofitted with wheelchair lifts. In addition, each bus system has received a number of new, lift-equipped buses. In Florida, the full fleet of 40 buses was accessible and in service in May 1980. In Illinois, accessible service is being phased in by routes beginning in July 1980.

A number of factors will be evaluated in both demonstrations, such as the cost of retrofitting, the utility and durability of the lift technology, the level of accessibility provided, the effect on maintenance costs, driver responsibility, the travel characteristics of the transportation handicapped, and, in the case of Champaign-Urbana, the effect of severe weather conditions.

Accessible Bus Driver and User Training, Washington, D.C.

In Washington, D.C., a joint effort between the Washington Metropolitan Transit Authority (WMATA) and The George Washington University's Rehabilitation Research Center (DC-06-0239 and DC-06-0233) has resulted in the development, packaging, and testing of a sensitivity and skills training program for bus operators and training instructors in the use of accessible buses, and awareness of the transportation needs of elderly and handicapped people. The training materials include an instructor's manual for the three-hour program and two video tapes. These materials have been sent to transit operators throughout the country and are available through The George Washington University.

In addition, The George Washington University is developing a model training program for allied health professionals to help them teach the handicapped to use accessible buses. WMATA has also instituted an outreach program to familiarize handicapped people with lift-equipped buses. The objective of this project is to maximize handicapped people's use of the 150 lift-equipped transit buses in service in the Washington metropolitan area.

Coordinated Services for the Elderly and Handicapped

In many cities and regions, special transportation services for elderly and handicapped people are either funded or provided by a variety of social service agencies and organizations. As a whole, the agencies in a particular locality may not be making the most efficient use of their transportation resources. Meanwhile, many elderly and handicapped people, particularly those not affiliated with any social service agency, remain unserved. Often, experienced transportation providers such as taxi operators may be overlooked while new services are established.

A coordinated transportation program, encompassing public and private transportation firms in conjunction with the social service agencies, could provide at least a partial solution to the problem of lack of mobility which is still experienced by millions of elderly and handicapped Americans living in cities.

UMTA has been experimenting with systems to bring about a more coordinated approach to transportation services in a number of localities of various sizes, including New York City, Mercer County, N.J., and Pittsburgh, Pa. These range from consolidating services under one central provider, to developing multi-funded neighborhood-based paratransit, to a "brokerage" approach, in which a transportation broker matches individual and agency needs with the most appropriate provider.

In Mercer County, N.J., a pilot program called TRADE (NJ-06-0008) was begun in November 1977 to coordinate the transportation services of a number of social service agencies. In addition to the agencies, the project was eventually to include public and private transportation providers in the coordinated services as well. The objective of the project was to provide a foundation for supplying transportation services to all elderly and handicapped people in the region by establish-

ing an effective, multi-modal network of vehicles.

During its first year of operation, however, progress was slow, and TRADE encountered many institutional and operational obstacles. While the original plan was to coordinate and eventually consolidate seven designated county agencies, the first year's experience caused a shift in the project's direction. TRADE was unable to coordinate all of the agencies in the original plan, and it now appears that several of the agencies may not have been appropriate candicates for coordination. A central dispatch system was established, and nutrition vans and drivers were brought totally under TRADE's control, along with vehicles from several other agencies. TRADE moved beyond the original plan and became a third-party provider under a series of purchase-of-service contracts with funds from the Department of Labor and other government sources. By the end of FY 1980, TRADE was operating a fleet of 18 vehicles, including several new vans purchased under the service contracts, and was beginning to offer service accessible to wheelchairs on one van.

Over 40 percent of all trips taken through ACCESS are by people who use wheelchairs.

In New York's Lower East Side, a project conducted by the Vera Institute of Justice, Specialized Transportation for the Elderly and Disabled (NY-06-0053), is assessing the costs and effectiveness of providing door-to-door transportation to frail elderly and disabled people of an inner city area. The service, known as EASYRIDE, was planned and implemented to test whether higher quality, low cost, community-based paratransit could be provided in a cost-effective manner in New York City. EASYRIDE also provides operating information on paratransit alternatives for meeting section 504 requirements in New York.

EASYRIDE began pilot operations in the summer of 1977. By July 1980, EASYRIDE had increased its fleet from 11 to 18 vehicles, 12 of which are accessible to wheelchairs. All of these vehicles were purchased through UMTA's 16B(2) program. Also, in 1980, EASYRIDE moved to a semi-automated scheduling system, which will facilitate service expansion. EASYRIDE maintains an automated record-keeping system for management information, billing, and accounting purposes. Service is provided 12 hours per day, five days a week for any trip purpose. A unique aspect of the operation is the hiring and training of rehabilitated ex-offenders and ex-addicts to drive the buses.

During FY 1980, EASYRIDE delivered over 45,000 trips at an average trip cost of $10.20. Thr receipt of additional vehicles has allowed EASYRIDE to extend its

Special User Subsidy Demonstrations

CITY	POPULATION	ELDERLY AND HANDICAPPED POPULATION	TYPE OF SERVICE	SUBSIDY METHOD	PERCENT SUBSIDY TO SPECIAL USER
Montgomery, Alabama	135,000	21,000	Shared-ride taxi	Voucher	50
			Local bus	Tickets	50 (peak periods) 100 (off-peak)
Lawrence, Massachusetts	66,900	14,700	Shared-ride taxi	Tickets	50
			Local bus	Tickets	95
Kinston, North Carolina	22,000	3,000	Shared-ride taxi	Advance sale tickets	50
Danville, Illinois	42,000	7,500	Fixed-route bus	Advance sale tickets	89 (special users)
			Shared-ride taxi		78 (general population)
Chico, California	40,125	7,000	Shared-ride taxi	Advance sale tickets	74-100 (depending on agency criteria)

service area to the Lower West Side, thereby increasing economies of scale, and raising productivity.

EASYRIDE trips are financed by an amalgam of funding sources in order to offer comprehensive service to eligible clients. The Vera Institute of Justice received a special waiver which allows elderly Medicare participants to receive Medicare reimbursements for EASYRIDE transportation to health destinations, such as medical facilities and nutritional centers. Transportation costs are not normally eligible expenses under the Medicare program. The Department of Health, Education, and Welfare has also contributed funds to this project to determine the impacts of mobility improvements on the quality of life and on the health care costs of the Lower East Side target population. In addition, EASYRIDE receives funds from Medicaid, Department of Aging, Office of Vocational Rehabilitation, Community Development Block Grants, CETA, and private sources.

In Pittsburgh, Pa., a grant was awarded in FY 1978 to the Port Authority of Allegheny County to conduct a two-year demonstration (PA-06-0042) of transportation brokerage as a means of coordinating paratransit services. Program objectives are to improve the quality, quantity, and cost effectiveness of specialized services available to elderly and handicapped persons in Allegheny County.

The brokerage service, called ACCESS, has been operating since March 1979. During this time ACCESS has proven to be a viable and effective means of providing high quality, coordinated transportation. The ACCESS service delivery network contracts on a competitive bid basis with taxi companies, specialized nonprofit carriers, and

social service agency carriers. Currently eight carriers are under contract to serve specific geographic sectors of the city, covering over 800 square miles. Over thirty-three human service agencies and other community organizations purchase service through ACCESS. This accounts for one-third of all trips taken. A scrip system allows nonaffiliated people to use ACCESS. The Port Authority provides a 75 percent subsidy for handicapped persons who are unable to use regular transit. Over 40 percent of all trips taken on ACCESS are by persons using wheelchairs.

A grant amendment was made in FY 1980 to continue the demonstration for an additional year. During this time, ACCESS will be making a number of changes in its operation to allow it to be evaluated as "comparable" to fixed-route transit. This will include removing the twenty-four hour advance call-in requirement, expanding service hours, offering service to out-of-town visitors, and eliminating any capacity constraints.

A project in San Diego, Calif., (CA-06-0134) will develop a comprehensive plan to coordinate and/or consolidate the transportation resources of social service agencies and other providers in the city and county of San Diego. In an effort to create an acceptable implementation plan, a unified approach has been developed to include the resources of the state department of transportation (CALTRANS) and the metropolitan planning agency, the Comprehensive Planning Organization (CPO). The project will make an inventory of existing resources and present several alternatives for coordinated area-wide services.

User Subsidy Demonstrations

Another way in which UMTA has attempted to improve transportation for the elderly and handicapped in various cities is through directly subsidizing the cost of trips purchased by those users, rather than subsidizing the transportation providers. User subsidies in the form of discounted rates for bus or taxi fares through the use of tickets or voucher systems are being tested by UMTA in demonstrations in Danville, Ill., Montgomery, Ala., Kinston, N.C., Lawrence, Mass., and Chico, Calif. There projects are summarized in the accompanying table.

The latest user subsidy demonstration was approved for Chico, Calif., (CA-06-0136) to test the feasibility of utilizing this concept as the catalyst for coordinated social service transportation services. Agencies will purchase ride tickets from the city and distribute them to their clients based on their own criteria. The tickets can then be used on any eligible provider, including any agency vehicles. Administrative, operational, and service aspects of the project will be evaluated.

These cities offer a diversity of population sizes and transportation needs, and the subsidy demonstrations are tailored to fit the specific conditions of the cities in which they are being tested. Consequently, one purpose of the demonstrations is to test how well the user subsidy concept works under a variety of circumstances.

Other objectives include evaluating the operational and administrative requirements of user subsidy programs; determining whether user subsidies allow the elderly and handicapped to travel further and more widely; and examining the effects of subsidies on the quality of transportation services themselves.

A Test of the User Subsidy Concept in Developing a Small Citywide Transportation System: Danville, Ill.

One of the first user subsidy experiments in the nation was implemented in 1975 in Danville, Ill. The City of Danville established a reduced fare system for the elderly and handicapped under which those groups could directly purchase shared-ride taxi tickets at 25 or 50 percent of actual cost.

The Danville demonstration (IL-06-0034), once the longest operating project of its kind, succeeded in attracting nearly 50 percent of the eligible population in the city to register for the service.

In FY 78, the city expanded the scope of the demonstration from a service exclusively for the elderly and handicapped to a general user subsidy system designed to serve the entire population of the city.

Under the expanded system, private transportation operators are invited to bid for the contract to provide transportation services for the city. Under the contract, adult fares are limited to 40 cents, fares for eldery and handicapped passengers and students under 18 are set at 20 cents, and transfers are free. The contract also stipulates the subsidy amount that the city will pay for passengers and the number of different operators that the city will utilize.

In order to be eligible for the special 40 cent and 20 cent fares, users must purchase the subsidized tickets in ad-

vance. Tickets are available in Danville at 36 locations including all major banks, grocery stores and restaurants. Passengers who have not purchased the subsidy tickets are not eligible for the reduced fares, and the transit operators are allowed to propose unsubsidized cash fares, which were set at $1.00. During the last demonstration period, the cash fare was subsidized and lowered to 50 cents because of the fear that the high cash fare was a deterrent to ridership. From the results, it appears that the $1.00 cash fare did have some negative impact on ridership.

In order to protect both the city and the operators from incorrectly estimating potential ridership, the entire contract for service is rebid every four months. During the first two bidding periods, a single provider was selected to implement service. The service was traditional, fixed-route trainsit on standard-size buses. During the third and fourth periods, a local taxi operator was also contracted to provide fixed-route and demand-responsive service in areas of low demand.

Cost per passenger on the standard-size bus system has ranged from as high as $2.00 per trip at the beginning of the project, to $1.65 per trip under the most recent contract. Cost per passenger on the demand-responsive system has been $1.50 per trip.

According to city officials, transit productivity under the user subsidy system is increasing, while the cost per trip is declining.

As the experiment continues, officials hope to examine the reaction of the public to an advanced-purchase ticket system, the amount of administrative work involved in operating a large ticket distribution system, the use of multiple operators, and the user subsidy as the funding mechanism for a public transportation system. Recently, the state of Illinois and FHWA approved the user-subsidy system for continuing funding under Section 18.

The project showed that the user subsidy is feasible as a method for supporting fixed-route and demand-responsive transportation services for the general public and especially for testing the market for transit where no transit system currently exists.

Other Projects

Bridgeport Inner-City Mobility

During 1980, a project was funded in Bridgeport, Conn., (CT-06-0010) to improve the mobility of residents of an inner-city neighborhood on the city's east side. Detailed planning for the demonstration will begin early in FY 81. One of the objectives of the project is to encourage active participation by neighborhood residents in both the planning and operation of the service. While the specific services to be implemented are dependent on the results of a neighborhood origin-destination survey, it is anticipated that paratransit services will be designed to accommodate both internal community circulation needs and employment travel. Possible service concepts include a flexibly routed minibus and subscription vans to employment centers. Through its ongoing brokerage demonstration, the Greater Bridgeport Transit District will also integrate the east side paratransit services with other services sponsored by the transit district, such as shared-ride taxis, special services for the elderly and handicapped, ridesharing, and conventional buses.

Santa Monica Recreational Transit Service

The projects CA-06-0130 and CA-06-0142 examined the feasibility of providing a seasonal recreational transit service from inner-city areas of Los Angeles to Malibu Creek State Park and Tapia County Park over a two-year period. These parks, previously unserved by public transportation, are located in the Santa Monica Mountains 35 miles west of downtown Los Angeles. The demonstration project provided access to outdoor recreational opportunities for a large segment of the region's population whose primary travel mode is public transportation. During the first year of the demonstration, the Southern California Rapid Transit District (SCRTD) was the sole provider. In an effort to bring the cost of the service down, private operators provided a portion of the service during the second year.

The key issues in the demonstration concerned the level of demand, economic feasibility, and acceptability to the target population of a weekend subscription transit service designed to improve mobility for inner-city residents to recreational facilities outside the city. Despite a slow start, service ran at or near capacity for most of the demonstration period, which was probably due to the extensive marketing program. In general, the project has received positive reaction from participating agencies and from the public.

Transportation Services for Special User Groups

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
ACCESSIBILITY PROGRAMS						
Evaluation of Accessibile Full-Size Bus Services	MA-06-0049	$275,000 (Estimated)	Feb. 1977-Jan. 1980	Washington, D.C., Seattle, Wash.; Hartford, New Haven, Stamford, Conn.	TSC	Lynn Sahaj (202) 426-4984
Total Accessibility Demonstration, Palm Beach County, Florida	FL-06-0015	$689,000	June 1977-Jan. 1980	Palm Beach County Transportation Authority, Fla.	TSC; Multisystems, Inc.	Lynn Sahaj (202)426-4984
Total Accessibility Demonstration, Champaign-Urbana, Illinois	IL-06-0039	$502,404	July 1977-Sept. 1980	Champaign-Urbana Mass Transit District, Ill.	TSC	Larry Bruno (202) 426-4984
Accessible Bus Training Programs	DC-06-0233	$410,618	Dec. 1978-Dec. 1980	The George Washington University	N/A	Lynn Sahaj (202) 426-4984
Accessible Bus Training Programs	DC-06-0239	$240,000	Dec. 1978-Dec. 1980	WMATA	N/A	Lynn Sahaj (202) 426-4984
COORDINATED SERVICES						
Elderly and Handicapped Social Service Coordination Demonstration	NJ-06-0008	$195,960	Nov. 1977-Nov. 1980	Mercer County, N.J.	Multisystems, Inc.	Mary Martha Churchman (202) 426-4984
Vera Insitute Experimental Transportation for the Elderly and Disabled	NY-06-0053	$450,700	Jan. 1977-Jan. 1981	Vera Institute of Justice	TSC	Lynn Sahaj (202) 426-4984
Implementation of an Agent/Broker to Coordinate Paratransit Services, Allegheny County, Pa.	PA-06-0042	$1,900,000	July 1978-Sept. 1981	Allegheny County Port Authority, Pittsburgh	Charles River Associates	Lynn Sahaj (202) 426-4984

Transportation Services for Special User Groups

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
COORDINATED SERVICES						
Elderly and Handicapped Social Service Coordination	CA-06-0134	$160,000	March 1980-March 1981	City of San Diego, Calif.	N/A	Larry Bruno (202) 426-4984
USER SUBSIDIES						
User-Side Subsidy Demonstration	IL-06-0034	$977,000	June 1975-Aug. 1979	City of Danville, Ill.	TSC; Crain and Associates	Larry Bruno (202) 426-4984
User-Side Subsidy for the Elderly and Handicapped	AL-06-0003	$518,405	Nov. 1976-April 1979	City of Montgomery, Ala.	TSC	Larry Bruno (202) 426-4984
User Subsidy for the Elderly	MA-06-0076	$422,061	Aug. 1978-Feb. 1980	City of Lawrence, Mass.	TSC; Charles River Associates	Larry Bruno (202) 426-4984
User Subsidy for the Elderly and Handicapped	NC-06-0063	$213,529	July 1977-July 1980	City of Kinston, N.C.	TSC; Charles River Associates	Lynn Sahaj (202) 426-4984
User-Side Subsidy in Coordination	CA-06-0136	$125,000	March 1980-March 1982	City of Chico, Calif.	TSC; Crain and Associates	Larry Bruno (202) 426-4984
OTHER PROJECTS						
Inner City Mobility	CT-06-0010	$360,000	Sept. 1980-Sept. 1982	Greater Bridgeport Transit District	TSC; COMSIS Corp.	Mary Martha Churchman (202) 426-4984
Recreational Transit Service, Santa Monica Mountains	CA-06-0130	$51,850	April 1979-Aug. 1979	Southern California Rapid Transit District	TSC; Crain and Associates	Larry Bruno (202) 426-4984
Recreational Transit Service, Santa Monica Mountains	CA-06-0142	$100,000	March 1980-Dec. 1981	Southern California Association of Governments	TSC; Crain and Associates	Larry Bruno (202) 426-4984

Transportation Services for Special User Groups

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
Research on Transportation Problems of Transportation Handicapped People	NY-06-0054	$1,900,000	Oct. 1976-Dec. 1980	Grey Advertising	N/A	Patricia Cass (202) 426-4984
Study of Costs and Ridership of Transportation Services for Handicapped Persons	VA-06-0076	$100,000	Aug. 1980-Aug. 1981	Chase, Rosen and Wallace, Inc.	N/A	Patricia Cass (202) 426-4984

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

Study of the Transportation Problems of the Transportation Handicapped, Off-Peak Half-Fare Study
Proj. NY-06-0054
July 1976, PB 268-867

Study of the Transportation Problems of the Transportation Handicapped, Off-Peak Half-Fare Study; Ten Case Studies
Proj. NY-06-0054
Grey Advertising, Inc.
October 1976, PB 263-868

Summary Report of Data From National Survey of Transportation Handicapped People
Proj. NY-06-0054
June 1978

Technical Report of National Survey of Transportation Handicapped People
Proj. NY-06-0054
October 1978, PB 290-161

Service and Methods Demonstration Program Annual Reports
Proj. MA-06-0049
Transportation Systems Center
August 1979, PB 270-673

Evaluation Guidelines for Service and Methods Demonstration Projects
Proj. MA-06-0049
Transportation Systems Center and CACI, Inc.
February 1976, PB 251-891

Incidence Rates and Travel Characteristics of the Transportation Handicapped in Portland, Oregon: Final Report
Proj. OR-06-0004
Crain and Associates
April 1977, PB 269-859

TRIMET: Automated Fare Billing System
Proj. OR-06-0004
MITRE Corporation/METREK Division
December 1977, PB 275-661

The Lift: Special Needs Transportation in Portland, Oregon: Final Report
Proj. OR-06-0004
Crain and Associates
August 1979, UMTA-OR-06-0004-79-1

Handicapped and Elderly Vertical Movement Assessment Study
Proj. MA-06-0047
Transportation Systems Center
February 1976, PB 252-516

Transportation Problems of the Transportation Handicapped
Proj. CA-06-0092
Crain and Associates
August 1976

Vol. I, **The Transportation Handicapped Population Definition and Counts,** PB 258-579

Vol. II, **The Roles of Government and the Private Sector in the Provisions of Mobility Systems for the Transportation Handicapped,** PB 258-580

Vol. III, **Alternative Planning Methodologies,** PB 258-581

Vol. IV, **Transportation Solutions for the Handicapped,** PB 258-582

Coordinating Transportation for the Elderly and Handicapped: A State of the Art Report
Proj. DC-06-0106
The Institute of Public Administration
November 1976, PB 265-079

Special Transportation Services for the Elderly and Handicapped Demonstration Project, Baton Rouge, Louisiana
Proj. LA-06-0001
CACI, Inc.
November 1976, PB 263-904

City of Cleveland Neighborhood Elderly Transportation Project, Dial-A-Bus: Interim Report
Proj. OH-06-0018
City of Cleveland
January 1976, PB 253-237

Cleveland Neighborhood Elderly Transportation Demonstration Project: Final Report
Proj. OH-06-0018
Crain and Associates
April 1977, PB 269-860

User Side Subsidies for Shared Ride Taxi Service in Danville, Ill.: Phase I
Proj. IL-06-0034
June 1977, UMTA-IL-06-0034-77-1

User-Side Subsidies for Fixed-Route Transit in Danville, Illinois: Phase II Evaluation Plan
Proj. IL-06-0034
August 1978, UMTA-IL-06-0034-78-1

Subsidized Taxi Program for Elderly and Handicapped Persons in the San Francisco Bay Area
Proj. MA-06-0049
September 1977, UMTA-MA-06-0049-77-9

The Valley Transit District: Specialized Transportation for the Elderly and Handicapped and Low Income in the Lower Naugatuck Valley, Ct.
Proj. CT-06-0003
Cambridge Systematics, Inc.
February 1979, PB 80-113-087

Share A Fare: A User Side Subsidy Transportation Program for Elderly and Handicapped Persons in Kansas City, Missouri
Proj. MA-06-0049
July 1979, PB 80-142-193

Evaluation of the EASYRIDE Specialized Transportation Service
Proj. NY-06-0053
Applied Resource Integration, Ltd.
November 1979

Recreational Transit Service to the California Santa Monica Mountains
Proj. CA-06-0130
January 1980, PB 80-183-056

Accessible Bus Service in St. Louis: Final Report
Applied Resource Integration, Ltd.
February 1980, UMTA MA-06-0049-80-6

CHAPTER 9

Fare and Pricing Policies

Trends and Highlights

The main objective of the Pricing Policy Division within UMTA's Service and Methods Demonstrations Program is to increase transit ridership levels, thereby improving the productivity of a transit system. Adjusting fares and providing special service options can increase ridership in certain market segments. Rather than determining fare policies on the basis of aggregate user demand and operating subsidy levels, the current pricing program is examining the impact of different strategies aimed at particular market segments which have a high potential for increased ridership.

The cumulative information on fare incentives is providing specific marketing strategies to stimulate private sector involvement in public transportation. There is a growing interest among employers and merchants to share the users' cost of transit and ridesharing. These fare incentives, when coordinated with auto management techniques, can encourage the private sector to work cooperatively with the public sector in promoting ridesharing and providing alternatives to subsidized parking.

Transit fare prepayment techniques, through employer and merchant sponsored programs, are helping transit operators to manage the increasing public transportation demand by penetration of specific market groups. The diversity of these market segments is requiring improved fare collection mechanisms. More comprehensive fare policies are needed to accommodate various demographic and travel markets while simplifying the collection and distribution of revenues. Further, development of service pricing techniques within conventional transit operations is being used to analyze the

integration of paratransit services through transportation broker management.

It appears that the transit industry needs to improve the retrieval of data on productivity changes and planning methodology for fare variations. The research and demonstration studies in this area are providing guidelines for planning fiscal operating budgets through clarification of service and fare elasticities in estimating demand and revenue impacts.

In addition, annual conferences on the operational and research experiences in multimodal pricing and related service improvements have been held. These conferences, attended by transportation and community leaders, representatives from research and consulting firms, and industry operators, are leading to an assessment of progress, and recommendations for future pricing activities.

Promotional Fare Incentive Strategies

It has been generally recognized that fare reductions can promote additional transit ridership. The nature of the fare reduction and the characteristics of the ridership market are important determinants of the effectiveness of the fare incentives. Four demonstration projects and four evaluation projects are providing results to address the many gaps in the current knowledge regarding the costs and benefits of fare incentives.

In two systemwide off-peak fare-free demonstrations in Denver (CO-06-0010), and Trenton (NJ-52-0001), ridership increased appreciably from 50 percent to 80 percent during the off-peak, with increases in all day ridership of 32 percent and 10 percent respectively. Two downtown fare-free zones in Albany (NY-06-0064) and Knoxville (TN-06-0006(1)) also showed remarkable ridership increases by tripling pre-fare-free levels. A major impact of the fare abolitions was an increase in the frequency of individual transit trips by different groups. Systemwide off-peak free fares attract appreciable ridership from the peak hours if the off-peak service borders on the peak hours. This does provide some credence to the theory that peak-hour demand can be alleviated by off-peak incentives.

While there have been disruptive operational problems associated with the fare-free projects, the findings suggest that none of these are so severe that they would preclude free services in other locations. There is likely to be a disruptive but transitory change in the on-board atmosphere of the buses as a consequence of increases in ridership by boisterous youths. Also, as ridership increases, it becomes increasingly difficult to maintain schedules. The increased ridership improves passenger per mile productivity with major reductions in cost per passenger for the free CBD operations and less for systemwide operations. In Denver, the subsidy per passenger fell about fifteen percent during the off-peak free-fare period.

One of the major findings of these demonstrations was that a large proportion of new riders was retained following the termination of free systemwide off-peak service. Since these added riders are now paying fares, the cost and subsidy per passenger is even more favorable

In UMTA demonstration projects, tickets such as these can be purchased by elderly and handicapped people for discount fares on bus and taxi trips.

than under free conditions. It is not known, however, how long a fare reduction period is needed to attract and retain new riders. In all the demonstrations, the ridership increases occurred within the first three months. Whether this period is sufficient to engender a long-term change in transit use habits is being addressed in ongoing demonstrations and evaluations.

A Promotional Transit Fare Incentives Demonstration Design (PA-06-0047) has been completed that developed an urban demonstration program of marketing approaches to transit promotion. A review of the state-of-the-art has been performed that specifically assesses promotion strategies evolving from the "psychological reinforcement" theory. From this

The use of passes can make transfer between bus and rapid rail easy.

research, two sites have been identified for operational demonstrations incorporating reinforcement theory procedures. One demonstration in Spokane, Wash. (WA-06-0018/WA-52-0001) will test reinforcement to encourage off-peak ridership through merchant discount coupons obtained on the bus when the fare is paid. This is a price-valued incentive for boarding passengers; the coupons can be exchanged for discounts on goods and services offered by several merchants in the CBD. The program is economically viable, in that participating merchants bear the cost of the token reimbursement. The other demonstration in Minneapolis—St. Paul, Minn. (MN-52-0001) will systematically explore the differential impact of several free-ride promotions on transit ridership and operators. Free-ride parameters to be investigated include the distribution, quantity, and promotion of free transit for users and nonusers. Selected tests of these variants will be conducted on specific routes for comparative analysis.

A promotion of free/reduced fares in Scranton, Penn. (PA-06-0055) will test different levels of one-month fare incentive promotions that will include half-fare, marginal fare (5 cents) and free fare. Each one-month promotion will be separated by five months in order to assess ridership retention, and revenue recovery. These promotional fare reductions will be combined with other promotional efforts by the transit system and by third parties, primarily merchant groups and individual stores.

These promotional projects are expected to begin operations in spring, 1981. They will provide a cross section of

the opportunities for private and public sector coordination of promotional programs. Other opportunities will be explored through a continuing study in this area (PA-06-0056).

Transit Fare Prepayment (TFP) Options

The growth in transit ridership will increase the burden on farebox revenues to cover a larger portion of operating costs and service provision. Transit fare prepayment programs can be effective techniques to implement fare policies for managing transit demand and its cost. Most transit properties offer some form of prepaid fares, but only recently have transit operators begun to actively promote transit fare prepayment instruments. There has been much interest in the initial four SMD demonstration and research projects on TFP strategies involving reduced price promotion and employer programs. These projects have provided a basis for identifying new opportunities for TFP programs to manage transit ridership by targeting specific markets.

In Austin, Tex. (TX-06-0021), and Phoenix, Ariz. (AZ-06-0002), Transit Fare Prepayment Reduced Price Promotional programs were implemented to assess the market response to temporary discount pass sales. Two one-month sale periods at 40 percent and 20 percent discounts were offered to promote the plan. The order of the discounts was reversed in the two demonstrations to assess market perception of the sale. Market response was similar in both cases; pass sales increased up to four times over those of the previous nondiscount month for the 40 percent discount, and approximately half that for the 20 percent discount.

The promotional TFP reduced-price demonstrations provide information on the market penetration of TFP by promoting and discounting the prepaid instruments. The temporary discounts attracted sizable numbers of old and new buyers with approximately half of the new purchasers continuing to purchase TFP's following the sale period. The demonstrations indicated that increased sales of TFP instruments may not lead to long-term increases in transit riding. However, during the discounted period, individual trip rates do increase, but due to the small proportion of pass users and method of distribution, it was found that cash flow did not enhance the operators' position significantly.

The employer-sponsored TFP demonstrations in Sacramento (CA-06-0102) and Jacksonville (FL-06-0016) enabled the targeting of TFP promotions to employees by their employers. Pass sales were the highest when the pass was reasonably discounted by the transit operator or the employer. During the discount period, pass sales tripled with about a 50 percent retention of new pass purchasers. There was, aproximately, a 10 percent transit ridership increase among employees. The cost of the program among participating employers was considered marginal compared with the benefits received and was estimated to be approximately 50 cents per pass sold. During these demonstrations the transit community has expressed interest in the results and operational aspects of the program. Many transit systems across the country have initiated employer-sponsored fare prepayment plans. The SMD projects are assisting local agencies and employers to plan and implement these programs.

A manual of the implementation and marketing procedures of employer pass programs is being developed (VA-06-0072) based on several case studies of local programs. The manual will contain information targeted to board members and other community leaders, transit operators and staff, and potential employers.

TFP programs appear to have a potential for penetration into various localized markets. A demonstration in Tucson, Ariz. (AZ-06-0009) provides an opportunity to test the effectiveness of using TFP instruments to increases transit riding by university students—a market segment that exhibits distinctive socio-economic and travel characteristics. By marketing transit to students, the local officials expect to relieve traffic congestion in the vicinity of the campuses, and to lessen the demand for campus parking spaces. The preliminary results show appreciable increases in discount semester and monthly pass sales, which have in turn resulted in peaking of transit ridership along routes to and from the campus.

Discounted TFP instruments are being tested for differential pricing during peak hours so that ridership is more evenly distributed in the peak hour by reducing peak loading within a narrow time band. The Transit Fare Prepayment/Staggered Work Hour Program in Duluth, Minn. (MN-06-0013), is encouraging workers in the CBD to use available transit services for their work trips. The

program will offer monthly transit passes to employees participating in staggered work hour or flexitime programs within the CBD. Special discounted monthly passes, restricted from the 7 to 8 a.m. rush hour period, will be available to CBD employees. The principal objective is to increase CBD-oriented transit work trips without overburdening transit facilities during the morning rush period.

TFP's are also being used to promote fare integration among different carriers and agencies. A major problem in the acceptance of TFP for fare integration is the revenue distribution among the parties involved, as well as the political and institutional process of bringing together many different operators in multijurisdictions.

San Francisco, Calif. (CA-06-0137), is planning a demonstration of transit fare prepayment to encourage intermodal/interagency coordination. The primary objective of this study is to develop a uniform fare structure for all modes and operators in at least one part of the San Francisco Bay Area, so that the concept of intermodal/interagency fare coordination can be evaluated in an operational environment. A fare prepayment instrument will be the medium by which transit patrons will be able to transfer between modes or operators without having to pay an additional fare. Fares will vary according to distance traveled, regardless of which modes or lines within the combined network are used. A study of the fare integration options in the Bay Area has been developed.

In Chicago, Ill. (IL-06-0045), the Regional Transit Authority will test three types of intermodal passes. These passes will provide riders with an unlimited number of rides for a period of one month. The types offered will be: 1) a pass that can be used on bus and/or rail rapid transit service in conjunction with commuter rail service; 2) a pass that can be used on all regular bus and rail rapid transit service; and 3) a pass that can be used on local and feeder buses. Since various transportation companies and carriers are providing these services, the institutional relationships and coordination of the fare integration decision-making will be an important component of the evaluation.

In Atlanta, Ga. (GA-06-0012), an evaluation is under way of the impact of integrated fare collection (intermodal integration) and fare prepayment methods on transit users and the operations of the Metropolitan Atlanta Transit Authority. A pass, "TransCard", is used in the integrated bus/rail system. The fare structure in use is a single fare payment at a flat rate for completion of the entire transit trip regardless of the number and mode of transfers required. A barrier-free transfer between bus and rail is included. Recently a weekly pass has been introduced to limit the impact of a fare increase on low income people.

Other markets are being considered in ongoing projects, (MD-06-0031), building on the success of attracting regular users to TFP's.

Fare and Service Improvement Strategies

While the pricing demonstrations of transit fare policies are showing the characteristics of fare incentives required to increase ridership and of fare payment to better manage revenue-producing transit markets, more information is needed regarding fare policy decision-making as it relates to service levels. Demonstration projects and several research studies are addressing this relationship. In a demonstration in Vancouver, Wash. (WA-06-0010), service changes of additional trailer bus capacity and shorter headways have increased ridership by 40 percent and 20 percent respectively. A 10 cent fare increase after the headway change reduced ridership by only 5 percent. The marginal loss of ridership due to the fare increase suggests that fare changes at higher service levels are more inelastic. During the second phase of the project, two separate transit components will be evaluated for their effect on transit ridership: service expansion, and a revenue-producing fare structure. The fare structure component will be designed to establish break-even fares on new extended routes, and in the event that break-even fares are not marketable, promotional fare reductions will be instituted to determine a marketable fare.

A study of the relationships between fares and service, and demand and service (elasticities) is providing support for the concept that a pattern (regularity) exists between higher quality urban transit service and low values of price elasticity. The study has produced a set of operator guidelines by which to evaluate fare and service changes with documented elasticities from other transit systems.

The use of fare incentives to promote service delivery is being developed in Knoxville, Tenn. (TN-06-0006). A package of fare incentives is being implemented to

promote increased use of ridesharing and transit to the downtown. The fare incentives include a downtown fare-free zone, merchant validation of shoppers' fares and integrated taxi/fixed-route fares. The fare incentives have been able to attract employers and merchants to join a city-sponsored program by contributing to the users' cost of ridesharing. Ridership has approximately tripled in the downtown area with numerous employees participating in ridesharing programs and twenty-three merchants participating in the shoppers' validation promotion. The improved downtown mobility in Knoxville will be enhanced with a better transit service circulation design in the CBD.

In St. Louis, Mo. (MO-06-0011), the transit service in the CBD will include enhanced service improvements in high occupancy vehicles for developing a comparison of the CBD free/reduced fare programs with different service levels. Within a set of fare increase case studies the relationships between the ridership impact of the additional fare and quality of service have been assessed. The results are providing a more realistic analysis of fare increase elasticities. Evaluation reports of the impact of fare increases in Fort Worth, Tex., Newport, Ky., Rochester, N.Y., Erie, Pa., and Jacksonville Fla. are now available.

SMD demonstrations are being monitored for potential service and fare tradeoffs. In Denver, as part of the fare-free demonstration, an evaluation comparing the patronage response due to improved direct service and headways as a result of route restructuring and the ridership changes due to the fare abolition were evaluated.

A variety of fare prepayment programs using bus/rail passes are being evaluated by various transit operators.

An evaluation study (MA-06-0049) was completed on transfer fare policies and characteristics of transit service network design. The report investigated cost, ridership, revenue, and user satisfaction as consequences of alternative transfer policies. The wide variety of transfer strategies and charges in effect at various transit agencies across the country, as well as alternatives such as rout-

ing, passes, and route simplification were investigated. A review of transfer-related literature has been completed, as well as identification of the research issues associated with the study of transit transfer policies. Representatives of several transit properties were interviewed in detail on their transfer policies. The report summarized current transit transfer practices, developed an operator's guidelines manual, and made recommendations for further demonstrations.

Two demonstrations, in Omaha, Neb. (NE-06-0003), and Columbus, Ohio (OH-06-0027), have begun to implement a computerized information system providing periodic updates on service delivery, operating revenue data and patronage characteristics. The computerized system will use techniques and results developed within the SMD program and the transit community for effecting service and fare policy decisions in medium sized cities.

Fare Collection Techniques

The method of fare collection is a primary determinant of the fare policy a transit system can implement. Because systemwide fare policies are giving way to fare policies targeted at specific user groups, it is becoming more important to develop fare collection techniques capable of handling a wide diversity of fare structures.

In Santa Cruz, Calif., a complex automatic fare and data collection system will be developed that will accommodate a zonal fare system with a variety of prepayment options and contract billing for employees at local businesses. Future phases of this project (CA-06-0129) will include wayside vending of tickets and a complete self-service fare collection system.

The applicability of self-service fare collections, which have met with wide success in European transit systems, is being considered by several U.S. transit properties. The issues of fare structure flexibility, evasion, costs, implementation procedures, and hardware requirements, will be examined closely during the demonstrations of several variations at different sites. These variations will include different levels of hardware use, driver involvement in the fare collection process, and methods of determining fare compliance.

Flat fare structures are often depicted as being inequitable to the transit users and inefficient in producing revenues commensurate with service provided. The distance-based fare structures, on the other hand, pose problems with administration and fare collection. A cooperative agreement was recently initiated with the State University of New York at Albany (NY-06-0074) to implement a distance-based fare structure in a transit system and analyze its impact on costs and revenues, ridership, and user equity. The new fare policy will derive maximum revenue from transit service supplied with individual fares that more accurately reflect the service provided. A fare collection procedure will be tested that simplifies the collection of the variable fares characteristic of distance-based systems. The transit property selected was Elmira, N.Y., and the actual implementation of the new fare structure is scheduled for early spring 1981.

Auto Management Techniques

It is generally acknowledged that automobiles occupied by only the driver making work trips are a primary contributor to traffic congestion, air pollution, and energy waste in urban areas. By restricting the use of the single-occupant auto work trip through the control of parking capacity as well as the CBD innovative pricing techniques, it will be possible to increase the efficiency of the existing transit system and reduce the negative impacts of automobile use. The use of pricing disincentives in these programs can make them financially self-supporting and a source of funds for other transportation improvements.

A Parking Management and Employee Incentive Program in Los Angeles (CA-06-0140) is developing the administrative and legal framework for a coordinated program of reduced code-required parking for private sector businesses in exchange for employer-sponsored work trips in high occupancy vehicles. Another study, the Van Nuys, Calif. Employee Transportation Program (CA-06-0139), will develop a comprehensive parking management plan for a large office complex. The objective is to discourage single-occupant auto use through parking pricing disincentives plus incentives to participate in various ridesharing alternatives.

Pricing of the work trip through increased parking charges may be an effective method of encouraging ridesharing and use of existing transit services. A preliminary evaluation of the increase in federal government parking charges to

half the prevailing commercial rate appears to show an increase in the average car occupancy in a sample of federal parking facilities in Washington, D.C. (IT-06-0233). The final increase in the federal parking rate, equal to that charged for comparable commercial facilities, will be monitored when it takes place in November, 1981.

In Madison, Wis., a morning peak hour surcharge planned for autumn 1980 at several city-owned parking facilities, will be added to recently implemented express bus service from several fringe parking lots, and a program of discounted monthly bus passes offered to CBD employees. The new bus service is diverting auto trips that would have gone to the CBD, and the monthly bus passes have proved very popular among the CBD employees to whom it has been offered.

The use of residential parking permits is an effective technique commonly used to restrict commuter parking in residential neighborhoods. This technique is being applied in two recreational settings to test its effectiveness in controlling parking and traffic congestion caused by users of the recreational facility. Such programs are being developed in Santa Cruz (CA-06-0129) and Hermosa Beach, (CA-06-0126) Calif. They are designed to be financially self-supporting with revenue from the sale of nonresident permits paying for alternative shuttle bus service and parking enforcement.

Another pricing disincentive technique, road pricing, is being considered in Honolulu (HI-06-0004). A series of workshops will be held to develop publicly acceptable alternatives. This technique appears to generate interest in areas suffering from acute traffic congestion and few options for alleviating the problems caused by extensive use of low occupancy autos.

Fare and Pricing Policies

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
PROMOTIONAL FARE INCENTIVES						
Promotional Free Ride Distribution	MN-52-0001	$354,482	April 1980-April 1983	MTC, St. Paul, Minn.	TSC; Multisystems, Inc.	Vince Milione (202) 426-4984
Price Incentives Through Merchant/ Transit Operator Coordination	WA-06-0018 WA-52-0001	$380,817	April 1980-April 1983	TSC; Spokane, Wash.	TSC; SYSTAN, Inc.	Vince Milione (202) 426-4984
Promotional Fare-Free/Reduced Fare Demonstration	PA-06-0055	$235,671	Jan. 1980-Jan. 1983	COLTS, Scranton, Penn.	TSC; Crain and Associates	Vince Milione (202) 426-4984
CBD Low Fare Honor System Demonstration	MO-06-0011	$325,020	Oct. 1979-Oct. 1982	Bi-State Development Agency, Mo.	TSC; Crain and Associates	Vince Milione (202) 426-4984
FARE PREPAYMENT PROGRAMS						
Integrated Fare Evaluation	GA-06-0012	$126,000	Aug. 1979-Dec. 1980	MARTA Atlanta, Ga.	TSC; Charles River Associates	Vince Milione (202) 426-4984
Integrated Fare Design	CA-06-0137	$50,000	Sept. 1979-Dec. 1980	MTC Berkeley, Calif.	TSC; Charles River Associates	Vince Milione (202) 426-4984
Fare Integration Project	IL-06-0045	$700,000	March 1980-March 1982	Chicago Regional Transit Authority, Ill	Chicago Regional Transit Authorty, Ill.	Vince Milione (202) 426-4984
Demonstration of Various Transit Fare Prepayment Instruments Through Employers	FL-06-0016	$185,000	Sept. 1977-Feb. 1980	Jacksonville Transportation Authority, Fla.	TSC; Charles River Associates	Vince Milione (202) 426-4984
Transit Fare Prepayment Through Employers	CA-06-0102	$144,300	June 1977-June 1980	Sacramento Regional Transit, Calif.	TSC; SYSTAN, Inc.	Stewart McKeown (202) 426-4984

Fare and Pricing Policies

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
FARE PREPAYMENT PROGRAMS						
Transit Fare Prepayment with Reduced Price Promotion	AZ-06-0002	$116,963	July 1977-Feb. 1979	City of Phoenix, Ariz.	TSC; Crain and Associates	Stewart McKeown (202) 426-4984
Transit Fare Prepayment Through Employers	CA-06-0162-2	$326,697	Oct. 1980-Sept. 1982	City of Phoenix, Ariz.	N/A	Vince Milione (202) 426-4984
Variable Work Hour/ Employee Pass Program	MN-06-0013	$254,559	March 1980-July 1982	Duluth Transit Authority, Minn.	TSC; Charles River Associates	Stewart McKeown (202) 426-4984
Transit Fare Prepayment	MD-06-0031-1	$100,000	Sept. 1980-Feb. 1982	Ecosometrics, Inc.	N/A	Stewart McKeown (202) 426-4984
Student Transit Fare Prepayment	AZ-06-0009	$113,500	Aug. 1979-Dec. 1980	City of Tucson, Ariz.	TSC; SYSTAN, Inc.	Stewart McKeown (202) 426-4984
Transit Fare Prepayment with Reduced Price Promotion	TX-06-0021	$125,081	May 1977-Oct. 1978	City of Austin, Tex.	TSC; Crain and Associates TED contract	Vince Milione (202) 426-4984
FARE-FREE OFF-PEAK TRANSIT SERVICE						
Fare-Free Off-Peak Transit Service	NJ-52-0001	$625,000	June 1977-March 1978	New Jersey Department of Transportation	TSC; Deleuw Cather and Co.	Vince Milione (202) 426-4984
Off-Peak Fare-Free Transit Demonstration	CO-06-0010	$3,400,000	March 1978-June 1979	Denver Regional Transportation District, Colo.	TSC; Deleuw Cather and Co.	Stewart McKeown (202) 426-4984
CBD Off-Peak Fare-Free Transit	NY-06-0064	$407,380	June 1978-Jan. 1981	Capital District Transportation Authority, Albany, N.Y.	TSC; Cambridge Systematics, Inc.	Vince Milione (202) 426-4984

Fare and Pricing Policies

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
TRANSIT FARE AND SERVICE IMPROVEMENT DEMONSTRATIONS						
Fare and Service Improvement Demonstration	TN-06-0006-1	$450,000	Nov. 1978-June 1981	City of Knoxville, Tenn.	TSC; Multisystems, Inc.	Vince Milione (202) 426-4984
Price and Service Improvement Demonstration	WA-06-0010	$900,000	June 1978-Dec. 1981	City of Vancouver, Wash.	TSC; SYSTAN, Inc.	Vince Milione (202) 426-4984
Parking Pricing Demonstration	WI-06-0006	$1,496,221	Oct. 1978-Aug. 1980	City of Madison, Wis.	TSC; Charles River Associates	Stewart McKeown (202) 426-4984
Permit Parking and Improvement Program	CA-06-0126-1	$299,950	April 1979-July 1981	City of Hermosa Beach, Calif.	TSC; SYSTAN, Inc.	Stewart McKeown (202) 426-4984
Permit Parking and Transit Improvement Program	CA-06-0129	$319,700	July 1979-July 1981	County of Santa Cruz, Calif.	TSC; Crain and Associates	Stewart McKeown (202) 426-4984
Brokerage Demonstration: Pricing	CT-06-0008	$191,066	Oct. 1979-June 1981	Greater Bridgeport Transit District, Conn.	TSC; COSMIS, Corp.	Vince Milione (202) 426-4984
TRANSIT RESOURCE PRODUCTIVITY DEMONSTRATIONS						
Transit Resource Productivity Demonstration	OH-06-0027	$352,000	Oct. 1978-Dec. 1980	Central Ohio Transit Authority	TSC	Stewart McKeown (202) 426-4984
Transit Resource Productivity Demonstration	NE-06-0003	$291,500	Sept. 1978-Dec. 1980	Metro Area Transit, Omaha, Nebr.	TSC; Cambridge Systematics, Inc.	Vince Milione (202) 426-4984

Fare and Pricing Policies

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
RESEARCH AND DESIGN STUDIES						
Transfer Policy and Cost Study	MA-06-0049	$77,500	Oct. 1977-May 1978	TSC; Charles River Associates	N/A	Stewart McKeown (202) 426-4984
Self-Service/ Automatic Fare Billing Demonstration Design	VA-06-0049	$375,893	Sept. 1978-Sept. 1980	MITRE Corporation	N/A	Stewart McKeown (202) 426-4984
Promotional Transit Fare Incentives Demonstration Design	PA-06-0047	$57,864	June 1978-March 1979	Pennsylvania State University	N/A	Vince Milione (202) 426-4984
Evaluation of Federal Government Parking Price Increase	DC-06-0277	$90,000	Sept. 1979-Sept. 1980	Metropolitan Washington Council of Governments	N/A	Stewart McKeown (202) 426-4984
Road Pricing Feasibility Study	HI-06-0004	$117,200	Oct. 1979-March 1980	Hawaii Department of Transportation	N/A	Stewart McKeown (202) 426-4984
Residential Parking Permit Demonstration	CA-06-0129	$319,700	July 1979-July 1981	County of Santa Cruz, Calif.	TSC; Crain and Associates	Stewart McKeown (202) 426-4984
Alternative Distance Based Fare Policies	NY-06-0074	$98,394	Aug. 1979-Jan. 1981	Research Foundation of SUNY, Albany, N.Y.	N/A	Stewart McKeown (202) 426-4984
Parking Management and Employee Incentive Program	CA-06-0140	$520,689	Feb. 1980-Jan. 1981	City of Los Angeles, Calif.	N/A	Stewart McKeown (202) 426-4984
Employee Transportation Program Design	CA-06-0139	$9,800	Feb. 1980-Jan. 1981	Wallen and Associates	N/A	Stewart McKeown (202) 426-4984

Fare and Pricing Policies

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
RESEARCH AND DESIGN STUDIES						
Fare/Service Demonstration Design Assistance	CA-06-0138	$17,500	Oct. 1979-Dec. 1980	A. H. Studemund; Occidental College	N/A	Vince Milione (202) 426-4984
Promotional Pricing Research Assistance	PA-06-0056	$85,000	March 1980-March 1983	Pennsylvania State University	N/A	Vince Milione (202) 426-4984
Technical Support Services	PA-06-0054	$105,255	Jan. 1980-Jan. 1983	Booz, Allen and Hamilton, Inc.	N/A	Vince Milione (202) 426-4984
Technical Support Services	VA-06-0072	$146,569	Jan. 1980-Jan. 1983	SG Associates	N/A	Vince Milione (202) 426-4984
Technical Support Services	IT-06-0233	$382,856	Jan. 1980-Jan. 1983	Urban Institute	N/A	Vince Milione (202) 426-4984
ATTITUDE MEASUREMENT						
Attitude Measurement Techniques for Transportation Planning and Evaluation	DOT-TSC-1168	$177,456	July 1976-July 1978	TSC; Abt Associates, Inc.	N/A	Vince Milione (202) 426-4984

Pricing and service innovations are designed to promote more efficient use of existing transportation facilities. They include increasing transit ridership during times of excess capacity, discouraging use of low-occupancy automobiles during heavy congestion periods, and improving the overall image of transit in the eyes of the general public.

Passengers can board this bus for free as it travels within a free-fare zone.

Registered user-side subsidy client purchasing taxi tickets at half fare.

Free parking for registered carpools may provide just enough additional incentive to induce many commuters to share rides.

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

Albany CBD Fare-Free Demonstration: Evaluation Plan
Proj. NY-06-0064
Cambridge Systematics, Inc.
August 1978

The Consequences of Transit Fare and Service Policies: A Classified Bibliography
Proj. DC-06-0120
The Urban Institute
April 1976, PB 253-101

Low Fare and Fare-Free Transit: Some Recent Applications by U.S. Transit Systems: Interim Report
Proj. DC-52-0002
The Urban Institute
February 1977, PB 271-077

Plan for a Demonstration of Means for Measuring Transit Resource Productivity and Adjusting Services or Revising Routes in Omaha, Nebraska
Proj. NE-06-0003
Institute of Public Administration

Plan for Demonstration of Transit Fare Prepayment Promoted by Employers in Jacksonville
Proj. FL-06-0016
The Urban Institute
December 1977, 5066-6-4

The San Diego Transit Corporation: The Impact of Fare and Service Changes on Ridership and Deficits, 1972-1975
Proj. DC-52-0002
The Urban Institute
May 1977, PB 275-009

The San Diego Transit Study Data Base: Reference Manual
Proj. DC-52-0002
The Urban Institute
June 1977, PB 275-010

Transit Fare Prepayment
Proj. MA-06-0049
The Huron River Group, Inc.
August 1976, PB 265-227

Service and Methods Demonstration Program Annual Report
Proj. MA-06-0049
Transportation Systems Center
November 1975, PB 251-325
April 1977, PB 270-673

Vancouver, Washington: Transit Service Demonstration Management Plan
Proj. WA-06-0010
The Urban Institute

Denver Off-Peak Fare-Free Public Transit Experiment: Interim Report
DeLeuw Cather and Company
May 1979, UMTA-CO-06-0010-79-1

Findings of Preliminary Analysis of the Trenton Off-Peak Fare-Free Transit Demonstration: Interim Report
DeLeuw Cather and Company
January 1979, UMTA-NJ-52-0001-79-1

Case Studies in Reduced-Fare Transit: Portland's Fareless Square
DeLeuw Cather and Company
April 1979, UMTA-MA-06-0049-79-2

Case Studies in Reduced-Fare Transit: Seattle's Magic Carpet
DeLeuw Cather and Company
April 1979, UMTA-MA-06-0049-79-3

The Analysis of Ridership Impacts of Elderly and Handicapped Fare Policies
Chase, Rosen, and Wallace, Inc.

Plan for a Demonstration of Means for Measuring Transit Resources Productivity and Adjusting Services or Revising Routes in Omaha Nebraska
Proj. NE-06-0003

Management Plan for the Knoxville Service and Fare Demonstration Project
Proj. TN-06-0006(1)
The Urban Institute

TRANSIT FARE PREPAYMENT

Transit Fare Prepayment Demonstrations in Austin, Texas and Phoenix, Arizona: Final Report
Proj. MA-06-0049
Crain and Associates
1979, PB 80-192-818

Transit Fare Prepayment
Proj. MA-06-0049
Hudson River Group, Inc.
1976, PB 265-227

SELF-SERVICE FARE COLLECTION

Self-Service Fare Collection
Proj. VA-06-0049
Mitre Corporation
Vol. I, **Review and Summary**
PB 80-132-251
Vol II, **Survey of European Transit Properties**
PB 80-132-269
Vol III, **Hardware Considerations**
PB 80-132-277
Vol IV, **Legal and Labor Issues**
PB 80-132-285
Set of Vol I-IV, PB 80-132-244

SYSTEMWIDE FREE/REDUCED FARE

Trenton Free-Fare Demonstration Project: Evaluation Plan
Proj. NJ-52-0001
DeLeuw, Cather and Company
1979, PB 291-455

Amherst, Massachusetts Free-Fare Bus Research and Demonstration Project
Proj. MA-06-0006
William Goss, et al.
1978, PB 095-097

CHAPTER 10

Conventional Transit Service Innovations

Trends and Highlights

Innovative demonstration projects for conventional transit service have the longest history of success in the Service and Methods Demonstration area. For the most part, attention in conventional transit service has been shifting from the radial corridor to suburban, downtown shopping, and business district trips.

A second generation of more ambitious, more restrictive priority treatments with more positive control has emerged. These priority techniques reflect the result of a decade of experimentation, demonstration, and education. Several U.S. jurisdictions with supportive political leadership and imaginative technical staffs have developed new priority techniques that may have been considered radical heretofore. Examples of these projects include the bus and taxi only program for 49th and 50th streets in New York; special treatments on Sutter, Post, and Mission streets in San Francisco; and the planned reserved dual bus lanes on Madison Avenue in New York.

Revitalization efforts and the subsequent resurgence of many downtown areas have often been accompanied by transit projects in the central business district (CBD). Examples of this resurgence include the skywalk system in Minneapolis, Renaissance Center in Detroit, Pioneer Square and Pier 99 in Seattle, and Quincy Market-Faneuil Hall in Boston.

To encourage and assist urban revitalization efforts, transit projects have been designed to study the development of auto restricted zones, transit malls, and priority treatment of buses in downtown areas. Studies and research are also being conducted to evaluate the efforts of demonstration projects. Many of these

projects are designed to de-emphasize or discourage the use of automobiles in congested portions of cities. Many of the projects are also intended to improve the environment and the aesthetic atmosphere, promote economic growth, restructure traffic and pedestrian circulation, or to improve transit service.

Transit Malls

Transit malls usually consist of one or two streets from which automobile and truck traffic is completely or mostly banned. Sidewalks are widened, amenities added, and a narrow roadway is usually designed for efficient bus operation within the mall. Parts of the mall may be reserved for pedestrians only.

Transit malls are generally planned as part of a scheme of downtown redevelopment and often include transit improvements adjacent to the mall, auto restrictions, and parking modifications. Major issues involved in planning transit malls include the environmental, aesthetic, and safety problems of mixing transit and pedestrian uses, the best physical designs for transit operations, the effects on automobile traffic, and the economic impacts on businesses located on or near the mall.

A large scale revitalization project, Broadway Plaza Transit Mall (NY-06-0056), is planned for New York City's famous and congested Times Square. Included as a major part of the project is the redesign of Broadway, an important cross link in the area's street pattern, to include a

An artist's conception of the Broadway Plaza Transit Mall which will exclude automobiles and include a pedestrian plaza and priority lanes for buses.

transit mall, pedestrian plaza, and priority treatment of buses on adjacent streets.

The transformation of Broadway into Broadway Plaza will include complete street closings, progressive sidewalk widenings and a transitway on Broadway between 49th and 45th Streets. As streets are closed and private vehicles diverted, an open pedestrian plaza will be created, free of all but emergency vehicles, and a transitway approaching and abutting the plaza will be built. The plaza will be directly served by transit and taxi passenger loading areas.

A Transit Information Center, featuring a coordinated map and graphics display, will serve to make the plaza a center for transit service and tourist information, and will help to attract new patrons to the transit system. In addition, the plaza will include shops, services and other businesses in the district. A major, new, 54-story 2,000-room hotel is being planned to face the plaza.

The auto restricted zone in downtown Memphis is an attractive, uncongested area.

Auto Restricted Zones

The auto restricted zone (ARZ) is similar in concept and design to the transit mall. The major difference is that the ARZ generally includes a more extensive area, or, at the very least, side streets leading to and from a larger, centrally located and similarly restricted roadway. An ARZ, like a transit mall, can be created through the use of either parking restrictions, barriers to traffic, or prohibition of all automobile traffic. Three auto restricted zone projects (Boston, Mass., Memphis, Tenn., and Providence, R.I.) have been constructed or are in their final planning stages.

An auto restricted zone was developed in Boston to demonstrate the feasibility of the ARZ concept (MA-06-0089). In this program, scarce street space was partially restricted in the downtown shopping district to better serve the needs of pedestrians, transit services, merchandise shipment, taxis, and private autos. The project has three basic components: 1) redesigned circulation system for buses, 2) physical reconstruction to reserve streets for pedestrians, and 3) a one-year program to subsidize extended bus operations. Evaluation reports on the zone indicate that the program has been well received by pedestrians, the media, transit patrons and most merchants. The anticipated major traffic tie-ups on the periphery of the zone did not materialize.

A grant (TN-06-0008) was awarded in FY 78 to conduct and evaluate a program that combines the development of an auto restricted zone with improvements to the Memphis transit system. Improvements to Memphis transit operations will be made by upgrading transit stops,

developing a downtown transit terminal, and instituting a high frequency/low fare shuttle bus service between the downtown ARZ and the highly populated medical center. A parallel purpose of this grant is to support the downtown revitalization program which began with a locally sponsored pedestrian mall.

The City of Providence, R.I., plans to develop an auto restricted zone in conjunction with CBD revitalization and transit service improvements. An UMTA grant (RI-06-0010) of $960,000 out of $5 million required for the total project was awarded to Providence in 1978. With goals similar to those sought in Boston's ARZ program, a large pedestrian plaza will be constructed. In addition, transit service improvements will be made, including a revamped bus routing system to allow for through downtown routing and the construction of a major 12-berth downtown bus terminal and a small transit mall. The ARZ and transit improvement project are scheduled to begin construction in 1981.

Over 400 articulated buses are in operation in at least ten cities in the United States.

Innovative Studies

Timed Transfer (MA-06-0049) is one technique that has been suggested to improve suburban accessibility by transit. Timed Transfer is the name given to the reconfiguration of routes and schedules so that routes intersect at transfer points on schedules that permit a transfer of less than five minutes. Timed Transfer is being implemented in a number of U.S. cities. Through TSC, the Office of Service and Methods Demonstrations (SMD) began a study of several of these systems in FY 79

The study was to investigate such things as applicability of the concept to various types of areas; reliability of transfers; productivity and costs; and user, operator, and nonuser attitudes. In 1981, a report will be developed from the study.

SMD sponsored a study to investigate the feasibility of implementing express bus service on abandoned or underutilized rail rights of way (MA-06-0049). This study was to identify a sample of 20 potential sites and conduct a more indepth analysis on a subset of this sample.

Another SMD effort is the provision of assistance with FHWA and HUD to seven cities—Atlanta, Boston, New York, Hartford, Philadelphia, Providence, and St. Louis—which are planning open public spaces. SMD's transfer of $40,500 (DC-06-0254) in FY 79 to HUD assisted the seven cities in analyzing current use of the open space as well as aided in the design of the proposed improvement. Two of the seven cities—Boston and Providence—were selected because of current auto restricted zone activities. An additional $60,000 was transferred to

Reserved lanes for buses in downtown areas encourage the use of public transportation.

HUD in FY 80 to allow the contractor to develop educational materials documenting the findings of the study.

SMD is also evaluating the effectiveness of articulated vehicles in a variety of conventional transit uses in the U.S. (MA-06-0049). Some 400 articulated buses manufactured by MAN of West Germany and AM General went into operation at ten U.S. transit properties in 1979. This study is aimed at evaluating the vehicles' performance in a variety of situations.

There are approximately 320,000 school buses in the U.S., about five times the number of transit vehicles owned by public operators. This enormous resource is used mostly by students. The goal of a school bus study (MA-06-0049) is to explore ways to improve the overall efficiency of the two (school and public) transportation systems.

Priority Treatments for High-Occupancy Vehicles

Many groups and individuals have voiced concern over the need to improve air quality and conserve energy while simultaneously reducing government expenditures. This concern has led federal, state, and metropolitan governments to develop plans to encourage the use of public transportation and carpools while maximizing the use of existing roadway systems. SMD has funded a variety of techniques to attract people to public transit. One of the most effective and obvious strategies has been to improve transit services by offering buses and carpools preferential treatment both on major highways and city streets.

To assist in the implementation of preferential treatment strategies, a planning manual for high-occupancy vehicle (HOV) priority facilities was published. The manual, developed for SMD by the Urban Consortium, seems to have had a good reception and is being used by local planners and by many universities as an instructional aid. On the whole, however, implementation of recommended strategies has been slow, partly due to the constraint upon funds.

Several SMD projects have been initiated in recent years in San Francisco, Calif., Houston, Tex., St. Louis, Mo., and Philadelphia, Pa.

San Francisco's downtown transit priority lane project (CA-06-0118) is designed to demonstrate the effectiveness of improved signing and pavement markings for reserved bus lanes in downtown business and shopping areas. The project also includes studies of the possibility of expanding the preferential street network in downtown areas, and of the use of nontraditional personnel to enforce compliance with lane restrictions. The project started in FY 79 and will be completed early in FY 81.

The Houston Corridor Improvement Project (TX-06-0018) is being implemented by the city of Houston as one of a number of coordinated improvements in the city's transportation system. The major activity in this project is the construction of ten miles of contraflow lanes for public transit vehicles on the North Freeway. The lanes opened in August 1979. Park-and-ride lots accommodating 2400 vehicles are now open. In addition, transit priority treatment for another Houston corridor, the Katy Freeway, is currently under study. Other improvement projects include the acquisition of new equipment to refurbish and update the bus fleet, the development of new transit facilities, a carpooling program, a downtown circulation system, and an express bus service.

The St. Louis Project (MO-06-0010) will focus on simplifying the transit route structure in the CBD along with providing reserved curb lanes and adjusted signal timing to improve the movement of buses. This project was funded for a two year period beginning September 1979.

The Philadelphia project (PA-06-0053) includes the provision of signal preemption for trolley buses along Frankfort Avenue (Transit Route 66). This project will also provide additional overhead wire to accommodate the expansion of 50 peak period express trips. The Philadelphia project was funded for a three year period, beginning in September 1979.

Madison Avenue in New York City is the site of a demonstration project (NY-06-0082) to test the feasibility of a truly effective reserved curb lane for buses. Madison Avenue, from 42nd to 59th Streets, will be signed and striped so that the two right hand lanes will be reserved for buses all of the time. Right turns will be prohibited and all curb loading will be banned, so there should be no vehicles in the bus lanes at anytime. This one-year project is scheduled to begin in November 1980.

General Transit Improvements

The purpose of the Dulles International Airport Improved Access demonstration project (IT-29-2001) in the northern Virginia suburbs of Washington, D.C., is to determine whether improved high-speed bus service can encourage some air passengers to shift from the more accessible National Airport to the relatively less accessible Dulles International Airport. Rather than institute new transit service, most of the project budget will go for improved information about the existing service. In addition, a midpoint airport bus stop will be developed at the conveniently located Rosslyn Metro Station. A second purpose of this project is to test the effectiveness of such an improved bus service in encouraging passengers to change their habit of travelling by auto and taxi to one of travelling by the higher capacity bus.

Common problems facing many transit patrons are knowing what bus to take and on what schedule it operates. These problems increase with the number of discrete routes in a transit system or corridor. Common to larger transit systems is a labyrinth of routes with numerous turnbacks, branches, etc. Conveying this kind of information to regular riders is made difficult by the number of different routes.

A project (FL-06-0019), funded in FY 79 in Dade County, Fla., was aimed at reducing the number of routes in the Miami Beach corridor and implementing a new, higher speed, limited stop trunk route on the main corridor arterial.

Transit Reliability

The Office of Service and Methods Demonstrations sponsored a transit reliability project (MN-06-0011) in Minneapolis-St. Paul beginning in FY 79. The purpose of this project was to test the hypothesis that improved transit reliability can be realized without a significant increase in operating cost or other adverse effects. This project was to demonstrate the effectiveness of schedule changes in improving reliability. The demonstration was expected to take place during a two year period beginning in September 1979.

In a related effort, SMD is conducting an evaluation (CA-06-0145) of a major bus route and schedule change occurring in the Los Angeles central area. Many of the proposed changes are designed to improve reliability. Also part of this study is an analysis of a major fare increase.

In another FY 80 demonstration (VA-06-0079), an inner city transit improvement is proposed for Newport News-Hampton, Va. Several routes operated by Penntran will be redesigned to better serve some suburban shopping centers that are the new destinations of inner city residents.

A major FY 80 demonstration (PA-06-0058) is planned for Erie, Pa. An Automatic Bus Passenger Information (ABPI) system will be tested in Erie. The ABPI will allow potential patrons to call a telephone number and receive a taped message about the arrival time of the next bus at any bus stop in the system.

Conventional Transit Service Innovations

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
TRANSIT MALLS						
Broadway Plaza Transit Mall	NY-06-0056	$500,000	June 1976-Sept. 1982	Administration and Management Research Associates, Inc.	TSC	Joseph Goodman (202) 426-4984
AUTO RESTRICTED ZONES						
Boston Auto Restricted Zone	MA-06-0089	$2,091,000	June 1978-Sept. 1980	Boston Redevelopment Authority, Mass.	TSC; Cambridge Systematics, Inc.	Joseph Goodman (202) 426-4984
Memphis Auto Restricted Zone	TN-06-0008	$960,000	Sept. 1978-Sept. 1982	City of Memphis, Tenn.	TSC; Charles River Associates	Marvin Futrell, Jr. (202) 426-4984
Providence Auto Restricted Zone	RI-06-0010	$960,000	June 1981-June 1982	City of Providence, R.I.	TSC; Charles River Associates	Joseph Goodman (202) 426-4984
INNOVATIVE STUDIES						
Timed Transfer Study	MA-06-0049	$53,110	July 1979-Dec. 1980	TSC; SYSTAN, Inc.	N/A	Joseph Goodman (202) 426-4984
Abandoned Rail Rights of Way	MA-06-0049	$30,000	FY 1979-FY 1980	TSC; Charles River Associates	N/A	Joseph Goodman (202) 426-4984
Open Space Planning Technical Assistance	DC-06-0254	$100,500	Sept. 1979-Oct. 1980	HUD; Project for Public Spaces, Inc.	N/A	Joseph Goodman (202) 426-4984

Conventional Transit Service Innovations

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
INNOVATIVE STUDIES						
Articulated Bus Study	MA-06-0049	$97,000	Sept. 1979-Dec. 1980	TSC; Cambridge Systematics, Inc.	N/A	Joseph Goodman (202) 426-4984
School Bus Study	MA-06-0049	$26,000	Oct. 1979-Sept. 1980	TSC; Multisystems, Inc.	N/A	Joseph Goodman (202) 426-4984
PRIORITY TREATMENTS						
Improved Transit Priority Lanes in San Francisco, California	CA-06-0118	$213,498	Oct. 1978-Oct. 1980	Planning Dept., City of San Francisco, Calif.	TSC; SYSTAN Inc.	Joseph Goodman (202) 426-4984
Corridor Improvements in Houston, Texas	TX-06-0018	$1,051,760	June 1975-Oct. 1980	City of Houston, Tex.	TSC; Cambridge Systematics, Inc.	Joseph Goodman (202) 426-4984
St. Louis CBD Transit Priority Project	MO-06-0010	$374,000	Sept. 1979-Sept. 1981	Bi-State Development Agency, Mo.	TSC	Joseph Goodman (202) 426-4984
Philadelphia Signal Preemption	PA-06-0053	$1,028,080	Sept. 1979-Sept. 1982	SEPTA	TSC; Multisystems, Inc.	Joseph Goodman (202) 426-4984
Effective Reserved Bus Lane	NY-06-0082	$788,300	Nov. 1980-Nov. 1981	New York City Department of Transportation	TSC; COMSIS	Joseph Goodman (202) 426-4984

Safety and Product Qualification

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
GENERAL TRANSIT IMPROVEMENTS						
Dulles International Airport Improved Access Program	IT-29-2001	$175,000	Sept. 1979-Sept. 1980	Northern Virginia Transportation Commission	TSC; Multisystems, Inc.	Joseph Goodman (202) 426-4984
Corridor Route Simplification	FL-06-0019	$448,800	Oct. 1979-Oct. 1981	Dade County, Fla.	TSC; Multisystems, Inc.	Joseph Goodman (202) 426-4984
Minnesota Transit Reliability	MN-06-0011	$239,630	Sept. 1979-Sept. 1981	Metropolitan Transit Commission, Minn.	TSC; Multisystems, Inc.	Joseph Goodman (202) 426-4984
Los Angeles Transit Reliability and Fare Change Analysis	CA-06-0145	$199,140	May 1980-Dec. 1981	Southern California Rapid Transit District	TSC; Multisystems, Inc.	Joseph Goodman (202) 426-4984
Inner City Transit Improvement	VA-06-0079	$556,536	Nov. 1980-Nov. 1981	Penntran, Hampton, Va.	TSC; Peat, Marwick, Mitchell and Co.	Joseph Goodman (202) 426-4984
Automatic Bus Passenger Information	PA-06-0058	$1,230,024	Oct. 1980-Sept. 1983	Erie Metropolitan Transit Authority	TSC	Joseph Goodman (202) 426-4984

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

The Santa Monica Freeway Diamond Lanes Demonstration Project, Vol. I, Summary
Proj. MA-06-0049
Systan, Inc.
September 1977, PB 286-567

The Santa Monica Freeway Diamond Lines Demonstration Project, Vol. II, Technical Report
Proj. MA-06-0049
Systan, Inc.
September 1977, PB 286-568

The Los Angeles Double Deck Bus Demonstration Project: An Evaluation
Proj. CA-06-0069
CACI, Inc.
March 1978, PB 287-837

New York City Double Deck Bus Demonstration Project: An Evaluation
Proj. NY-06-0044
CACI, Inc.
May 1978, PB 287-836

The Double Deck Bus Demonstration Project: Executive Summary
Proj. MA-06-0049
CACI, Inc.
May 1978, PB 287-838

A Comparative Analysis of Results from Three Recent Non-Separated Concurrent-Flow High Occupancy Freeway Lane Projects: Boston, Santa Monica and Miami
Proj. MA-06-0049
Transportation Systems Center
June 1978, PB 289-278

Priority Treatment for High Occupancy Vehicles in the United States: A Review of Recent and Forthcoming Projects
Proj. MA-06-0049
Transportation Systems Center
August 1978, PB 294-511

Southeast Expressway High Occupancy Vehicle Lane Evaluation Report
Proj. MA-06-0049
Transportation Systems Center
May 1978, PB 285-209

Auto Restricted Zones/Multi-User Vehicle System Study
Proj. VA-06-0042
Alan Voorhees and Associates, Moore-Heder, and Cambridge Systematics, Inc.
Vol. I, **Auto Restricted Zones: Background and Feasibility,** PB 286-313
Vol. II, **Multi-User Vehicle Systems: Feasibility Assessment,** PB 286-314
Vol. III, **Auto Restricted Zones: Plans for Five Cities,** PB 286-315
Vol. IV. **Site Selection Methodology**
PB 286-316
Technical Appendix: Boston ARZ Study
PB 286-317
Technical Appendix: Burlington ARZ Study
PB 286-318
Technical Appendix: Memphis ARZ Study
PB 286-319
Technical Appendix: Providence ARZ Study
PB 286-320
Technical Appendix: Tucson ARZ Study
PB 286-321

Miami, Florida I-95/NW 7th Avenue Bus/Car Pool Systems Demonstration Project
Proj. FL-06-0006
Metro, Dade County Transit Authority, and University of Florida
September 1977

Phase I, Evaluation

Report I-1, **Evaluation of the NW 7th Avenue Express Bus and Bus Priority Systems,**
J. A. Wattleworth, et al.
PB 291-137

Report I-2, **Effects of NW 7th Avenue Bus Priority Systems on Bus Travel Times and Schedule Variability,**
K. G. Courage, et al.
PB 291-138

Report I-3, **Changes in Transit Operational Characteristics on the NW 7th Avenue Express Bus System,**
R. Wolfe, et al.
PB 291-139

Report I-4, **Modal Shift Achieved on the NW 7th Avenue Express Bus System,**
J. A. Wattleworth, et al.
PB 291-140

Report I-5, **Effect of the Park 'n' Ride Facility on Usage of the NW 7th Avenue Express Bus System,**
J. A. Wattleworth, et al.
PB 291-141

Report I-6, **Effects of NW 7th Avenue Bus Priority Systems on NW 7th Avenue Traffic Stream Flow and Passenger Movements,**
J. A. Wattleworth, et al.
PB 291-142

Report I-7, **Evaluation of Characteristics of Users and Non-Users of the NW 7th Avenue Express Bus/Car Pool System,**
D. P. Reaves, et al.
PB 291-143

Report I-8, **Effect of Bus Priority Systems Operation on Performance of Traffic Signal Control Equipment on NW 7th Avenue,**
K. G. Courage, et al.
PB 291-144

Report I-9, **Economic Viability of the NW 7th Avenue Express Bus Operation,**
C. E. Wallace, et al.
PB 291-145

Phase II, Evaluation

Report II-1, **Evaluation of the I-95 Express Bus and High Occupancy Vehicle Priority Systems,**
J. A. Wattleworth, et al.
PB 291-146

Report II-2, **Evaluation of the Effects of the I-95 Exclusive Bus/Car Pool Lane Priority System on Vehicular and Passenger Movements,**
J. A. Wattleworth, et al.
PB 291-147

Report II-3, **Evaluation of the Effects of the I-95 Exclusive Bus/Car Pool Priority System on the Express Bus System,**
J. A. Wattleworth, et al.
PB 291-148

Report II-4, **Evaluation of Characteristics of Users and Non-Users of the I-95 Bus/Car Pool System,**
G. Long, et al.
PB 291-149

A Manual for Planning and Implementing Priority Techniques for High Occupancy Vehicles
Proj. DOT-06-60076
The Urban Consortium for Technology Initiatives
June 1977

Transit Service Reliability
Proj. MA-06-0049
Mark Abkowitz, et al.
December 1978, PB 292-152

The Restraint of the Automobile in American Residential Neighborhoods
Proj. MA-06-0049
Howard Simkowitz, et al.
June 1979, PB 287-485

Boston Auto Restricted Zone Demonstration Evaluation Plan
Proj. MA-06-0049
Cambridge Systematics, Inc.
March 1979

CHAPTER 11

Paratransit

Trends and Highlights

Paratransit as a service concept has apparently come of age and has begun to receive growing attention as an accepted part of the urban transportation network.

The recognition that one kind of transportation service cannot serve all markets and that services must be designed to meet the needs of particular market segments is one important reason for the growing interest in paratransit. A second major reason for developing paratransit services is to make better use of existing transportation resources in both the public and private sectors. UMTA's Service and Methods Demonstrations (SMD) paratransit program is designing service models to show how these resources can be used in a coordinated fashion to serve markets more effectively than had been possible under a fixed-route system.

During FY 80, steady progress toward larger, more comprehensive projects has been made in the paratransit area. Attention has focused on effective brokerage arrangements under which a mix of transportation services are coordinated to serve both the general public and special user groups, such as the transportation handicapped.

In spite of such progress, many problems remain. Labor agreements require time-consuming negotiations, and the agreements sometimes place restrictions on service. This is not a problem as far as the demonstrations are concerned, but could affect the flexibility of future paratransit operations. There have been difficulties, too, in attempting to integrate the private taxi industry with public transit.

Nonetheless, the paratransit demonstrations discussed in this section show that positive changes can be made in the approach to transportation problems. It is hoped that these demonstrations will continue to produce essential data and analytical results to assist others in planning similar operations.

Integration of Paratransit and Fixed-Route Systems

UMTA has conducted a number of demonstrations to show how paratransit can supplement and complement fixed-route transit service. Among the completed projects is the Rochester, N.Y. Integrated Transit Demonstration (NY-06-0048), which used demand-responsive service to improve area coverage of the city and its environs and provide special services for the elderly and handicapped.

The most significant development of the project was a computerized dispatching system for demand-responsive vehicles. This system proved effective and provided management information which was not easy to obtain with the manual system. Another positive development was the specialized service for the elderly and handicapped, which was continued after the demonstration and has been expanded countywide. A third important innovation was the use of a private transportation company to provide demand-responsive service in two suburban towns, Brighton and Henrietta. The use of a private company created no significant operational problems, and the service was considerably cheaper than that provided by the transit operator.

However, all demand-responsive service available to the general public has since been discontinued because the local governments did not want to subsidize it, even though the service would have been less expensive than fixed-route service in the same areas. For the most part, the areas formerly having demand-responsive transportation now have no service at all, or are served by fixed-route transit which predated the demonstration.

Under another project (CA-06-0097), the software perfected in Rochester is being applied in Orange County, Calif., which has developed a program to provide community demand-responsive service for the entire county. Scheduled to go on line in the fall of 1980, the software system will provide the dispatching function for all demand-responsive service in the county.

Another project which was continued at the conclusion of the demonstration is the Westport, Conn. Integrated Transit Service Demonstration (CT-06-0007-2). This project began in April 1977 and was designed to integrate fixed-route service provided by the district with new shared-ride taxi service provided by a private operator. The major features of the project include expanded fixed-route service, development of a shared-ride taxi service, implementation of a special advance-request, demand-responsive service for Westport's elderly and handicapped citizens, and package delivery service for Westport businesses.

The Westport Transit District, acting as the broker, is contracting with a local taxi operator to provide the paratransit services.

During the course of developing shared-ride service, legal proceedings were initiated by another local taxi operator. The U.S. Circuit Court of Appeals in January 1978 reversed, in part, a previous decision of the District Court and held that Sections 3 (d) and 3 (e) of the Urban Mass Transportation Act which deal with public hearings, environmental impact,

Special buses pull bicycle trailers on selected routes in Santa Barbara. This service allows bicyclists to transfer to fixed-route service with ease.

and protection of private operators apply to Section 6 grants. However, the Court also ruled that the taxi operator in question did not qualify as a "mass transportation company," and therefore was not entitled to Section 3 (e) protection. The United States Supreme Court refused to hear an appeal of the case in October 1978.

Westport's shared-ride taxi ridership has increased steadily to over five passengers per vehicle hour. An important finding has been that the shared-ride taxi operation is providing a complementary rather than competing service to the fixed-route service. The transit district is also promoting ridesharing for local employers and providing shuttle services to downtown businesses. The contract for operating the shared-ride taxi service will be rebid periodically.

The Dade County, Fla. Integrated Transit project (FL-06-0018) is designed to develop detailed plans for a future demonstration of an integrated transit and paratransit system. Major features are expected to include a revision of taxi regulations in Dade County, integration of transit and taxi services, including taxi feeder to fixed-route service, and improved services for the elderly and handicapped through coordination of social service transportation.

The Bicycle Transit Integration Demonstration (CA-06-0114) in Santa Barbara, Calif., is demonstrating the integration of fixed-route bus service with special services for bicycle users. The project is designed to stimulate increased transit use. Special facilities include bicycle trailers pulled by buses on selected routes and bicycle racks and lockers placed at various locations for bicycle access to bus routes. The bicycle trailer service has been successful on the longer bus routes, with over 150 bikes per day now being carried on the trailers. The bus operator is also satisfied with the outcome of the project.

Vanpool demonstrations proved so successful that capital and operating funds are now available from UMTA or FHWA.

Transportation Brokerage

A relatively new concept in transportation management is the use of a transportation broker to identify needs of various market segments and match them with the appropriate resources available.

Differences in urban areas require variations in transportation brokerage models. For example, in some cases the regional transit authority might assume the role of broker, while in other cases the city could perform the broker function.

Depending upon existing circumstances, the broker's duties include contracting with private operators, modifying existing transit services, establishing carpool and vanpool programs, and/or coordinating social service agency travel. The broker acts in a coordinating role as far as providing service is concerned, and takes an active role in removing barriers to the more efficient use of existing vehicles.

The projects described below were specifically designed to demonstrate the concept of transportation brokerage.

The demonstration phase of the Commuter Services Brokerage project (MN-06-0008) in Minneapolis, Minn., was completed during 1980 and the program has been continued by the Metropolitan Transit Commission (MTC), the local transit operator. Acting as a broker, the MTC coordinates a variety of ridesharing services including carpooling, vanpooling, and transit service. The project has developed a fleet of over 90 vanpools. The vans are leased from a private contractor who manages all operational elements of the vanpool program including insurance, maintenance, and driver training. Carpool formation has been very successful. About 5000 persons have been placed in carpools. The use of active telephone brokerage facilitates matching. However, the subscription bus service has been eliminated due to insufficient demand.

A new project begun in FY 78 and continuing in 1980 is the RTA Paratransit Brokerage (IL-06-0048) in the Chicago, Ill., metropolitan area. In this demonstration, the Regional Transportation Authority (RTA) is functioning as broker, coordinating a range of paratransit services for communities in the suburban Chicago area. The transportation services, based on the needs of the individual communities, include shared-ride taxi, taxi feeder to fixed-route, subscription bus service, and special services for the elderly and handicapped.

Short-haul subscription bus service is available to the El Segundo employment area of Los Angeles, Calif.

The paratransit services are funded by, and provided with technical and management assistance from, the RTA. Both private and public operators provide the actual services.

The Pittsburgh Paratransit Broker Demonstration (PA-06-0042) is designed to coordinate paratransit services for elderly and handicapped people in the Pittsburgh, Pa. metropolitan area through the use of a broker. The Port Authority of Allegheny County has selected a private firm to serve as the broker. The broker's primary function is to ensure the availability of all necessary dispatching and transportation resources, to provide a mechanism for the flow of funds, to market the system actively, and to monitor the entire system.

The project gives all social service agencies and individual elderly and handicapped consumers the opportunity to buy services on a unified paratransit system at ride-sharing rates. Allegheny County is divided into service sectors for which providers bid. Elderly and handicapped users who are not affiliated with an agency are subsidized through a Port Authority user subsidy program.

A project in Bridgeport, Conn. (CT-06-0008), is demonstrating a systemwide brokerage approach to planning, implementing, and operating a variety of transit and paratransit services in both the public and private sectors. The Bridgeport

Transit District is operating the fixed-route transit system and working in other areas such as ridesharing, coordination of social agency transportation, taxi/transit integration, suburban community transit service, and economic development. The transit district will develop an array of services to meet the needs of various market segments in the community.

The Knoxville program has served as a model for many vanpools throughout the country.

Vanpool Demonstrations

SMD funded four demonstrations involving vanpools in Knoxville, Tenn. (TN-06-0006), Minneapolis-St. Paul, Minn. (MN-06-0008), Tidewater, Va. (VA-06-0033), and Marin County, Calif. (CA-06-0095). All four demonstrations were completed successfully and are being continued under local sponsorship. The projects tested a variety of approaches to vanpool development, including an association of vanpool owner/operators, a third party van leasing company, transit authority ownership of vans, and a "seed van" approach. Under the latter concept, publicly owned vans are leased to groups of commuters for a period of six months to one year. The commuters then switch to a van which they acquire themselves by lease or purchase.

The choice of approach to vanpooling depended upon local desires and conditions. The four projects currently have about 400 vanpools and 13 owner/operator buses in commuter service. The vanpool concept is now considered to have been successfully demonstrated and vanpools can be funded with regular program resources of UMTA and FHWA.

Other Paratransit Innovations

Other studies undertaken by the program are intended to provide planning and technical assistance or to test other promising paratransit innovations.

One demonstration, the Employment Center Subscription Service (CA-06-0109), tested the concept of providing short-haul subscription bus service to the El Segundo employment area of Los Angeles, Calif.

In the past, the use of subscription bus service has involved relatively long trip distances. This has been necessary in order to make economical use of the vehicle and still charge reasonable fares. However, the El Segundo employment area has shorter trip distances and staggered work hours, which allow a vehicle to make multiple trips during the peak period. These conditions greatly increase

vehicle and labor productivity, thereby reducing the cost to the user.

The El Segundo service began in June 1978, offering service along 14 routes on seven standard transit buses. The routes are designed to serve employees of large firms employed on various shifts and at several work locations. Each bus in the project makes several prearranged pickup stops to serve walking or park-and-ride customers, and then travels express to the employment center. The bus then travels empty to a second pickup point and repeats the operation. Ridership grew dramatically between March and June 1979 with several routes operated at standing room only capacity. The demonstration was completed in 1980, and the service was continued by the local transit operator.

A demonstration of ridesharing brokerage in the Newport News-Hampton, Va. area is a follow-on to an earlier planning project (VA-06-0050). The project will identify and promote formation of ridesharing pools; develop and operate an area-wide computer matching system; provide a backup fleet for existing vanpools; and, improve social service agency transportation.

A demonstration in Marin County, Calif. (CA-06-0128), of a "casual carpool" concept, sponsored by the Golden Gate Bridge Highway and Transportation District, was completed in 1980. Commuters, both riders and drivers, can share rides on an irregular, flexible basis. The concept, which builds on the more informal practice of hitchhiking, is based on the premise that drivers will be more willing to pick up riders on a casual basis when riders can indicate their destination by means of a sign or boarding pass. The project sponsor is marketing the casual carpool, registering participants, and issuing identification cards. The project has been moderately successful, with about 150 people per day matching riders. The project sponsor is continuing to market the service as part of its ridesharing program.

Projects in San Diego, Calif. (CA-06-0127), and Seattle, Wash. (WA-06-0019) are evaluating the impact of recent regulatory reforms affecting the local taxi industry. The revisions have eased entry requirements, implemented competitive pricing, and allowed competition with fixed-route public transit. The project will focus on the taxi industry, users, institutional issues, and impacts on the urban transportation system.

The left-hand column shows the cost to one person of owning and maintaining a van. The right-hand column shows how the cost can be divided among more people.

Vanpooling pays for itself

Monthly Expenses		Monthly Receipts	
1. Lease or purchase	$140	1. Ernest Helper	$27
		2. Betty Brown	$27
		3. Warren Quickly	$27
2. Insurance	40	4. Donald Jones	$27
		5. Joan Wachowski	$27
3. Gas, oil, and maintenance (1000 miles @ 9¢)	90	6. Bill Slater	$27
		7. Martin Sleeper	$27
		8. William Reed	$27
		9. George Dolittle	$27
		10. Mary Tilden	$27
Total	$270	Total	$270

Paratransit

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
INTEGRATED PARATRANSIT, FIXED-ROUTE SYSTEMS						
Orange County Computerized Demand-Responsive Transit	CA-06-0097	$2,671,107	May 1978-June 1982	Orange County Transit District, Calif.	TSC; Crain and Associates	Paul Fish (202) 426-4984
Dade County Integrated Transit	FL-06-0018	$167,162	Aug. 1978-Dec. 1979	Dade County Office of Transportation Administration, Fla.	TSC	Paul Fish (202) 426-4984
Bicycle-Transit Integration	CA-06-0114	$182,000	March 1978-Dec. 1980	Santa Barbara Metropolitan Transit District, Calif.	TSC; SYSTAN, Inc.	Paul Fish (202) 426-4984
TRANSPORTATION BROKERAGE						
RTA Paratransit Brokerage	IL-06-0038	$550,188	March 1978-Continuing	Chicago Regional Transportation Authority, Ill.	TSC; DeLeuw Cather and Co.	Mary Martha Churchman (202) 426-4984
Pittsburgh Paratransit Brokerage Demonstration	PA-06-0042	$1,900,000	July 1978-Sept. 1981	Allegheny County Port Authority, Penn.	Charles River Associates	Lynn Sahaj (202) 426-4984
Brokerage Demonstration	CT-06-0008	$999,205	Aug. 1978-Oct. 1981	Greater Bridgeport Transit District, Conn.	TSC	Mary Martha Churchman (202) 426-4984
Dissemination of Transportation Brokerage Concept	TN-06-0010	$239,834	Oct. 1978-June 1981	University of Tennessee	N/A	Mary Martha Churchman (202) 426-4984

Paratransit

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
OTHER PARATRANSIT INNOVATIONS						
Easy-Ride Transportation Brokerage	VA-06-0050	$570,000	Sept. 1978-Sept. 1981	Peninsula Transportation District Commission, Va.	N/A	Lynn Sahaj (202) 426-4984
San Diego Taxi Regulation Study	CA-06-0127	$90,564	July 1979-July 1981	City of San Diego, Calif.	N/A	Larry Bruno (202) 426-4984
Seattle Regulatory Evaluation	WA-06-0019	$81,000	Aug. 1980-Aug. 1981	City of Seattle, Wash.	DeLeuw Cather and Co.	Larry Bruno (202) 426-4984

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

Feasibility Study of the Employment Center Bus Service Concept
Proj. CA-06-0084
The Aerospace Corporation
August 1976, PB 259-941

An Analysis of Commuter Van Experience
Proj. DC-06-0120
The Urban Institute
February 1976, PB 252-304

Guidelines for the Organization of Commuter Van Program
Proj. DC-06-0120
The Urban Institute
February 1976, PB 252-304

Evolution of the Knoxville Transportation Brokerage System: Interim Report
Proj. TN-06-0006
CACI, Inc.
October 1976, PB 270-103

A Compendium of Provisions for a Model Ordinance for the Regulation of Public Paratransit
Proj. IL-06-0029
International Taxicab Association
February 1976, PB 253-182

Small City Transit Characteristics: An Overview
Proj. MA-06-0049
Transportation Systems Center
March 1976, PB 252-501

Free-Fare, Student-Operated Transit in a University Community: Amherst, Massachusetts
PB 251-502

Pilot Dial-A-Ride Project in a Sector of the City: Ann Arbor, Michigan
PB 251-503

Privately Operated Subscription Bus Service to an Industrial Site: Bremerton, Washington
PB 251-504

Public Transit Serving a University and Town: Chapel Hill, North Carolina
PB 251-505

Free-Fare Transit in a High Density, Industrialized Area: East Chicago, Indiana
PB 251-506

City-Wide Shared Ride Taxi Service: El Cajon, California
PB 251-507

Extensive County-Wide Transit Coverage: Eugene/Sprinfield, Oregon
PB 251-508

A Low Subsidy Transit Service: Evansville, Indiana
PB 251-509

Dial-A-Ride Transit in an Agricultural Community: Merced, California
PB 251-510

Point Deviation Service in a Rural Community: Merrill, Wisconsin
PB 251-511

A Short-Lined Suburan Transit Service: Sudbury, Massachusetts
PB 251-512

Comprehensive Transit is an Affluent Suburban Community: Westport, Connecticut
PB 251-513

A Transit Service for a Rebuilding City: Xenia, Ohio
PB 251-514

Summary of State Aid Programs
PB 251-515

Service and Methods Demonstration Program Annual Reports
Proj. MA-06-0049
Transportation Systems Center
November 1975, PB 251-325
August 1979, PB 270-673

Evolution and Operations of the Reston, Virginia Commuter Bus Service: Final Report
Proj. MA-06-0049
CACI, Inc.
August 1977, PB 275-792

Pre-Demonstration Activities of the Westport Integrated Transit System: Interim Report
Proj. MA-06-0049
CACI, Inc.
July 1977, PB 271-998

Com-Bus: A Southern California Subscription Bus Service, Final Report
Proj. MA-06-0049
CACI, Inc.
May 1977, PB 272-470

Feasibility Study of Shared Ride Auto Transit
Proj. IT-06-0144
O. Kocur, D. Zaelke, and L. Neuman
September 1977, PB 276-539

Rochester, N.Y., Integrated Transit—Final Evaluation Report: 3 Vols.
Proj. NY-06-0048
Roy Lave and Michael Holoszye
September 1978, PB 296-875/6/7

The Knoxville Transportation Brokerage Project
Proj. TN-06-0006
The University of Tennessee
Transportation Center
Vol. I, **Philosophy and Institutional Issues**
Number 1978, PB 292-592
Vol. II, **Operations and Management**
October 1977, PB 282-248
Vol. III, **An 18-Month Evaluation**
November 1978, PB 292-593

Evaluation Plan: The Minneapolis Ridesharing Communter Services Demonstration
Proj. MN-06-0008
Len Sherman
May 1978, PB 289-798

Interim Evaluation Report: The Minneapolis Ridesharing Commuter Service Demonstration
Proj. MN-06-0008
Len Sherman
November 1978, PB 295-189

Knoxville Commuter Pool, Annual Report 1977-1978
Proj. TN-06-0006
John Beeson
November 1978, PB 295-046

Golden Gate Vanpool Demonstration Project: Interim Evaluation Report
Proj. CA-06-0095
Edith Dorosin and Peter Fitzgerald
July 1979, PB 300-685

Employment Center Bus Service—Guidelines for Implementation
Proj. CA-06-0113
The Aerospace Corporation
March 1978, (Available from UMTA-UPM-31)

Comparison and Organizational Aspects of Four Vanpool Demonstration Projects
Proj. MA-06-0049
Carla Heaton, Jesse Jacobson, and James Poage
April 1979, UMTA-MA-06-0049-79-6

Implementing the Rochester Community Transit Service Demonstration
Proj. NY-06-0048
May 1979, PB 298-979

St. Bernard Parish, Louisiana Taxi Feeder Demonstration Project
Proj. LA-06-0002
Gerald Miller, Ulrich Ernst
August 1979

The Westport Connecticut Integrated Transit System: Final Report
Proj. CT-06-0007
Robert E. Furniss
July 1979, PB 80-129-877

The Knoxville Tennessee Transportation Brokerage Demonstration; An Evaluation: Final Report
Proj. TN-06-0006
R. D. Juster
August 1979, PB 80-169-337

Vanpool Research; State-of-the-Art Review: Final Report
John H. Suhrbier, Frederick A. Wagner
April 1979, PB 80-119-613

The Xenia, Ohio Model Transit Service Demonstration
Proj. OH-06-0022
April 1979, PB 300-385

SECTION III

Transportation Planning and Management

SECTION THREE

Transportation Planning and Management

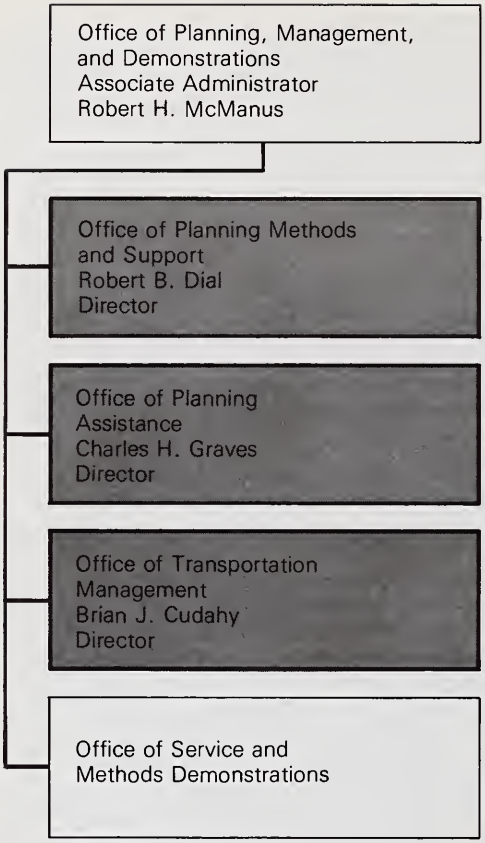
The objective of UMTA's planning and management programs is to achieve more effective and economical results from federal planning and spending by developing better information systems and improved planning and management techniques. Through its Office of Planning Assistance, UMTA makes grants to states, metropolitan planning organizations and local governments for the preparation of plans and programs and for other technical studies described in Chapter 12. These activities improve the quality of technical information available for local use in planning and the improvement of transportation services and in UMTA investment decisions.

During FY 80, studies to investigate the impact of major transit investments continued to have a high priority. Special studies were undertaken to determine the effects of major rail rapid transit improvements in San Francisco, Washington, D.C., and Atlanta. Studies were also undertaken to examine the efficiency of various UMTA policies, such as elderly and handicapped regulations, and to develop Transportation System Management (TSM) prototype planning studies, as well as new planning tools for TSM in response to UMTA's policy on efficient use of existing transportation facilities. Funds allocated for special studies were also expended during FY 80 on projects designed to improve short-range transit planning tools and demonstrate the capabilities of local agencies in conducting energy contingency planning studies.

Under the Planning Methods and Support Program, discussed in Chapter 13, improved computer and manual techniques are being developed to assist federal, state, and local agencies in planning, programming, and budgeting improvements to their transportation systems. This package of techniques, known collectively as the Urban Transportation Planning System (UTPS), supports both national and local transportation agencies and is useful in evaluating alternative system improvements. The goal of the UTPS system is to provide essential support for UMTA's planning assistance and capital support programs by continually improving local and federal planning capabilities.

Work in the Transportation Management Program is described in Chapter 14. This program is designed to assist mass transit operators in making the most effective use of their limited funds. The program undertakes research and demonstration projects to develop improved management techniques for the transit industry, as well as efforts to implement these techniques in the daily operations of transit systems. The Transit Management Program is also responsible for administering the uniform reporting system required under Section 15 of the Urban Mass Transportation Act. The regulation requires the development of uniform operating and financial reporting, as well as uniform accounts and recordkeeping systems.

The organization of the Office of Planning, Management and Demonstrations is shown below. The projects described in this section are funded and administered through the program offices indicated in the shaded boxes on the chart.


Office of Planning, Management, and Demonstrations
Associate Administrator
Robert H. McManus
Office of Planning Methods and Support
Robert B. Dial
Director
Office of Planning Assistance
Charles H. Graves
Director
Office of Transportation Management
Brian J. Cudahy
Director
Office of Service and Methods Demonstrations

CHAPTER 12

Planning Methods and Support

Trends and Highlights

The Planning Methods and Support (PMS) program provides essential support for UMTA's planning assistance and capital grant programs. The continuing goal of PMS is to research, develop, demonstrate, and disseminate computerized and manual techniques to assist federal, state, and local agencies in planning, programming, budgeting, and implementation of improvements in their transportation systems.

Inseparable from these activities has been the maturation of the Urban Transportation Planning System (UTPS). UTPS is an expanding, carefully coordinated collection of computer software, technical manuals, and other analytic aids developed and distributed by UMTA and the Federal Highway Administration (FHWA). The content of UTPS is continually evolving. Old tools are improved and new tools are added as new policy and technical requirements surface, or R&D breakthroughs occur.

The PMS program responds to what is consistently reported as the highest priority near-term need of state and local agencies, i.e., for people and tools which can come to grips with the highly complex variables and constraints involved in transportation planning. The information and information handling requirements for estimating demand, evaluating alternatives, and assessing energy, environmental, and economics impacts make UTPS essential.

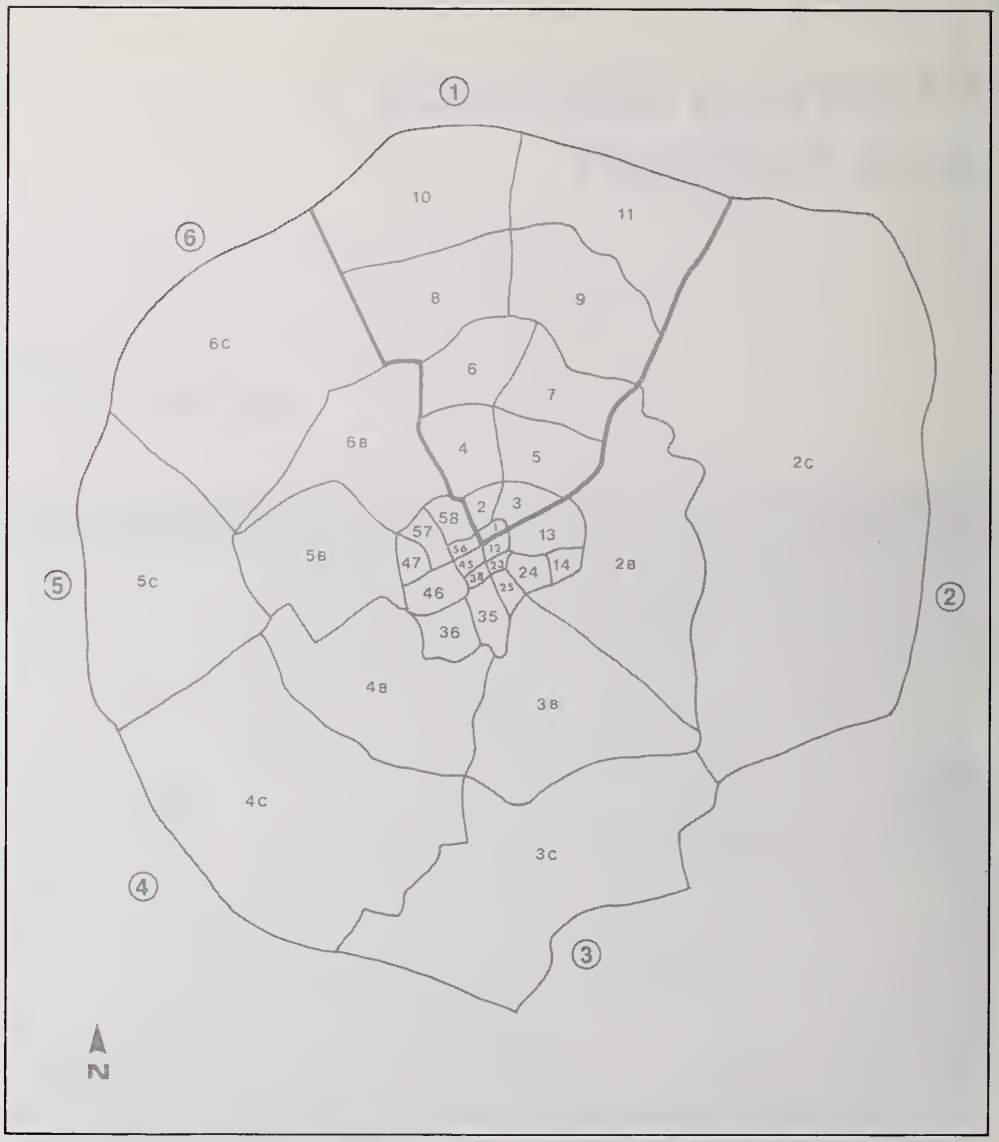
Mission of the Urban Transportation Planning System

UTPS programmable calculator techniques can be used for quick-response approximations and for less complex planning problems. The procedures usually solve only specialized problems and consist of evaluations, graphs, and curves to forecast or estimate impacts.

The UTPS computer-based package is provided for examining transportation options requiring greater planning detail and comprehensiveness. Various combinations of highway and transit can be evaluated. The package consists of a number of modules which provide the analytical framework to incorporate locally described transportation networks and land use, and socioeconomic data. The process can address either short- or long-range planning horizons. The initial time and cost required to use the computer are greater than for a manual analysis, but the resulting information is much more detailed and comprehensive.

Capabilities of the computer package include estimation of land development impacts, transportation system costs, travel demand forecasts, major facility and corridor travel volumes, energy use, major air quality effects, and accidents. The package can be employed to answer questions at a microscopic, detailed, street-by-street level for short-range problems. For more macroscopic decisions, sketch planning methods are available at a reduced level of effort and lower cost.

The computer package consists of a number of related and permutable pro-



One of the products of sketch planning which is a manual technqiue for analyzing alternatives.

Computers are capable of performing all functions of the Urban Transportation Planning System (UTPS).

grams. Each program represents a separate step in the local transportation planning process which might include network preparation, travel demand estimation, and assignment of travel to the network. At each step, modifications can be made to model the transportation option that is to be tested. For example, roads or transit lines might be added to or deleted from the network in the first step, land use changed to generate more trips in the second, and highway capacities changed in the third. There are also several programs which can be used to prepare plots, tables, or graphs to compare results from different alternatives.

Current Program Plans

The PMS program intends to accomplish its mission by continually improving the UTPS package of planning tools. R&D results from many sources are integrated into UTPS and passed on to the planning community. This more conservative approach ensures an ever-improving state-of-the-art, and guarantees concrete benefits, at the lowest possible financial risk.

There are seven major project areas within the Planning Methods and Support program. A brief description of each area, together with specific projects planned for the future, follows.

System Evaluation

System evaluation is the essence of planning. The PMS program will produce tools to greatly improve the planner's ability to generate, evaluate, and select transportation alternatives of both the

capital and noncapital-intensive varieties, taking into consideration policy issues such as air quality and energy consumption. The following projects are being undertaken:

1. Continued research and development of land use forecasting and evaluation models;
2. Continued research of interactive computer planning methods, including development of prototype interactive minicomputer planning software, with initial emphasis on transit planning;
3. Incorporation of improved cost estimation and financial planning methods useful in long-and short-range planning for high- and low-capital options; and
4. Various planning case studies.

Transportation System Management (TSM)

The most important characteristic of the PMS program is its emphasis on developing tools to examine short-term improvements and to assist in highway and transit operational planning. This emphasis shows itself in the transportation system evaluation tools and in the data capture and disclosure tools, as well as in this particular project area.

Major TSM concerns include multimodal cost analyses and trade-offs among a range of transit operations and traffic engineering options, as well as air quality, joint development, and energy conservation. Under TSM are listed those projects which directly assist in the optimal use of existing transportation resources. The most promising of them include:

1. Traffic engineering and transit operations case studies, including paratransit and high-occupancy vehicles, reflecting energy conservation and air quality concerns;
2. Case study using microsimulation models to develop more abstract network parameters and more responsive sketch planning models;
3. Completion of air quality modeling enhancements to UTPS;
4. Continuation of development of computer-aided transit routing and scheduling tools; and
5. Continued development of transit operations planning techniques and productivity measures.

Data Capture and Disclosure

Planners and transit operators need information to monitor performance. To reduce the cost and increase the accessibility of these data, census data exploitation, survey technology projects, and data-set packaging will be continued.

Computer Science and Operations Research

One of the projects to be conducted in this area is the development of dedicated computer software systems. Computer technology has advanced to a state where it is no longer cost-effective for planners and operators to depend on large centralized computing facilities. It now makes economic sense for them to have their own dedicated machine, if they have the software to run on it.

Computer hardware capable of performing virtually all foreseeable UTPS functions now costs less than the cost of one bus. Such a computer could put the latest operations research, data management, financial analysis, inventory, planning, and payroll tools at the fingertips of every planning agency and operating property. With good software, a $50,000 machine could provide significant increases in staff productivity, plan quality, and operating efficiency.

It is planned, therefore, to complete prototype software for a minicomputer Operations and Planning System (OPS). OPS will embrace the relevant functions now resident in UTPS plus those outlined above. The first phase of the minicomputer software development should begin in 1981, with a system operating in the field by 1982.

Another project will study UTPS machine transferability which UTPS has evolved on IBM computer systems. Although this has limited competitiveness in the local procurement of computer systems for UTPS use, expanding UTPS operation to other than IBM systems will be very expensive and time-consuming. However, a commitment has been made to make UTPS machine-independent, and in FY 81 the majority of UTPS programs will be converted to a newly designed high-level software language that will enable UTPS to be used on a range of main-frame and minicomputer systems.

Other projects include:

1. Implementation of a computerized UTPS data base manager, which will greatly simplify software use and transferability;
2. Continued development of a linear programming package useful in

transit operation planning and cost/financial planning;
3. Continued research on interactive computer planning methods; and
4. Continued investigation of techniques operable on microcomputer systems.

Technology Transfer

While requiring only a small percentage of the PMS budget, technology transfer nonetheless has a significant payoff. The acceptance, use, and utility of the PMS products, and therefore of the program itself, is increased in supporting UMTA's goals to improve transportation systems. Several areas are emphasized:

1. Continued development and distribution of simplified aids for all planning horizons and contexts; programmable calculator technology as well as manual and graphical techniques are used.
2. Continued research to improve response time and reduce costs for all planning methods.
3. Enhanced methods-dissemination and training activities, including an expanded documentation series; self-instructional and programmed learning packages; videotaped training sessions; improved classroom training sessions and user symposia; and case studies on improved local institutionalization of planning methods.

Citizen participation is an important part of transportation planning.

Analytical Methods Maintenance and Pilot Testing

An absolutely essential component of the planning methods development program is strong maintenance. When computer programs are being used in the field to support million-dollar planning studies to make billion-dollar investment decisions, their users must be assured that the software will be up to the job, and that UMTA is committed to their total support. Also, as manual, desktop procedures are used, experience and new data often indicate modifications to ensure reliability and accuracy.

Maintenance is the most expensive phase of a software item's life cycle and often costs more than all the others added together. Good software grows as it is used. Its utility is improved by being modified to perform new functions or do old ones better, faster, or cheaper. In addition, most software does not run perfectly, and subtle "bugs" remain hidden until long after the developing contractor has concluded his work. When uncovered, these difficulties are repaired in the maintenance stage. In FY 81, six minority firms will begin work on a three-year UTPS maintenance program.

Further, proven analytical techniques and models developed outside the PMS program can be uncovered to benefit the

planning community. Such conversion efforts will be funded under this area.

To assure the reliability and validity of new planning methods, both manual and computerized, a program of pilot testing must be undertaken prior to the dissemination of the method. This program will be formalized, and a competitive award made, in FY 81.

Computer Time

Computer time for UTPS research, development, and maintenance is obtained through DOT Basic Ordering Agreements. In past years, this category was not separately budgeted, but was intermixed with the other six project areas, at a level of $600,000. Improved technology in the areas of mini- and microcomputers will reduce by 50 percent the cost of this program area in the future. As a beginning, in FY 81 the purchase of a minicomputer system will be initiated. Cost savings will be minimal in the first year of operation, but will be significant in FY 82. Also, several low-cost microcomputer systems will be purchased.

Recent Program Products

Major products of the Planning Methods and Support Program during FY 80 are software development, planning manuals, technology transfer, and general planning research.

Software Development

Three new programs, INET, UFIT, and UCEN70 were distributed for use. INET reduces transit network modeling time to less than a fourth of that previously required while greatly increasing realism. A comprehensive user guide greatly facilitates local implementation. UFIT is a robust data organizer and statistical regression package. UCEN70 provides a direct interface between the 1970 census tapes and UTPS. Simple modifications will allow its use for the 1980 census data.

The program UMATRIX has been dramatically changed to become a very general and powerful computerized data base manager. In addition to handling lookup tables and matrices, it now processes files which can contain urban area zonal data, transportation system network data, interview data, and other similarly organized data. Heretofore complicated processing for trip generation, mode choice, data screening, and transformation are now trivially accomplished using the new UMATRIX program. Its use goes well beyond the specifics of transportation systems design in that it encourages manipulation and analysis of most data available for urban planning. The program greatly facilitates the preparation and transformation of data for other UTPS computer programs.

The Interactive Graphics Transit Design System (IGTDS), which permits evaluation of transit service to high-activity centers, was made publicly available on IBM and DEC computers. A comprehensive case study is also provided. In another area, software for generalized address-matching and for inexpensive line-printer map graphics was incorporated in UTPS by the U.S. Census Bureau, through a technology transfer project.

Several programs will enter the field-testing phase by year end: the small city generation/distribution model (SCAGM), a new more flexible highway network program (HNET), a module for the analysis of traffic flow through intersections (MICRO), a model that attempts to make land use and population projections based on current trends and existing demographics (CAM), a non-network approach to short-range transit and carpool analysis (RIDE), and a transit information system based on UTPS transit network analysis models.

Software development was initiated for the following: improved transit modeling and costing, an improved downtown people mover simulation model, an interactive land use transportation system model which operates on a minicomputer, an air quality evaluation module, and several projects using microcomputer technology for general data manipulation and for special transit operations applications. Specification of the software design language SDL was completed and compiler development begun.

Planning Manuals

Several planning manuals were distributed during the year: a user guide for a logistically-based demand modeling package, sketch planning methods for air quality analysis, a sketch planning method for energy analysis, a TSM-oriented programmable calculator series, and two transit-related analytical aids. Two additional guides were started, one related to use of the UMATRIX program, another illustrating case study applications of the census software packages.

Technology Transfer

Several items which generally relate to improving planning and improving access to the PMS products included: 1) a UTPS management guide for professionals not familiar with UTPS; 2) major enhancements to the five-day UTPS course; 3) development and field testing of an advanced UTPS course using interactive computing methods; 4) improved entry-level planning courses jointly sponsored with FHWA; 5) initiation of two planner aid contracts emphasizing:

a. TSM case studies illustrating traffic engineering/transit operation interactions,
b. the feasibility of a tutorial system for planners installed in a desk-top microcomputer,
c. treatment of special issues such as transit pricing analysis, and
d. a user's guide for new capabilities in highway network analysis;

6) significantly increased UTPS support; 7) well documented and distributed summaries of the computer user symposia; and 8) distribution of the Baltimore disaggregate data set useful to researchers.

General Planning Research

Several research topics were completed and others initiated during the year. The results will be distributed for information and will be incorporated in development of other planning methods.

Work performed in FY 80 included: 1) initiated several feasibility studies in the use of microcomputers for transportation planning and system operations; 2) completed specification of a generalized network optimization model using linear programming techniques; 3) completed feasibility studies in the area of life-cycle costing and factors affecting transit service reliability; 4) completed initial research phases of spatial form analysis; and 5) initiated several projects through the Transportation Research Board related to land use and transportation system interactions, institutional planning for transportation, and transit service performance indicators.

Current Capabilities of UTPS

Each UTPS computer program relates to one of the following analytical categories:

1. Sketch Planning,
2. Travel Demand Forecasting,
3. Transportation Network Analysis, and
4. Data Manipulation, Evaluation, and Display.

Sketch planning is the analysis of an alternative transportation plan by simplified techniques to reduce the large number of possible alternatives to a few which can be analyzed in detail. Both computerized techniques and manual methods described in numerous planning manuals are included in UTPS for sketch planning.

Demand forecasting is the prediction of the number of trips, the kinds of trips (e.g., work, nonwork), the mode of trips (e.g., auto, bus, carpool), and the origin and destination of trips which people will make under alternative transportation plans in some future year. UTPS programs are used both in the estimation and application of the numerical models which perform these predictions. Resulting forecasts of travel demand may be highly aggregate, appropriate for sketch planning, or finely detailed, appropriate for input to the network analysis programs.

Network analysis consists of network design, the estimation of passenger or vehicle loads resulting from the design, and determination of the associated impacts such as costs, pollution emitted, and fuel consumed. UTPS programs perform these functions for both highway and transit networks and analyze interactions between these two systems.

Socioeconomic data to estimate and apply demand models and network data to describe the transportation network must be collected, checked, manipulated, and evaluated during the planning process. Many UTPS programs are designed to change data formats, display or plot the data, statistically check the data, and most importantly, manipulate the data as specified by the planner.

During FY 80, major new capabilities were added to the Network Analysis and Data Manipulation programs. HNET, the highway network program, now generates a highly structured network data base which may be processed by other UTPS programs at reduced cost. UMATRIX, the data manipulation program, now operates on this highway data to perform any form of analysis specified by the user. In the past, the user had little flexibility in the type of analysis performed. UROAD, the traffic assignment program, now allows detailed analysis of traffic flow and delay at intersections caused by conflicts (left turn) or control devices (lights).

UTPS only runs on an IBM 360/370 (OS) compatible computer system or an IBM compatible minicomputer. The programs and all documentation are provided on a 2400-foot magnetic computer tape supplied by the requestor.

A one-time copying fee of $40.00 is charged to profit-making organizations (subsequent versions are copied free of charge). A check or money order should be made payable to the Urban Mass Transportation Administration. There is no charge to nonprofit organizations. The tape will be returned as SL, 9-track in the density specified on the order form. Allow one week, plus postal delivery time, for processing. Recipients of UTPS will automatically be kept informed regarding UTPS status and developments.

Further information about the UTPS package is available from:

Dr. Robert B. Dial, Director
Office of Planning Methods and
Support, UPM-20
Urban Mass Transportation Administration
U.S. Department of Transportation
Washington, D.C. 20590

To complement the dissemination of computerized and manual methods, improved training materials and courses have been developed. Slidetape presentations and a self-instructional text on the planning process are available. FHWA and UMTA jointly teach four introductory one-week courses per year on transportation planning. A five-day UTPS technical session is offered four times per year. These sessions are updated to reflect the most current state-of-the-art. Symposia are scheduled periodically to inform current UTPS users of new research products and to provide an opportunity for mutual information exchange.

Upcoming UTPS Improvements

Additional products resulting from development efforts in FY 80 will be distributed to the planning community in the near future. These products include new UTPS computer programs to extract data from 1980 census tapes, to analyze priority treatment for carpools and buses, and to generate air pollution estimates suitable for input to EPA's dispersion models. A new transit sketch planning model is under development, as well as an interface between UTPS and the highly detailed traffic simulation models developed by FHWA.

Additional planner aids documenting the use of UTPS programs and manual techniques will be distributed in FY 81. Specific aids include a detailed description of the analysis steps used to develop a TSM plan for Seattle, Wash. Improved documentation of the traffic assignment process (UROAD) will be produced along with programs for programmable calculators and computers to apply existing manual techniques more efficiently.

A major future effort will be the development of an entire transportation planning package to run on the new, inexpensive mini- and microcomputers. Major advances in computer technology will soon result in small computers with nearly the same capabilities as large mainframe computers at a fraction of the cost. Research during FY 80 indicated that these computers will be the planner's most important tool in the very near future. Programming of new software to run on microcomputers is already under way, and efforts continue to enable existing software to run on minicomputers and on a wider variety of main-frame systems.

Planning Methods and Support

PROJECT TITLE	NUMBER	FY 80 FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
Transportation Corridor Sketch Planning Model	NY-06-0068	$57,633	Oct. 1978-Aug. 1981	State University of New York at Buffalo	Robert Dial (202) 426-9271
Programmable Desk Calculator TSM Planning Methodology	MA-06-0092	$99,700	July 1978-Aug. 1981	Massachusetts Institute of Technology	Ron Fisher Lee Jones (202) 426-9271
A Model Relating Transportation to Neighborhood Change	MA-06-0090	-0-	May 1978-Sept. 1980	Massachusetts Institute of Technology	Larry Quillian (202) 426-9271
Enhanced Transit Cost Model (UCOST)	MD-06-0041	$99,847	July 1978-Sept. 1981	University of Maryland	Larry Quillian (202) 426-9271
Short-Range Transit Planning	IT-06-9020	-0-	Completed in FY 80	Peat, Marwick, Mitchell and Co.	Larry Quillian (202) 426-9271
Developmental Support • DPM Guideway Flow Simulation Model • DPM Planning Manual • Station Simulation • Interactive Software • General Software Development • R&D Feasibility Studies	MA-06-0039	$800,000	Multi-year continuing	TSC	Gran Paules (202) 426-9271
Land Use Sketch Planning Models	IL-06-0047	$58,130	Feb. 1980-March 1981	University of Illinois	Lee Jones (202) 426-9271
Shortest Path Algorithm R&D	DC-06-0318	$98,046	July 1980-July 1981	Research and Special Projects Administration (UMTA); University of Texas	Robert Dial (202) 426-9271

Planning Methods and Support

PROJECT TITLE	NUMBER	FY 80 FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
Interactive Graphic Software for IBM System	MI-06-0020	-0-	Sept. 1979-Jan. 1980	General Motors Transportation Systems	Ed DeLong (202) 426-9271
Interactive Transportation Planning Model (Functional Specifications)	VA-06-0059	-0-	May 1979-Feb. 1980	Alan M. Voorhees, Inc.	Robert Dial (202) 426-9271
UTPS Maintenance and Enhancement: Highway Network Analysis	IT-06-0222	$425,000[a]	Nov. 1980-Nov. 1983	OAO Corporation	Ed DeLong (202) 426-9271
UTPS Maintenance and Enhancement: Transit Network Analysis	IT-06-0223	$450,000[a]	Nov. 1980-Nov. 1983	To be selected	Ed DeLong (202) 426-9271
UTPS Maintenance and Enhancement: Demand and Matrix Manipulation	IT-06-0224	$450,000[a]	Oct. 1980-Oct. 1983	Automated Sciences Group	Ed DeLong (202) 426-9271
UTPS Maintenance and Enhancement: General Purpose Subroutines	IT-06-0225	$150,000[a]	Nov. 1980-Nov. 1983	To be selected	Ed DeLong (202) 426-9271
UTPS Maintenance and Enhancement: Interactive Graphics	IT-06-0226	$100,000[a]	Nov. 1980-Nov. 1983	To be selected	Ed DeLong (202) 426-9271
UTPS Maintenance and Enhancement: Microsimulation	IT-06-0227	$125,000[a]	Oct. 1980-Oct. 1983	Wilson-Hill Associates, Inc.	Ed DeLong (202) 426-9271

[a]Amount includes funding for three years.

Planning Methods and Support

PROJECT TITLE	NUMBER	FY 80 FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
Use of Census Data and Design of Machine-Independent Software Language for UTPS	DC-06-0178	-0-	Multi-year continuing	National Institute for Community Development, Inc.	Robert Dial (202) 426-9271
UTPS User Aids	DC-06-0240	$256,299	Sept. 1979-Dec. 1981	FHWA	Mark Stahr George Schoener (202) 426-0182
UTPS Technical Support and Dissemination	MD-06-0049	$161,394	Multi-year continuing	Price, Williams and Associates	Gran Paules (202) 426-9271
Collection of Disaggregate Data Set: Baltimore, Md.	IT-06-0076	-0-	Multi-year continuing	FHWA	Larry Quillian (202) 426-9271
Interactive Planning System Design Support	IT-06-0050	-0-	Multi-year continuing	Peat, Marwick, Mitchell and Co.	Robert Dial (202) 426-9271
Stochastic Transportation Networks	NY-06-0081	$55,833	June 1980-June 1981	Rensselaer Polytechnic Institute	Robert Dial (202) 426-9271
Interactive GBF/DIME Data Base Management System	MN-06-0014	$99,500	June 1980-July 1981	Metropolitan Council of Twin Cities	Robert Dial (202) 426-9271
Dissemination Support Through Urban Consortium	DC-06-0187	-0-	Multi-year continuing	Office of the Secretary of Transportation; Public Technology, Inc.	Gran Paules (202) 426-9271
Census Software and Data Interface with UTPS	DC-06-0248	-0-	Multi-year continuing	Bureau of the Census	Tong Louie (202) 426-9271
UTPS Air Quality Software	DC-06-0258	-0-	Aug. 1979-May 1980	EPA	Joe Ossi (202) 426-9271
Network Equilibrium	TX-06-0027	$56,849	Oct. 1978-Sept. 1980	Southern Methodist University	Robert Dial (202) 426-9271
Transit Information System Development	MD-06-0056	$47,500	Oct. 1979-Oct. 1981	COMSIS Corp.	Ron Fisher (202) 426-9271

Planning Methods and Support

PROJECT TITLE	NUMBER	FY 80 FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
Transit Information System Pilot Test	RI-06-0011	$2,000	Aug. 1979-Oct. 1981	Rhode Island DOT	Ron Fisher (202) 426-9271
Transit Operations Planning Software	VA-06-0064	$120,000	July 1979-March 1981	National Institute for Community Development, Inc.	Robert Dial (202) 426-9271
Transit Operations Planning	OR-06-0006	-0-	Oct. 1979-May 1981	TRIMET	Ron Fisher (202) 426-9271
Transit Operations Planning	WA-06-0016	-0-	Sept. 1979-Sept. 1981	Seattle Metro, Wash.	Ron Fisher (202) 426-9271
General R&D	DC-06-0316 DC-06-0317	$50,000 $150,000	Multi-year continuing	Research and Special Programs Administration	Lee Jones (202) 426-9271
CATNAP Conversion	DC-06-0288	$127,000	March 1980-March 1981	Research and Special Project Administration; John Hamburg and Associates	Robert Dial (202) 426-9271
Access to GBF/DIME Files on Microcomputer	CA-06-0148	$99,542	Sept. 1980-Oct. 1981	Santa Clara County, Calif.	Robert Dial (202) 426-9271
Traffic Equilibrium Algorithm R&D	CT-16-0011	$86,124	Sept. 1980-Oct. 1981	Yale University	Robert Dial (202) 426-9271
Support to Census Urban Transportation Planning Package	DC-06-0311	$25,000	Sept. 1980-Oct. 1981	FHWA; Bureau of the Census	Tong Louie (202) 426-9271
Traffic Engineering Software Contract	DC-06-0323	$100,000	Oct. 1980-Nov. 1981	FHWA	Tong Louie (202) 426-9271
Art and Design in Public Transportation	DC-06-0294	$100,000	March 1980-Dec. 1981	To be selected	Lee Jones (202) 426-9271
Computerized Bus Monitoring System	MA-06-0123	$125,000	Oct. 1980-Jan. 1982	Multisystems, Inc.	Brian McCollom (202) 472-5140

Planning Methods and Support

PROJECT TITLE	NUMBER	FY 80 FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
Automated Grants Tracking System	DC-06-0327	$21,840	Nov. 1980-April, 1981	ADP Network Systems	Ed DeLong (202) 426-9271
Automated Network Abstraction from GBF/DIME Files	MD-06-0079	$99,550	Sept. 1980-Oct. 1981	Baltimore Regional Planning Council	Robert Dial (202) 426-9271
Multinomial Logit Model Study	MD-06-0065	-0-	Sept. 1979-Nov. 1979	DTM, Inc.	Lee Jones (202) 426-9271
INET Default Values	CT-06-0009	-0-	Oct. 1979-March 1980	H. Levinson	Larry Quillian (202) 426-9271
TSM Sketch Planning Document	DC-06-0273	-0-	Aug. 1979-Feb. 1980	EPA	Gran Paules (202) 426-9271
Joint Development	DC-06-0253	-0-	July 1979-May 1980	National Center For Urban Ethnic Affairs	Gran Paules (202) 426-9271
Transportation Research Board (TRB)	DC-06-0279	-0-	Oct. 1979-Oct. 1980	Transportation Research Board (TRB)	Gran Paules (202) 426-9271

Bibliography

This list of reports, computer tapes, and audio-visual presentations contains those published or made from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Materials not available through NTIS may be obtained by contacting the appropriate office within UMTA.

Finally, additional reports or materials relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

UTPS Software Package
(Computer Tape)
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1979 (revised periodically)

Characteristics of Urban Transportation Supply [CUTS]
(Also on UTPS Computer Tape)
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1979, PB 233-580

Characteristics of Urban Transportation Demand [CUTD]—with Appendix
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978, UMTA-IT-06-0049-78-1, 2

Traveler Response to Transportation System Changes
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978, PB 265-830

Analyzing Transit Options for Small Urban Communities, Vols. 1, 2, 3
UPM-20, Office of Planning Methods and Support UMTA/DOT
1978, UMTA-IT-06-9020-78-1, 2, 3

Simplified Aids for Transportation Analysis
Vol. I, **Annotated Bibliography**
Vol. II, **Forecasting Auto Availability and Travel**
Vol. III, **Estimating Ridership and Cost**
Vol. IV, **Transit Route Evaluation**
Vol. V, **Estimating Parking Accumulation**
Vol. VI, **Fringe Parking Site Requirements**
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1979, UMTA-IT-06-9020-78-1, 2, 3, 4, 5, 6

Dual Mode Transit Planning Case Studies: Milwaukee: 3 Volumes
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1980, UMTA-VA-06-0030-80-1 and 2

Orange County, Vols. 1, 2
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1980, UMTA-MA-06-0056-80-1, 2, 3

Transit Sketch Planning Manual
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978

Modeling Demand-Responsive Feeder Systems in the UTPS Framework
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978, UMTA-MA-06-0049-78-9

Method for Estimating Patronage of Demand Responsive Transportation Systems
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978, DOT-TST-77-77

An Introduction to Travel Demand Forecasting: A Self-Instructional Test
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978

USS Transit Station Simulation Film
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978 (loan)

USS Transit Station Simulation User's Guide
Proj. MA-06-0010
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978

USS Transit Station Simulation Slide/Tape
Proj. MA-06-0039
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978 (loan)

An Introduction to Urban Travel Demand Forecasting Slide/Tapes
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978 (loan)

An Overview of Urban Transportation Planning Slide/Tape
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978 (loan)

Shirley Highway Data Set—1974
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1978

Transit Corridor Analysis: A Manual Sketch Planning Technique
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1979, UMTA-MD-06-0046-79-1

DPM Guideway Flow Simulation Film
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1979 (loan)

Transportation and Air Quality Analysis: Selected Sketch Planning Methods
Proj. DC-06-0273
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1979

Transit Network Analysis: INET (five tutorial documents)
UPM-20, Office of Planning Methods and Support
UMTA/DOT
1979, UMTA-UPM-20-79-3

Highway Sketch Planning: CAPM
UPM-20, Office of Planning Methods and Support
UMTA/FHWA/DOT
1979, UMTA-UPM-20-79-2

DPM: Planning for Downtown People Movers, Vols. 1, 2, 3
UPM-20, Office of Planning Methods and Support
UMTA/TSC/DOT
1979, DOT-TSC-UM917-PP-78-9

CHAPTER 13

Special Planning Studies

Trends and Highlights

Projects undertaken by the Special Planning Studies Program are determined in large part by major UMTA policy directions and key issues identified in the implementation of UMTA's Technical Studies Grant Program. Each year, a portion of the funds available for technical studies is set aside for use in a variety of special planning studies. These special projects supplement the technical studies grants by allowing for study of local issues with national significance or for the development of procedures and methods having a wide application.

In FY 80, a number of special planning studies were initiated to address continuing concerns over the increasing cost of providing transit services. These concerns indicated the need for improved tools to assist local operators in making short-range planning decisions.

The increasing inclusion of accessible buses in area transportation programs and the promulgation of regulations implementing Section 504 of the Rehabilitation Act of 1973 suggested the need for a method of evaluating accessible fixed-route service and developing guidelines for planning more accessible fixed-route service.

Other continuing projects include studies to provide better information on the cost effectiveness of new rapid rail transit, and studies to assist local areas to meet Transportation System Management (TSM) planning requirements. Approximately two-thirds of the special study projects were undertaken by local government agencies.

Rail Rapid Transit Impact Studies

UMTA has provided an increasing amount of funds for the development of relatively new rail rapid transit systems. An assessment of how these new systems affect regional development and the institutional environment is needed for future planning decisions at the local level and by UMTA.

The Washington, D.C., Metropolitan Area Transit Authority (WMATA) Impact Study (IT-09-0086, IT-09-0097, DC-09-7001, DC-09-7002, DC-09-7003) continued travel behavior studies, an activity and development study, and a policy and development study, and a policy interpretation study. The travel behavior studies include efforts to make short-range forecasts of changes in commuting patterns, and to compare the results with those derived from existing forecast models. Mid-day travel changes and "induced" travel are also to be addressed. The activity and development study will monitor changes in such indicators as population and employment, retail sales, property transfers, and land value development, and assess the relationship of these changes to the presence of WMATA. Finally, the policy interpretation study will attempt to catalogue the transportation-related goals and expectations held by citizens, planners, and local officials.

Working papers have been prepared in several of these impact assessment areas in FY 80. The first major product of this effort, an extensive document covering in detail the impacts of the initial Red and Blue line segments, is expected late in 1980.

In Atlanta, Ga., the Metropolitan Atlanta Rapid Transit Authority (MARTA) Impact Study (GA-09-0037, GA-09-0038, GA-09-7001, GA-09-7002) has two components. The major component is a comprehensive assessment of the economic impacts of transportation on land use and is being conducted by the Atlanta Regional Commission (ARC). A second study, being undertaken by MARTA itself

UMTA regulations require local communities to plan for the special needs of elderly and handicapped people.

with funding passed through ARC, is to assess the institutional experience of MARTA in all phases of implementation.

Design for this effort was begun in 1977. During the later part of 1977, ARC began preparing for operation of the system by conducting an initial test effort using the East Line area as a pilot corridor. This work was completed in the spring of 1978. Since no actual system operation was underway at that time, the results set the background for the future operations. Little direct impact of construction on the land use factors studied was noted.

Work has been completed on a detailed study design, broadening the effort to include a wider range of potential transportation impacts. A variety of base data has been collected using the new study design. The collection of data after the system was opened in 1979 has been begun. Analysis reports are due in 1981.

Transportation System Management Planning (TSM)

Transportation System Management (TSM) is a concept which involves the planning, programming and implementation of low-capital, short-range improvements designed to enhance the efficiency of existing transportation systems.

The TSM special planning studies are designed to assist localities in planning a wide range of TSM strategies which increase the efficiency of their transportation systems by 1) identifying the institutional arrangements which facilitate effective TSM planning and programming; 2) identifying factors important in the implementation of TSM projects; and 3) developing technical tools for use in TSM planning.

The Kansas City TSM Prototype Planning Study (IT-09-0103, IT-09-0078) seeks to develop a set of procedures for TSM planning, to demonstrate these procedures in selected sub-areas, and to devise a method for integrating these procedures into the overall planning process in the Kansas City area. During the first phase of the study, problems were identified for each study area, a set of proposed projects was developed addressing the problems identified, and a project report was written describing how the process would be integrated into a region's ongoing transportation planning process. The second phase of the study, initiated in FY 78, is designed to demonstrate the application of the proposed procedures on a regional scale. A new regional TSM element report was the final product.

The goal of the Seattle, Wash., TSM Prototype Planning Study (WA-09-0018) is to formulate, develop and evaluate a transportation management program for the King County subregion of the Seattle metropolitan area, such that immediate, low-capital improvements may be accomplished to improve the system and resolve special problems. A key feature of this study will be the creation of the position of TSM coordinator who will be responsible for initiating and supporting the TSM process and for coordinating implementation of TSM projects throughout the subregion.

While the Seattle study used a TSM coordinator, the Middlesex County TSM Prototype Planning Study (IT-09-0089) in New Jersey used a TSM Planning Task Force for each subarea studied. After establishing a set of general goals for TSM in Middlesex County, a set of demonstration subareas were identified and a task force established. This task force was a combination of local jurisdiction staff and members of the Metropolitan Planning Organization (MPO). County staff members monitored the local transportation system to identify future problems. This process, together with the results of the local efforts, was used to assess the success of the task force approach to subsequent TSM planning in the county.

As these studies have been undertaken, it has become increasingly clear that there is a need to better understand the process by which TSM projects actually move through planning to implementation. In addition, further information on the actual impacts of previously implemented projects would provide for more effective decisions on the directions which the TSM Program should take. Information on impacts, on the other hand, can serve the local planner in allowing for a better understanding of what may be expected if a specific alternative TSM improvement is tried. Thus, a project designed to provide answers in both these matters (NY-09-9001) was initiated. When completed, reports on these issues will be made available.

Major institutions such as hospitals, universities, and medical centers can be major traffic generators and can have large demands for parking and other

UMTA is continuing an assessment of how new rail rapid transit systems affect regional development and land use.

transportation facilities. When these institutions are located in or near residential areas, these demands are sometimes disruptive to the neighborhoods. Transportation System Management measures may be applied, however, to reduce such impacts. The San Francisco Institutional TSM Program (CA-09-0070, CA-09-7004) involves the planning and subsequent implementation of a set of TSM measures at a number of hospitals and universities in that city. With planning complete, each institution will have a transportation coordinator who will serve to broker transportation services including transit, carpooling and vanpooling. Parking management measures are also included in the packages of actions being taken. An evaluation of the results of the work is to be conducted and will be completed in 1981.

Planning Transportation for Elderly and Handicapped People

Section 16(a) of the Urban Mass Transportation Act declares that it is ". . . . national policy that elderly and handicapped persons have the same right as other persons to utilize mass transportation services, (and) that special efforts shall be made in the planning and design of mass transportation facilities and services so that the availability to elderly and handicapped persons of mass transportation which they can effectively utilize will be assured."

UMTA planning regulations make it clear that meeting this requirement is an important aspect of each area's local urban transportation planning process. Thus, activities are required that identify the location and transportation needs of elderly and handicapped persons and that develop services to meet these needs. DOT promulgated regulations implementing Section 504 of the Rehabilitation Act of 1973 in May, 1979. This statute, prohibiting discrimination against handicapped persons in any federally assisted program, has been interpreted to require that, in the future, mass transportation systems must be made accessible to handicapped persons. This will require proper implementation of planning—specifically, the development of transition plans laying out how, in local transit systems, accessibility will be phased in.

Based on these factors, a number of special planning studies in this area have been initiated to 1) identity cost-effective

approaches to data collection; 2) develop procedures for coordinating service; 3) provide information on the effectiveness of various types of services for elderly and handicapped persons; and 4) develop methods for planning the phase-in of accessible services.

Many different studies comprise this effort, and are designed to assist localities in meeting the elderly and handicapped planning requirements.

Four of the studies are related to data collection. In the study entitled Use of Existing Data in Elderly and Handicapped Transportation Planning (MD-09-9001), the objectives of the project include 1) identification and description of specific sources of usable data; 2) delineation of steps required to correct problems prior to use of such data; 3) identification of planning data that is required but is not likely to be obtainable through existing services; and 4) development of a manual for use of secondary sources for planning services for elderly and handicapped persons.

The goal of the study, Data Collection System for Planning Services for Elderly and Handicapped Persons (IT-09-9009), is to develop practical and effective data collection procedures which facilitate the ongoing planning of special services for elderly and handicapped persons, and in particular for wheelchair users and semiambulatory persons. The specific objectives of the study include 1) specifying the information requirements for special efforts planning, 2) determining that portion of planning which can be satisfied by using inexpensive data gathering methods and self-identification techniques; and 3) determining the essential primary data collection needed for special efforts planning. The data collection system developed by this study will be tested in two localities. Grants to local agencies (OH-09-7001, PA-09-7002) will support these tests.

A related study, the Prototype Elderly and Handicapped Planning Data Collection Study (CA-09-7001), is designed to develop a system for gathering information on the transportation needs of elderly and handicapped persons, again, particularly wheelchair users and semiambulatory persons, and to undertake a detailed test of the system proposed. This study has been coordinated with the national elderly and handicapped transportation demand study undertaken by the Office of Service and Methods Demonstrations. While the system is designed to fit local conditions and local needs, the emphasis of this study will also be on the application and testing of the system.

Another project, Self-Identification Techniques Prototype Study (WA-09-7001), is an attempt to learn from the techniques used by the City of Tacoma, Wash. to identify the transportation needs of the elderly and handicapped and to disseminate information on available services. The project will also assist the city in incorporating data from the self-identification efforts into a management information system for elderly and handicapped programs. The self-identification data is an integral part of the city's elderly and handicapped data system, and the project will enable the city and UMTA to evaluate the effectiveness of this approach.

One of the major results of the project will be a report describing Tacoma's methods for identifying the elderly and handicapped and how such information is used in assessing their mobility needs and in determining what services are provided to meet these needs. The document will evaluate the success or failure of the methods employed and will offer recommendations about each of these methods.

In many urban areas, a wide range of transportation services exists to serve elderly and handicapped persons. Yet, because these services are not coordinated, the level of service provided is not commensurate with the resources being applied. Services are often duplicative, and gaps in service areas or in clientele sometimes mean that those persons most in need of transportation are not being served.

A continuing study, Planning for Coordination of Elderly and Handicapped Services (DC-09-9006, DC-09-9013), is being conducted by the Department of Health and Human Services (HHS), formerly HEW. This project is designed to provide case studies and a summary analysis of five demonstrations which are currently under way through HHS sponsorship. Coordination concepts will be examined to assess their feasiblity. The potential impact on productivity and implementation techniques will also be examined.

Another study, Analysis of Existing Elderly and Handicapped Transportation Services (IT-09-9006), is attempting to determine what improved transportation services, particularly those services designed to accommodate wheelchair users and semiambulatory persons, have accomplished. The approach of this project consists of an assessment of 20 urban areas in which significant improvements

have been made. Service changes will be described in detail, and an estimate of the consequences in terms of cost, street traffic, fares, organizational arrangements, financing, and service levels, will be made. The response of user groups to the implementation will also be described.

Another study in this area is related to the evaluation of existing accessible fixed-route services and the development of planning guidelines for new accessible, fixed-route services. This study, Planning for the Phase-In of Accessible Buses (IT-09-9010), is under way. For some time after delivery of the initial accessible buses, these vehicles will only be a portion of the total fleet in each city. Thus, a primary focus of this project will be the development of guidelines for the assignment of these accessible vehicles as each area moves toward a totally accessible, fixed-route bus operation.

This study will include appropriate data collection, marketing, operations coordination, and evaluation recommendations. The project will attempt to identify the scope of all critical concerns, appropriate timing, and recommendations on appropriate approaches. The recommendations from this project will be based, in part, on experiences with accessible bus projects in those cities that presently have accessible, fixed-route service, or are about to institute such service.

In addition, as an interim activity, detailed guidance was developed on the preparation of the transition plans required by the regulations implementing Section 504 of the Rehabilitation Act of 1973. This guidance provided timely assistance to the local agencies faced with deadlines meeting the new requirement.

Energy Planning Studies

In recent years, with the increased possibility of shortages in petroleum supplies, attention has focused on the need for transportation contingency planning to maintain essential mobility. Studies in this area are designed to use the existing urban transportation planning process to marshal the necessary resources to effectively develop local level contingency transportation plans should there be an energy emergency. In addition, recent attention to energy conservation, including regulations issued late in FY 80 in response to the Powerplant and Industrial Fuels Use Act and Executive Order 12185, has indicated a need for further guidance in this area.

The Kansas City (Mo.) Energy Contingency Planning Prototype Study (MO-09-7001) represents a comprehensive effort to develop a set of transportation strategies which could be applied in the case of an energy emergency. The initial step involved an inventory of institutional constraints at all government levels. This was followed by an evaluation of the current transportation system with respect to energy needs and usage patterns. A set of "crisis scenarios" was then developed, and an assessment was made of methods for relating energy shortages to travel behavior. Finally, a set of strategies for each shortage scenario was developed. The involvement of local agencies throughout the process is a key aspect of this project. Reports on all steps of the study are expected.

The Dallas-Fort Worth, Tex., area prepared an energy contingency plan using regular planning funds during 1977. That study indicated the need for further work in local participation and in the use of school buses and taxis during energy emergencies. As a result, the Dallas-Fort Worth Energy Contingency Planning Prototype Study (TX-09-7001) was initiated. This project represents the efforts of the North Central Texas Council of Governments to investigate the potential role of school buses and taxis in an energy contingency situation. This effort includes consideration of the legal, institutional, and operational aspects of this potential.

The study also incorporates local government energy policy into the process. It is hoped that local government staff may be enlisted into a network of "energy coordinators." This will help insure a realistic and effective strategy for energy contingencies.

The role of transit in dealing with energy shortfalls and in inducing conservation of energy is an important one. In order to assist transit operators in responding to these needs, a Prototype Energy Management Planning Study was initiated in Seattle (WA-09-0034). This study will develop a number of products useful in both contingency and conservation planning. The study will update an existing contingency plan, and in so doing, document the process used. Also, studies on fuel stockpiling will be conducted. A detailed transit operations energy audit tool will be developed and tested. This tool should be useful to other operators wishing to study their entire

system with an eye towards reducing fuel consumption.

Increasing attention is being paid to energy conservation in the overall urban transportation planning process. As this is a fairly new emphasis for transportation planning, a number of issues have arisen over how this concern can best be integrated into the process. In order to develop some additional guidance on this matter, a grant has been made to the New York State Department of Transportation (NY-09-8006). Issues to be addressed include data collection methodology, the role of transit in energy conservation, the sensitivity of work and nonwork travel to energy constraints, the energy impacts of TSM actions, and the energy costs involved in implementing various transportation measures and projects.

Short-Range Transit Planning

The emphasis of transit planning has shifted from long-range planning and design of capital-intensive transit system improvements, to an emphasis on short-range, low-cost transit improvements that can effectively increase the efficiency of the existing system. This change in emphasis requires the transit operator to make planning decisions in a manner quite different than in the past. The operator must have a much wider range of accurate and current information to enable continuing evaluation of an existing system.

Projects in this study area are designed to assist in transit planning by providing methods for data collection and analysis, and by developing training materials for transit operators and for Metropolitan Planning Organization (MPO) personnel on transit planning issues and methods.

The change in focus to short-range planning has increased the importance of transit system surveillance. A significant amount of information is necessary to properly evaluate system performance and identify potential improvements. This information includes data on patronage (boarding locations, travel patterns, transfers, etc.), level-of-service indicators (on-time performance, travel speeds, delay points, etc.), and revenue/cost performance.

Unfortunately, existing knowledge regarding this data collection is limited. Little is known about the types of data which should be collected, the methods which should be used, the frequency with which data should be collected, or how transit surveillance should be coordinated with other data collection activities. The Bus System Monitoring System (IT-09-9008) is a study designed to improve and advance transit surveillance techniques and procedures. This study has two objectives 1) to develop a model monitoring system which will facilitate the ongoing evaluation of existing transit services; and 2) to demonstrate that the model monitoring system is a practical and effective method for obtaining current information about existing service performance.

The final product of this research effort will be a monitoring manual. This manual will provide transit properties with a step-by-step procedure for implementing and maintaining the monitoring system. Reference will be made to appropriate Urban Transportation Planning Systems manuals and software pertaining to the processing of the surveillance data. Procedures will also be detailed for estimating manpower and cost requirements of the system.

The proposed system design will be tested and validated by the contractor in the Chicago area at the Chicago Transit Authority and the Regional Transportation Authority, and at the Metropolitan Transit Commission in Minneapolis—St. Paul. The contractor will be responsible for the overall design of the system demonstration. Grants (IL-09-7001, IL-09-7002, MN-09-7002) have been made to support the costs of the tests performed by the two transit operators.

Four transit surveillance prototype studies—Boston (MA-09-7001), Norfolk (VA-09-7001), Albany (NY-09-0054) and Bridgeport, Conn. (NY-09-0064)—have been initiated to provide transit operators with a systematic evaluation method which can measure existing service performance, identify new potential areas of transit, and provide insight into the analysis of service alternatives.

Specifically, the studies' objectives are 1) to develop a service evaluation system which utilizes existing planning techniques for the identification of new and improved bus service opportunities; and 2) to test and verify that such a service evaluation is a practical and effective method for service evaluation. The Boston project is focusing on the needs of larger systems, while in Norfolk the requirements of small- to medium-sized operators will be assessed.

An effective transit planner needs a good working knowledge of all areas of transit operations. These areas include service planning, scheduling, maintenance, finance, and facility design. In many cases, new planners do not receive any training in operations and must learn through experience. The need exists for coordinated training courses to be developed for new transit planners. These courses should provide new planners with basic knowledge and an understanding of transit operations.

A course in Transit Operations and Planning (IT-09-9011) is a project to 1) develop a training course which will provide the necessary background knowledge and understanding of transit operations to individuals in entry level positions in transit planning; and 2) demonstrate that the training course is a practical and effective method for educating entry level transit planners.

The work to be undertaken will be in two phases. In Phase I the needs of new transit planners will be determined and a course outline designed to meet these needs. In Phase II, the materials for the training course will be developed. These materials will be tested and validated by the contractor through a trial course.

Estimating costs of proposed changes in service is critical to planning improvements of transit services, which were themselves designed to enhance system productivity. Unfortunately, state-of-the-art techniques to estimate these changes are limited. Methods available involve either complex, expensive analyses or simpler, easily applied models that are less expensive but subject to critical theoretical shortcomings which detract from a given model's usefulness. There is a need to improve cost estimation techniques for bus service planning.

Thus, the objectives of the Cost Estimation Techniques study (IT-09-9014) are 1) to develop inexpensive, readily applicable cost estimation techniques that are still theoretically sound as well as accurate in their forecasts; and 2) to demonstrate the effectiveness and practicality of these techniques by testing them on-site. The final product of this project will be a report covering the state-of-the-art in cost estimation, the techniques developed by the study, procedures for applying the techniques, and estimated costs of using the proposed methods. A review panel will be formed to assist in the study and to review its products, insuring their usefulness to local transit operators.

While knowing the cost of a particular schedule change is important (and the above study will provide further means of assessing these costs), without knowing the impact on system patronage and subsequent revenues, the total impact on system finances will not be measurable. Unfortunately, very little is known about the impact of different service variables, e.g., headway, travel time, or socio-economic factors such as age or income, or about how a transit operator might develop models applicable to a system. Because of this, route patronage modeling studies have been initiated by the Greater Cleveland Regional Transit Authority (OH-09-7002), Southern California Rapid Transit District (CA-09-0099), and TRI-MET in Portland, Ore. (OR-09-7001). These projects are designed to 1) develop patronage models which can be applied at a route level; and 2) demonstrate that patronage models can be developed within a local transit operating environment. The report developed as a result of this study should serve as a model by which other local transit operators can develop their own patronage models. Thus, it is expected that simple, easy-to-apply methods will be given primary attention. Technical assistance for this work is being provided by the Transportation Systems Center (MA-09-9009).

A key factor in the reliability of bus service is maintenance. The ability of a transit operator to maintain vehicles often depends upon the characteristics of the maintenance facility available. Many operators are presently considering rebuilding, replacing, or expanding maintenance facilities. However, no comprehensive planning tools are available to insure that operators can plan the best possible facilities. A study on Maintenance Facility Planning (IT-09-9018) has been initiated. This study will assess the current thinking on facility planning, and will develop guidelines on a wide range of topics, including siting, site planning and layout, size, operations organization and layout, and maintenance planning practices.

Special Planning Studies

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
RAIL RAPID TRANSIT IMPACT STUDIES					
Washington Metropolitan Area Transit Authority (WMATA) Impact Study	DC-09-7001 DC-09-7002 DC-09-7004 IT-09-0086 IT-09-0097	$1,567,245	May 1977- Dec. 1981	Metropolitan Washington Council of Governments, Washington, D.C.	Richard Steinmann (202) 472-5140
Metropolitan Atlanta Rapid Transit Authority (MARTA) Impact Study	GA-09-0037 GA-09-0038 GA-09-7001 GA-09-7002	$706,674	Sept. 1977- Dec. 1981	Atlanta Regional Commission, Ga.	Richard Steinmann (202) 472-5140
TRANSPORTATION SYSTEM MANAGEMENT PLANNING (TSM)					
Kansas City TSM Prototype Planning Study	IT-09-0103 IT-09-0078	$115,000	Jan. 1977- Dec. 1979	Mid-America Regional Council	Richard Steinmann (202) 472-5140
Seattle TSM Prototype Planning Study	WA-09-0018	$80,240	Sept. 1978- Dec. 1979	Puget Sound Council of Governments, Wash.	Richard Steinmann (202) 472-5140
Middlesex County TSM Prototype Planning Study	IT-09-0089	$60,000	July 1977- Dec. 1979	Middlesex County Planning Board, N.J. (through Tri-State Regional Planning Commission)	Richard Steinmann (202) 472-5140
Evaluation of TSM Implementation Experiences and Project Impacts	NY-09-9001	$200,000	Sept. 1979- March 1981	Urbitran, Inc.	Richard Steinmann (202) 472-5140
San Francisco Institutional TSM Program	CA-09-0070 CA-09-7004	$86,000	June 1978- June 1981	Metropolitan Transportation Commission	Richard Steinmann (202) 472-5140

Special Planning Studies

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
PLANNING FOR TRANSPORTATION FOR ELDERLY AND HANDICAPPED PERSONS					
Use of Existing Data in Elderly and Handicapped Transportation Planning	MD-09-9001	$38,100	June 1977-March 1980	Verve Research Corp.	Eileen Koc (202) 472-5140
Data Collection System for Planning Services for Elderly and Handicapped Persons	IT-09-9009	$235,000	Nov. 1977-June 1980	Peat, Marwick, Mitchell and Co.	Brian McCollom (202) 472-5140
Data Collection System Trials	OH-09-7001 PA-09-7002	$171,360	July 1979-June 1980	Montgomery-Greene County Transportation Planning Program; Port Authority of Allegheny County (PAAC)	Brian McColom (202) 472-5140
Prototype Elderly and Handicapped Planning Data Collection Study—San Diego	CA-09-7001	$98,014	March 1978-Dec. 1979	Comprehensive Planning Organization, San Diego	Brian McCollom (202) 472-5140
Self-Identification Techniques Prototype Study	WA-09-7001	$49,612	May 1978-Dec. 1980	City of Tacoma, Wash.	Eileen Koc (202) 472-5140
Planning for Coordination of Elderly and Handicapped Services	DC-09-9006 DC-09-9013	$160,000	Sept. 1977-March 1980	Department of Health and Human Services (HHS)	Douglas Kerr (202) 472-5140
Analysis of Existing Elderly and Handicapped Services	IT-09-9006	$264,248	Sept. 1977-March 1980	National Institute for Advanced Studies	Richard Steinmann (202) 472-5140
Planning for the Phase-In of Accessible Buses	IT-09-9010 IT-09-9010-1	$260,000	May 1978-Jan. 1981	Booz, Allen and Hamilton	Brian McCollom (202) 472-5140

Special Planning Studies

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
ENERGY PLANNING STUDIES					
Kansas City Energy Contingency Planning Prototype Study	MO-09-7001	$75,000	May 1978-Dec. 1980	Mid-America Regional Council	Richard Steinmann (202) 472-5140
Dallas-Fort Worth Energy Contingency Planning Prototype Study	TX-09-7001	$70,000	June 1978-Sept. 1980	North Central Texas Council of Governments	Richard Steinmann (202) 472-5140
Seattle Metro Transit Operations Energy Planning Prototype	WA-09-0034	$120,000	July 1980-July 1981	Seattle, Wash.	Richard Steinmann (202) 472-5140
New York State Energy Conservation Technical Guidance Study	NY-09-8006	$105,000	July 1980-July 1981	New York State Department of Transportation	Richard Steinmann (202) 472-5140
SHORT-RANGE TRANSIT PLANNING					
Bus System Monitoring System	IT-09-9008	$280,000	Jan. 1978-July 1981	Multisystems, Inc.; ATE Management and Service Co.	Brian McCollom (202) 472-5140
Bus System Monitoring System Trials	IL-09-7001 IL-09-7002	$209,200	April 1979-Dec.1980	Chicago Transit Authority; N.E. Illinois Regional Transit Authority; Metropolitan Transit Commission, Minn.	Brian McCollom (202) 472-5140
Transit Surveillance Prototype Study: Albany	NY-09-0059	$48,000	May 1980-July 1981	Capital District Transportation Authority	Brian McCollom (202) 472-5140
Transit Surveillance Prototype Study: Bridgeport	NY-09-0064	$54,199	June 1980-July 1981	Greater Bridgeport Transit District, Conn.	Brian McCollom (202) 472-5140
Transit Surveillance Prototype Study: Boston	MA-09-7001	$130,400	June 1978-July 1979	Massachusetts Bay Transportation Authority (MBTA)	Brian McCollom (202) 472-5140

Special Planning Studies

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
SHORT-RANGE TRANSIT PLANNING					
Transit Surveillance Prototype Study: Norfolk	VA-09-7001	$47,104	June 1978-July 1979	Tidewater Transportation District Commission, Va.	Brian McCollom (202) 472-5140
Course in Transit Operations and Planning	IT-09-9011 IT-09-9011-1	$100,000	Sept. 1978-Jan. 1981	To be selected	Brian McCollom (202) 472-5140
Cost Estimation Techniques for Bus Service Planning	IT-09-9014	$125,000	April 1979-March 1981	To be selected	Brian McCollom (202) 472-5140
Route Patronage Modeling Prototype Study	OH-09-7002	$60,000	Sept. 1979-Sept. 1980	Greater Cleveland Regional Transit Authority	Brian McCollom (202) 472-5140
Route Patronage Modeling Prototype Study: Los Angeles	CA-09-0099	$20,000	July 1980-July 1981	Southern California Rapid Transit District	Brian McCollom (202) 472-5140
Route Patronage Modeling Prototype Study: Portland	OR-09-7001	$60,000	July 1980-July 1981	TRIMET	Brian McCollom (202) 472-5140
Route Patronage Modeling Technical Assistance	MA-09-9009	$100,000	March 1980-July 1981	TSC	Brian McCollom (202) 472-5140
Maintenance Facilities Planning Guides	IT-09-9018	$150,000	May 1980-Dec. 1981	To be selected	Brian McCollom (202) 472-5140

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

Urban Mass Transportation Abstracts: Volume No. 4
Proj. TRIC-77-1
Urban Mass Transportation Administration
December 1977, PB 278-646

Urban Mass Transportation Abstracts: Volume No. 3
Proj. TRIC-76-1
Urban Mass Transportation Administration
July 1976, PB 264-905

A Selected Bibliography and Reference Document in Urban Public Transportation
Proj. DC-06-0114
JHK and Associates
July 1976, PB 266-252

Environmental Impacts of BART: Interim Service Findings
Proj. CA-09-0042
Gruen Associates and
DeLeuw Cather and Co.
January 1976, PB 257-498

Impacts of BART on the Social Environment: Interim Service Findings
Proj. CA-09-0042
Gruen Associates and
DeLeuw Cather and Co.
March 1976, PB 257-510

Impacts of BART on Visual Quality: Interim Service Findings
Proj. CA-09-0042
Gruen Associates
March 1976, PB 257-509

Transportation and Travel Impacts of BART: Interim Service Findings
Proj. CA-09-0042
Peat, Marwick, Mitchell and Co.
April 1976, PB 261-017

Urban Densities for Public Transportation
Proj. IT-09-0023
Tri-State Regional Planning Commission
May 1976, PB 256-636

Impacts of BART on Bay Area Health Care Institutions
Proj. CA-09-0042
Jefferson Associates
March 1977, PB 266-614

BART Impacts on Highway Traffic and Transit Ridership
Proj. CA-09-0042
Peat, Marwick, Mitchell and Co.
May 1977, PB 267-675

Impacts of BART on Bay Area Political Institutions
Proj. CA-09-0042
Jefferson Associates
May 1977, PB 273-389

Impacts of BART on Bay Area Institutions of Higher Education and Their Students
Proj. CA-09-0042
Dr. Terry Lunsford
May 1977, PB 273-396

The Impact of BART's Bond Issue on Regional Public Financing
Proj. CA-09-0042
Raymond K. O'Neil and Charles A. Long
August 1977, PB 273-387

BART in the San Francisco Bay Area: Final Report of the BART Impact Program
Proj. CA-09-0025, CA-09-0042
Metropolitan Transportation Commission
June 1979, DOT-BIP-FR-11-3-78

Impacts of BART on the Competitive Advantage and Efficiency of Bay Area Business Operations
Proj. CA-09-0042
McDonald and Smart, Inc.
August 1977, PB 273-485

Standard for Bus Service Contract Payments and a System of Incentives
Proj. IT-09-0058
Simpson and Curtin
December 1976, PB 269-054

An Analysis of Transportation Planning Effectiveness: Final Report
Proj. MA-09-9003
Transportation Systems Center
July 1977, PB 272-756

Magic Carpet Evaluation Study: Final Report
Proj. MA-09-0012
Municipality of Metropolitan Seattle
May 1977, PB 271-214

A Metropolitan Transportation Plan for National Energy Contingencies
Proj. TX-09-7001
North Central Texas Council of Governments
August 1977

TSM Prototype Process Study: Working Paper
Proj. IT-09-0103, IT-09-0078
JBM and Associates for Mid-America Regional Council
March 1978

Transit Impact Monitoring Program, Results of East Line Pilot Project 1970-1976: Executive Summary and Technical Appendix
Proj. GA-09-0037, GA-09-0038
Atlanta Regional Commission
April 1978

Changing Transit Goals Due to METRO Rail: Draft Report
Proj. DC-09-7001, IT-09-0086, IT-09-0097
Metropolitan Washington Council of Governments
July 1978

TSM Prototype Study: Final Report
Proj. IT-06-0068
Columbia Regional Council of Governments
July 1978

Bus Service Evaluation Procedures: A Review
Proj. MA-09-7001; VA-09-7001
Massachusetts Bay Transportation Authority and Tidewater Transportation District Commission
April 1979, UMTA-MA-09-7001-79-1

Bus Transit Monitoring Study: Data Requirements & Collection Techniques
Proj. IT-09-9008
Multisystems; ATE Management and Service Co.
April 1980, UMTA-IT-09-9008-79-1

Phase-in of Accessible Buses: Six Case Studies
Proj. IT-09-9010
Booz, Allen, and Hamilton
January 1980, UMTA-09-9010-80-1

Transit Service Evaluation: Berkshire RTA
Proj. MA-09-0050
Berkshire Regional Transit Authority
October 1979, UMTA-MA-09-0050-80-1

Transportation Energy Contingency Strategies: Transit, Paratransit and Ridesharing
Part 1: **Planning Process Roles and Responsibilities**
Part 2: **Synopsis of Actions**
Massachusetts Institute of Technology
March 1980

Advisory Guidance for Urbanized Areas with Fixed Route Bus and/or Paratransit System for the Preparation of Transition Plans in Compliance with the DOT 504 Regulation
Proj. IT-09-9010
Booz, Allen and Hamilton
June 1979, UMTA-09-9010-79-1

Advisory Guidance for Urbanized Area with Multimodal Transit Systems for the Preparation of Transition Plans in Compliance with the DOT 504 Regulation
Proj. IT-09-9010
Booz, Allen and Hamilton
March 1980, UMTA-IT-09-9010-80-2

Transportation Energy Contingency Planning: Local Experiences
Proj. TX-09-9001
FHWA/UMTA
June 1979, UMTA TX-09-9001-79-1

CHAPTER 14

Transportation Management

Trends and Highlights

Management skills and techniques to improve the productivity of urban transportation are developed through UMTA's Transportation Management Program. In FY 80 this program continued to explore new ways for improving transit management, and also emphasized the dissemination of information and the implementation of existing techniques through workshops, seminars, "out-reach programs," and information service programs.

The Office of Transportation Management is divided into five units, each of which is responsible for a number of new and continuing programs. These units are 1) Human Resources Division; 2) Marketing Division; 3) Operations and Maintenance Division; 4) Information Services Division; and 5) Transit Industry Liaison Division.

Human Resources Division

Among the projects conducted by the Human Resources Division in FY 80 was the Transit Industry Employee Training Program (WV-06-0011). This program is developing modular training units for all phases of bus transit blue collar work as well as a mechanism for industry-wide distribution of these training materials.

Thus far, the project has produced a set of bus operator training materials. Work is proceeding in the area of bus mechanics' training.

The National Transit Intern Project (DC-06-0180) is a pilot project designed to attract and recruit college graduates for placement in entry-level administrative

and professional positions in the transit industry.

Evaluation of the Feasibility of Developing a Bus Operator Training Simulator (MA-06-0074) examined the use of a simulator as a means of teaching safe driving and other operating techniques to bus operators.

The Bus Operator Validated Test Battery (MA-06-0011) is in the final stages of completion and has been validated for black and white male and female applicants. The project will be closed out at the Massachusetts Bay Transportation Authority (MBTA), the transit property that served as UMTA's grantee for the project, and all future testing will be carried out by the University of Chicago Industrial Relations Institute, the originators of the battery.

Employee Absenteeism and Workmen's Compensation Claims in the Transit Industry (PA-06-0050) developed a baseline of transit industry experience with employee absenteeism and workmen's compensation and recommendations on ways to deal with employee excesses in these areas. A related project, Comprehensive Employee Assistance Program (MI-06-0019), was aimed at establishing a framework of policies and procedures to enable public transit employers to address and resolve personal problems that affect worker performance. This effort also involved a review of current and outstanding industry programs in this area.

Through project CA-06-0123, the use of Computer Assisted Training (CAT), techniques and methodologies are being compared with conventional forms of route training for bus operators to see if significant improvements can be made in operator safety and operating performance.

A set of transit performance and productivity training materials was developed and will be tested under project IT-06-0231. This will result in a "packaged" workshop on performance and productivity suitable for on-site presentation by transit operators or other local government representatives.

A review of transit industry recruitment, testing, selection, and training procedures is being conducted under contract IT-06-0252 to gain further insight into the role and significance of these elements in the subsequent performance of bus operator personnel. This project

The first class to complete an intensive course dealing with the relationship between labor practices and job performance in the transit industry poses in front of the George Meany Center for Labor Studies.

was to complement the work previously done in the area of bus operator applicant screening methodology.

The focus of project MD-06-0062, is on a series of studies to investigate ways in which changes in industry labor practices could be accomplished through planned demonstrations. Through cooperative efforts between the three major transit industry labor bargaining units and industry management representatives, the project will examine and explore areas in the industrial relations subset that offer possibilities for new and/or innovative approaches to job performance.

Marketing Division

Programs in the Marketing Division were designed to develop transit marketing techniques and to assist transit operators in understanding and successfully applying these techniques.

A project (MA-06-0102) begun in FY 79 was the design of a series of five regional workshops to help transit marketers sharpen their skills, learn more about their profession, and exchange information about marketing programs. The workshops, conducted during FY 80, were designed primarily for medium-sized transit properties needing practical assistance in the areas of market research, marketing plans, and user information and communications.

Following program evaluations, their refined curriculum will provide the transit industry with a tool for further marketing training efforts.

The Transit Marketing Information Exchange Project (IT-06-0238) was designed to improve the exchange of existing transit marketing materials within the transit community, to plan a clearinghouse for the materials, and to reduce or eliminate excessive expenditures of time, effort, and dollars in investigating state-of-the-art programs and techniques. A contractor was selected to develop a compendium of marketing materials and to design a clearinghouse activity.

The Marketing Division also sponsored, through a contract with the Transportation Research Board (TRB), a workshop on information aids for transit consumers. The workshop addressed the planning, designing, implementation, evaluation, and interaction of various information aids, including system maps, timetable brochures, bus destination (roller) signs, and signs at bus stops. Proceedings were developed and distributed. A demonstration grant (IN-06-0010) was awarded in FY 80 to the Northern Indiana Commuter Transportation District to conduct a comprehensive marketing demonstration along the corridor served by the South Shore Railroad. This project will make use of techniques developed in an earlier marketing project conducted in both Baltimore, Md. and Nashville, Tenn. and is designed to underscore the applicability of such techniques to different environments.

In an effort to draft a research agenda in the area of passenger security for the coming years, a seminar/workshop was held in autumn, 1980 (NY-06-0083). Representatives of major rail transit systems gathered in New York to share experiences on successful ways of enhancing passenger security aboard their facilities. Following publication of the proceedings of this workshop, the Marketing Division will begin a series of demonstrations based on recommendations from the group.

Maintenance is an orderly, continuing process at RTD in Denver, Colo.

Operations and Maintenance Division

The purpose of the Automatic Bus Diagnostic System (IT-06-0102), is to develop, demonstrate, and evaluate an automated bus inspection system. The project will measure, analyze, and report data pertinent to routine servicing of transit buses. Considerable time has elapsed since the initial grant was awarded in 1975. Additional funds were added to the original grant to cover

UMTA sponsored a series of five regional workshops on marketing transit.

inflationary costs of the demonstration equipment and changes to the scope of work.

The Vehicle Rehabilitation Study (IT-06-0032) examined the feasibility of purchasing rebuilt buses as an alternative to purchasing new buses. This project catalogued bus rebuilding sources, analyzed various rebuilt components (e.g., frames, bodies, interiors, engines, transmissions, etc.) and compared the estimated cost of rebuilt versus new buses. The data collected was related to federal policies on purchasing mass transit equipment.

The Maintenance Manual Specification Project (IT-06-0235) is developing specifications for acquiring maintenance manuals, or job performance aids, to improve maintenance productivity and reduce repair errors. A companion project (MI-06-0023) is taking this specification and developing an actual maintenance manual for a particular bus model, and testing its effects in a real maintenance environment.

A computer software project entitled Run Cutting and Scheduling, (RUCUS) (MA-06-0046), produced a software system providing transit operators with an automated system for vehicle scheduling and driver run-cutting. The implementation of the RUCUS system usually resulted in transit operators being better able to cover all route assignments with fewer vehicles and less manpower. As this project progressed, a system study was conducted to modernize the existing RUCUS package.

Section 15 Processing System (IT-06-0201) is a project that developed a software system for maintaining the national Section 15 reporting system data base. The software operates routine sets of quarterly and annual reports distributed to members of the reporting system. In addition, the system has the capability to respond to ad hoc requests for information.

Service, Inventory, and Maintenance System (SIMS) Demonstration (MI-06-0021) is a project to enhance bus maintenance practices through the development and testing of a bus servicing system. The SIMS system, developed by UMTA in 1973, was intended to provide transit management with the information needed to plan repair activities, avoid road calls, and control expenses. This demonstration serves to evaluate the effectiveness of the service module of SIMS.

Information Services Division

Section 15 of the UMT Act requires beneficiaries of Section 5 operating and assistance grants to uniformly report operating and financial data to the computerized Section 15 Reporting System.

This system generates routine and ad hoc reports from the raw data. Using these reports, individual and comparative analyses can be performed with selected efficiency and effectiveness indicators. Annual and one-time summaries of the

analyses will be published for national dissemination and will be used to provide or enhance transit management information. The system's performance is being objectively evaluated and recommendations will be implemented by this office. In addition, an Advisory Committee, whose membership reflects the diverse user group, will address the transit industry's current needs and usages for transit information. Scheduled meetings will be announced in the *Federal Register*.

This office's documentation center processes UMTA-sponsored project reports resulting from Section 6, 8 and 11 of the UMT Act. Reports are abstracted, processed, and selectively sent to the National Technical Information Service (N.T.I.S.). Reports and abstracts receive national distribution.

A project (DC-06-0285) has been initiated to provide an Urban Mass Transportation Information Service (UMTRIS) which will be UMTA's interface with the Transportation Research Board's extensive computer files that currently house information from three of the Department of Transportation's other operating elements. With the inclusion of UMTRIS, TRB's data base will represent all transportation modes. All transportation research information will be centrally controlled and will be nationally accessible.

A project will begin this year to improve UMTA's exchange of mass transit information with its transportation constituency. Selected reports will be summarized, evaluated and organized by subjects that have the highest level of interest. These subject matter "thesauri" will receive wide distribution on a regular basis (IT-06-0251).

In San Francisco, rapid rail schedules are available in three languages.

Transit Industry Liaison Division

In addition to conducting a regular program of data collection and publication about the mass transit industry, a research project was begun this past year to explore ways in which incentive payments might be incorporated into conventional contract management relationships. Approximately 60 U.S. transit systems currently employ this system of governance, and the aim of this evaluation is to determine if further federal demonstrations might be useful to test various forms of incentive payments. (IT-06-0246).

Transportation Management

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
HUMAN RESOURCES DIVISION					
Transit Industry Employee Training Program	WV-06-0011	$1,398,000 (to date)	Ongoing	AFL-CIO Appalachian Council, W. Va.	Charles T. Morison, Jr. (202) 426-9274
National Transit Intern Project	DC-06-0180	$272,241	Ongoing	American Public Transit Association	Charles T. Morison, Jr. (202) 426-9274
Evaluation of the Feasibility of Developing a Bus Operator Training Simulator	MA-06-0074	$75,000	Oct. 1978-Sept. 1979	TSC	Charles T. Morison, Jr. (202) 426-9274
Bus Operator Validated Test Battery	MA-06-0011	$584,618 (to date)	Ongoing	Massachusetts Bay Transportation Authority (MBTA)	Frank E. Enty (202) 426-9274
Case Studies in Human Resources Management in Public Transportation	PA-06-0045	$30,150 (to date)	Ongoing	University of Pennsylvania	Frank E. Enty (202) 426-9274
Employee Absenteeism and Workmen's Compensation Claims in the Transit Industry	PA-06-0050	$176,000	Ongoing	Port Authority of Allegheny County (PAAC)	Frank E. Enty (202) 426-9274
Comprehensive Employee Assistance Program	MI-06-0019	$156,000	Ongoing	Detroit Department of Transportation, Mich.	Frank E. Enty (202) 426-9274
Automated Technical/ Testing Techniques	CA-06-0123	$112,000	June 1979-Jan. 1981	San Diego Transit Authority, Calif.	Charles T. Morison, Jr. (202) 426-9274
Productivity Workshop Development	IT-06-0231	$116,000	April 1979-June 1981	Urban Resources, Inc.	Frank E. Enty (202) 426-9274
Bus Operator Testing and Training	IT-06-0252	$90,000	Dec. 1979-Nov. 1980	Jordan-DeLaurenti, Inc.	Frank E. Enty (202) 426-9274
Industrial Relations Project	MD-06-0062	$153,330	Ongoing	George Meany Center for Labor Studies	Frank E. Enty (202) 426-9274

Transportation Management

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
MARKETING DIVISION					
Regional Transit Marketing Workshops	MA-06-0102	$100,000	May 1979-July 1980	TSC	Carol Kerr (202) 426-9274
Transit Security Demonstration	IL-06-0032	$630,080	July 1976-Sept. 1979	City of Chicago, Ill.	Marvin Futrell (202) 426-9274
Transit Market Information Exchange Project	IT-06-0238	$50,000 to $100,000	To be determined	To be selected	Carol Kerr (202) 426-9274
Marketing Demonstration	IN-06-0010	$80,000	Sept. 1980-July 1981	Northern Indiana Commuter Transportation District	Carol Kerr (202) 426-9274
Passenger Security Workshop	NY-06-0083	$78,000	Oct. 1980	New York State Senate Committee on Transportation	Marvin Futrell (202) 426-9274
INFORMATION SERVICES DIVISION					
Evaluate Section 15 Data Base and Generate Output Reports	MA-06-0107	$60,000	Ongoing	TSC	Donald M. Chapman (202) 426-9157
Develop MPO's Section 15 Reporting Format	IT-06-0234	$105,000	N/A	COMSIS Corp.	Donald M. Chapman (202) 426-9157
Provide Information Interface (UMTRIS) with TRB	DC-06-0285	$93,419 (To date)	Ongoing	Transportation Research Board	Donald M. Chapman (202) 426-9157
Prepare Information Thesauri for Outreach	IT-06-0251	$60,000	N/A	To be selected	Donald M. Chapman (202) 426-9157
Develop Performance Measures for Statewide Evaluation of Transit Service	MA-06-0018	$150,000	Oct. 1980-Oct. 1981	Commonwealth of Massachusetts	Brian J. Cudahy (202) 426-9274

Transportation Management

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
TRANSIT INDUSTRY LIAISON DIVISION					
Development of a Transit Management Incentive Contract	IT-06-0246	$60,000	To be determined	To be selected	J. P. Jones (202) 426-9274
OPERATIONS AND MAINTENANCE DIVISION					
Automatic Bus Diagnostic System	IT-06-0102	$210,000	Ongoing	Tri-State Regional Planning Commission, N.Y.	A. B. Hallman (202) 426-9274
Vehicle Rehabilitation	IT-06-0232	$60,000	April 1980-Dec. 1980	ATE Management and Service Co.	A. B. Hallman (202) 426-9274
Maintenance Manual Specification	IT-06-0235	$340,000	Feb. 1980-April 1981	XYZYX, Corp.	A. B. Hallman (202) 426-9274
Development and Demonstration of Bus Maintenance Repair Aids	MI-06-0023	$1,500,000	Ongoing	City of Detroit, Mich.	A. B. Hallman (202) 426-9274
RUCUS, SIMS	MA-06-0046	$860,000	Ongoing	TSC	A. B. Hallman (202) 426-9274
Rail System MIS	MA-06-0074	$756,000	Ongoing	TSC	A. B. Hallman (202) 426-9274
Section 15 Processing System	IT-06-0201	$272,000	Ongoing	International Business Service, Inc.	A. B. Hallman (202) 426-9274
Service, Inventory, and Maintenance (SIMS) Demonstration	MI-06-0021	$200,000	To be determined	City of Detroit, Mich.	Shang Hsiung (202) 426-9274

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

A Program for Improving Transit Industry Management Information Systems
Proj. IT-06-0094
Arthur Anderson and Company
September 1976
Vol. I, **Information Systems Improvement Plans Summary,** PB-264-524
Vol. II, **Systems Development Work Programs,** PB 264-525
Vol. III, **Systems Design Reference Manual,** PB 264-526
Final Report, PB 264-523

Urban Mass Transportation Industry Uniform System of Accounts and Records and Reporting System
Proj. IT-06-0094
Arthur Anderson and Company
January 1977
Vol. I, **General Description,** PB 264-877
Vol. II, **Uniform System of Accounts and Records,** PB 264-878
Vol. III, **Reporting System Forms and Instructions: Required,** PB 264-879
Vol. IV, **Reporting System Forms and Instructions: Voluntary,** PB 264-880

Transit Marketing Management Handbook: User Information Aids
Proj. IT-06-0078
Ilium Associates, Inc.
November 1975

Transit Marketing Management Handbook: Marketing Organization
Proj. IT-06-0078
Lesko Associates
November 1975

Transit Marketing Management Handbook: Pricing
Proj. IT-06-0078
Grey Advertising, Inc.
April 1976

Transit Marketing Management Handbook: Marketing Plan
Proj. IT-06-0078
Grey Advertising, Inc.
April 1976

The Transit Marketing Project: Summary of Consumer Research, Baltimore MTA and Nashville MTA
Proj. IT-06-0078
Grey Advertising, Inc.
June 1976

A Directory of Regularly Scheduled, Fixed Route, Local Public Transportation Service in Urbanized Areas over 50,000 Population
UMTA Technical Notice 2-80
Office of Transportation Management
August 1980

A Directory of Regularly Scheduled, Fixed Route, Local Rural Public Transportation Service
UMTA Technical Notice 1-80
Office of Transportation Management
February 1980

Public Transportation: An Element of the Urban Transportation System
FHWA-TS-80-211
JHK & Associates
February 1980

Public Transit Risk Management: A Handbook for Public Transit Executives
Proj. IT-06-0173-79-1
James & Company of Virginia
December 1978, PB 80-145-287

Urban Mass Transportation Abstracts
Vol 6
UMTA-TRIC-79-1
Office of Transportation Management
December 1979

Urban Mass Transportation Abstracts
Vol. 5
UMTA-TRIC-78-1
Office of Transportation Management
December 1978, PB 297-355

Urban Mass Transportation Abstracts
Vol. 4
UMTA-TRIC-77-1
Office of Transportation Management
December 1977, PB 277-290

Urban Mass Transportation Abstracts
Vol. 3
UMTA-TRIC-76-1
Office of Transportation Management
July 1976, PB 264-904

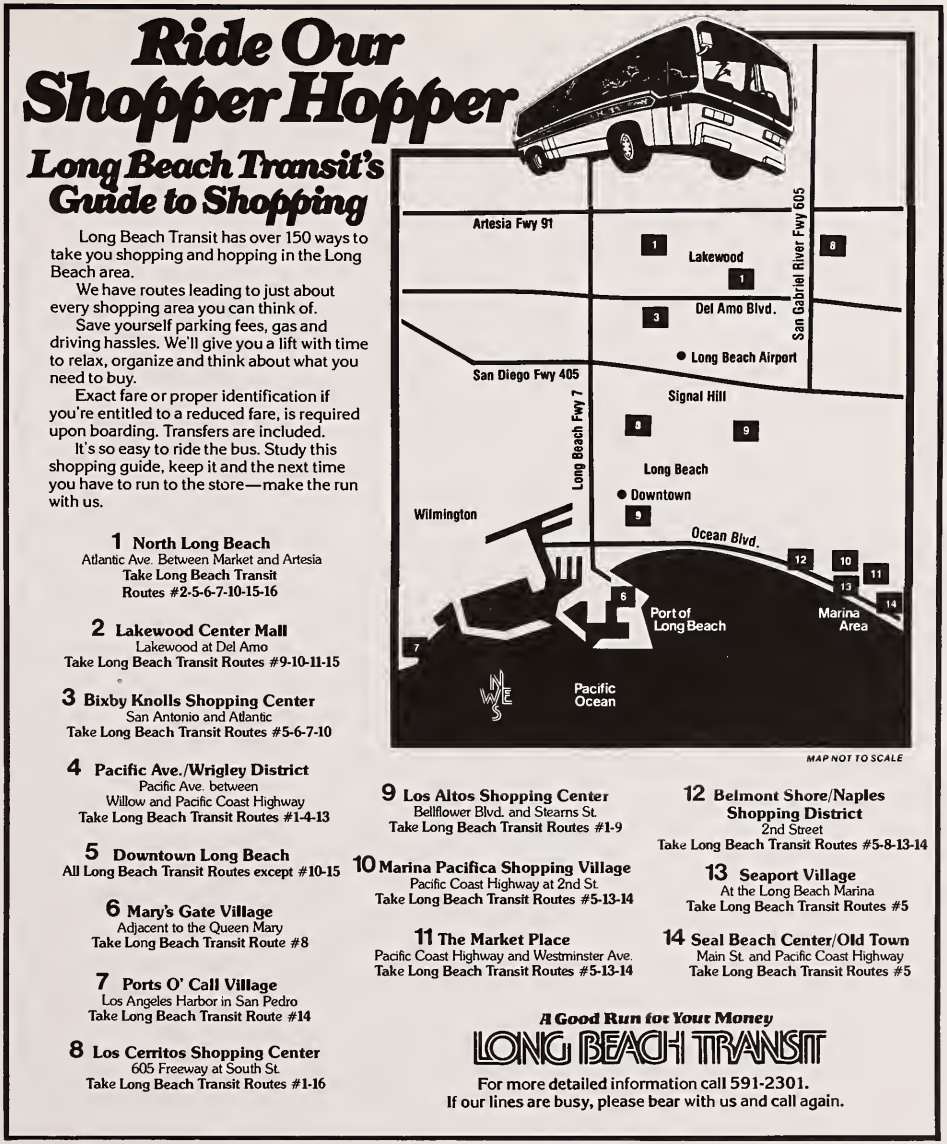
Study of Operator Absenteeism and Workers' Compensation Trends in the Urban Mass Transportation Industry
Proj. PA-06-0050
Port Authority of Allegheny County; Peat, Marwick, Mitchell & Co.
February 1980

Human Resource Development Study of the Southeastern Pennsylvania Transportation Authority
Proj. IT-09-0073-79-2
University of Pennsylvania/Human Resources Center
May 1979, PB 298-405

The Productivity and Efficiency of Inputs in the Provision of Transportation Services of the Southeastern Pennsylvania Transportation Authority
Proj. IT-09-0073-79-1
University of Pennsylvania
Human Resources Center
May 1979, PB 298-161

Transit Productivity: Improvement through Management Training and Development
Proj. NY-11-0019-79-1
City University of New York/Center for Productive Public Management
June 1979, PB 299-369

National Validation of a Selection Test Battery for Male Transit Bus Operators
Proj. MA-06-0011-77-1
University of Chicago/Industrial Relations Center
June 1976, PB 283-709



An example of marketing material put out by the transit authority in Long Beach, Calif.

SECTION IV

Policy Development and Research

SECTION FOUR

Policy Development and Research

The primary purpose of research in the field of policy development is to promote a better understanding of the emerging issues, needs, and objectives involved in urban transportation; to monitor and evaluate the effectiveness of UMTA programs; and to aid in the formulation of new policies and program directions.

Chapter 15 describes studies which are funded under Section 6 of the Urban Mass Transportation Act to support the formulation of programs and policies. The studies are grouped by responsible office.

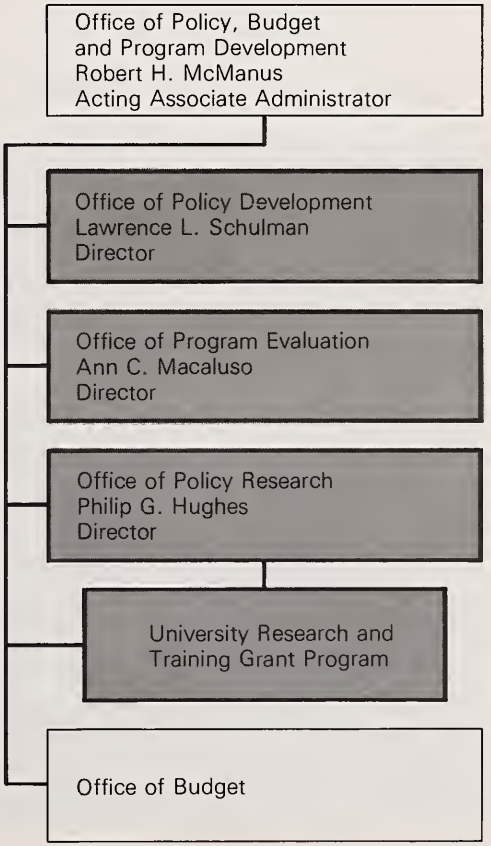
Under the Office of Policy Development, projects focus on the development of policies and programs relating to such issues as private versus public transportation services, the potential effect of transit projects on urban development, and transportation accessibility to the elderly and handicapped.

The Office of Program Evaluation conducts assessments of UMTA programs, such as the formula assistance and rail modernization programs, and is involved in the development of performance measures and the analysis and evaulation of transit trends.

The Office of Policy Research performs studies and analyses designed to explore and resolve urban transportation problems and to aid in formulating policy and program decisions at the federal level. Studies have focused on such issues as transportation and land use interactions, productivity, financing, energy conservation, center city and low-density service problems, and the accessibility of transportation for the elderly and handicapped.

The Office of Policy Research is also responsible for directing UMTA's University Research and Training Grant Program which is described in Chapter 16. Grants to universities are authorized under Section 11 of the Urban Mass Transportation Act. Grants are awarded to universities throughout the country in an effort to support research in the field of transportation, to provide training for transportation professionals, and to encourage universities to become involved in the field of transportation as a source of advice, observation, and evaluation.

The organization of the Office of Policy, Budget and Program Development is shown below. The projects described in this section are funded and administered through the program offices indicated in shaded boxes on the chart.



CHAPTER 15

Policy and Program Development

Trends and Highlights

The Office of Policy, Budget and Program Development is responsible for planning, coordinating, and evaluating UMTA programs, as well as developing its budget. The office is also charged with policy analysis and with helping to formulate national transportation legislation and major DOT and UMTA policies, regulations, and directives.

The long range goal of the office is to gain a better understanding of the issues involved in the provision and public support of local transportation services, and to improve the capability of federal programs and policies addressing these issues. The primary concern of the office is to: develop policies, programs, guidelines, and procedures which are responsive to local needs; anticipate emerging issues; and effectively monitor and evaluate transportation system performance. These activities lead to a continual assessment of current federal programs.

The efforts of this office have contributed to the development of a number of recent policy and program initiatives. Among these are: the policy on major investment decisions (alternative analysis); paratransit services; joint development and value capture strategies; non-urbanized area assistance; rail modernization; role of private operators in public transportation; elderly and handicapped transportation needs; energy conservation; neighborhood revitalization; and transportation system management strategies.

The office contains four organizational components: policy development, program evaluation, policy research, and budget. The Office of Policy Research also administers the University Research and Training Grant Program described in Chapter 16.

Office of Policy Development

The functions of the Office of Policy Development fall into four major areas.

- Legislation. The development of the UMTA legislative agenda and the coordination and monitoring of the legislative implementation process.
- Budget. Policy-related budget activity and oversight and coordination of the initial aspects of budget preparation.
- Policy Development. The implementation and management of the overall policy development process within UMTA, and the drafting of specific statements of policy.
- Program Development. The initiation of new program elements or refinements of current programs, and the coordination of program elements within UMTA.

In 1980, issues studied with a view toward improving or developing UMTA policies and programs included the development of a Report to Congress on making rail transit systems accessible to the handicapped, other considerations in the elderly and handicapped area, development of a paratransit policy statement, development of a regulation on private enterprise, energy policy development, the rural program, and work on a new formula for apportioning Section 5 funds.

As part of the paratransit program, five regional conferences were held to inform taxi operators and public officials of their rights and opportunities in federally-assisted local transportation programs (MD-06-0073). At the conferences, taxi operators from around the country and local federal officials described examples of how taxi operators have participated in the UMTA program. Emphasis at the conferences was placed on how the taxi industry can participate in the Section 504 and Section 18 programs.

Another project, Taxicab Operating Characteristics (MD-06-0080) provides for a survey and analysis of the operating trends within the taxicab industry. Such a study was undertaken five years ago, but since then many taxi operators have faced financial difficulties because of rising fuel costs. This project will look at the current state of the industry to ascertain its economic health and those problems which are arising as transportation costs continue to increase.

Three other projects also relate to paratransit. One, Taxi-Based Specialized Transit Services (CA-06-0153), is exam-

Parking management can stimulate use of public transportation and achieve a broad spectrum of urban goals.

ining the role of taxis as providers for the elderly and handicapped. Such a role has become increasingly popular in California; this study will look primarily at California services, but will also look at taxi-based specialized transit in other cities. Another project, Technical Assistance for Small Taxi Operators (NC-06-0005), is designed to help small taxi operators in North Carolina understand the complexities of the federal transportation program so that they can apply for federal assistance and participate in the local transportation process. The final paratransit project, Analysis of Paratransit Labor Protective Arrangements (IT-06-0249), provided an analysis of labor protection agreements and Department of Labor determinations among paratransit operators. The effect of labor protection issues on labor-management relationships was examined, and the project analyzed the ability of the transit and taxi industries to provide paratransit service.

Three other projects were performed relating to public transportation access for handicapped persons. Rail Access Retrofit Study (DC-06-0310) provided supplemental funding to a team of contractors to help rail transit operators carry out Section 321 of the Surface Transportation Assistance Act of 1978 to estimate the costs and feasibility of making their systems accessible to handicapped persons. Assistance to Handicapped Organizations, DC-06-0298, provided funds to aid organizations representing handicapped persons to review rail transit operators' subsequent accessiblity designs, cost estimates, and travel demand forecasts. This project also helped organizations to hire experts to review the operators' extensive and complex material and to submit timely comments for consideration in DOT's preparation of a required report for Congress. A third contract, Environmental Impact of 504 Regulations (DC-06-0305), provided UMTA's share of a DOT environmental impact statement for its 1979 504 regulations mandating that transit facilities be made accessible. The EIS was in response to a 1980 Federal District Court order.

UMTA also funded three public interest groups in 1980 to undertake policy research efforts in a number of important areas. Under these grants, DC-06-0306, DC-06-0307 and DC-06-0308, the U.S. Conference of Mayors, the National Association of Counties, and the National League of Cities undertook research in three areas: local governments' current and future financial commitments to public transportation programs; the integration by local governments of energy, air quality, and transportation planning; and the effectiveness of local Transportation Improvement Programs.

Obstacles to Private Enterprise Participation in Public Programs (TN-06-0011) was a project to develop background material for a Private Enterprise Regulation which is currently under development. The contractor in this project examined the private operators' perceptions of the difficulties and obstacles to becoming involved in the planning of local transportation programs as well as the operation of contracted services with public agencies.

A conference on Art in Public Transportation, DC-06-0330, is being planned for May 1981. This conference, part of a departmental program in Design, Art, and Architecture in Transportation, is being held to demonstrate to local officials and members of local art communities how good design and sensitive inclusion of artwork have been achieved in public transportation facilities.

Office of Policy Research

Projects within this office embrace studies and analyses designed to provide data and concepts which will assist in the establishment of long-term goals and objectives for UMTA programs. The office also administers the University Research and Training Grant Program described in the following chapter.

Major research efforts in FY 80 were in the areas of urban revitalization joint transit land use development, paratransit, light rail transit, parking management, transit futures and financing.

Paratransit

Two paratransit studies are being conducted. An analysis of the progress being made by foreign countries (FN-06-0004) in the field of paratransit will enable the United States to benefit from foreign experience. A second study (DC-06-0150) is evaluating the potential of paratransit based upon experience to date. The evaluation will help determine the future role of paratransit in improving mobility.

Large American Cities

UMTA, in conjunction with FHWA and the Brookings Institution, is cooperatively funding a study of the future of large American cities. This study (DC-06-0221) will analyze the combined influence

of several major variables, such as housing, transportation, and economic health, and what impact they will have upon the future of major urban areas.

Light Rail Transit

Two projects were continued to improve the performance and lower the costs of light rail transit (LRT). One of the projects, Means for Reducing Light Rail Transit Cost Through Standardization of System Elements (IT-06-0103-03), investigated the possibilities and procedures for standardizing many of the components of LRT systems; such as power distribution subsystems, signals and controls, at-grade intersections, switches, stations, and other elements which, if standardized, could be mass produced, would cost less, be more reliable, and require less maintenance.

The other LRT project, Study of Methods of Improving LRT Service (IT-06-0103-02), looked into methods of improving LRT service or reducing its cost. Specific areas of research in this study included a self-service fare collection system that could reduce trip time and manpower requirements, thereby permitting a more equitable fare structure; pre-emptive signals at intersections; pedestrian protective barriers; pedestrian malls; and various methods for improving vehicle flow.

Samples of the tiles which were commissioned for one of the new MBTA stations in the metropolitan Boston area.

Parking Management

Two studies were continued in parking management. One of the studies (DC-06-0225) provides a state-of-the-art overview of the most important current transportation practices across the country, how successful they are, how widely they are used, and the impact they have. This study is aimed at management and decision makers. The second study (MA-06-0094) is aimed at identifying innovative parking strategies—especially, how they can be implemented to help achieve a broad spectrum of urban goals, such as to stimulate economic growth, revitalize decayed neighborhoods, and reverse urban flight.

The Office of Policy Research, in FY 80, supported a number of ongoing transportation programs of the National Academy of Science Transportation Research Board (TRB) (DC-06-0279). The TRB program includes a wide range of specific research and information sharing activities.

The TRB publishes several newsletters to inform and encourage the transportation community to expand its interest in research activities. Among its publications are *TRB News, Newsline, Paratransit News, Land Use and Transportation Newsletter,* and *Light Rail Transit Newsletter.*

In addition to its annual meeting, which serves as a national forum for the discussion of transportation issues, TRB sponsored conference workshops on a wide range of transportation issues during the year. TRB activities also involved a study of socioeconomic issues of AGT and improved in-station mobility for elderly and handicapped transit users.

Other Topics

A project, Communications Program: Urban Transportation Innovations Abroad (DC-06-0266) continued to facilitate the exchange of information on international developments in transportation management and urban revitalization. The project consists of two main activities; the development of a newsletter on public transportation innovations abroad; and the development of a clearinghouse for the exchange of information on transportation, planning, and the environment.

Finally, FY 80 policy research concluded a study, Electric Trolley Bus Feasibility (IT-06-0193), to provide a comprehensive report on the economics, technology, and operation of the electric trolley bus. A report on the study will be written as a guide for transit decision-makers, planners and operators to assist them in evaluating the feasibility of the electric trolley bus. The study can also be used as a basis for comparisons with other models in an alternatives analysis study.

Office of Program Evaluation

The Office of Program Evaluation is responsible for conducting and coordinating evaluation studies of UMTA programs and assessing the effectiveness of urban transportation performance. The office is developing new approaches, methods, and measures for continuous monitoring of transit performance and for the evaluation of UMTA assistance programs.

The three-year travel to work surveys initiated in 1975 were completed in FY 79. The Survey of Travel to Work (DC-06-0124, DC-06-0144 and DC-060-0189) was conducted by the Bureau of the Census as a supplement to the HUD Annual Housing Survey. This survey of the nation's commuting patterns includes information on residential and workplace locations, current and prior mode of travel, time of departure, travel time and distance, satisfaction with travel mode, and other demographic and economic information.

16(b)(2) Program

Section 16(b)(2) of the Urban Mass Transportation Act authorizes grants to private nonprofit corporations to provide transportation services for the elderly and handicapped. This project (MA-06-0109) assessed the administration of the 16(b)(2) program by the federal and state governments. The study examined the UMTA administration of the program, state organization and management, state application selection, state assistance agencies, local funding sources, and state monitoring and evaluation. The study findings and recommendations dealt with policy and program management. The information contained in the final report on the 16(b)(2) program will be used to assist the UMTA staff in preparing a new Notice of Proposed Rulemaking for this grant program.

Urban Initiative Program

The Urban Initiative Program focuses on the mass transit goals of the President's urban policy. UMTA is authorized to provide financing, under the Urban Initiatives Program, for transportation projects which contribute to urban revitalization. In the evaluation of this program,

the Rice Center (TX-06-0028) tried to determine the impacts of the program as well as its administrative efficiency. The research effort concentrated on three major issues: 1) the likely effect of Urban Initiative grants on the cities receiving funds; 2) the administrative problems local agencies may encounter in implementing urban initiative projects; and 3) approaches UMTA could employ to assess the long-term effectiveness of the program. All 17 cities receiving urban initiative funds in 1979 were examined as part of the research study. It is anticipated that the results of this study will provide UMTA with early evaluation information which can be used to refine project selection criteria, and (if appropriate) redirect program goals, and change administrative procedures.

State Role Study

This project (MA-06-0109) involves the assessment of the role of the states in public transportation. Case studies are being conducted in several states to examine the development of state assistance programs for public transportation. The results of the study will be used by UMTA in examining trends of state support of transit and implications for future federal assistance programs.

Market Segmentation of Transit and Ridesharing Commuters

This project (DC-06-0257), to conduct market segmentation analyses of commuters to distinguish the socioeconomic and demographic characteristics of workers who use transit and carpools in contrast to those who drive alone was conducted at TSC. The results will be used to evaluate the current and potential markets which would be receptive to public policies and campaigns designed to attract commuters to more energy efficient modes of travel.

Commuting Travel and Transportation-Related National Trends

The primary objectives of this project (DC-06-0263) are to 1) summarize and analyze for publication the most recent census information on the use of transit for work, shopping, recreation, and other trip purposes, and 2) examine and assess other current social, economic, and demographic trends that may affect future travel demand and transit usage in the United States. The probable impacts of these trends on future federal transit programs will also be examined. The study is being conducted by the Bureau of the Census.

Policy and Program Development

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
OFFICE OF POLICY DEVELOPMENT					
Regional Conference on Taxicab Participation in Public Transportation	MD-06-0073	$49,200	April 1980-June 1980	International Taxicab Association	Douglas Birnie (202) 426-4060
Assistance to Handicapped Organizations	DC-06-0298	$125,000	April 1980-Oct. 1980	Washington Consulting Group	Sal Caruso (202) 426-4060
Public Interest Group Policy Research	DC-06-0306	$49,500	April 1980-Mar 1981	U.S. Conference of Mayors; National Association of Counties; National League of Cities	Richard Cohen (202) 426-4060
	DC-06-0307	$48,000	April 1980-June 1981		
	DC-06-0308	$50,000	April 1980-Aug. 1981		
Taxicab Operating Characteristics	MD-06-0080	$99,500	Sep. 1980-Dec. 1981	International Taxicab Association	Douglas Birnie (202) 426-4060
Rail Access Retrofit Study	DC-06-0310	$137,125	June 1980-Dec. 1980	DeLeuw Cather and Co.; Parsons, Brinkerhoff, Quade and Douglas; Crain and Associates	Sal Caruso (202) 426-4060
Obstacles to Private Enterprise Participation	TN-06-0011	$62,300	Aug. 1980-July 1981	Ground Airport Transportation Association	Jim Stratton (202) 426-4060
Conference on Art in Public Transportation	DC-06-0330	$75,800	Aug. 1980-June 1981	Public Technology, Inc.	Richard Cohen (202) 426-4060
Environmental Impact of 504 Regulations	DC-06-0305	$30,000	April 1980-Dec. 1980	Nero and Associates	Sal Caruso (202) 426-4060
Technical Assistance for Small Taxi Operators	NC-06-0005	$28,200	Oct. 1980-April 1983	University of North Carolina	Douglas Birnie (202) 426-4060
Analysis of Paratransit Labor Protective Arrangements	IT-06-0249	$48,500	Nov. 1979-Feb. 1981	ATE Management and Service Co.	Douglas Birnie (202) 426-4060

Policy and Program Development

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
OFFICE OF POLICY DEVELOPMENT					
Support of Regional Workshops on Paratransit Implementation	DC-06-0210	$60,000	Dec. 1979-Dec. 1981	Urban Institute	Douglas Birnie (202) 426-4060
Survey of Public Transportation in Small Urban Areas	DC-06-0155	$55,000	June 1980-Dec. 1981	Urban Institute	Douglas Birnie (202) 426-4060
OFFICE OF POLICY RESEARCH					
Means for Reducing Light Rail Transit Cost Through Standardization of System Elements	IT-06-0103-03	$55,000	Sept. 1976-Aug. 1981	DeLeuw Cather and Co.	James Yu (202) 426-0080
Study of Methods of Improving LRT Service	IT-06-0103-02	$53,000	Sept. 1976-April 1981	DeLeuw Cather and Co.	James Yu (202) 426-0080
National Academy of Sciences, Transportation Research Board (TRB)	DC-06-0216	$460,000	Sept. 1978-Dec. 1980	Transportation Research Board	Judy Z. Meade (202) 426-0080
Communications Program: Urban Transportation Innovations Abroad	DC-06-0266	$70,000	Nov. 1977-Sept. 1980	Council for International Urban Liaison	Philip Hughes (202) 426-0080
Study to Identify Relevant Criteria for Selection of Sites for Fixed Guideway Systems	NY-06-0061	$60,000	Jan. 1977 Dec. 1980	Regional Plan Association, Inc.	James Yu (202) 426-0080

Policy and Program Development

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
OFFICE OF PROGRAM EVALUATION					
Survey of Travel to Work	DC-06-0124 DC-06-0144 DC-06-0189 DC-06-0264	$1,195,000 $1,025,000 $1,110,000 $45,000	June 1975- Sept. 1979	Bureau of the Census	Tong Louie (202) 426-9271
National Personal Travel Survey	DC-06-0174	$219,500	Jan. 1977- June 1978	Bureau of the Census	Tong Louie (202) 426-9271
Commuting Travel and Transportation-Related National Trends	DC-06-0263	$8,360	Sept. 1979- Aug. 1981	Bureau of the Census	Yvonne Griffin (202) 426-4058
Development of Evaluation and Analysis System to Measure UCR Effectiveness on Transit Industry	DC-06-0243	$25,000	May 1979- June 1981	Urban Resources, Inc.	Michael Steadham (202) 426-4058
Program Evaluation Support Contract	DOT-UT-70068	$371,390	Aug. 1977- Aug. 1979	Peat, Marwick, Mitchell and Co.	Jack Bennett (202) 426-4050
Market Segmentation of Transit and Ridesharing Commuters	DC-06-0257	$100,000	July 1979- Jan. 1981	TSC	Yvonne Griffin (202) 426-4058
Urban Initiatives Program Evaluation	TX-06-0028	$60,000	April 1980- Nov. 1980	Rice Center	Ann Macaluso (202) 426-4058
State Role in Transit	MA-06-0109	$60,000	Oct. 1979- Sept. 1980	TSC	Fred Williams (202) 426-4058
Assessment of Federal and State Administration of UMTA Section 16(b)(2) Program	MA-06-0109	$25,000	Oct. 1979- Sept. 1980	TSC	Jack Bennett (202) 426-4058

Bibliography

This list of reports contains those published from January 1976 to the present. For each report, a National Technical Information Service (NTIS) document number, if available, is listed following the publication date. Reports may be ordered through NTIS by using the order blanks provided at the back of this document.

Reports not available through NTIS may not have been published in sufficient quantity for general distribution. However, further information may be obtained by writing to the appropriate office.

Finally, additional reports relating to the research in this chapter will become available during the upcoming year. For information on these reports and for suggestions on additional reference materials, call or write to the technical contact associated with each project.

POLICY DEVELOPMENT

The United States and the International Market for Rail Equipment
Proj. DC-06-0213
Richard Barber Associates
March 1978

Transportation System Management: An Assessment of Impacts
Proj. VA-06-0047
Alan M. Voorhees
November 1978, PB 294-986

Urban Public Transportation and Energy
Proj. IT-06-0170
System Design Concepts
October 1979

An Evaluation of Making Rail Transit Systems Accessible to Handicapped Persons
Transportation Systems Center
April 1980

Taxicabs and Federal Programs: A Handbook
Proj. MD-06-0073
Public Technology, Inc.
March 1980

Arts on the Line
Proj. MA-06-0091
Cambridge Arts Council
March 1980

POLICY RESEARCH

Center City Environment and Transportation: Local Governments' Solutions
Proj. DC-06-0163
Public Technology, Inc.
February 1978

Transit Station Area Joint Development: Strategies for Implementation
Proj. NY-06-0047
Administration and Management Research Association of New York City, Inc.
February 1976
Economic Case Studies, PB 268-104
Final Report, PB 268-103

Joint Development: Making the Real Estate-Transit Connection
Proj. DC-06-0183
Urban Land Institute with Gladstone Associates
June 1979

Financing Transit: Alternatives for Local Government
Proj. IT-06-0127
Institute of Public Administration
December 1979

Innovative Transit Financing
Proj. IT-06-0127
Gladstone Associates
November 1979

The Trolley Coach Deployment and State-of-the-Art: Final Report, Task 1
Proj. IT-06-0193
October 1979

Potential Market, Capital, and Operating Costs: Impacts and Barriers, Task 2
June 1980
Chase, Rosen and Wallace, Inc.

PROGRAM EVALUATION

Selected Characteristics of Travel to Work in 21 Metropolitan Areas: 1975
Proj. DC-06-0124, DC-06-0144
Bureau of the Census
Series P-23, No. 68
February 1978

Selected Characteristics of Travel to Work in 20 Metropolitan Areas: 1976
Proj. DC-06-0124, DC-06-0144
Bureau of the Census
Series P-23, No. 72
September 1978

Increasing Transit Ridership: The Experience of Seven Cities
Urban Mass Transportation Administration
November 1976, PB 271-071

Proceedings of the First National Conference of Transit Performance
Proj. DC-06-0184
Public Technology, Inc.
January 1978

Transit Operating Performance and the Impact of the Section 5 Program
Urban Mass Transportation Administration
November 1976

Automobile Costs in 61 Urbanized Areas
Urban Mass Transportation Administration
September 1978

Transit System Performance Indicators: An Assessment of Current U.S. Practices
Urban Mass Transportation Administration
October 1978

The Cost of Making Urban Rail Transit Accessible to the Handicapped
Urban Mass Transportation Administration
November 1978

Trends in Bus Transit Operations: 1960-1974
Control Data Corporation and
Wells Research Co.
January 1977

The UMTA Rail Modernization Program, Evaluation of the Impact of Section 3 Capital Grants for Rail Rehabilitation and Modernization, 1965-1977
Proj. IT-06-0118
Peat, Marwick, Mitchell and Co.
June 1979

Transit System Performance Indicators: An Assessment of U.S. Practices
Proj. IT-06-0118
Peat, Marwick, Mitchell and Co.
October 1978

The Cost of Making Urban Rail Transit Accessible to the Handicapped
Proj. IT-06-0118
Peat, Marwick, Mitchell and Co.
October 1979

The Journey to Work in the United States: 1975
Proj. DC-06-0124
Bureau of the Census
Series P-23, No. 99
July 1979

CHAPTER 16

University Research and Training Grant Program

Trends and Highlights

The University Research and Training Program is designed to support and encourage university research and education projects which assist all levels of government in meeting their transportation needs. Projects funded under this program include research on the planning, design, construction, operation and evaluation of transportation systems, and training for working professionals.

The program promotes greater interaction between the academic community and local transportation authorities by encouraging universities to become sources of advice and information on transportation-related issues. Universities are also encouraged to develop programs to help practicing professionals stay abreast of current transportation programs and technologies.

Projects awarded grants in FY 80 and unfinished projects awarded grants in FY 79 are grouped and described in the appropriate project area.

Reports published in FY 80 as part of the University Research Program are listed at the end of the chapter.

Transportation Analysis, Planning, and Evaluation

Summary of Transportation Needs for Selected Ethnic Minority Groups as a Model for Evaluating Travel Needs (FL-11-0004)
Funding: $30,000
Schedule: May 1980-April 1981
Grantee: Edward Writers College
(Prof. S. Tolbert)

Technical Contact: Shannon Sorzano
(202) 426-9150

To gather data on current travel demands of selected minority groups.

Management Decision Procedures for Transit Market Selection and Service Delivery (VA-11-0010)
Funding: $69,438
Schedule: Sept. 1980-Nov. 1981
Grantee: University of Virginia
(Prof. L. Hoel)
Technical Contact: Stewart McKeown
(202) 426-4984

To develop a set of unified transit market identification, service evaluation, and management decision procedures to aid in evaluating unproductive services and expanding service to growing markets.

Los Angeles County Transportation Commission Public Policy Impact Study (CA-11-0002)
Funding: $149,064
Schedule: June 1977-Aug. 1981
Grantee: California State University, Long Beach
(Prof. P. Shaw)
Technical Contact: Philip Hughes
(202) 426-0080

To study the effects of the Los Angeles County Transportation Commission's work program on public policy.

Examination of Alternative Methods for Organization of Transportation Planning Functions (WI-11-0007)
Funding: $56,183
Schedule: Sept. 1980-Aug. 1981
Grantee: University of Wisconsin, Milwaukee
(Prof. E. Beimborn)
Technical Contact: Richard Steinman
(202) 472-5140

To evaluate four communities' approaches to the management and organization of planning activities.

Policy Sensitive Interactive Computer Graphics for Urban Transportation Planning (NJ-11-0008)
Funding: $65,775
Schedule: Dec. 1979-Feb. 1981
Grantee: Princeton University
(Prof. Alain Kornhauser)
Technical Contact: Larry Quillian
(202) 426-9271

To identify 1) improved techniques for displaying travel time, 2) methods which enable one to propose a rich and creative range of alternative solutions, 3) ways to encourage greater use of UMTA computer-based planning tools such as UTPS, and 4) mini-computer applications of interactive graphics for transit systems analysis.

Role of Women in Family Transportation (KY-11-0001)
Funding: $53,629
Schedule: July 1980-June 1981
Grantee: University of Kentucky
(Prof. P. Kimsey)
Technical Contact: Mary Martha Churchman
(202) 426-4984

To analyze the role of women in the energy consumption of family transportation patterns.

Effect of Budgetary Conditions on Transit Decision-Making, Service, and Impacted Groups (PA-11-0022)
Funding: $70,935
Schedule: July 1980-June 1981
Grantee: University of Pennsylvania
(Prof. E. Moylok)
Technical Contact: Fred Williams
(202) 426-4058

To examine the impact of the budget on decisions made by local transit systems and the effect of those decisions on the quality of service.

Integrating Project Worthiness into a Cost-Effectiveness Framework for Alternatives Analysis (IL-11-0026)
Funding: $58,966
Schedule: Oct. 1978-Nov. 1980
Grantee: Northwestern University
(Profs. J. Schofer and M. Turnquist)
Technical Contact: Al Harf
(609) 292-3160

To construct a framework for the evaluation of alternatives analyses submitted by urban areas applying for financial support for fixed-guideway transit projects; the results will be used for the efficient and balanced allocation of federal resources.

User Response to Time of Day Variations in Transit Service Level and Reliability (PA-11-0024)
Funding: $69,791
Schedule: July 1980-Sept. 1981
Grantee: Carnegie-Mellon University
(Prof. C. Hendrickson)
Technical Contact: Stewart McKeown
(202) 426-4984

To analyze the factors affecting travelers' decisions as to time of departure and mode choice for trips made during the daily peak travel periods; variations in conventional measures of service level, reliability, and schedule delay will be examined.

Case Study Analysis of Impact of Reinstating Transit Service in a Small City (TN-11-0003)
Funding: $52,932
Schedule: July 1979-Aug. 1980
Grantee: University of Tennessee
(Prof. F. Wegmann)
Technical Contact: Alex McNeil
(404) 881-3948

Identify the consequences of reinstating fixed-route bus service in Johnson City, Tenn., including the impact on travel behavior, modal choice, vehicle occupancies, alternative supplies of transportation services, and local businesses.

Analysis of Incentives for Living Closer to Where You Work (NJ-11-0009)
Funding: $53,768
Schedule: July 1980-Sept. 1981
Grantee: Princeton University
(Prof. A. Kornhauser)
Technical Contact: Edward Thomas
(202) 426-2360

To study the impact of the "Princeton Plan" on work trip patterns of Princeton University employees; identify similar incentive programs for employers, formulate local, state, and national programs that would encourage people to live closer to work; and estimate the potential for increased use of transit and carpooling as a result of these plans.

A Methodology for Locating and Sizing Transit Fixed Facilities and the Detroit Case Study (MI-11-0004)
Funding: $69,963
Schedule: June 1980-May 1981
Grantee: Wayne State University
(Prof. S. Khasnablis)
Technical Contact: Ronald Fisher
(202) 426-9271

To apply optimizing techniques to minimize total cost of facility locations and size; the procedure selected will be used on an actual experimental site in Detroit.

Transportation and Land Use Interactions

Perceptions of Transit-Linked Development in Minority Neighborhoods (GA-11-0010)
Funding: $58,848
Schedule: July 1979-Oct. 1980
Grantee: Clark College
(Prof. N. Jackson)
Technical Contact: Steven Dukes
(404) 257-3848

To analyze the perceptions of diverse groups interested in the potential for development around transit stations in minority neighborhoods.

Transportation/Land Use Interactions (NY-11-0022)
Funding: $69,905
Schedule: June 1979-Dec. 1980
Grantee: State University of New York, Buffalo
(Prof. R. Passwell)
Technical Contact: Edward Thomas
(202) 426-2360

To investigate the nature of public transportation and private investment to determine the relationship between them, policies relating to them, measures of their profitability, and their impact on land use.

Transportation System Management (TSM)

Enforcement Component in Short-Range Transportation Planning (MA-11-0034)
Funding: $39,200
Schedule: Sept. 1979-Aug. 1980
Grantee: Massachusetts Institute of Technology
(Prof. M. Meyer)
Technical Contact: Richard Steinmann
(202) 426-2360

To develop an understanding of the role of enforcement agencies in the transportation planning process, as well as the institutional barriers to their participation in the planning process.

Public Transportation Systems and Services for Low-Density Areas

An Analysis of the Potential for Dynamic Ride-Sharing in a Low-Density Area (CT-11-0001)
Funding: $69,973
Schedule: July 1979-Sept. 1980

Grantee: University of Connecticut
(Prof. C. Davis)
Technical Contact: Jim Stratton
(202) 426-4060

To investigate the effectiveness of an on-line computer matching system for non-work trip ride sharing in a low-density area.

Design of Consumer-Oriented Services to Regional Malls (WA-11-0008)
Funding: $73,284
Schedule: June 1980-June 1981
Grantee: University of Washington
(Prof. J. Schneider)
Technical Contact: Joseph Goodman
(202) 426-4984

To identify which alternative transit service concepts would be preferred most by travelers to regional shopping malls.

Monitoring the Implementation of Innovative Public Transportation Services (IL-11-0012)
Funding: $95,561
Schedule: Sept. 1977-Feb. 1981
Grantee: Northwestern University
(Profs. J. Hauser and
F. Koppelman)
Technical Contact: Mary Martha
Churchman
(202) 426-4984

To monitor, document, and evaluate the implementation of two innovative public transportation systems in Illinois; one system is a combination of subscription and dial-a-ride services, the other is a combination of fixed-route feeder, subscription, and route-deviation services.

A Public Transportation Needs Study for the Low-Density Areas in the Midwest (KS-11-0001)
Funding: $64,680
Schedule: Oct. 1979-Oct. 1980
Grantee: University of Kansas
(Prof. J. Lee)
Technical Contact: Catherine Regan
(202) 426-2053

To study the unique needs and systems of communities in the low-density areas of the Midwest; seminars will be conducted to address the need for public transportation planning and supply.

Paratransit Integration in Medium and Small Cities (TX-11-0011)
Funding: $68,101
Schedule: June 1979-May 1980
Grantee: University of Texas, Austin
(Prof. S. Rosenbloom)
Technical Contact: Jack Bennett
(202) 426-4050

To develop methods of identifying classes of riders versus assistance requirements, the overlapping of vehicle/personnel assistance needs, and related cost questions.

Public Transportation Systems and Services for Low-Density Areas (WA-11-0007)
Funding: $48,994
Schedule: July 1979-June 1980
Grantee: University of Washington
(Prof. J. Schneider)
Technical Contact: Kenneth Walker
(206) 442-4210

To study low-density area transit centers and produce a handbook suitable for use by transit planners.

Network Concepts for Improved Bus Services in Low-Density Areas (PA-11-0021)
Funding: $44,860
Schedule: July 1979-Sept. 1980
Grantee: University of Pennsylvania
(Prof. V. Vuchic)
Technical Contact: Joseph Goodman
(202) 426-4984

To analyze possible methods of improving the level of transit services in low-density areas by offering an integrated network of routes with coordinated schedules, and information systems supported by modern marketing techniques.

Transit Productivity and Efficiency

Comparative Analysis of Transit Performance (CA-11-0020)
Funding: $69,177
Schedule: July 1980-June 1981
Grantee: University of California, Irvine
(Prof. G.J. Fielding)
Technical Contact: Donald Chapman
(202) 426-9157

To develop norms for a standard set of performance indicators and compare these norms across different types of fixed-route bus operations.

Train Crew Reduction for Increased Productivity of Rail Transit (PA-11-0023)
Funding: $69,791
Schedule: July 1980-June 1981
Grantee: University of Pennsylvania
(Prof. V. Vuchic)

Technical Contact: Robert Abrams
(202) 426-6997

To analyze duties of rail transit train crews and attempt to develop methodologies for reducing train crew size, thereby increasing the productivity of rail transit.

Market Segmentation Marketing Strategy: A Low Capital Method to Improve Bus Transit Ridership (TN-11-0004)
Funding: $56,152
Schedule: June 1979-Sept. 1980
Grantee: Tennessee State University
(Prof. V. Surti)
Technical Contact: Carol Kerr
(202) 426-9274

To examine consumer travel behavior and market segmentation marketing methods in an attempt to provide an understanding of these processes and their interrelationships.

Field Application and Evaluation of Bus Transit Performance Indicators (IN-11-0005)
Funding: $61,952
Schedule: June 1979-Dec. 1980
Grantee: Purdue University
(Prof. K. Sinha)
Technical Contact: Brian McCollom
(202) 472-5140

To refine and improve transit productivity, efficiency, and performance measures by field applications and evaluation.

Transportation and Energy Conservation

The Effects of Potential Fuel Limitations and Price Increases on Travel Patterns and Mode Choice (CA-11-0021)
Funding: $40,204
Schedule: June 1980-March 1981
Grantee: University of California, Berkeley
(Prof. W. Garrison)
Technical Contact: Jimmy Yu
(202) 426-0080

To study the manner in which various energy availability and price configurations are likely to affect the use of urban public transportation and mode choices.

Urban Transportation Energy Accounts, Analysis and Methods (IL-11-0027)
Funding: $79,425
Schedule: July 1978-Oct. 1980
Grantee: University of Illinois, Champaign-Urbana
(Profs. D. Boyce and M. Romanos)
Technical Contact: Richard Cohen
(202) 426-4060

To develop a study of the Chicago region to analyze the relationship of energy consumption to various combinations of transportation services and land use patterns; also, to develop a manual of procedures for analyzing energy use, transportation services, and land use relationships.

Development and Implementation of Dynamic Methodologies for Evaluating Energy Conservation Strategies (MN-11-0004)
Funding: $70,033
Schedule: Aug. 1980-July 1981
Grantee: University of Minnesota
(Prof. Y. Stephenedes)
Technical Contact: Carl Rappaport
(202) 426-4168

To identify and evaluate regional energy, economic, environmental, and mobility indicators to be used for evaluating dynamic energy conservation policies with special emphasis on long-range policy evaluation.

Identification, Analysis and Evaluation of Alternative Actions for Achieving Energy Savings (TX-11-0010)
Funding: $68,010
Schedule: Aug. 1979-Nov. 1980
Grantee: Rice Center
(Prof. P. Rowe)
Technical Contact: Richard Cohen
(202) 426-0060

To identify alternative public policies and transportation strategies that can potentially reduce energy consumption; alternative strategies and the practical feasibility of applying these strategies will be evaluated.

Transportation for the Elderly and Handicapped

Development of Practical Manuals for Operating Local Elderly and Handicapped Transportation Systems (TX-11-0013)
Funding: $38,582
Schedule: Sept. 1980-Aug. 1981
Grantee: University of Texas, Austin
(Prof. S. Rosenbloom)
Technical Contact: Patricia Cass
(202) 426-4984

To prepare a series of brief, simple, straightforward manuals, each dealing with one major issue of importance to local transportation providers for elderly and handicapped people.

The Study of Informal Transportation Networks and the Implications of the Operations of these Networks for the Development of Effective Transportation Programs for the Elderly and Handicapped (WV-11-0002)
Funding: $49,237
Schedule: May 1979-Oct. 1980
Grantee: West Virginia University
(Prof. W. Smith)
Technical Contact: Lynn Sahaj
(202) 426-4984

To study issues associated with the "actual" potential ridership for special public transportation programs; existing data will be used.

Transportation Pricing and Financing

The Redistributive Impact of Transit Services Financing (IL-11-0029)
Funding: $50,400
Schedule: May 1980-April 1981
Grantee: Illinois Institute of Technology
(Prof. S. Rock)
Technical Contact: Vince Milione
(202) 426-4984

To examine the equity of transit investments and services by investigating the redistributive impact (who pays vs. who benefits) inherent in a transit project.

Equity in Transit Financing: A Quantitative Assessment of the Impacts of Fare Structure, Subsidy Expenditures, and Tax Burdens on Low Income and Minority Groups (NJ-11-0010)
Funding: $75,364
Schedule: July 1980-Sept. 1981
Grantee: Rutgers University
(Prof. J. Pucher)
Technical Contact: Harry Takai
(202) 426-9150

To estimate the extent of finance inequities at an aggregate, nationwide level; assess in detail finance inequities in approximately five representative metropolitan areas; and propose alternative policies for reducing inequities in transit financing.

A Training Program for Upper-Level Transit Managers (TX-11-0012)
Funding: $69,444
Schedule: Sept. 1980-Nov. 1981
Grantee: Texas A&M University
(Prof. V. Stover)
Technical Contact: Charles Morison
(202) 426-9274

To conduct an executive seminar for upper-level transit managers to address the problems of small bus operations in the southwestern United States.

Future Directions

Long-Range Prospects and Requirements for Urban Public Transportation (PA-11-0019)
Funding: $68,213
Schedule: July 1979-Oct. 1980
Grantee: University of Pennsylvania
(Prof. A. Tomazinis)
Technical Contact: Jimmy Yu
(202) 426-0080

To study the cause-and-effect relationships among changing factors which influence urban public transportation in order to develop a better understanding of long-range program directions.

State-of-the-Art

State-of-the-Art Review on the Routing and Scheduling of Vehicles and Crews (MD-11-0004)
Funding: $35,203
Schedule: June 1980-May 1981
Grantee: University of Maryland
(Prof. L. Bodin)
Technical Contact: Ronald Fisher
(202) 426-9271

To review the state-of-the-art of the routing and scheduling of vehicles and crews to provide planners with the various planning and analysis tools available.

State-of-the-Art Literature Review on Integrated Planning and Facilities Design for Pedestrians (IA-11-0004)
Funding: $13,658
Schedule: July 1980-June 1981
Grantee: Iowa State University
Technical Contact: John Fegan
(202) 426-9271

To produce a comprehensive state-of-the-art literature review of pedestrian facilities and planning to provide planners with access to a variety of information.

State-of-the-Art Review of Urban Freight Movement (PA-11-0020)
Funding: $44,860
Schedule: Oct. 1979-Sept. 1980

Grantee: Pennsylvania State University
(Proj. K. Crowley)
Technical Contact: Michael Halladay

To identify and evaluate the existing literature on urban freight movement and prepare a state-of-the-art document.

Multi-Activity Research and Training Program Grants

Research and Training Program Grant (IL-11-0028)
Funding: $348,698
Schedule: June 1979-June 1982
Grantee: University of Illinois, Chicago Circle
(Prof. R. Michaels)
Technical Contact: Judy Meade
(202) 426-0082

To develop and apply a bus maintenance model; travel behavior, as it relates to transit service information needs and paratransit management arrangements will be assessed; workshops will be held for planners and engineers; and paratransit services will be coordinated in each region.

Research and Training Program Grant (NC-11-0009)
Funding: $350,000
Schedule: July 1979-June 1982
Grantee: North Carolina A&T State University
(Prof. A. Saltzman)
Technical Contact: Philip Hughes
(202) 426-0080

To conduct research on 1) local transportation financing, 2) market segmentation of the elderly and handicapped in small urban areas, 3) analyses of Census Mobility Data to test various hypotheses on travel behavior, 4) identification of the state-of-the-art of paratransit and transit market interactions, 5) conduct the Paratransit Executive Institute, and the Transportation Management Institute.

Research and Training Program Grant (NY-11-0023)
Funding: $350,000
Schedule: Sept. 1979-Aug. 1982
Grantee: Polytechnic Institute of New York
(Prof. L. Pignataro)
Technical Contact: Nat Jasper
(202) 426-0081

To study the impact of fully accessible vehicles on the operating costs of bus transit service; an energy contingency plan for a local jurisdiction will be designed; a prior study of future national directions in urban transportation will be extended; pricing options for a model to provide total system pricing for a multimodal network, and short courses on transportation planning, will be prepared.

Research and Training Program Grant (MA-11-0035)
Funding: $287,515
Schedule: Sept. 1980-Aug. 1983
Grantee: Massachusetts Institute of Technology
(Prof. N. Wilson)
Technical Contact: Nat Jasper
(202) 426-0081

To develop short-range transit improvement strategies and define the role of transit in accommodating future energy shortages; simple performance models for flexible-route feeder service, and a transit planning course, will be developed.

Research and Training Program Grant (WV-11-0003)
Funding: $290,000
Schedule: July 1980-June 1983
Grantee: West Virginia University
(Prof. S. Elias)
Technical Contact: Philip Hughes
(202) 426-0080

To study the visual impacts of AGT guideways, electric power and energy requirements for AGT vehicles, optimization of AGT route alignment, and feasibility of power transfer to vehicles at AGT stations.

Other Projects

Dissemination of the Transportation Brokerage Concept (TN-11-0005)
Funding: $41,769
Schedule: May 1980-Dec. 1981
Grantee: University of Tennessee
(Prof. R. Mundy)
Technical Contact: Judy Meade
(202) 426-0082

To increase the potential for effective, efficient, and economical local public transportation services by providing a training program in the transportation brokerage concept for transit professionals and academicians.

Optimal Design Methodology for Elevated Automated Guideway Transit Spans (NC-11-0010)
Funding: $60,000
Schedule: June 1980-May 1981
Grantee: Duke University
(Prof. J. Wilson)
Technical Contact: George Izumi
(202) 426-4047

To develop a methodology for the optimal design of practical, least-weight, dynamically balanced AGT guideway structures.

Bibliography

This list identifies final research reports published through September, 1980 by UMTA's University Research and Training (URT) Program subsequent to completion of the December 1979 Supplement to *Abstracts for University Research Projects*. A National Technical Information Service (NTIS) order number is indicated for each report.

Reports generated by current URT projects listed elsewhere in this chapter may become available during the coming year. For information on those reports, contact the technical person associated with each project.

UMTA University Research and Training Program Abstracts
Proj. UPP-30
Urban Mass Transportation Administration
February 1978, PB 278-646

Abstracts for University Research Projects-Supplement
Proj. UPP-30
Urban Mass Transportation Administration
December 1979, PB 80-148547

TRANSPORTATION ANALYSIS, PLANNING, AND EVALUATION

The Census and Transportation Planning: Survey of Evaluations and Recommendations as to the Usefulness of 1970 Census Data in Urban Transportation Planning
Proj. VA-11-0003
Virginia Polytechnic Institute and State University
January 1976, PB 254-802

Accessibility Applications in Urban Transportation
Proj. VA-11-0002
Virginia Polytechnic Institute and State University
January 1977, PB 269-240

User Documentation for the Metropolitan Accessibility Program
Proj. VA-11-0002
Virginia Polytechnic Institute and State University
January 1977, PB 269-239

The Significance of Telecommunications as a Partial Substitute for Transportation
Proj. PA-11-0013
Carnegie-Mellon University
September 1976, PB 284-718

Advanced Dial-A-Ride Algorithms Research Project
Proj. MA-11-0024
Massachusetts Institute of Technology
March 1976, PB 254-752

A Computerized Bus Transit Management Information System Using Credit Card Fare Collection Information
Proj. NY-11-0001
Rensselaer Polytechnic Institute
April 1976, PB 255-982

A Modal Split Model for High Density Urban Corridors
Proj. IL-11-0008
University of Illinois, Chicago Circle
March 1978, PB 284-745

Elementary Analysis—Manual Methods Trip Distribution Modeling
Proj. IL-11-0008
University of Illinois, Chicago Circle
March 1978, PB 285-179

Market Segmentation Analysis: The Potentials of Cartographic Analysis and Census Data
Proj. IL-11-0008
University of Illinois, Chicago Circle
March 1978, PB 285-056

Methodology for Identifying Urban Transportation Technology Alternatives
Proj. IL-11-0008
University of Illinois, Chicago Circle
March 1977, PB 271-225

Preliminary Systems Design for a Multi-Purpose Transit Planning and Management Information System
Proj. WA-11-0005
University of Washington
March 1976, PB 255-178

An Interactive Spatial Analysis and Display System
Proj. WA-11-0005
University of Washington, Seattle
July 1977, PB 280-693

Utilizing Geographic Basefiles for Transportation Analysis: A Network Basefile System
Proj. WA-11-0005
University of Washington
June 1977, PB 275-586

Employer Vanpool Programs: Factors in Their Success or Failure
Proj. WA-11-0005
University of Washington
June 1977, PB 276-955

Urban Freight Consolidation: Legal, Attitudinal, and Operations Considerations Associated with Implementation
Proj. OH-11-0001
Ohio State University, Columbus
May 1978, PB 286-547

The Location and Sizing of Urban Freight Terminals with Multiple Planning Periods: The Urban Terminal Investment Model (UTIM)
Proj. OH-11-0001
Ohio State University, Columbus
December 1977, PB 286-490

A Methodology for Determining Characteristics of Small Shipments
Proj. OH-11-0001
Ohio State University, Columbus
July 1976, PB 279-649

Management of Vehicular Traffic Facilities for Better Transit Movement: Some Aspects
Proj. NY-11-0009
Polytechnic Institute of New York
December 1976, PB 267-942

RAM: A Normative Tool for Transit Route Planning
Proj. NY-11-0009
Polytechnic Institute of New York
September 1977, PB 275-213

Taxicab Utilization by Lower Income Groups
Proj. NC-11-0004
North Carolina A&T State University
October 1976, PB 269-581

Establishing Innovative Taxicab Services: A Guidebook
Proj. NC-11-0005
University of North Carolina
August 1977, PB 278-647

Integrated Para-Transit Transportation Planning for Off-Peak Low-Density Travel—Report 1: Off-Peak Trip Characteristics
Proj. IL-11-0023
University of Illinois at Chicago Circle
September 1978, PB 295-464

Integrated Para-Transit Transportation Planning for Off-Peak Low-Density Travel—Report 2: Elderly and Handicapped Transportation
Proj. IL-11-0023
University of Illinois at Chicago Circle
September 1978, PB 295-465

Integrated Para-Transit Transportation Planning for Off-Peak Low-Density Travel—Report 3: Planning Methodology
Proj. IL-11-0023
University of Illinois at Chicago Circle
September 1978, PB 295-466

Fare Elasticities for Exclusive-Ride Taxi Services
Proj. NC-11-0006
University of North Carolina
October 1978, PB 296-201

A Study of Transit Rider Characteristics
Proj. NY-11-0014
Polytechnic Institute of New York
November 1978, PB 295-107

Future Directions for Public Transportation: A Basis for Decision
Proj. NY-11-0017
Polytechnic Institute of New York
December 1978, PB 292-781

Methodology for Determining Urban Goods Consolidation Terminal Investment and Location Decisions: Executive Summary
Proj. OH-11-0001
Ohio State University
December 1977, PB 288-760

On-Board Transit Origin-Destination Survey Data: Expanding Their Use Via On-Line Data Access and Analysis
Proj. WA-11-0005
University of Washington
September 1978, PB 294-967

Peninsula Transit Study: Simplified Transit System Planning and Assessment Processing for Low-Density, Small to Medium Sized Cities
Proj. VA-11-0007
Hampton Institute
October 1978, PB 291-879

Transit Problems in Small Cities and Non-Urbanized Areas: Inventory of Transportation Services in Places Less than Ten Thousand Population Outside of Urbanized Areas
Proj. NC-11-0004
North Carolina A&T State University
April 1978, PB 291-402

Measuring the Achievement of National Urban Transportation Goals and Objectives: The Role of Metropolitan Planning Organizations
Proj. IA-11-0001
University of Iowa
November 1978, PB 300-417/AS

Public Transportation Planning Effectiveness: Case Studies
Proj. IA-11-0001
University of Iowa
December 1978, PB 300-418/AS

Transit Service and Organizational Alternatives for a Low Density Suburban-Rural Area: A Study of Public Transit Options for Albemarle County, Virginia
Proj. VA-11-0006
University of Virginia
May 1979, PB 299-475/AS

Self-Sustaining Public Transportation Services—Volume I: Guidelines for Implementation
Proj. PA-11-0017
University of Pennsylvania
November 1979, PB 80-196140

Self-Sustaining Public Transportation Services—Volume II: Technical Report
Proj. PA-11-0017
University of Pennsylvania
November 1979, PB 80-196157

Feasibility of a Complementary Solution to the Bus Operator Scheduling Problem
Proj. WV-11-0001
West Virginia University
December 1979, PB 80-138282

Logit Analysis of Rapid Transit Access Choices
Proj. VA-11-0005
University of Virginia
June 1979, PB 80-159411

Logit Analysis of Rapid Transit Access Choices—Executive Summary
Proj. VA-11-0005
University of Virginia
June 1979, PB 80-159403

Increasing Transit's Share of the Regional Shopping Center Travel Market: An Initial Investigation
Proj. WA-11-0006
University of Washington
August 1979, PB 80-131360

TRANSPORTATION AND LAND USE INTERACTIONS

Potential for Betterment District Financing and Joint Development Applications to Surface Transit
Proj. WA-11-0005
University of Washington, Seattle
July 1977, PB 274-618

Urban Transportation and Neighborhood Preservation
Proj. MD-11-0003
University of Maryland
September 1978, PB 290-590

Guidelines for Undertaking a Neighborhood Transportation Needs Assessment
Proj. MD-11-0003
University of Maryland
November 1978, PB 290-589

Baltimore's Hollins Park Neighborhood: A Transportation Case Study
Proj. MD-11-0003
University of Maryland
September 1978, PB 290-592

Pittsburgh's Central Northside Neighborhood: A Transportation Case Study
Proj. MD-11-0003
University of Maryland
September 1978, PB 290-591

The Effect of the Washington Metro on Urban Property Values
Proj. Ma-11-0004
Massachusetts Institute of Technology
July 1978, PB 293-730

Feasibility Analysis of Joint Development for Transit Stations in the Detroit Area
Proj. MI-11-0003
Wayne State University
November 1978, PB 295-347

Joint Development Report
Proj. TX-11-0006
Rice Center
June 1979, PB 80-150139

An Analysis of Joint Development Projects: Final Report on First Year Tasks
Proj. NY-11-0020
State University of New York at Buffalo
May 1979, PB 300-414/AS

TRANSIT MANAGEMENT PRODUCTIVITY, AND EFFICIENCY

Bus Actuated Signal Preemption Systems: A Planning Methodology
Proj. WI-11-0003
University of Wisconsin, Milwaukee
May 1976, PB 165-797

Improving Urban Mass Transportation Productivity
Proj. MA-11-0026
Harvard University
February 1977, PB 266-920

Design for a National Urban Transportation Reporting System
Proj. PA-11-0002
University of Pennsylvania
1976, PB 259-002

The Role of Security in Marketing Urban Mass Transportation
Proj. IL-11-0008
University of Illinois, Chicago Circle
February 1977, PB 271-224

Factors Influencing the Adoption of Management Innovation in the CTA
Proj. WI-11-0002
Marquette University
July 1976, PB 226-154

Development of Performance Indicators for Transit: Final Report
Proj. CA-11-0014
University of California
December 1977, PB 278-678

Transit Performance Measures: Their Significance in Local Funding Allocation
Proj. WA-11-0005
University of Washington
June 1977, PB 276-141

Transit Authority Boards of Directors: Membership, Organization, Functions, and Performance
Proj. PA-11-0010
Pennsylvania State University
October 1976, PB 265-744

The Effects of Labor Strikes on Bus Transit Use
Proj. IN-11-0003
Purdue University
December 1976, PB 267-077

Labor Relations in Urban Transit
Proj. WI-11-0004
University of Wisconsin, Madison
August 1977, PB 274-059

The Legal Framework for Collective Bargaining in the Urban Transit Industry
Proj. WI-11-0004
University of Wisconsin, Madison
November 1976, PB 266-110

A Comprehensive Analysis of Urban Bus Transit Efficiency and Productivity: Executive Summary
Proj. IN-11-0003
Purdue University
December 1978, PB 295-220

A Comprehensive Analysis of Urban Bus Transit Efficiency and Productivity: Part I. Definition and Measurement of Urban Transit Performance
Proj. IN-11-0003
Purdue University
December 1978, PB 295-221

A Comprehensive Analysis of Urban Bus Transit Efficiency and Productivity: Part II. Labor Aspects of Urban Bus Transit Productivity
Proj. IN-11-0003
Purdue University
December 1978, PB 295-222

A Comprehensive Analysis of Urban Bus Transit Efficiency and Productivity: Part III. Analysis of Options to Improve Urban Transit Performance
Proj. IN-11-0003
Purdue University
December 1978, PB 295-223

Preferential Bus Lanes on Urban Arterials—Selected Studies on Their Feasibility and Performance
Proj. NY-11-0014
Polytechnic Institute of New York
December 1978, PB 294-673

Transit Productivity: Improvement Through Management Training and Development
Proj. NY-11-0019
City University of New York,
John Jay College
June 1979, PB 299-369

The Effect of Organization Size and Structure on Transit Performance and Employee Satisfaction
Proj. CA-11-0016
University of California at Irvine
December 1978, PB 296-629

Application of Transit Performance Indicators
Proj. UT-11-0001
University of Utah
September 1979, PB 80-121569

Handbook for Management Performance Audits—Volume I
Proj. IN-11-0004
Indiana University
October 1979, PB 80-117484

Handbook for Management Performance Audits—Volume II
Proj. IN-11-0004
Indiana University
October 1979, PB 80-117492

Northeast Labor-Management Conference on Issues in Urban Transit
Proj. WI-11-0006
University of Wisconsin/Madison
September 1979, PB 80-155526

TRANSPORTATION FOR THE ELDERLY AND HANDICAPPED

Assuming Responsibility for Mobility of Elderly and Handicapped: The Role of Transit Properties, Transit Planners, and Social Service Agencies in Small Cities
Proj. NC-11-0004
North Carolina A&T State University
July 1976, PB 267-231

Cost-Effectiveness Measures for Transportation Services for the Elderly and Handicapped
Proj. TX-11-0009
University of Texas/Austin
October 1979, PB 80-141880

Negotiating the Subway by the Elderly and Handicapped: METRO—A Case Study
Proj. DC-11-0006
Howard University
September 1979, PB 80-156995

Negotiating the Subway by the Elderly and Handicapped: METRO—A Case Study—Executive Summary
Proj. DC-11-0006
Howard University
September 1979, PB 80-156987

TRANSPORTATION PRICING AND FINANCING

Estimation of the Operating Cost of Mass Transit Systems
Proj. NY-11-0012
State University of New York, Stony Brook
September 1976, PB 262-729

Sources of Non-Federal Support for Public Transportation Programs in Non-Urbanized Areas
Proj. NC-11-0004
North Carolina A&T State University, Greensboro
June 1978, PB 284-410

Monetization of Transportation Impacts: Policy Evaluation Methodology
Proj. IL-11-0008
University of Illinois, Chicago Circle
April 1978, PB 284-585

Fare Policy and Structure
Proj. NY-11-0014
Polytechnic Institute of New York
September 1978, PB 289-194

The Feasibility of State-Level Multi-Modal Transportation Trust Funds
Proj. NY-11-0014
Polytechnic Institute of New York
November 1978, PB 292-396

Impacts of Transit Subsidies on Modal Efficiency
Proj. IA-11-0001
University of Iowa
October 1978, PB 300-416

Evaluation of Ridership, Revenue and Equity Implications of Distance-Based Fares for Transit Systems
Proj. NY-11-0016
State University of New York at Albany
December 1979, PB 80-148695

The Financing of Multijurisdictional Public Transportation Services
Proj. NC-11-0008
North Carolina A&T State University
March 1980, PB 80-198625

IMPROVING TRANSPORTATION IN CENTER CITIES

Transit's Role in the Creation of the Polycentric City: An Initial Assessment
Proj. WA-11-0005
University of Washington
August 1977, PB 275-043

Urban Corridor Trip Distribution Models: A Study of the Chicago Area Using the Census UTPP Data
Proj. IL-11-0008
University of Illinois, Chicago Circle
September 1977, PB 275-161

Factors Influencing the Success of Company-Based Carpooling Programs
Proj. NC-11-0004
North Carolina A&T State University
May 1976, PB 259-434

Taxicab Characteristics in Small and Medium-Size Cities
Proj. NC-11-0003
University of North Carolina, Chapel Hill
January 1976, PB 251-984

Vanpools for Urban Transportation—Their Legislative Base, Promotion and Potential
Proj. WA-11-0005
University of Washington, Seattle
June 1977, PB 279-590

Urban Design and Usage Factors of Paratransit Vehicles and Facilities
Proj. NY-11-0011
Pratt Institute
April 1976, PB 255-541

Central Area Auto Restraint: A Boston Case Study
Proj. MA-11-0007
Harvard University
November 1978, PB 290-913

The Development of an Evaluation Framework for Transportation System Management Strategies
Proj. NE-11-0001
University of Nebraska
August 1978, PB 295-023

Auto-Use Disincentives
Proj. PA-11-0016
University of Pennsylvania
October 1978, PB 299-597

Increasing the Productivity of Urban Expressways: Combining TSM Techniques and Transit Improvements
Proj. MA-11-0031
Harvard University
October 1979, PB 80-150568

Increasing the Productivity of Urban Expressways: Combining TSM Techniques and Transit Improvements—Executive Summary
Proj. MA-11-0031
Harvard University
October 1979, PB 80-181076

Parking Policy as a Transportation System Management Measure
Proj. PA-11-0016
University of Pennsylvania
August 1978, PB 299-515/AS

Impacts of Regulations on the Use of Taxicabs for Paratransit Service
Proj. NC-11-0007
North Carolina A&T State University
June 1978, PB 300-510

Paratransit Resource Guide
Proj. OK-11-0001
University of Oklahoma
June 1978, PB 80-103237

Colonial Taxi Company of Bethel Park, Pennsylvania—Private Enterprise in Paratransit
Proj. OK-11-0001
University of Oklahoma
June 1978, PB 80-103252

The Dial-A-Bat Paratransit Service of Brockton, Massachusetts, Area Transit—Public Transit in Coordinated Human Services Transportation
Proj. OK-11-0001
University of Oklahoma
June 1978, PB 80-103278

Knoxville, Tennessee Commuter Pool—Matching Markets to Modes with Paratransit Brokering
Proj. OK-11-0001
University of Oklahoma
December 1978, PB 80-103286

The Paratransit Services of the Choanoke Area (North Carolina) Development Association—Rural Transit in Coordinated Human Services Transportation
Proj. OK-11-0001
University of Oklahoma
June 1978, PB 80-103260

The Seattle/King County Commuter Pool Program—Paratransit and Rush Hour Congestion
Proj. OK-11-0001
University of Oklahoma
June 1978, PB 80-103245

URBAN TRANSPORTATION TECHNOLOGIES

Vehicle Follower Longitudinal Control for Automated Guideway Transit
Proj. MN-11-0002
University of Minnesota
February 1977, PB 264-554

Analysis and Design of Steering Controllers for Automated Guideway Transit Vehicles
Proj. MA-11-0023
Massachusetts Institute of Technology
September 1976, PB 261-327

Analytical Models for Guideway Surface Irregularities and Terrain Smoothing
Proj. TX-11-0001
University of Texas, Arlington
January 1976, PB 256-847

OTHER

Noise Abatement in Rail Rapid Transit: Effect of Some Variations
Proj. NY-11-0002
Polytechnic Institute of New York
December 1978, PB 292-032

Noise Degradation over Time in Rail Rapid Transit Cars
Proj. NY-11-0002
Polytechnic Institute of New York
December 1978, PB 292-031

Moving People: The Case for Public Transportation
Proj. IL-11-0025
University of Illinois, Chicago Circle
January 1980, PB 80-182-686

Appendixes

APPENDIX A
Sources of UMTA RD&D Information

National Technical Information Service

Reports on UMTA research and development described in this volume are available for purchase from the National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Va. 22161; (703/487-4650). NTIS is the principle repository and disseminating agency for all reports issued in conjunction with federal research and development activities.

There are different ways of purchasing documents from NTIS:

1) *NTIS Deposit Account.* The easiest and fastest way of ordering documents is to establish an NTIS Deposit Account (minimum deposit of $25). Documents can be ordered and the purchase price deducted from your account.
2) *Prepayment.* Send check, payable to NTIS, or money order with request for publication. Always include the NTIS report order number (PB number);
3) *Charge Cards.* Orders can be placed by phone or mail and purchases charged to your American Express, Mastercard, or VISA credit card;
4) *Ship and Bill.* This service is available if you specify it. A service fee of $5 is added to each order; and
5) *Rush Order Service,* (703) 487-4700. This service is available at a $10 surcharge on each report mailed or a $6 surcharge on each report picked up from the Washington, D.C. or Springfield, Virginia office. Orders are shipped or available for pickup within 24 hours after the order is received by NTIS. Items are shipped by priority mail for quick delivery and can be expected within a few days.

NTIS will fill stock items within three days; allow up to two weeks for reprinted reports. Items are normally sent 3rd or 4th class and can take as much as three weeks in the mail.

Most reports in NTIS are also available on microfiche. Microfiche copies have a uniform price of $3.50 per volume for orders sent within the United States, Canada, and Mexico. Foreign price for microfiche copy is $7.00. Copies of the NTIS mail order forms are reproduced at the end of this document and may be photocopied and used for ordering reports.

The Transit Research Information Center

Another repository for UMTA reports is the Transit Research Information Center (TRIC) which operates within UMTA's Office of Planning, Management, and Demonstrations. TRIC maintains a full collection of all UMTA-sponsored reports. Although TRIC does not stock copies of reports for distribution, it will provide, upon request, a one-page technical abstract of any report. It is also possible to request abstracts of all UMTA reports related to a specific topic.

UMTA Abstracts

The annual guides to UMTA's research reports are the *Urban Mass Transportation Abstracts* which contain abstracts of reports sponsored by UMTA that are available for purchase from NTIS. Each volume is indexed by title, author, geographic area, project number, and subject. The abstracts are of reports done under UMTA research, development, and demonstration grants; technical studies grants; and university research and training grants.

The following volumes are available from NTIS:

Volume I, October 1972, PB 213-212;
Volume II, September 1973, PB 225-368;
Volume III, July 1976, PB 264-905;
Volume IV, December 1977, PB 277-290;
Volume V, December 1978, PB 297-355;
Volume VI, December 1979, PB 80-215-999.

Volume VI is the final annual edition of these UMTA-sponsored research reports. Future annual editions will be provided by the Transportation Research Board, and will encompass not only UMTA-sponsored research, but also research abstracts and descriptions of mass transportation activities from many sources, including international. UMTA will continue to publish a bimonthly edition of the *UMTA Abstracts* listing only UMTA-sponsored reports. A cumulative Retrieval Term Index will appear at the end of every third bimonthly abstract. Anyone wishing to receive these abstracts should write to:

Urban Mass Transportation Administration
Office of Transportation Management
Transit Research Information Center
400 Seventh Street, S.W.
Room 6432
Washington, DC 20590

Technology Sharing

UMTA, The Office of the Secretary of Transportation, and the Federal Highway Administration sponsor Technology Sharing programs which provide information relating to urban public transportation. The programs assist state and local governments, transportation agencies, industry, the research community, and the public to locate technical information. They also conduct workshops and training programs and prepare documents which are designed to help local agencies in the evaluation and introduction of new methods or technologies.

Technology Sharing reports are free upon request as long as copies are available. When supplies are exhausted, the documents may be obtained through NTIS, and in some cases through the Superintendent of Documents.

Listed below are reports that may be ordered by title from the Office of Technology Sharing, RSPA, Transportation Systems Center, Kendall Square, Cambridge, MA 02142:

Introductory Publications
Transit Organizations Guide
New Bus Equipment
Automatic Vehicle Monitoring: Program Fact Sheet
Energy Primer
The Taxicab in Transportation: An Annotated Bibliography
Sample State and Local Programs: An Annotated Bibliography

Technical and Management Publications
Urban Rail Tunneling Technology: Program Digest
Urban Rail Noise Abatement: Program Digest
Transportation for the Elderly and Handicapped: Programs and Problems, I
Transportation for the Elderly and Handicapped: Programs and Problems, II
Energy Conservation in Transportation
State-Initiated Transportation Programs: Ten Case Studies

State-of-the-Art Overviews
Rural Passenger Transportation
Priority Techniques for High Occupancy Vehicles
Paratransit

Listed below are publications that may be ordered by title from the Technology Sharing Division, I-25, U.S. Department of Transportation, 400 Seventh Street, Washington, D.C. 20590:

Introductory Publications
Technology Sharing: A Guide to Assistance in Obtaining and Using Research, Development and Demonstration Outputs
Urban Consortium Information Bulletins

Technical and Management Publications
Transit Actions: Techniques for Improving Productivity and Performance
Center City Environment and Transportation: Local Government Solutions
Marketing Rural Public Transportation

Technology Sharing Reprint Series
An Analysis of Transit and Paratransit Options for the Elderly and Handicapped
An Approach to Local Transportation Planning for National Energy Contingencies
Marketing Manual for Transit Operators
Michigan Small Bus Program System Management Handbook
Public Transit Management/Technical Assistance in Iowa
Taxis, The Public, and Paratransit: A Coordination Primer
Transportation Development Planning in Non-Urbanized Areas
The Use of School Buses for Public Transportation

The Federal Highway Administration has prime responsibility for the rural and small city transit program authorized in Section 18 of the UMT Act, and has developed summary information packages, many of which are also useful to urban transportation agencies. These include such topics as noise barriers, bikeway design, ridesharing programs and a wide variety of construction technologies. To expedite its technical assistance programs, the FHWA has established a technology transfer coordinator in its Division Offices located in each state. The Division Offices, normally located in state capitals, are the best initial contact for information about FHWA's technology sharing products and activities. General information on FHWA technical programs may also be obtained by writing to: Implementation Division, HDV-20, Federal Highway Administration, 400 Seventh Street, S.W., Washington, D.C. 20590.

UMTA Public Information Service

UMTA conducts an active public information program through its Office of Public Affairs. Announcements are made of important project milestones, usually through press releases. Anyone wishing to receive such press releases should write to the Office of Public Affairs. The office also publishes a number of brochures, available upon request, describing various UMTA programs and policies.

UMTA's activities are also reported regularly in a magazine published by the Department of Transportation and entitled *Transportation USA.* This magazine is available through the Superintendent of Documents.

Congressional Hearings

Each year UMTA, like all other federal agencies, appears before the Senate and House Appropriations Committees to request funds for the following fiscal year.

An abundance of factual and statistical data concerning UMTA's present program and plans for the future are submitted. Committee members elicit additional information through questioning. The entire transcript, constituting a comprehensive record of UMTA's activities, is published and may be obtained by writing to the two committees: Subcommittee on Transportation, Committee on Appropriations, United States Senate, Washington, D.C. 20510; and Subcommittee on Transportation, Committee on Appropriations, United States House of Representatives, Washington, D.C. 20515.

The Department of Transportation (DOT) Library

DOT's library began operation in 1969 when the libraries of the Bureau of Public Roads, the Coast Guard and the Federal Aviation Administration were consolidated. The Bureau of Public Roads' library had extensive materials on urban mass transportation and the collection has been substantially enriched since it was taken over by DOT. The library maintains all reports produced by UMTA's R&D program and contains approximately 500,000 volumes and pamphlets and 170 drawers of vertical file material. The library re-

ceives more than 1,500 periodical titles. Most materials are available from interlibrary loan.

UMTA Files

In conformance with the Freedom of Information Act, UMTA has established within the Office of Public Affairs a document inspection facility. This facility is open to the public during regular working hours. The following records are available for inspection at the facility:

- Any final opinions and orders made in the adjudication of cases and issued within the administration;
- Any policy or interpretation issued within the administration, if that policy or interpretation can reasonably be expected to have precedential value in any case involving a member of the public;
- Any administrative staff manual or instruction to staff which affects any member of the public;
- An index to the material described above.

Any person desiring to inspect such a record or to obtain a copy must submit a written request, specifying the record, to the Director of Public Affairs, Rm. 9330, Urban Mass Transportation Administration, Nassif Building, 400 Seventh Street, SW, Washington, D.C. 20590. Each request for a copy must be accompanied by the appropriate fee. Prices for various kinds of copies are given in 49 C.F.R., Part 7, Section 7.95. Photocopies are 25 cents for the first page and 5 cents for each additional page. The fees prescribed may be paid by check, draft or postal money order, payable to the Treasurer of the United States.

Any person to whom a record is not made available within a reasonable time after submission of a written request, or any person who has been notified that a record he has requested cannot be disclosed, may apply in writing to the Administrator, Urban Mass Transportation Administration, for reconsideration of the request. The decision of the Administrator is final.

Correspondence with UMTA

UMTA is responsive to letters of inquiry. Letters addressed to the Administrator will be routed to the appropriate offices for reply.

UMTA headquarters and most offices are located in the Nassif Building at 400 Seventh Street, SW, Washington, D.C. 20590.

APPENDIX B

Urban Mass Transportation Grants and Contracts: Application and Procurement Procedures

Introduction

The Department of Transportation issues a publication entitled *Contracting with the Department of Transportation* (DOT P 4200.1) which provides information intended for organizations desiring to do business with the government.

The document is available free of charge from the Procurement Operations Division (M-43), Office of the Secretary, Department of Transportation, 400 Seventh Street, SW, Washington, D.C. 20590. While neither the pamphlet nor this appendix is a substitute for the official rules and regulations governing procurement, they should provide useful background information and serve as initial guides in a somewhat complex field.

Methods of Funding

UMTA funding is provided in three ways—through grants, contracts, or cooperative agreements. Grants (usually to state or municipal governments, transit properties, universities, or nonprofit organizations) are made in cases where the primary purpose of the funding is to benefit the grant recipient's own project or program, rather than to benefit a government project or program. A grant might be proper, for example, to assist an organization-sponsored project which produces training materials or technical documents which are needed by the organization or those it serves. Contracts are used when the purpose of the funding is to acquire goods or services needed by UMTA to carry out its own programs. The Federal Grant and Cooperative Agreement Act of 1977 provides for still another funding instrument—the cooperative agreement, used when the primary purpose is to distribute federal benefits to a client organization but with substantial federal involvement in the execution of the agreement.

Grants

A grant award is essentially a two-step process involving the UMTA Administrator's approval of a project and the amount of the grant deemed necessary to accomplish it, followed by the execution of a grant agreement which becomes the basic document describing the mutual obligations of the government and the grantee with respect to the project.

Those interested in applying for a grant should follow the guidance provided by the UMTA Circular 6100.1, July 9, 1979, entitled *Application Instructions for Section 6, Research, Development and Demonstration (RD&D) Grants and Cooperative Agreements*. This can be obtained from the Office of Administrative Services (UAD-40), Urban Mass Transportation Administration, 400 Seventh Street, Washington, D.C., 20590. A reading copy is available in the UMTA Office of Public Affairs, Room 9330 at the same address.

Contract Procurement

The contract procurement process is circumscribed by an extensive body of federal contract law. Any firm wishing to do business with the federal government should have ready access to the federal procurement regulations. A copy of Title 41 of the *Code of Federal Regulations* may be procured at nominal cost from the Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402.

Contract procurements are made by either formal advertising or negotiation as described below. Regardless of whether the formal advertising or negotiated method of procurement is used, DOT tries to obtain the maximum amount of competition consistent with efficient administration practices. This includes, as appropriate, notifying all interested suppliers on its Bidders' Mailing List (described below), and any other known suppliers of the procurement, and placing notice of the procurement in public places, including the Department of Commerce *Commerce Business Daily*.

Under formal advertising, invitations for bids are issued to solicit for articles or services. All bids are submitted sealed and are kept in a locked box until the time and date specified; they are then publicly opened, read, and made available for public inspection. A contract is then made to the lowest responsible bidder meeting all conditions and specifications contained in the invitation. Formal advertising is the preferred method of procurement for construction, repair, or alteration projects which may exceed $2,000, and for all other transactions which exceed $2,500.

The negotiated method of procurement is used in those instances where it is impractical to obtain the article or service by formal advertising. This situation often occurs where there is only one firm able to furnish a particular item, where definitive specifications are not available, or where there is an urgent need for the articles or services. Generally research and development procurements are conducted by negotiation. In negotiated procurements, the solicitation is usually referred to as a "Request for Quotation" or a "Request for Proposal." The solicitation provides all of the information necessary for submitting a proposal.

Bidders' Mailing List

Each DOT procurement office tries to obtain as many contractor sources for supplies and services as possible. To do so, each maintains a bidder's mailing list which identifies the equipment, supplies, materials, or services that vendors wanting to do business with the U.S. Government desire to sell.

To be placed on a Bidders' Mailing List, a contractor (other than Architect and Engineering (A&E) firms) must submit a Standard Form 129, Bidders' Mailing List Application, with complete and exact information about the products or services on which the contractor wishes to bid. Architect and Engineering (A&E) firms desiring to do work for DOT should submit a Standard Form 254, US Government Architectural and Engineering Questionnaire, to DOT procurement offices.

Copies of the application forms for the Bidders' Mailing List are available at all government procurement offices, and a copy of both SF-129 and SF-254 are attached to the DOT pamphlet, *Contracting with the Department of Transportation.* An acceptance by DOT of an SF-129 or SF-254 does not automatically signify prequalification for any specific requirement; a pre-award survey to determine a contractor's qualifications still may be necessary. Through submission of these Standard Forms, a contractor is placed on the mailing list of the procurement office receiving the form. To be placed on more than one procurement office Bidders' Mailing List, vendors must file separate forms with each DOT administrative office where they want to be listed. To be listed for UMTA procurements, potential contractors should mail the completed form to Program and Operations Support Division (UAD-72), Urban Mass Transportation Administration, Department of Transportation, 400 Seventh Street, S.W., Washington, D.C. 20590.

No one whose address is on the Bidders' Mailing List, however, should feel assured of receiving notification of all Request For Proposals (RFP) that may be of interest. Notifications are made selectively to firms which have claimed special skills or resources closely related to the topics covered by the RFP. However, all RFP's are recorded in the *Commerce Business Daily,* described below.

Pre-Award Surveys

Before awarding a contract, the contracting officer may require additional information to make sure that the prospective supplier is capable of performing satisfactorily under the specific contract. To do so, he may conduct an onsite pre-award study to determine:

1) Production capability for the items involved;
2) A description of the products normally produced by the prospective supplier;
3) Number and categories of present employees;
4) Available plant and transportation facilities;
5) Previous experience with U.S. Government contracts;
6) Financial status and other pertinent facts to indicate the responsible character of the firm;
7) Related information which indicates the nature and scope of the firm's operations; and
8) Ability to comply with the Equal Employment Opportunity Requirements.

Unsolicited Proposals

Prospective DOT contractors can make their new ideas and novel concepts known by submitting an unsolicited proposal to the procurement office which buys the type of item or service being proposed. The prospective contractor does not have to submit an SF-129 or be on the Bidder's Mailing List to submit an unsolicited proposal.

An unsolicited proposal is an offer initiated and submitted to the Department of Transportation by a prospective contractor, without solicitation from the Government, with the objective of obtaining a contract. It is used to submit, for purposes of evaluation, unique or novel concepts which the prospective contractor has originated, conceived, developed, or owns, and which have application to the work of DOT or one of its administrations. Acceptance of these proposals for evaluation does not imply a promise to pay, a recognition of novelty or originality, or any restriction on the use of information contained therein to which the U.S. Government would otherwise be entitled, nor does the fact that a procurement may follow receipt of, or is based on, an unsolicited proposal, in and of itself sufficient to justify sole source procurement.

To facilitate processing, prospective contractors are urged to submit their proposals without restrictions on the use of technical data included therein. However, in cases where the submitter wants technical data which is included in the proposal to be used only for purposes of evaluation, and wishes to retain proprietary interest in such data, certain specific procedures and markings described in the pamphlet, *Contracting with the Department of Transportation* must be followed.

UMTA's RD&D program has been formulated after several years of study and experience. It is the product of a thorough planning process which continually updates and refines the programs. Because of the lead times required in funding UMTA's RD&D program, many highly useful projects are deferred, and many others are eliminated by higher priority needs. This statement is not intended to discourage innovative and well qualified unsolicited proposals but to communicate the fact that all formative projects are subject to continuing priority challenges.

Minority Business Enterprise (MBE)

DOT actively supports the minority business enterprise program established by Executive Order 11625. In each procurement office a minority business liaison official is responsible for providing assistance to minority firms desiring to do business with that office. Contracts are awarded under the Small Business Administration Section 8(a) procedures, and efforts are made to ensure that MBE firms have an opportunity to bid or offer proposals for competitive awards. Problems in this program which cannot be resolved with the local

officials may be presented to the Director of Installations and Logistics, Office of the Secretary, Washington, D.C. 20590.

UMTA directives on procurement procedures ensure that maximum opportunity is extended to minority and women's business enterprises to provide the services needed. To this end, each project manager is required to prepare a Business Opportunity Memorandum indicating whether a proposed project could be performed by small business firms, and describing efforts undertaken to identify minority and women's firms appropriate for the work to be undertaken. The Memorandum is sent to the Office of Civil Rights which recommends the type of procurement that should be used for the project, recommends qualified minority and female entrepreneurs that exhibit the capabilities necessary to perform the required tasks, and offers advice and information on aspects of affirmative action that should be addressed before and after the contract is awarded. The Memorandum, with the comments from the Office of Civil Rights, becomes part of the project file. All this activity takes place before the project is sent to the procurement staff and before the RFP is released.

The Office of Civil Rights is a member of the Source Evaluation Board for contracts in excess of $500,000. This participation enables UMTA to negotiate with proposers regarding their affirmative action efforts in the area of minority business enterprise, as required by the standard Federal Procurement Regulation contract clauses.

UMTA civil rights staff members also meet with minority entrepreneurs seeking contracts in UMTA and refer them to appropriate program managers. The Office of Civil Rights maintains a file of capability brochures of MBE's as well as a computerized listing of all minority-owned firms.

UMTA's Evaluation of Proposals

The primary criteria employed in evaluating proposed RD&D projects (both solicited and unsolicited) are:

- Potential contribution to RD&D program plan and objectives;
- Potential for wide national application;
- Extent of the potential information to be developed;
- Degree of innovation incorporated; and
- Potential for eventual funding support by UMTA's Capital Assistance Program.

Subcontracting

Another possible means of participating in UMTA's procurements is by subcontracting. In many instances, an UMTA prime contractor wishes to use another firm for professional services, construction or equipment. Thus, if a firm considered itself well qualified to perform one aspect or part of a project for which another firm has been chosen, the first mentioned firm could approach the prime contractor and offer its goods or services on a subcontract basis.

The *Commerce Business Daily* is a source of information about contract awards. These are published, for the most part, for the benefit of potential subcontractors.

Cost Sharing

In some cases when a grant or procurement contract is awarded, financial participation by the performing organization may be required. This is intended to serve the mutual interests of the federal government and the performing organization by helping to assure efficient utilization of the resources available for the conduct of research projects and by promoting sound planning and prudent fiscal policies by the performing organizations. The requirement for cost sharing is determined on an individual project basis. The proportion of federal funding support to be supplied to an authorized RD&D project is determined by the Administrator of the Urban Mass Transportation Administration.

Commerce Business Daily

The *Commerce Business Daily* is designed to help American business firms keep abreast of federal government procurement and general contracting activity. It is published Monday through Firday, except on federal holidays. It lists, by commodity and service, US Government procurement invitations, subcontracting leads, contract awards, sales of surplus property, and other business opportunities. The *Commerce Business Daily* is sold by the Superintendent of Documents, Washington, D.C., 20402. Subscription blanks may be obtained from the Office of Field Services, US Department of Commerce, Washington, D.C., 20230, or from the nearest Department of Commerce field office.

UMTA University Research and Training (URT) Grants

University Research and Training (URT) Grants are made to public and private nonprofit institutions of higher learning performing research and offering training in urban transportation fields, such as economics, social sciences, engineering, physical sciences, law, public administration, and urban or metropolitan planning.

URT Proposals

In the late summer UMTA normally issues an announcement in the *Commerce Business Daily* inviting submittal of grant proposals. This announcement will provide any specific or yearly policy guidance necessary. It will also provide a deadline submittal date.

A formal proposal must be submitted outlining in detail the proposed research or training program, as well as a detailed delin-

eation of the organization, staff, faculty, and budget. When necessary, UMTA personnel can provide informal assistance in interpreting the guidelines and preparing the formal application. UMTA prepares each year an announcement brochure and also has a circular (C4900.1), "Application Instructions for University Research and Training Program," both of which can be requested from UMTA. They include a suggested format and detailed instructions for preparing an application.

Proposals should be submitted to: Urban Mass Transportation Administration, Office of Policy Research, University Research and Training Division, 400 Seventh Street, SW, Washington, D.C. 20590.

Evaluation of URT Proposals

Proposals submitted to UMTA will be reviewed and evaluated by persons selected from within the Department of Transportation. It is essential that proposals be complete and organized according to the specified format as set forth in the above-mentioned brochure to permit equitable evaluation. Each proposal will be reviewed as an entity, but elements of the budget may be negotiated with the applicant. Thus, amounts less than those requested may be approved.

UMTA will use the following factors when deciding on grant awards:

- Relevance of the program to urban transportation;
- Merits of the scientific and technological aspects of the research program and research methodology;
- Compatibility of the program with the institution's and DOT's goals of meeting future manpower requirements in urban mass transportation;
- Quality of the performing staff;
- Consistency of budget estimates with the type and level of the proposed work;
- Geographical location of the applicant institution (an effort will be made to encourage the establishment of research and training programs throughout the country to insure broad relevance to metropolitan problems);
- Extent to which opportunities are provided for participation of colleges and universities serving minority groups;
- Degree of involvement with local urban transportation problems; and
- Extent to which the institution is willing to share the costs of the project.

A proposal that does not result in a grant may be retained by UMTA. However, it will not be made available outside UMTA without the consent of those who signed the proposal or their successors in office, except to the extent that disclosure thereof may be required by a court of competent jurisdiction. Proposals may be withdrawn by the applicant at any time prior to final action by UMTA.

Additional information may be obtained by calling (202) 426-0080.

Indexes

AGENCY/CONTRACTOR INDEX

PROJECT INDEX

SUBJECT INDEX

☆ U. S. GOVERNMENT PRINTING OFFICE : 1981 727-171/1644

MAIL ORDER TO:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road
Springfield, Va. 22161

TELEX 89-9405
Telephone (703) 321-8543

Date _____

PURCHASER:

SHIP TO: (Enter if different from address at left)

Name _____

Organization _____

Address _____

Attention: _____

City, State, ZIP _____

- ☐ Charge my NTIS deposit account no. _____
- ☐ Send me an application for an NTIS deposit account.
- ☐ Purchase order no. _____
- ☐ Check enclosed for $ _____
- ☐ Bill me. See reverse for costs (not applicable to foreign customers).
- ☐ Charge to my American Express Card account number:

☐☐☐ ☐☐☐ ☐☐☐ ☐ ☐☐☐

Signature _____

Wherever a foreign sales price is NOT specified in the listings, all foreign buyers must add the following charges to each order:

$2.50 for each document
$1.50 for each microfiche

FOR DDC USERS ONLY

DDC User Code _____

Contract Number _____
(Last 6 characters only)

Allow 3-5 weeks for delivery on your order. If ordering without a document number, by title only, allow an additional 2 weeks.

DOCUMENT NUMBER [If ordering by title or if item ordered is a magnetic tape, please see reverse side.]	USER ROUTING CODE (see reverse)	Quantity			Unit Price	Total Price
		Paper Copy	Micro-fiche	Other (specify)		
					Enter Grand Total	$

USER ROUTING CODE: NTIS can label each document for routing within your organization. If you want this service put your routing code in the box marked USER ROUTING CODE. (Limit eight characters)

SHIP & BILL SERVICE: NTIS appreciates prepayment for documents through the use of an NTIS Deposit Account, check, or money order. Should this not be convenient, NTIS will mail your order and bill you about 15 days after shipment. The handling charge for ordering documents is $5.00 per order (not line item); $5.00 per NTISearch ordered; $2.50 per subscription ordered. NTIS does not bill customers for magnetic tapes or shipments destined for outside the United States.

ORDERING MAGNETIC TAPE: (check mode) ☐ 9 track ☐ 1600 BPI (odd parity) ☐ 800 BPI ☐ 7 track ☐ 200 BPI ☐ 556 BPI ☐ 800 BPI ☐ odd parity ☐ even parity

ORDERING BY TITLE: If ordering without document number, by title only, allow an additional 2 weeks.

TITLE #1

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
Turn to other side. Write "1" in the Document Number block and complete the rest of the line.		

TITLE #2

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
Turn to other side. Write "2" in the Document Number block and complete the rest of the line.		

TITLE #3

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
Turn to other side. Write "3" in the Document Number block and complete the rest of the line.		

TITLE #4

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
Turn to other side. Write "4" in the Document Number block and complete the rest of the line.		

TITLE #5

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
Turn to other side. Write "5" in the Document Number block and complete the rest of the line.		

FORM NTIS-173 (REV. 2-76) GPO 886-993 USCOMM-DC 6367-P76

An UMTA Technology Sharing Report

Prepared by:

Technology Sharing Office
U.S. DEPARTMENT OF TRANSPORTATION
Research and Special Programs Administration
Transportation Systems Center
Kendall Square
Cambridge, MA 02142