



U.S. Department  
of Transportation

Urban Mass  
Transportation  
Administration

Fiscal Year 1983

# INNOVATION in public transportation

# INNOVATION



UMTA Technical Assistance Program Directory

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December, 1984

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**UMTA Technical Assistance Program**



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## Introduction

This directory contains descriptions of technical assistance projects sponsored by the Urban Mass Transportation Administration (UMTA) of the U.S. Department of Transportation (DOT). Its purpose is to inform the public and especially the transit industry on the nature and scope of work which is underway to assist State and local agencies in improving services and reducing the cost of public transportation. Under the program, technical assistance is provided in a broad range of disciplines and fields of knowledge that are essential to transit, including analysis, planning, demonstrations, management, vehicles, equipment, and facilities.

Technical assistance is furnished by UMTA primarily by providing information about and by sponsoring the development and introduction of improved techniques, equipment, and facilities. Information is disseminated by means of technical reports and other publications and by workshops and training courses. In addition to initiating the development of new techniques and equipment, the technical assistance program provides funding to transit operators to help evaluate and introduce innovations and new products by the private sector.

UMTA technical assistance concentrates on common management problems and technological needs of the transit industry, seeking broad applications to improve productivity, safety, and performance. The program supplements private initiative in the equipment, construction, and consulting industries where technological risks or market size do not produce incentives for privately financed

research and development in proportion to the benefits which can be achieved nationally.

Another important UMTA role consists of accelerating the flow of information on solutions and improvements which have been developed locally and can be adopted by a large proportion of the transit community. In this role, UMTA assists the transit community by serving as a clearinghouse for current information on the state-of-the-art and problem-solving resources. In addition to collecting, organizing and disseminating useful technical and management information, UMTA also sponsors demonstrations, independent evaluations, peer reviews, seminars, and site inspections when such activities are necessary for effective transfer of new techniques.

The current technical assistance program is based on needs and problems expressed by State and local agencies through a number of channels including: conferences and workshops, industry liaison boards, special user advisory groups, and general solicitations. Where problems are insufficiently defined or the cost-effectiveness of innovation is unclear, specific studies and surveys are undertaken with the cooperation and full participation of the transit industry. The UMTA regional offices support this communication process by providing a contact point for requesting technical assistance and by participating in project selection. The resulting higher levels of communication have enabled UMTA to direct its resources to programs which are more immediately useful to local agencies in improving their productivity.

Most of the projects described in this volume are managed by the Associ-

ate Administrator for Technical Assistance and his staff offices. A listing of principal organizational elements in the Office of Technical Assistance is provided in the Staff Directory.

Tables summarizing funding and other information about individual R&D 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 and the expected completion date. Funding figures are provided to give an indication of the scope of individual tasks, and are generally cumulative. The dollar figures in the tables, therefore, cannot be used for analysis of the FY83 annual budget.

Technical documents describing the results of most of the completed projects have either been issued or are currently in 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 or other sources. Details on how to obtain reports are provided in Appendix A. Forms for ordering publications from NTIS are also included at the end of this document.

Appendix B provides general information for potential contractors and grantees on participation in the UMTA Technical Assistance programs, and includes material on university research grants.

This document was prepared by the Office of Technology Sharing, Transportation Systems Center, U.S. Department of Transportation, Kendall Square, Cambridge, Mass. 02142. Copies may be obtained by contacting that office.

## Office of Technical Assistance — Staff Directory

Organization Code		Telephone (Area Code 202)
URT-1	Associate Administrator for Technical Assistance, Peter Benjamin Secretary, Brenda Williams	426-4052 426-4052
URT-5	Administrative Management Staff, Diane K. Pisano, Director	426-9261
URT-6	Safety and Security Staff, Lloyd G. Murphy, Chief	426-2896
URT-2	Deputy Associate Administrator for Engineering and Applications, Franz K. Gimmler	426-4047
URT-10	Office of Systems Engineering Steven A. Barsony, Director	426-0090
URT-11	Urban Rail Division, Walter Kulyk, Chief	426-0090
URT-12	Technology Development Division, Ronald D. Kangas, Chief	426-9264
URT-20	Office of Bus Technology, Thomas A. Norman, Director	426-4035
URT-21	Vehicles and Facilities Division, Raymon A. Lopez, Chief	426-8483
URT-22	Subsystems Technology Division, Vincent R. DeMarco, Chief	426-4035
URT-3	Deputy Associate Administrator for Management and Demonstrations, Harold B. Williams	426-4047
URT-7	Information Services Staff, Ronald J. Fisher, Director	426-9157
URT-30	Office of Management Research and Transit Services, W.H. (Ray) Lytle, Director	426-4995
URT-31	Services and Methods Division, James A. Bautz, Chief	426-4984
URT-32	Transit Management Division, Philip G. Hughes, Chief	426-9274
URT-33	Research and Training Division, Frank E. Enty, Chief	426-9274
URT-40	Office of Methods and Support, Samuel Zimmerman, Director	426-4991
URT-41	Methods Division, Granville E. Paules, Chief	426-9271
URT-42	Analysis Division, Ross W. Adams, Chief	426-9267

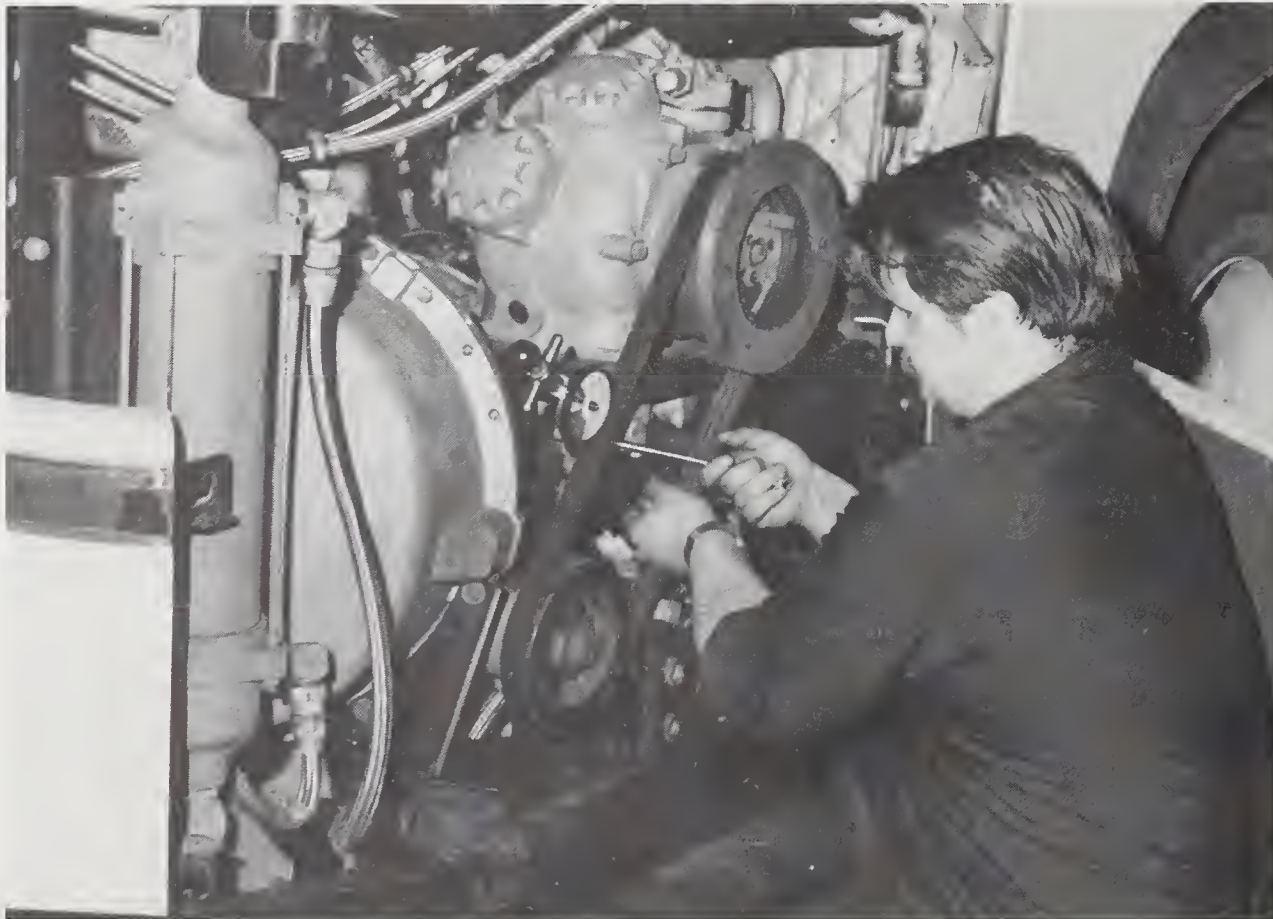




# Bus and Paratransit Systems

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## Trends and Highlights



The major goals of the Urban Mass Transportation Administration's (UMTA) Bus and Paratransit Systems program in FY 83 have been to reduce life cycle costs, promote more efficient use of energy, and supply technical assistance to the providers of public transportation.

In FY 83, UMTA continued the Bus and Bus Subsystem Technology Program, the New Bus Equipment Introduction (NBEI) Program and the Section 3(a)(1)(C) New Technology Introduction Program. The Bus and Bus Subsystems Technology Program is designed to help solve the most serious equipment problems currently being encountered by transit operators. The introduction of new subsystems and components and the improvement of equipment currently available will enhance vehicle reliability and reduce operating and maintenance costs. Technical assistance has been supplied to transit operators in the area of developing and validating Life Cycle Cost (LCC) data for use in making investment decisions. As a part of this effort, fuel consumption data has been collected and disseminated concerning six standard size transit buses. The NBEI program enables transit operators to evaluate innovative features developed by the private sector. The purpose of this program is to facilitate the introduction of innovative features to the transit industry and make them generally available in a shorter span of time.

## Bus and Bus Subsystems Technology

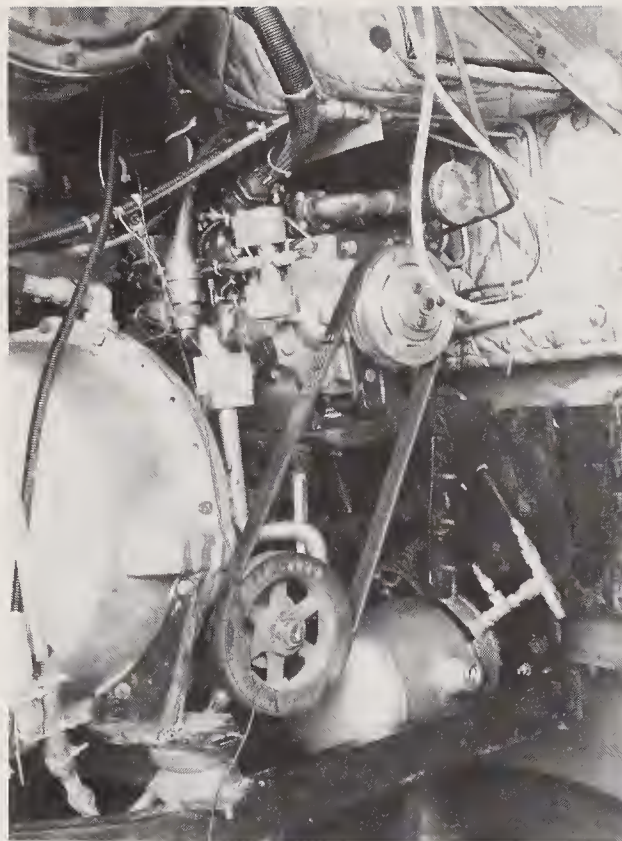
The goal of the Bus and Bus Subsystems Technology Program is to develop

more efficient, reliable, and easily maintained components and subsystems which will result in lower operating and maintenance costs while simultaneously improving service reliability. Separate projects to improve transmissions, brakes, retarders, air conditioning systems, fare collection systems, passenger counters, and structures (chassis, wall, and roof) have been established. The emphasis of this program is on the development of near-term solutions for day-to-day problems experienced by bus operators.

Four transmission projects are underway at the Michigan DOT (MI-06-0029), Southern California Rapid Transit District (CA-06-0164), San Diego Transit District (CA-06-0179), and Southeastern Pennsylvania Transit Authority (PA-06-0082). These projects will provide an evaluation of improvements which can be retrofitted in buses to reduce maintenance costs.

Brake retarders are also being tested by the Michigan DOT (MI-06-0025), Southeastern Pennsylvania Transit Authority (PA-06-0082), and the New York Regional Transit Authority to establish their effectiveness for increasing brake lining life and reducing maintenance costs.

An air conditioning system which incorporates an improved screw-type compressor is being tested to determine cost benefits in the Washington Metropolitan Transit Authority (DC-06-0469) and the Southeastern Pennsylvania Transit Authority (PA-06-0086). Results indicate that this system offers the potential for lower operating and maintenance costs in comparison with conventional compressors.



***In San Antonio, the rotary screw compressor is ready for testing to measure improvements in Advanced Design Bus air conditioner performance.***

Four Automated Passenger Counter Systems projects are underway to increase reliability (CA-06-0119), reduce costs of collecting passenger ridership data, (WA-06-0025), and to integrate fare collection and passenger counter data (GA-06-0019, MI-06-0042).

Two projects for the assessment of fare collection systems and of the latest electronic registering fare boxes are currently being performed (MI-06-0041, CA-06-0164). Rising fares and particularly the increased flow of dollar bills have created major problems in the sorting and counting of fare revenues. These projects will

develop recommended solutions for reducing or eliminating fare collection problems.

A project to reduce costs of fare collection and processing of farebox revenues, particularly dollar bills, is being performed by Michigan DOT (MI-06-0041). Another project is being performed to improve revenue data collection and provide "accountability" (MA-06-0160).

Projects to develop and validate Life Cycle Cost (LCC) procurement techniques continued during FY 83. These activities included collecting information on LCC procurement procedures and cost drivers as well as supporting the test and demonstration of the LCC concept in the acquisition of articulated and small buses by Santa Clara County, Calif. (CA-06-0146).

During FY 1983, a fuel economy test program was completed. Tests of standard size buses were conducted according to an accepted, standardized test procedure. The results may be useful to transit agencies using LCC procurement procedures to purchase new transit buses.

### **Bus Testing Procedures**

Over the past few years, UMTA has become acutely aware of equipment failures in both old and new buses. This has caused considerable downtime and other hardships to transit systems. Many of these problems could have been detected and corrected with adequate testing and evaluation of the hardware prior to delivery. Manufacturers, especially those new to the domestic market, may not perform adequate vehicle testing, and in many cases transit agencies requesting new equipment do not ask for sufficient testing in their bid packages.

## New Bus Equipment Introduction (NBEI)

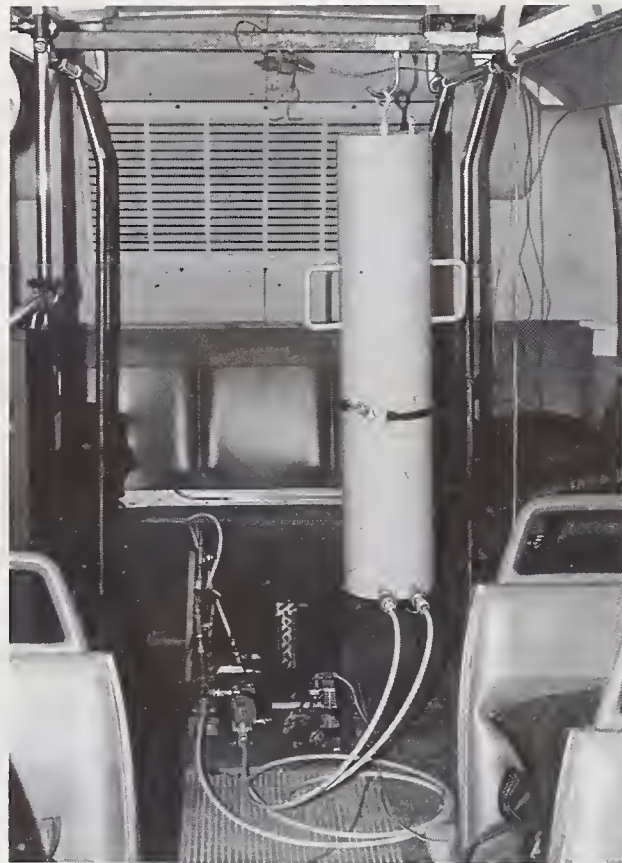
The NBEI program is intended to provide transit operators an opportunity to select and test various innovative bus design features not currently available on existing production vehicles. These features have been developed to improve fuel efficiency, reliability and accessibility, and to reduce operating and maintenance costs. In FY 83, UMTA solicited letters of interest from operators to test and evaluate innovative features in transit buses. Section 3 capital grants will be made to the selected transit agencies to purchase buses with innovative features. Section 6 grants were made to Florida DOT and the Metropolitan Suburban Bus Authority (NY) to assist them in testing and evaluating the buses (FL-06-0039, NY-06-0014). Additional Section 6 grants may be awarded in FY 84. When completed, the

program will provide the industry with the impetus to develop improved specifications leading to the delivery of better buses financed with federal funds.

## Energy and Propulsion

While the reduction of energy costs for transit is a worthwhile objective, the high level of dependence on petroleum-based fuels is of continuing concern to transit operators. Greater independence from petroleum could be achieved by using alternative fuels or vehicles powered by electricity. Electricity is a major option because, in the United States, only 16 percent of the source energy used in the generation of electricity comes from petroleum.

In support of more efficient diesel propulsion systems, simple calculations indicate that a 10 percent improvement in propulsion system efficiency can save



*The fuel economy test program used special equipment such as this gravimetric tank system to precisely measure fuel consumed on the test track.*

UMTA is assisting the Metropolitan Atlanta Regional Transit Authority (MARTA) in developing procedures for accelerated in-service tests and acceptance of their new Neoplan buses. These procedures will be coordinated with other transit agencies and manufacturers through the American Public Transit Association's Bus Technology Liaison Board. MARTA will be responsible for conducting these tests, and procedures developed can be applied by other transit agencies at their discretion (GA-06-0015).



*Transit operators will be able to learn more about innovative bus design features in actual operating conditions through the New Bus Equipment Introduction Program.*

U.S. transit operators in excess of \$40 million per year. UMTA has a three-pronged approach to the transit energy problem: 1) to investigate the increased use of electricity, 2) to examine alternative fuel capabilities in existing bus systems, and 3) to promote more efficient use of petroleum in existing bus systems.

### **Electric and Hybrid Propulsion**

In 1983 the Massachusetts Bay Transportation Authority tested a trolley bus equipped with diesel/generator emergency power supply system (MA-06-0130). The emergency system permitted the trolley to operate "off wire" at a top speed of 15 miles per hour and a range of nearly 4 miles. More extensive revenue service tests are planned for 1984 through 1986 at the Miami Valley Regional Transit Authority (Dayton) and the San Francisco Municipal Railway.

In 1983 the San Francisco Municipal Railway began an evaluation of three types of controllers (cam, dc chopper, ac inductor) in revenue service with a trolley bus (CA-06-0147). The evaluation will be completed in June 1984.

### **Alternative Fuels**

In 1983 the Port Authority of Allegheny County (PAT), Pittsburgh, Pa. completed a study of various alternative fuels to an entire bus transit system (PA-06-0060). Based on abundant American feed stocks and its similarity in handling and storage to diesel fuel, methanol was identified as the most promising alternative. A plan for the test of a metha-

nol bus at a cold weather site was prepared as part of the report.

During 1983, the Florida Department of Transportation modified a 6V71 engine to operate on methanol (PL-06-0022). Tests of the engine are scheduled to be completed by June 1984. Track tests of three modified buses will be conducted in 1985.

## **Paratransit Technologies**

### **Paratransit Vehicle Program**

The overall goal of the Paratransit Vehicle Program is to stimulate the automotive industry to manufacture vehicles which meet the needs of paratransit service and to provide these vehicles at an



*A report exploring various alternative fuels is to be followed by the testing of several experimental methanol fueled buses.*

affordable cost. The main objective of the program is to promote the 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.

PAT and Florida DOT will purchase, test and evaluate innovative paratransit vehicles in revenue service. Data will be collected and analyzed, and disseminated to the paratransit industry for use in making future manufacturing and purchasing decisions (PA-06-0064, FL-06-0029).

## Facilities and Maintenance

The goal of the bus facilities and maintenance program is to assist transit operators in developing their requirements and specifications for the design, construction and utilization of new bus maintenance facilities and to support the test and evaluation of new/improved test equipment techniques. Transit operators have experienced rising maintenance costs due to aging or poor maintenance facilities, increased complexity of new buses and lack of experienced technicians. Operators are preparing to construct new facilities, but have limited understanding about how to maximize the effectiveness of the facility through proper design and procurement of equipment. This is especially true for newly introduced bus designs and articulated buses.

During FY 83, a project was awarded to Comprehensive Technologies Interna-

tional (VA-06-0108) to survey bus facility problems in eight selected sites. Two value engineering studies were initiated to demonstrate the use of value engineering in the design of bus maintenance facilities. Sites selected for the study are Washington Metropolitan Area Transit Authority (WMATA) (DC-06-0461) and Greater Bridgeport Transit District (CT-06-0015). A peer review study was initiated in FY 83 with ARAWAK Consulting Corporation (VA-06-0110) to assess the expected benefits and cost of the peer review process in the planning and design of bus maintenance facilities.

During FY 83, two equipment-related studies were initiated. One project (MD-06-0101) will review bus maintenance equipment being used by the military, trucking industry, and intercity bus agencies that can be used to increase transit productivity. The other project (MD-06-0102) is developing an evaluation methodology for determining the cost/benefits of the Automatic Bus Diagnostic System to be purchased by a consortium of four transit agencies.

Project (NY-06-0091) for evaluating a bus automatic grease lubrication system is continuing. It is anticipated that increased subsystem life and reduced maintenance costs will be demonstrated.

## Bus and Paratransit Systems

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>BUS AND BUS SUBSYSTEMS TECHNOLOGY</b>					
Transmission Test and Evaluation	MI-06-0029	\$280,000	Aug. 1981- June 1984	Michigan DOT	George Izumi (202) 426-8483
Tests of Improved Components and Subsystems on AMG & RTS Buses	CA-06-0164	\$372,000	Sept. 1981- July 1984	SCRTD	George Izumi (202) 426-8483
Transmission Test and Evaluation	CA-06-0179	\$141,000	July 1982- Aug. 1983	San Diego Transit Corp.	Vincent DeMarco (202) 426-4035
Bus Transmission and Brake Retarder Evaluation	PA-06-0082	\$153,000	Aug. 1983- Feb. 1985	SEPTA	George Izumi (202) 426-8483
Evaluation of Bus Retarders	MI-06-0025	\$292,000	Aug. 1981- May 1984	Michigan DOT	George Izumi (202) 426-8483
Brake Retarder for Small Bus	NY-06-0118	\$34,000	Oct. 1983- April 1985	Central New York RTA	George Izumi (202) 426-8483
Rotary Screw Air Conditioning Compressor Evaluation	DC-06-0469	\$40,000	Oct. 1983- Nov. 1984	WMATA	George Izumi (202) 426-8483
Rotary Screw Air Conditioning Compressor Evaluation	PA-06-0086	\$60,000	Sept. 1983- March 1985	SEPTA	George Izumi (202) 426-8483
Rotary Screw Air Conditioning System Evaluation	MA-06-0120	\$455,000	Aug. 1981- Jan. 1983	TSC; Garrett AiResearch	George Izumi (202) 426-8483
GFC 870 Air Conditioning Retrofit Evaluation	GA-06-0016	\$96,000	Sept. 1981- Feb. 1984	MARTA	George Izumi (202) 426-8483
Evaporative Cooler Evaluation	CO-06-0012	\$240,000	March 1982- Feb. 1983	Denver RTD	George Izumi (202) 426-8483
AM General Roof-Mounted Air Conditioning Retrofit Evaluation	NY-06-0094	\$325,000	May 1982- Sept. 1983	Central New York RTA	George Izumi (202) 426-8483
Bus Noise Reduction	OR-06-0005	\$155,000 (UMTA) \$65,000 (EPA)	July 1978- Feb. 1983	TRIMET	Patrick J. Sullivan (202) 426-4035
Passenger Counter Improvements	WA-06-0025	\$159,000	Sept. 1983- March 1985	Seattle METRO	George Izumi (202) 426-8483

## Bus and Paratransit Systems

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>BUS AND BUS SUBSYSTEMS TECHNOLOGY (CONT.)</b>					
Passenger Counter/Farebox Integration	GA-06-0019	\$80,000	Sept. 1983- March 1985	MARTA	James Collins (202) 426-4035
Passenger Counter/Farebox Integration	MI-06-0042	\$79,000	July 1983- Jan. 1985	Michigan DOT/Kalamazoo	James Collins (202) 426-4035
Dollar Bill Handling Improvements	MI-06-0041	\$165,000	June 1983- June 1984	Michigan DOT/Detroit DOT	Vincent DeMarco (202) 426-4035
Fare Collection Assessment	MA-06-0120	\$125,000	Dec. 1982- Dec. 1983	TSC; Dynatrend	Vincent DeMarco (202) 426-4035
Electronic Registering Farebox Assessment	MA-06-0120	\$55,000	Jan. 1983- Sept. 1983	TSC; Booz, Allen and Hamilton, Inc.	Vincent DeMarco (202) 426-4035
Farebox Modification Evaluation	NY-06-0093	\$35,700	July 1982- Oct. 1984	Metro Suburban Bus Authority	George Izumi (202) 426-8483
Life Cycle Costing	CA-06-0146	\$300,000	July 1980- June 1985	Santa Clara County (Calif.) Transportation Administration	Steve Asatoorian (202) 426-4035
Life Cycle Cost Information & Evaluation Study	VA-06-0112	\$200,000	Oct. 1983- Oct. 1985	Technology Application Inc.	Steve Asatoorian (202) 426-4035
Engine Testing Program for Standard Size Buses	MI-06-0037	\$192,000	Oct. 1982- Oct. 1984	Michigan DOT	George Izumi (202) 426-8483
Automated Maintenance Data Collection Study	VA-06-0093	\$115,000	Jan. 1983- March 1984	Technology Research Analysis Corp.	James Collins (202) 426-4035
ADB Operating and Maintenance Monitoring	DC-06-0364	\$50,000	Sept. 1981- Oct. 1982	APTA	Thomas Norman (202) 426-4035
Rear Tow Hoist for ADB Buses	NY-06-0093	\$28,700	July 1982- Aug. 1983	Metro Suburban Bus Authority	George Izumi (202) 426-8483
Bus Technology Liaison Board	DC-06-0410	\$110,000	Sept. 1983- Oct. 1985	APTA	Vincent DeMarco (202) 426-4035
Seattle Guided Bus	WA-06-0023	\$130,000	Aug. 1983- Oct. 1985	Seattle METRO	Vincent DeMarco (202) 426-4035



## Bus and Paratransit Systems

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>NEW BUS EQUIPMENT INTRODUCTION PROGRAM</b>					
Tandem Bus Evaluation	FL-06-0039	\$52,000	Sept. 1983- Sept. 1985	Florida DOT	John E. Ridgley (202) 426-8483
Articulated Bus Evaluation	NY-06-0014	\$75,000	Sept. 1983- Sept. 1985	Metro Suburban Bus Authority	John E. Ridgley (202) 426-8483
Articulated Bus Evaluation	RI-06-0013	\$100,000	June 1982- Sept. 1985	Rhode Island Public Transit Authority	John E. Ridgley (202) 426-8483
Small Bus Evaluation	MI-06-0032	\$106,000	June 1982- Sept. 1985	Michigan DOT	John E. Ridgley (202) 426-8483
Small Bus Evaluation	OH-06-0040	\$100,000	June 1982- Sept. 1985	Central Ohio Transit Authority	John E. Ridgley (202) 426-8483
<b>ENERGY AND PROPULSION</b>					
Emergency Propulsion Sys- tem for Trolley Coaches	MA-06-0130	\$77,000	Dec. 1981- April 1983	MBTA	Patrick J. Sullivan (202) 426-4035
Emergency Propulsion Sys- tem for Trolley Coaches	OH-06-0034	\$40,000	Dec. 1981- Dec. 1982	Miami Valley (Ohio) RTA	Patrick J. Sullivan (202) 426-4035
Comparative Trolley Bus Controller Project	CA-06-0147	\$661,000	Jan. 1981- Aug. 1983	MUNI	Patrick J. Sullivan (202) 426-4035
Alternative Fuels Study for Urban Mass Transit Buses	PA-06-0060	\$125,000	Oct. 1980- July 1982	PAT	Patrick 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 DOT	Patrick J. Sullivan (202) 426-4035
Santa Barbara Electric Vehicle Project	CA-06-0177	\$3,000,000	Aug. 1982- March 1985	Santa Barbara (Calif.) Metropolitan Transit District	Patrick J. Sullivan (202) 426-4035
Bi-Mode Trolley Bus Demonstration	WA-06-0020	\$227,525	Dec. 1981- March 1984	Seattle METRO	John E. Ridgley (202) 426-8483
Stored Hydraulic Energy	OR-06-0007	\$1,000,000	Oct. 1980- May 1983	TRIMET	Patrick J. Sullivan (202) 426-4035
Flywheel Energy Storage System	CA-06-0168	\$8,310,170	Nov. 1978- June 1985	Garrett Corporation	Steve Asatoorian (202) 426-4035

## Bus and Paratransit Systems

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>PARATRANSIT TECHNOLOGIES</b>					
Paratransit Vehicle Deployment Evaluation	PA-06-0064	\$682,000	Sept. 1981 Nov. 1985	PAT	John E. Ridgley (202) 426-8483
Paratransit Vehicle Deployment Evaluation	FL-06-0029	\$500,000	March 1982 Dec. 1985	Florida DOT	John E. Ridgley (202) 426-8483
Paratransit Vehicle Technical Support	IT-06-0272	\$170,000	Dec. 1981 Dec. 1985	Dynatrend, Inc.	John E. Ridgley (202) 426-8483
<b>FACILITIES AND MAINTENANCE</b>					
Survey of Bus Facility Problems	VA-06-0108	\$80,000	Oct. 1983- Sept. 1984	Comprehensive Technologies International	Steve Asatoorian (202) 426-4035
Value Engineering	DC-06-0461	\$45,000	Nov. 1984 May 1985	WMATA	Steve Asatoorian (202) 426-4035
Peer Review Application Study	VA-06-0110	\$50,000	Sept. 1983 June 1984	ARAWAK Consulting Corporation	Steve Asatoorian (202) 426-4035
Maintenance Equipment Study	MD-06-0101	\$50,000	Sept. 1983- April 1984	AMAF Industries	George Izumi (202) 426-8483
Automatic Bus Diagnostics Evaluation Methodology	MD-06-0102	\$80,000	Sept. 1983- June 1984	MAXIMA Corporation	George Izumi (202) 426-8483
Automatic Bus Lubrication	NY-06-0091	\$37,600	Jan. 1982- June 1984	NFTA	George Izumi (202) 426-8483
Value Engineering	CT-06-0015	\$44,700	Feb. 1984- Dec. 1984	Greater Bridgeport Transit District	Steve Asatoorian (202) 426-4035
Bus Lift Evaluation	OH-06-0045	\$80,000	Oct. 1983 - Feb. 1985	COTA	George Izumi (202) 426-8483

## Bibliography

A list of recent reports follows. Please consult previous editions of this Directory for earlier reports. If available, a document number assigned by the National Technical Information Service (NTIS) is listed. Reports may be obtained from NTIS by using the order blanks provided at the end of this document.

Reports which have not been assigned an NTIS number may not have been published in sufficient quantity for general distribution. Single copies and other information may be available from the issuing agency or organization.

Additional reports relating to the research described in this chapter may become available in the near future. For the most recent information or suggestions for additional reference materials regarding specific projects, call or write to the person listed as the technical contact in the Project Summary Table.

Local public agencies may obtain a single copy of those reports marked by an asterisk (\*)—while supplies last—by sending a self-addressed mailing label to: Office of Technology Sharing, DTS-31, U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge, MA 02142. Please specify which reports are needed and please request only those titles which are expected to be used in the near future.

### **\*Air Conditioning Modifications for GMC RTS II Series 01 Coach (Model 8201)**

Proj. MA-06-0120  
Transportation Systems Center  
March 1982

### **Advanced Design Bus Ventilation Testing**

Proj. MD-06-0024  
Booz, Allen and Hamilton, Inc.  
March 1981, PB 81-182-446

### **\*Reliability Evaluation of V-730 Transmission**

Proj. MA-06-0120  
Transportation Systems Center  
May 1982 (reprint),  
DOT-TSC-UM 262-PM-82-13

### **Updated Reliability Evaluation of V730 Transmission**

Proj. MA-06-0120  
Transportation Systems Center  
July 1983, DOT-TSC-UMTA-83-33

### **Evaluation of Retarders for Transit Buses**

Proj. MI-06-0025  
Michigan DOT  
June 1983, UMTA-MI-0025-83-1

### **Air Starters for Transit Buses**

Proj. MA-06-0120  
Transportation Systems Center  
May 1983, DOT-TSC-UMTA-83-21

### **\*Bill Handling Problems in Bus Fare Collection**

Proj. MA-06-0120  
Transportation Systems Center  
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### **\*Bus Transit Fare Collection Equipment Overview**

Proj. MA-06-0120  
Transportation Systems Center  
May 1982, DOT-TSC-UMTA-82-9

### **Automated Passenger Counter Systems**

Proj. MA-06-0120  
Transportation Systems Center  
May 1983, DOT-TSC-UMTA-83-23

### **Body Corrosion in Transit Buses**

Proj. MD-06-0024  
Booz, Allen and Hamilton Inc.  
November 1980, PB 80-196-546

### **\*Technology of Articulated Transit Buses**

Proj. MA-06-0120  
Transportation Systems Center  
May 1982 (reprint), DOT-TSC-UM  
262-PM-82-14

### **Economic Comparison of New Versus Rehabilitated Buses and Bus Rehabilitation Guidelines**

Proj. IT-06-0219  
Battelle Columbus Labs.  
January 1983, DOT-TSC-UMTA-83-23

### **\*Entry and Competition in the United States Transit Bus Manufacturing Industry**

Proj. MA-06-0120  
Transportation Systems Center  
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### **\*Transit Bus Manufacturers Profile**

Proj. MA-06-0120  
Transportation Systems Center  
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### **\*Preliminary Evaluation of the Scania 112 Bus: The First Three Months at Norwalk Transit District**

Proj. MA-06-0120  
Transportation Systems Center  
January 1982,  
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### **\*Highlights of the Transit Bus Technology Workshop, April 29-30, 1982**

Proj. MA-06-0120  
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### **New Bus Equipment Introduction Program Test and Evaluation Plan**

Proj. MD-06-0063  
Acumenics  
March 1981

### **Trolley Bus Auxiliary Power Unit Feasibility Test and Demonstration**

Proj. OH-06-0034  
AiResearch Manufacturing Company  
September 1982

**Investigation of the Applicability of a Stored Hydraulic Energy Propulsion System to a Conventional Bus**

Proj. OR-06-0007

Transportation Systems Center  
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**Transit Bus Fuel Economy Test**

Proj. DOT-TSC-1744

Booz, Allen and Hamilton, Inc.  
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Proj. PA-06-0060

Transportation Systems Center  
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Proj. IT-06-0219

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Proj. IT-06-0219

Battelle Columbus Labs.  
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Proj. IT-06-0219

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Proj. MA-06-0060

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Proj. MA-06-0120

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**Vol. III, Appendices A, B, C, and D**

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**Vol. V, Appendices F and G**

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Proj. CA-06-0098

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**Advanced Area Coverage Automatic Vehicle Monitoring Program, July 1980**

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Proj. MA-06-0086

Transportation Systems Center

# Rail and Construction Program

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## Trends and Highlights



**B**udgetary constraints and rising costs make it imperative for transit operators to increase productivity, make better use of existing capital intensive facilities, and improve design, engineering, and construction methods as well as improve construction management and maintenance techniques. Research and development efforts under the current Rail and Construction Program provide a substantial foundation for achieving these goals. The nature of rail transit requires that attention be focused primarily on basic technical problems encountered in normal operations. The objective of the UMTA program is to devise short-term solutions for these problems.

The program seeks to promote the following benefits for operators and passengers of urban rail transportation systems: 1) lower capital and operating costs for rail vehicles and facilities; 2) improvements in the reliability, maintainability and availability of vehicles and systems; 3) improved operations; and 4) a safer environment for passengers and system personnel.

The program is organized into five primary elements: problem analysis, application engineering, vehicles and subsystems, construction management, and the Transportation Test Center.

## Problem Analysis

Work in this program area involves system analyses, needs assessments, and special technical and economic studies required to determine the most productive projects for the transit industry within the Rail and Construction program. This work is intended to provide a link between the practical experience and problems of urban rail systems and the re-

search and development required to improve these systems. The urban rail transit market is continually evaluated from the standpoint of supply, demand, and capital and operating costs in order to maximize the impact of UMTA's research efforts.

Railcar and rail system maintenance is a major focus of this program area. This is in light of the fact that maintenance activities consume about 40% of the total operating costs of all U.S. rapid and light rail transit systems and that maintenance expenditures have been increasing by approximately 10% a year since 1975, with a progressively higher rate in recent years. These circumstances have been due to a variety of factors including the need to service an increasingly older fleet, on one hand and a more technologically complex inventory of railcars and facilities on the other. In order to help reduce maintenance expenditures, emphasis is being placed on the development and dissemination of information on more productive maintenance practices, data, information systems, and diagnostic equipment.

Under a grant to the Washington Metropolitan Area Transit Authority (WMATA), a new diagnostic and maintenance monitoring system is being developed. This system will record out-of-tolerance data on railcar-mounted equipment, and is intended for use to improve safety, maintenance, and reliability of the railcar system.

The Transit Reliability Information Program (TRIP) was conducted under this program category. TRIP was a coopera-

tive effort among transit operators and suppliers to gather and analyze subsystem reliability information of five railcar subsystems at six participating rail transit operations. A report analyzing propulsion system failures at two rail transit systems was completed utilizing the TRIP data bank information.

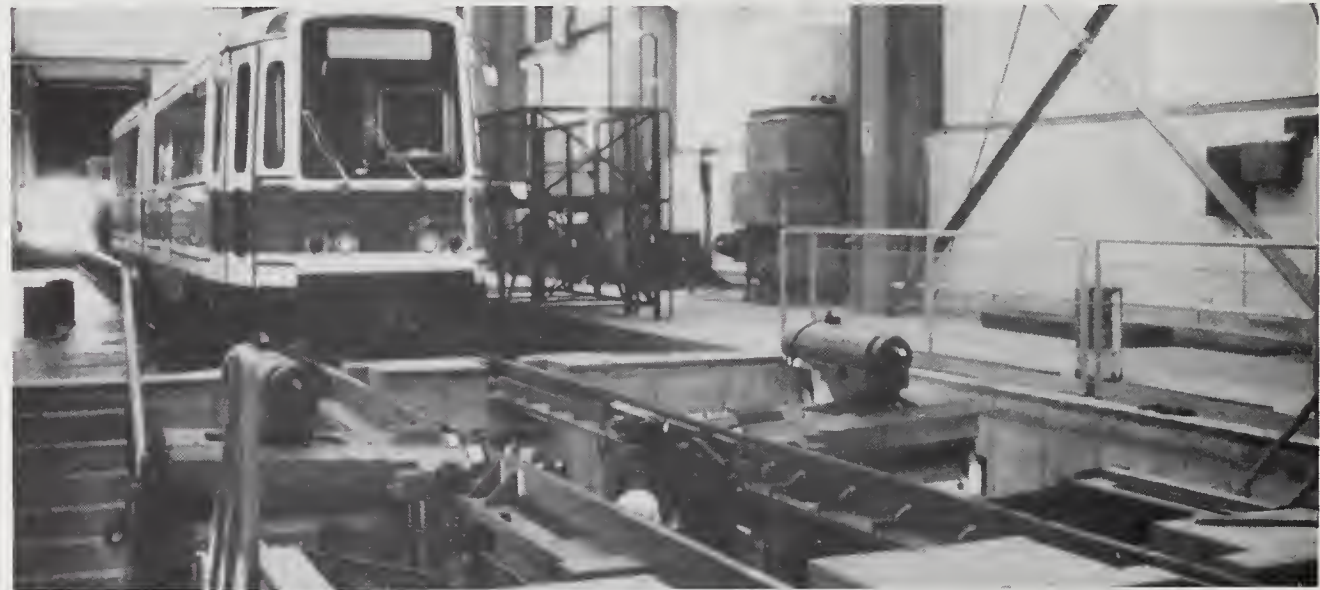
Efforts were initiated to assist transit operators to improve or institute maintenance management information system (MMIS) consistent with generic industry guidelines. Projects were undertaken with the Port Authority of Allegheny County (PA-06-0085) and the Port Authority Transit Corporation (NJ-06-0018) to make MMISs more efficient, thereby improving maintenance productivity.

UMTA is planning a project designed to determine if savings in maintenance costs can accrue to the transit industry

through the use of various methods of maintenance needs determination used in other industries. Specifically, planning was undertaken to examine the potential benefits of adapting maintenance procedures used successfully in the airline industry to current transit industry practices. Such practices have resulted in significant cost savings for the airlines.

## Application Engineering

Work in the Application Engineering program area addresses a number of generic problems affecting urban rail systems, including accessibility for the elderly and handicapped, noise abatement, and wheel/rail vibration and wear. Major program objectives are to increase safety, improve performance, and reduce



***Rail system maintenance is a major concern in UMTA's Rail and Construction Program.***

capital and operating costs associated with the operation and interaction of railcars over tracks.

The program to promote accessibility for the elderly and handicapped is focused on the development of alternative low cost hardware approaches to rail system accessibility. Noise abatement is necessary to maintain ridership and to permit normal community activities in the vicinity of urban rail transit systems.

### **Elderly and Handicapped Rail System Accessibility**

The Elderly and Handicapped Rail System Accessibility Program has focused on two major areas: rail vehicle lifts and the railcar/station platform interface. A detailed lift feasibility study (MA-06-0025) resulted in a comprehensive report, *The Feasibility of Retrofitting Lifts on Commuter and Light Rail Vehicles*. This report details which types of railcars are suitable for lift retrofit. A contract was awarded to the Budd Company for a lift retrofit on a Boeing LRV after preliminary analysis and design. A San Francisco Municipal Railway (MUNI) LRV with a retrofitted lift was tested under operating conditions (CA-06-0185). A test report and lift specification has been completed.

### **Noise Abatement Technology**

The objective 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.

The program was formulated based upon the needs of the transit industry, as

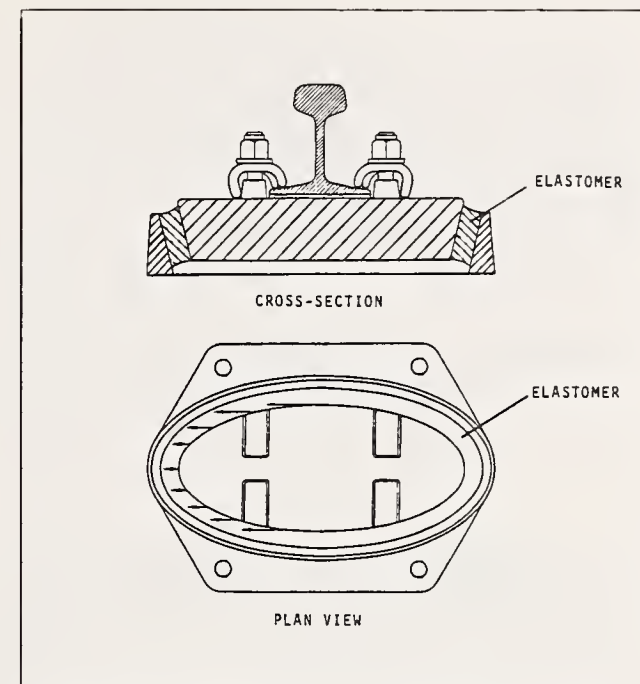
determined by survey of noise causing phenomena. Initial activity focused on problem definition and basic understanding. Subsequent activity was to recognize and ameliorate the predominant sources of rail transit noise including wheel/rail interactions and propulsion system noise. During FY 1983, the program concentrated on better ways to predict groundborne disturbances.

Groundborne noise and vibration from transit tunnels are major sources of community disturbance. Research is being carried out to find ways to ameliorate this problem (MA-06-0099). Different technologies in the United States and Europe have been surveyed and evaluated including floating slab trackbed, truck design parameters, ballast mats, trenches, and resilient fasteners. A model developed to predict groundborne vibrations for track types, tunnel structures, surrounding earth and building structures has been successfully applied at Baltimore and Los Angeles. Using this prediction model, modifications to existing designs will be made to optimize vibration control. The safety of the techniques, as well as installation and maintenance costs, will be assessed. Finally, recommendations for in-service testing of the selected techniques will be made, and further vibration tests and model refinements will be performed.

In addition, UMTA sponsored evaluations of damped wheels, elevated structure noise controls, and propulsion system raise controls, are being conducted.

### **Wheel/Rail Dynamics**

The Wheel/Rail Dynamics Program (MA-06-0025) will improve urban transit



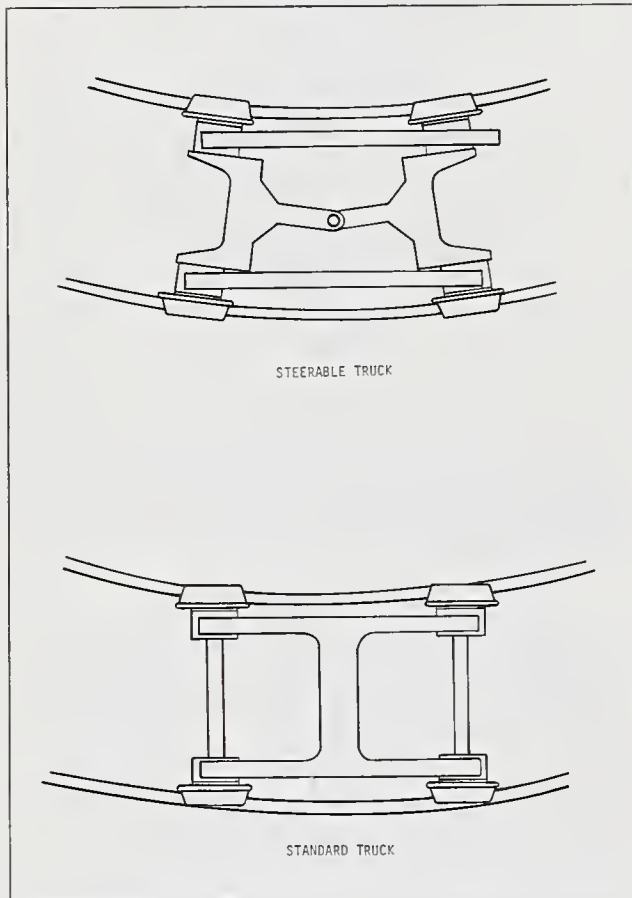
**Resilient fasteners, such as the Cologne Egg, utilize a layer of rubber to dampen track vibration and lessen noise.**

system performance and reduce operating costs by reducing wear, component failure, derailment potential, energy consumption and noise, thereby optimizing ride quality. Roadbeds, trucks and vehicles have often been inadequately designed, or, in many cases, the designs have been imperfectly understood. This has resulted unexpectedly high noise levels, wear rates, component failures, and potential safety hazards. These problems are reflected in unanticipated costs for material, labor and maintenance. The ultimate results are increased ridership costs, greater energy utilization, and reduced rail transit productivity.

Costs can be significantly reduced by the Wheel/Rail Dynamics Program-e.g.,

track replacement, wheel truing and replacement, lubrication and energy use.

Specific program activities involve studies on steerable trucks, wheel/rail wear, truck design development, and truck/track maintenance.



***Steerable trucks offer one potential alternative to mitigating detrimental wheel/rail interactions.***

Steerable trucks are being designed, tested and evaluated at PATCO. A prototype Budd steerable truck has been successfully operated in service and detailed performance measurements will be taken. Results will be used to estimate

truck performance on other U.S. rail systems.

Activities in wheel/rail wear include wear surveys, wear index development, wear mitigation studies, parametric analysis, and an evaluation of wheel profile effects at the Port Authority Trans-Hudson Corporation (PATH). Examples of truck design development projects include studies on truck/track characterization, shock and vibration effects, and the evaluation of performance limits. The principal activity in the area of truck/track maintenance is the development of a truck maintenance handbook.

## Vehicles and Subsystems (Subsystem Technology Application to Rail Systems — STARS)

There are presently 12 U.S. cities that have rapid rail transit systems in operation, under construction, or in an engineering phase: San Francisco, Chicago, Cleveland, Philadelphia, New York, Boston, Washington, Baltimore, Atlanta, Miami; Houston and Los Angeles.

In addition, the following urban areas have light rail systems planned, under construction, or in operation: Philadelphia, Boston, Pittsburgh, Newark, New Orleans, San Francisco, Cleveland, Buffalo, Santa Clara County, San Diego, Sacramento, and Portland. Including commuter railroads, rail transit systems carry more than two billion passengers annually, or one-third of all mass transit riders.

The reliability and availability of equipment is critical if this demand is to be met.

The Subsystem Technology Application to Rail Systems Program (STARS) emphasizes solutions for the day-to-day problems of operating and maintaining rail transit systems. This program includes identifying operational problems, and applies and deploys existing technology for near-term solutions.

The STARS program has had some major achievements. The development of hardware has been initiated for fare collection equipment, winterization equipment, AC propulsion and improved signalling circuits. Technology assessments have been conducted to quantify rail transit problems and to determine other potential STARS projects in the area of advanced propulsion systems, electromagnetic interference (EMI), energy optimization, air conditioning systems, doors and escalators.

### AC Propulsion

Alternating current propulsion systems provide potential operating cost benefits over conventional DC systems because the motors contain no brushes or armatures, which are high maintenance items. In addition, the inverter allows the motors to provide regenerative braking over a wide range of speeds. This reduces total energy consumption as well as wear on the friction brake system.

The AC Propulsion project is developing the technology to utilize alternating current induction motors to provide traction for rail transit systems. Two contractors, Garrett AiResearch (CA-06-0175) and Westinghouse Electric Company (IT-06-0253), received contracts in April 1982





*An AC propulsion system will be installed on New York City R-44's similar to these for testing first at the Transportation Test Center and ultimately in revenue service.*

for Phase I of the project, which includes design and analysis, and engineering model testing at the end of 1983. One contractor will then be selected for Phase II, which includes prototype fabrication, installation on two New York R-44 cars, testing at the Pueblo Transportation Test Center, and evaluation. Phase II is scheduled to be completed in early 1986. A third phase is planned which would include operation in revenue service.

### **Fare Collection**

The objective of UMTA's Fare Collection project is to improve the reliability and availability of rail transit fare collec-

tion equipment. The project is strongly supported by rail transit authorities and equipment suppliers who participate in periodic workshops and in research and development grants. Grants have been awarded to PATCO (NJ-06-0012) for designing and testing a high reliability ticket vendor, and to CTA (IL-06-0049) for evaluating various pass reader systems. Other grants have been awarded for the development of an improved bill validator at the Illinois Central Gulf Railroad (ICG) (IL-06-0052), a centralized auditing and monitoring system at the MTA, Baltimore, Md. (MD-06-0091), and an improved turnstile at SEPTA (PA-06-0080).

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 at BART and WMATA. A study to obtain a broad and uniform assessment of fare collection equipment has been completed, and included the MBTA, PATCO, CTA, ICG, PATH, and MARTA. Workshops provide continued coordination among transit authorities and suppliers.

### **Winterization**

The major snow storms of the winters of 1978 and 1979, which paralyzed many transit systems, alerted the industry to the special measures required to maintain operations during severe winter weather. In response, APTA formed a Task Force on Rail Transit Snow and Ice Emergencies. The Task Force concluded that there is a need for a high capacity, specialized snow removal vehicle.

In support of this activity, a contract previously awarded for a winterization technology and systems operation study was amended to develop specifications for a universal rail-mounted snow removal vehicle. CTA used these specifications for the procurement of a prototype vehicle, which was delivered in March 1981. CTA was awarded a grant to test and modify the vehicle (IL-06-0048) with technical support provided by TSC. The vehicle, in retrofitted form, is currently undergoing tests.

### **Energy**

A computer model known as the Energy Management Model (EMM) was

developed by Carnegie-Mellon University to assess tractive energy conservation strategies. The EMM features two major modules: a train performance simulator, and an electrical network simulator. A separate module was designed to optimize results on the basis of cost. EMM validation tests on the regeneration strategy were conducted. An industry/user workshop on the EMM was held in 1981.

Other completed activities in energy conservation include: a grant to WMATA (DC-06-0315) to develop methodologies for auditing energy use, identifying conservation strategies, and reducing costs; a grant to Carnegie-Mellon University (PA-06-0059) to study energy utility rate structures and provide criteria for energy management programs; a project report (MA-06-015) to contain guidelines for increasing vehicle efficiency and reducing energy consumption; and a report (MA-06-0025) to evaluate several energy computer models with actual energy consumption data acquired on the BART system. A grant to Carnegie-Mellon University (PA-06-0083) will develop energy management guidelines for transit industry use and is expected to be completed in 1985.

### **Electromagnetic Interference (EMI) and Compatibility (EMC)**

Because of potential advantages in reliability, maintenance, and energy efficiency, solid-state propulsion control is increasingly being applied to rail transit. Unfortunately, this new equipment can be electromagnetically incompatible with existing train control and signalling systems at certain U.S. transit facilities.

Since early 1979, UMTA, with technical support from TSC, has been working in a cooperative effort with transit operators, their consultants and suppliers to develop Recommended Practices which are standardized methods of analysis and testing to quantify and resolve problems involving electro-magnetic compatibility (EMC) in rail transit operations. A Technical Working Group (TWG) and an APTA Liaison Board have been established, and significant progress has been made toward solving EMC problems.

Recommended Practices for testing intra-system electromagnetic compatibility between rail transit vehicular electrical power and track circuit signalling subsystems have been developed and may be requested by the industry from the Land Transportation Committee of the Institute of Electrical and Electronic Engineers (IEEE).

Section 6 R&D grants were awarded to Baltimore, Md. (MD-06-0072), and Atlanta, Ga. (GA-06-0013), to develop cost-effective hardware designs to guarantee EMC between propulsion and signalling equipment. Based on these grants, new hardware designs and equipment have been developed and tested; they have been introduced into revenue service in Atlanta and into the signalling hardware for Baltimore and Miami.

Cost-effective alternatives for EMC between chopper propulsion and signalling equipment for both new and existing systems have been developed. A system specific alternatives assessment (MA-06-0025) has been completed in support of the introduction of new chopper-controlled railcars at WMATA. In addition, the initial phase of a comprehensive assessment program for EMC in AC

propulsion system development is nearing completion.

Planned EMI/EMC program activities include completion of an additional Recommended Practices document, development of general vehicle EMC tests for the TTC, continuation of EMC analysis of advanced propulsion, and implementation of the EMI/EMC program's orderly transition to the transit industry. Technical assistance has been given to NFTA, MTA-MD (Baltimore), MARTA, MBTA and the Greater Cleveland Regional Transit Authority (GCRTA) for EMI testing of railcars and resolution of site specific EMI/EMC problems. Additional activities will include appropriate technical assistance to transit agencies on EMI problems, and continued support of the AC propulsion activities at TTC and the New York City Transit Authority.

### **Automatic Train Operation (ATO) and Automatic Train Control (ATC)**

The goal of this program is to improve the efficiency and safety of rail transit systems by matching the level of ATO/ATC (automation) to the specific needs of a transit system. This program is expected to produce guidelines and criteria by which senior transit management can evaluate proposed implementation plans for new transit systems or for the rehabilitation of existing systems.

Efforts were initiated to assess costs, reliability and maintainability of current and future signal and control systems. Concurrently, studies were conducted to include a review of the state-of-the-art of microprocessor-based ATO/ATC equipment and to study the role of human factors in control and communications. This program is expected to be-

come an element of a proposed UMTA strategic plan to encourage the introduction of advanced technology into the conventional transit market.

## Construction Management

The Urban Rail Construction Management Program focuses on near-term solutions to decrease maintenance costs, increase productivity, and rehabilitate deteriorating transit facilities. Federal concern with the potentially large cost of maintaining, upgrading, modernizing, rehabilitating or replacing the nation's transit facilities is increasing. Many rail transit systems are deteriorating and are unable to provide effective, reliable service.

The cost of rehabilitation can be lessened through a systematic, comprehensive, and consistent program for providing technical assistance to the transit operators. Technical assistance can help to increase transit system productivity and safety and facilitate maintenance and management. The program is based on a current inventory of the nation's rehabilitation and modernization needs, which will approach \$20 billion over the next decade.

### Contracting and Management

Studies by UMTA and others indicate that traditional institutional practices are a serious barrier to the deployment of innovative technology and actually contribute to the spiraling costs of transit. In response to these findings, UMTA has initiated R&D projects to develop contracting and management criteria for

transit authorities. The inherent risks and complexities of underground construction and rehabilitation are provided for in the formulation and assignment of these criteria.

A computer model for Tunnel and Station Cost Estimating Methodology (TASCAM) was developed (MA-06-0100). This model has been used by the Southern California Rapid Transit District (SCRTD) to perform various construction

cost tradeoffs for their preliminary designs. TASCAM was designed to help transit authorities develop cost effective designs for the different types of construction. The model is presently being updated with recent cost data produced in several transit construction projects, including NFTA, WMATA, and MTA-Baltimore.

The Building Research Advisory Board of the National Academy of Scien-



**UMTA work in construction and management includes TASCAM, a computer model designed to help determine cost tradeoffs in project design as well as management plan criteria for federally funded urban construction programs.**

ces has completed a study entitled Management of Urban Construction Programs (MA-06-0100). The study presents criteria that 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 also identifies decision-making roles at all levels and presents criteria and procedures for assigning responsibility, authority and control in carrying out quality assurance and quality control programs. Two well attended seminars were conducted in Los Angeles and New York, 1982, and Houston in 1983, to disseminate, study and discuss the program (DC-06-0345). Additional seminars are scheduled for Detroit and other cities in 1984.

A Rail Transit Design Digest is being developed to assist UMTA, transit planners, engineers, and other transit professionals in developing new rapid rail transit systems or in expanding and modernizing existing systems. The Digest will contain sections on major rapid transit system elements such as stations, yards, maintenance facilities and electrification. Other material of a more generalized nature will also be included, such as system design, construction, and operations within a framework of operating efficiency, maintainability, reliability, accessibility and commonality of system elements. The project involves detailed analysis of industry practices and of various standards, guidelines, codes, regulations and other documents used by the industry for the planning, design, construction, and operation of urban rail transit systems. A detailed outline for the scope and content of the Digest was developed by the American Public Transit Association (APTA) in the first phase of the project. UMTA has

selected a contractor to develop the Digest in the second phase (IT-06-0271). APTA and other organizations will assist UMTA in reviewing the technical material produced.

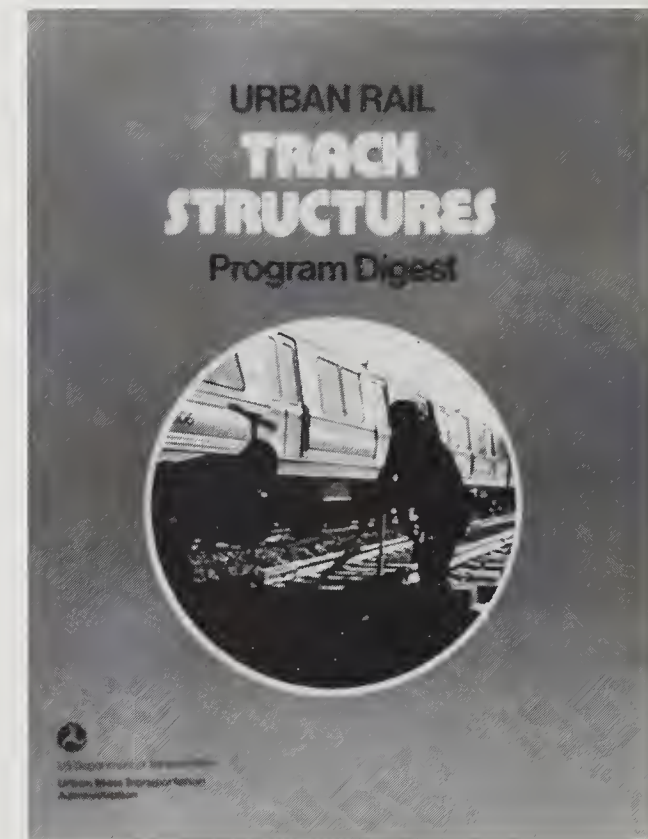
### **Elevated Structures**

Research underway on elevated structures emphasizes new techniques, procedures, and recommendations for technology-based inspection, maintenance, and rehabilitation. Deterioration and the associated increasing rehabilitation costs for elevated structures are becoming major problems for many rail transit operators. There are over 160 miles of rail transit elevated structures in the United States. These require varying degrees of maintenance and rehabilitation because of age and environmental effects. In-service inspection, including determination of degradation, is important to assure that these structures are safe for public use. Public safety also demands the development of improved criteria for replacement and rehabilitation projects.

Currently underway is a project to develop a design practices handbook (MA-06-0076) for steel box girders. This handbook will provide recommendations for the design of rail transit elevated structures. Also underway is a related study (GA-06-0010) that examines criteria which can be adjusted to local conditions, for the design of elevated structures. Studies have been initiated to develop better methods and techniques for the inspection and assessment of the structural integrity of elevated structures. In addition, an assessment has begun on the feasibility of retrofitting continuous welded rail and applying corrosion control treatments on elevated structures.

### **Track and Wayside Technology**

UMTA's objective in the Track and Wayside Technology Program is to improve the performance, reliability and safety of track, to reduce overall costs, and to optimize the use of rapid transit track. Every effort is being made to coordinate these activities with the different sectors of the U.S. transit industry to 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 generate recommendations for better track design, con-



struction standards, and maintenance guidelines.

A test section of track used to evaluate the noise characteristics of two different types of track structures in subway stations is underway in Chicago (IL-06-0042). The Chicago Transit Authority is evaluating direct fixation ties and ties made by STEDEF, Inc. Noise and ground vibration measurements will be taken in both railcars and station areas.

In New York on the Long Island Rail Road, measurements are being conducted on a 1-mile section of track which incorporates a continuous concrete slab instead of wooden ties for rail track support. These measurements and corresponding studies will determine the properties and effects of the concrete slab as compared to more conventional support systems. The use of continuous concrete slabs promises increased life and reduced maintenance requirements over wooden ties.

## Underground Structures

The primary focus of this program is to help reduce the cost of maintaining and rehabilitating existing tunnels. In addition, several projects are underway involving new construction procedures to help reduce underground construction costs.

Several tunneling studies are being made in the area of ground control and stabilization. Soil and construction parameters that affect the shifting of the ground around tunnels are being evaluated, and recommendations are being developed for procedures to predict and control these movements.

During site explorations for the MBTA Red Line Extension, innovative

geotechnical methods were used to predict subsurface conditions in "critical" construction zones (MA-06-0100). The 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 has been collected from the BART Berkeley Hills Tunnels. An analysis of the data was made to determine the state of the instrumentation and the extent of any ground movement around 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 is being monitored during construction through the use of construction control instrumentation. This evaluation (MA-06-0127) will examine the validity of the design approach in comparison with other designs.

Guidelines were completed for the structural design of tunnels based on the ultimate strength concepts of concrete behavior (MA-06-0100). The design recommendations reflect the application of nonlinear, ultimate strength analysis methods to concrete tunnel lining design and describe the beneficial effects of planned soil/structure interaction.

Water intrusion into subway structures is a major problem. WMATA has been awarded a grant (DC-06-0347) to investigate problems related to water leakage (e.g., calcification of hydrostatic pressure relief drains, acid water corrosion, and water intrusion through tunnel and station structures). The study will



***Research at WMATA will investigate causes and solutions to the water intrusion problems that plague subway systems, old and new.***

develop and test recommended solutions such as grouting and interior waterproofing mediums. This topic has been identified as an industry-wide problem as all tunnels experience some degree of water intrusion. Based on interest at NFTA, MARTA, and NYCTA, an additional study (MA-06-0156) with broader scope is examining a range of water related problems, potential solutions, and the success or failure of specific water-grout solutions for a variety of applications.

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

The Port Authority of Allegheny County (PAAC), Pittsburgh, Pa. has prepared an alternative design for the construction of the Mount Lebanon Transit

Tunnel (PA-06-0052). The PAT alternative is based on the New Austrian Tunneling Method (NATM), and is designed to offer this method as an option to bidders for the construction of the tunnel. Construction bids have been received for the tunnel project, and the winning contractor bid the NATM alternative. Early comparisons of the winning NATM bid against the PAAC engineer estimates indicate that significant construction cost potential exists for future NATM usage.

## Transportation Test Center

The Transportation Test Center (TTC), a DOT facility operating under the management of the Association of American Railroads (AAR) is a center for testing, evaluation and development of rail transportation systems and their components. The testing is performed by the AAR which assumed TTC operation in October 1982, under a contract with the Federal Railroad Administration.

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

In addition to the conventional third rail contact rail electrification, approximately two miles of simple overhead catenary has been constructed over part of the track to permit testing and evalua-



***Testing new rail cars at TTC, like these destined for the new Baltimore system, can help detect potential problems before entering revenue service.***

tion of urban railcars that use overhead power collection systems.

A permanent solid-state power station supplies electricity to the transit test track. It consists of two substations and a software control unit which gives the system the ability to automatically maintain desired third rail voltage levels at the vehicle, and to receive power regenerated from the vehicle.

The power station was first utilized in a fault clearing test on railcars used by the Metropolitan Atlanta Rail Transit Authority (MARTA). A surge of voltage was applied, and the operation of protective devices such as circuit breakers was observed.

The Rail Dynamics Laboratory is also located at TTC. It is designed to simulate vehicle/rail dynamics to facilitate study the periodic and random oscillations of

rail vehicles and its components.

The tight-turn loop is a 150-foot radius curve test track which enables researchers to validate wheel/rail dynamics and noise phenomena using the State-Of-The-Art vehicle.

The Urban Rail Building is another special facility at TTC. It is located within the transit test track oval and provides 20,000 square feet for vehicle service facilities.

Since 1978, test programs have been conducted on railcars from the Massachusetts Bay Transportation Authority (Orange and Blue Lines), Metropolitan Atlanta Rapid Transit Authority, Washington Metropolitan Area Transit Authority, Metropolitan Dade County Transportation Authority (these cars are similar to those purchased by the Maryland Mass Transit Administration for use in Baltimore), and

the Niagara Frontier Transportation Authority.

Items tested include brake systems and brake pad materials, coupler wear, noise measurements, thermal capability of the propulsion system, energy consumption measurements and electromagnetic interference evaluation. Special tests like these, quickly run at TTC, could not readily be performed by a transit operator.

## Rail and Construction Program

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>PROBLEM ANALYSIS</b>					
Transit Reliability Information System	MA-06-0060	\$2,500,000	Oct. 1980- Sept. 1981	TSC; Dynamics Research Corp.; APTA	Jeffrey G. Mora (202) 426-0090
<b>APPLICATION ENGINEERING</b>					
<b>Elderly and Handicapped Rail System Accessibility</b>					
Elderly and Handi- capped Accessibility	MA-06-0025 CA-06-0185	\$1,000,000	Sept. 1977- Dec. 1983	TSC; Veteran's Administration Rehabilitation Center; Technology Research and Analysis Corp.; Budd Co.; SFPUC	Jeffrey G. Mora (202) 426-0090
<b>Noise Abatement Technology</b>					
Damped Wheel In-Service Test	MA-06-0099	\$175,000	Feb. 1981- April 1983	Cambridge Collaborative	Paul Spencer (202) 426-0090
Resilient Fastener Evaluation	MA-06-0099	\$10,000	March 1979- April 1982	TSC; Chicago (Ill.) Urban Transportation District	Paul Spencer (202) 426-0090
Propulsion System Noise Control	MA-06-0099	\$285,000	Jan. 1981- Oct. 1982	Bolt, Beranek and Newman, Inc.	Paul Spencer (202) 426-0090
Elevated Structures	MA-06-0025	\$415,000	June 1978- April 1982	TSC; Bolt, Beranek and Newman, Inc.	Paul Spencer (202) 426-0090
Reduction of Groundborne Noise and Vibration	MA-06-0099	\$345,000	Aug. 1979- April 1982	TSC; Wilson, Ihrig and Associates	Paul Spencer (202) 426-0090
Noise Control	MA-06-0099	\$35,000	Sept. 1982- Sept. 1983	Energy and Environ- mental Engineering, Inc.	Paul Spencer (202) 426-0090



## Rail and Construction Program

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>APPLICATION ENGINEERING (CONT.)</b>					
<b>Wheel/Rail Dynamics</b>					
Steerable Truck Evaluation	MA-06-0025	\$900,000	Aug. 1977- July 1982	TSC; Budd Co.; Urban Transportation Development Corp.	Paul Spencer (202) 426-0090
Wheel/Rail Wear Investigation	MA-06-0025	\$200,000	July 1981- June 1984	TSC	Paul Spencer (202) 426-0090
Truck Performance Limits	MA-06-0025	\$60,000	June 1980- June 1984	TSC; Massachusetts Institute of Technology	Paul Spencer (202) 426-0090
Truck/Track Maintenance	MA-06-0025	\$150,000	Oct. 1981- Dec. 1984	TSC	Paul Spencer (202) 426-0090
<b>VEHICLES AND SUBSYSTEMS/STARS*</b>					
<b>AC Propulsion</b>					
AC Propulsion Project	CA-06-0175	\$1,351,000	April 1982- Dec. 1983	Garrett AiResearch	Robert Hoyler (202) 426-0090
AC Propulsion Project	IT-06-0253	\$2,510,000	April 1982- Dec. 1983	Westinghouse Electric Company	Robert Hoyler (202) 426-0090
AC Propulsion Project	IT-06-0253	\$291,000	March 1982- Jan. 1986	N.D. Lea and Associates	Robert Hoyler (202) 426-0090

\*STARS – Subsystem Technology Applications to Rail Systems.

## Rail and Construction Program

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>VEHICLES AND SUBSYSTEMS/STARS (CONT.)</b>					
<b>Fare Collection</b>					
Fare Collection Ticket Dispenser Development	NJ-06-0012	\$100,000	Oct. 1980- March 1982	PATCO	Walter Kulyk (202) 426-0090
Fare Collection Pass Reader Evaluation	IL-06-0049	\$200,000	Oct. 1981- Jan. 1982	CTA	Walter Kulyk (202) 426-0090
Fare Collection Bill Verifier Project	IL-06-0052	\$263,000	To Be Determined	Chicago RTA	Walter Kulyk (202) 426-0090
Fare Collection Monitor and Auditing Project	MD-06-0091	\$300,000	To Be Determined	MTA, Baltimore, Md.	Walter Kulyk (202) 426-0090
Improved Turnstile	PA-06-0080	\$225,000	Sept. 1982- May 1984	SEPTA	Walter Kulyk (202) 426-0090
<b>Winterization</b>					
Snow Removal Equipment	IL-06-0048	\$100,000	Oct. 1980- Oct. 1982	CTA	Ronald D. Kangas (202) 426-9264
<b>Energy</b>					
Energy Assessment	DC-06-0315	\$110,000	May 1980- May 1981	WMATA	Ronald D. Kangas (202) 496-9264
Energy Management Guidelines	PA-06-0083	\$200,000	June 1983- Feb. 1985	Carnegie-Mellon University	Fred L. Sing (202) 426-9264
Energy Use in Ground Transportation	MA-06-0153	\$95,000	Jan. 1982 June 1983	Booz-Allen & Hamilton, Inc.	Fred L. Sing (202) 426-9264
Comparative Evaluation of Energy Management Models for Transit Systems	MA-06-0025	\$188,000	Nov. 1981 Dec. 1983	TransTech International, Inc.	Fred L. Sing (202) 426-9264
<b>Electromagnetic Interference (EMI) and Compatibility (EMC)</b>					
EMI Countermeasures	MD-06-0072	\$400,000	Feb. 1980- March 1984	MTA, Baltimore, Md.	Fred L. Sing (202) 426-9264
EMI Countermeasures	GA-06-0013	\$195,000	June 1980- April 1983	MARTA	Fred L. Sing (202) 426-9264

## Rail and Construction Program

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>VEHICLES AND SUBSYSTEMS/STARS (CONT.)</b>					
<b>Air Conditioning</b>					
Air Conditioning Project	IT-06-0250	\$288,000	May 1982- Dec. 1985	Data Communications, Inc.	Jeffrey Mora (202) 426-0090
<b>CONSTRUCTION MANAGEMENT</b>					
<b>Contracting and Management</b>					
Allocation of Risk in Construction	MA-06-0097	\$142,000	July 1979- Feb. 1982	Massachusetts Institute of Technology	Howard Evoy (202) 426-9264
Construction Cost Estimating Methodology	MA-06-0100	\$220,000	Jan. 1980- Sept. 1983	TSC	John Putukian (617) 494-2275
Project Management Seminars	DC-06-0345	\$50,000	Aug. 1981 Aug. 1982	TSC; National Academy of Sciences	Raymond Williams (202) 426-0090
<b>Elevated Structures</b>					
Design Practices for Steel Box Girders	MA-06-0076	\$90,000	May 1980- July 1983	University of Maryland	Howard Evoy (202) 426-9264
Development of Design Criteria for Aerial Structures	GA-06-0010	\$135,000	Dec. 1978- April 1983	Harrington, George and Dunn, Inc.	Howard Evoy (202) 426-9264
Design Analysis of Elevated Structures	MA-06-0096	\$57,000	Sept. 1979- March 1982	Massachusetts Institute of Technology	Paul Spencer (202) 426-0090

## Rail and Construction Program

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>CONSTRUCTION MANAGEMENT (CONT.)</b>					
<b>Track and Wayside Technology</b>					
Transit Track/Noise Test Section	IL-06-0042	\$700,000	Nov. 1978- Dec. 1984	CTA	Raymond Williams (202) 426-0090
Industrial Engineering Support for Track Maintenance	DC-06-0333	\$1,200,000	Oct. 1980- Oct. 1983	WMATA	Howard Evoy (202) 426-9264
Rehabilitation Research Needs Study	MA-06-0100	\$238,000	Dec. 1979- March 1982	TSC; Urban Trans- portation Develop- ment Corp.	Howard Evoy (202) 426-9264
Track Structure Shear Test	MA-06-0100	\$75,000	Aug. 1980- Aug. 1982	TSC; University of Arizona	Howard Evoy (202) 426-9264
Concrete Tie Deployment Analysis	MA-06-0100	\$20,000	Dec. 1981- March 1982	TSC; Delon Hampton Associates	Howard Evoy (202) 426-9264
<b>Underground Structures</b>					
MBTA Site Exploration	MA-06-0100	\$486,000	Oct. 1978- June 1982	TSC; Bechtel Corp.; Haley and Aldrich, Inc.	Howard Evoy (202) 426-9264
Berkeley Hills Tunnel Instrumentation Analysis	CA-06-0120	\$100,000	Dec. 1978- July 1982	BART	Howard Evoy (202) 426-9264
Porter Square Design Evaluation	MA-06-0127	\$235,000	Oct. 1980- Dec. 1982	MBTA	Howard Evoy (202) 426-9264
Tunnel Boring Machine Evaluation	MA-06-0100	\$164,000	July 1980- June 1983	TSC; Goldberg, Zoino and Associates	Howard Evoy (202) 426-9264
Analysis of Dipped Guideways for Rail	CA-06-0144	\$178,000	July 1980- June 1982	Jet Propulsion Laboratory	Howard Evoy (202) 426-9264

## Rail and Construction Program

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>CONSTRUCTION MANAGEMENT (CONT.)</b>					
<b>Underground Structures (Cont.)</b>					
Design Recommendations for Concrete Tunnel Liners	MA-06-0100	\$350,000	April 1978- Feb. 1983	TSC; University of Illinois, Urbana-Champaign	Howard Evoy (202) 426-9264
Development of an Extruded Tunnel Lining System (ETLS)	MA-06-0100	\$2,051,000	Jan. 1978- March 1983	TSC; Foster Miller Associates, Inc.	Howard Evoy (202) 426-9264
ETLS Deployment Analysis	MA-06-0100	\$30,000	Oct. 1980- Oct. 1982	TSC; Delon Hampton Associates	Howard Evoy (202) 426-9264
Investigation of Water Intrusion Problems	DC-06-0347	\$455,000	March 1981- March 1983	WMATA	Howard Evoy (202) 426-9264
Nondestructive Testing (NDT) Tunnel Inspection	NY-06-0077	\$800,000	April 1980- Oct. 1983	PATH	Howard Evoy (202) 426-9264
Validation of WMATA Ventilation Design	DC-06-0267	\$469,000	Aug. 1979- March 1982	WMATA	Howard Evoy (202) 426-9264
Subway Environmental Simulation: Emergency Ventilation	MA-06-0100	\$210,000	Nov. 1978- Sept. 1983	TSC; Parsons, Brinkerhoff, Quade and Douglas	Howard Evoy (202) 426-9264
New Australian Tunneling Method (NATM) Test Section	PA-06-0052	\$484,000	June 1979- Feb. 1983	PAAC	Howard Evoy (202) 426-9264
Analysis of WMATA Construction Monitoring Data	MA-06-0100	\$40,000	March 1979- March 1982	TSC; FHWA; WMATA	Howard Evoy (202) 426-9264

## Rail and Construction Program

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>CONSTRUCTION MANAGEMENT (CONT.)</b>					
<b>Underground Structures (Cont.)</b>					
Monitoring of MBTA Slurry Wall Construction	MA-06-0100	\$50,000	March 1979- Sept. 1982	TSC; FHWA; MBTA	James H. Lamond (617) 494-2741
Precast Concrete Liners Test Section	MD-06-0029 MD-06-0039	\$728,000	Oct. 1978- June 1982	MTA, Baltimore, Md.	Howard Evoy (202) 426-9264
Tunneling Technology Workshops and Seminars	DC-06-0368	\$50,000	Oct. 1981- Oct. 1982	TSC; OAO Corp.	Howard Evoy (202) 426-9264
Rock Station and Tunnel Test Section	GA-06-0007	\$480,000	Aug. 1977- March 1982	MARTA	Howard Evoy (202) 426-9264
In Situ Stress Measurements in Tunnels	DC-06-0312	\$27,000	Aug. 1980- June 1982	National Science Foundation; University of California, Berkeley	Howard Evoy (202) 426-9264
Geologic Site Investigation for Tunnels	MA-06-0100	\$357,000	Oct. 1981- Oct. 1983	TSC; National Academy of Sciences	Philip A. Mattson (617) 494-2741
Program Development Support	MA-06-0100	\$50,000	Oct. 1981- Oct. 1982	TSC; OAO Corp.	Gerald R. Saulnier (617) 494-2356
Evaluation of Deep Weather Rock: Forest Glen Station	DC-06-0343	\$55,000	Feb. 1981- Dec. 1982	WMATA	Howard Evoy (202) 426-9264
Tunnel Water Intrusion In Transit Tunnels	MA-06-0156	\$100,000	Oct. 1983- Oct. 1984	Paul Parks, Assoc.	Howard Evoy (202) 426-9264
Rail Transit Design Digest	DC-06-0186	\$300,000	Aug. 1978- June 1984	APTA	Howard Evoy (202) 426-9264
Peer Reviews	FL-06-0032	\$100,000	June 1982- June 1984	Metropolitan Dade Transportation Administration	Howard Evoy (202) 426-9264
<b>TRANSPORTATION TEST CENTER</b>					
TTC Support	CO-06-0009	\$2,200,000	Oct. 1980- Continuing	FRA/AAR	Fred L. Sing (202) 426-9264

## Bibliography

A list of recent reports follows. Please consult previous editions of this Directory for earlier reports. If available, a document number assigned by the National Technical Information Service (NTIS) is listed. Reports may be obtained from NTIS by using the order blanks provided at the end of this document.

Reports which have not been assigned an NTIS number may not have been published in sufficient quantity for general distribution. Single copies and other information may be available from the issuing agency or organization.

Additional reports relating to the research described in this chapter may become available in the near future. For the most recent information or suggestions for additional reference materials regarding specific projects, call or write to the person listed as the technical contact in the Project Summary Table.

## PROBLEM ANALYSIS

### **Evaluation of the Transit Reliability Information Program**

Information Program  
Proj. MA-06-0126-82-15  
Carnegie-Mellon University  
July 1982

### **Transit Reliability Information Program PATCO-WMATA Propulsion Reliability/Productivity Analysis**

Proj. MA-06-0153  
Dynamics Research Corporation  
September 1983

### **Transit Reliability Information Program Final Technical Report**

Proj. MA-06-0153-84-1

Dynamics Research Corporation  
May 1984, PB 84-231117

## APPLICATION ENGINEERING

### ***Elderly and Handicapped Rail Accessibility***

#### **Installation of Existing Lift System for the Handicapped on Light Rail Vehicles**

Proj. MA-06-0025  
Budd Company  
December 1984

### ***Wheel/Rail Dynamics***

#### **Analysis of Wheel/Rail Force and Flange Force During Steady-State Curving of Rigid Trucks**

Proj. MA-06-0025  
Transportation Systems Center  
September 1980, PB 81-103459

#### **Measurement of Wheel/Rail Forces at the Washington Metropolitan Area Transit Authority**

Proj. MA-06-0025  
Transportation Systems Center  
July 1980, PB 80-212-772

#### **Algorithms and Parametric Studies for Assessing Effects of Two-Point Contact**

Proj. MA-06-0025  
Analytic Sciences Corporation  
March 1983

#### **Stability and Curving Performance of Conventional and Advanced Rail Transit Vehicles**

Proj. MA-06-0025  
D. Wormly, J. Hedrick, M. Nagarka  
MIT  
December 1983

## VEHICLES AND SUBSYSTEMS

### **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

### ***Fare Collection***

#### **Automatic Fare Collection Equipment, Reliability and Maintainability Assessment Plan for Urban Rail Transit Properties**

Proj. MA-06-0025  
Automated Services, Inc.  
March 1981, UMTA-MA-06-0025-81-1

#### **Assessment of WMATA's Automatic Fare Collection Equipment Performance**

Proj. MA-06-0080  
Input/Output Computer Services  
January 1981, UMTA-MA-06-0080-80-1

#### **Description and Evaluation of the MBTA Magnetic Card Fare Collection System**

Proj. MA-06-0025  
Dynatrend, Inc.  
September 1981, UMTA-MA-06-0025-81-2

#### **Rail Transit Fare Collection Technology Assessment**

Proj. MA-06-0025  
Jet Propulsion Laboratory  
In Process

### ***Energy***

#### **Energy Cost Reduction Study of the Washington Metropolitan Area Transit Authority Metrorail System**

Vol. I, Final Report  
Proj. DC-06-0315  
R.A. Uher and A. Sathi  
May 1982, PB 83-115378

#### **Energy Cost Reduction Study of the Washington Metropolitan Area Transit Authority Metrorail System Vol. II, Appendices**

Proj. DC-06-0315  
R.A. Uher, A. Sathi, and N. Sathi  
May 1982, PB 83-115-386

**Power Rate Structure Aspects of Energy Cost for Rapid Transit Systems**

Proj. PA-06-0059

R.A. Uher and O.N. Sharma

June 1982, PB 260118

**Energy Use in Ground Transportation**

Proj. MA-06-0153

Booz, Allen and Hamilton, Inc.

In Process

***Electromagnetic Interference (EMI) and Compatibility (EMC)***

**Harmonic Characteristics of Rectifier Substations and their Impact on Audio-Frequency Track Circuits**

Proj. MA-06-0025

V. Nene

May 1982, PB 82-229659

**Status of Advanced Propulsion Technology in Japan**

Proj. MA-06-0025-81-5

V. Nene

May 1982

**Electromagnetic Interference Characteristics of Advanced Propulsion Systems for Urban Rail Vehicles**

Proj. VA-06-0075

V. Nene

February 1981, PB 81-212-730

**Statistics of Chopper Interference on Multi-Car Trains**

Proj. MA-06-0025

University of Lowell

February 1981, UMTA-TSC-DTS-66/84-06

**Recommended Practices for Rail Transit Intra-System Electromagnetic Compatibility of Vehicular Electrical Power and Track Circuit Signalling Subsystems**

**Vol. I, Inductive Recommended Practices**

**Vol. II, Conductive Recommended Practices**

Proj. MA-06-0025

Transportation Systems Center

May 1982

**Electromagnetic Interference Mitigation of Audio Frequency Signalling System for Baltimore Regional Rapid Transit System**

Proj. MD-06-0072

Vaughn/Mokkapti/Bozio

November 1983, UMTA-MD-06-0072-83-1

**CONSTRUCTION TECHNOLOGY**

***Contracting and Management***

**Management of Urban Construction Programs**

**Vol. I, Guidelines for Development of Project Management Plans**

**Vol. II, Supplemental Information Committee on Management of Urban Construction**

Proj. MA-06-0100

National Research Council, Building Research Advisory Board

June 1981, PB 81-242-380,398

***Elevated Structures***

**Investigation of Design Standards for Urban Rail Transit Elevated Structures**

Proj. GA-06-0010

Harrington, George and Dunn, Inc.

June 1981, UMTA-GA-060-0010-81-1

***Track and Wayside Technology***

**Interaction and Load Transfer Through Track Support Systems**

**Parts I and II**

Proj. OS-80013

University of Arizona

September 1982

**Pilot Study for Definition of Track Component Load Environments**

Proj. MA-06-0100

Kaman Avidyne

February 1981, PB 81-203-531

**Technical and Economic Feasibility Study of At-Grade Concrete Slab Track for Urban Rail Transit Systems**

Proj. MA-06-0100

Amir N. Hanna

August 1981, PB 82-113-812

***Underground Structures***

**Field Evaluation of Advanced Methods of Geotechnical Instrumentation for Transit Tunneling**

Proj. MA-06-0100

Bechtel Corporation, Haley and Aldrich

March 1983

**Design Recommendations for Concrete Tunnel Liners**

Proj. MA-06-0100

University of Illinois

February 1983

**Development of an Extruded Tunnel Lining System**

Proj. MA-06-0100

Foster Miller Associates, Inc.

March 1983

**TRANSPORTATION TEST CENTER**

**Steady State Curving and Wheel/Rail Wear Properties of a Transit Vehicle on the Tight Turn Loop**

Proj. CO-06-0009

Transportation Test Center

December 1982, UMTA-CO-06-0009-83-1

**Transit Car Demonstration Test Program on the Roll Dynamics Unit**

Vol. I

Proj. CO-06-0009

Transportation Test Center

September 1982, UMTA-CO-06-0009-83-2

**Transit Car Demonstration Test Program on the Roll Dynamics Unit**

Vol. II

Proj. CO-06-0009

Transportation Test Center

February 1982, UMTA-CO-06-0009-83-3



# New Systems and Technology

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## Trends and Highlights



Not all transit improvements can be expected to evolve directly from conventional modes of service. General advancements in technology and innovations in related fields of transportation are a continuing source of opportunities for potential cost, safety and service improvements in public transit. The small automated transit systems, known as people movers and currently operating at a number of airports, college campuses, amusement parks and other activity centers in the U.S., are one such source of new technologies. These systems employ driverless vehicles on exclusive guideways and have proved to be reliable, effective, and popular modes of transportation. They use a wide variety of innovative propulsion, guideway and automatic control techniques.

UMTA's program in these technologies is known as the Advanced Group Rapid Transit (AGRT) Program. In the past, the AGRT Program concentrated on systems analysis and the development of operational test tracks to demonstrate automated guideway transit system concepts. Since FY 82, AGRT activities were shifted to focus on the important subsystems and components which have application not only to automated guideway systems, but also to conventional rail systems.

Other new technology projects currently underway include the testing of an accelerating walkway and a concentrated effort to find technological solutions to the severe problems faced by transit systems during severe cold weather or unusual snow and ice conditions.

## Advanced Group Rapid Transit (AGRT)

The concept definition phase of UMTA's Advanced Group Rapid Transit Program was completed in August 1975. Three contractors—Boeing Aerospace Co., Otis Elevator Co., and Rohr Industries—produced competing preliminary designs. Boeing's system concept included use of rubber-tired vehicles driven by rotary traction motors. The Otis concept employed an air-cushion suspension system operating in conjunction with linear induction motor propulsion. The Rohr concept included use of magnetically suspended and propelled vehicles. This approach, because of its elimination of most moving parts associated with vehicle propulsion and suspension, has the potential for significant reductions in capital and maintenance costs.

In June 1979 contracts were awarded to Boeing and Otis (WA-06-0011, CO-06-0011). Critical technology elements of the Boeing and Otis concepts are included in the current AGRT program. The Rohr magnetic levitation/propulsion effort was continued by Boeing, which acquired rights to the Rohr concept under license.

The specific objectives of the current program are 1) reduction of economic and technological risks associated with development of critical technology, 2) development of standards of performance and design for selected critical subsystems and 3) development and testing of subsystems.

Technologies which are being emphasized and which have broad applications to transit include: onboard colli-

sion avoidance sensors, fault-tolerant vehicle control equipment, and power conditioning equipment for control of linear induction and AC propulsion motors.

## Other Projects

### Accelerating Walkways

Work on accelerating walkways was carried out through a grant to the Tri-State Regional Planning Commission. Accelerating walkways are devices capable of transporting large numbers of pedestrians 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.

An accelerating walkway feasibility study was completed in FY 81 (IT-06-0126). 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 were completed by four contractors: Ateliers et Chantiers de Bretagne (ACB), Boeing Aerospace Co., Dean Research Corp. and Dunlop Transportation Systems, Ltd. The contracts covered design documentation, analytical studies, and preliminary demonstration studies. Phase III, which provides for acquisition of test and operational data, is currently underway in France, using a walkway manufactured by ACB.

### Cold Weather Transit Technology Program

In the aftermath of the major operational difficulties experienced by transit

systems during the winter of 1978, Congress became increasingly concerned with the inability of transit systems to operate 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 in severe winter weather.

Recognizing the need for fundamental research and development activity to address this problem, Congress appropriated \$5.5 million in FY 80 for the prompt initiation of research to advance cold weather transit technology, and an additional \$5.5 million in FY 81 to continue the program now scheduled for completion in early 1984. Congress also directed that the program be conducted by the University of Notre Dame in Indiana, and was in favor of pursuing the program proposed by the Vought Corp. in Texas. The program involved evaluation of high pressure water field testing, low frequency radiation laboratory testing, and other methods of removing ice and snow from third rails. Other tests included switch heater, third rail tests and traction motor snow ingestion prevention. The successful identification of the cause of rail pull-aparts for continuous welded rail, along with the recommended solutions, is a direct result of this program. All final reports are scheduled for completion in early 1984. The reports are identified in the bibliography.



*The Cold Weather Technology Program investigates problems and innovative solutions to cold weather transit operating problems on both the railcars and railbeds.*

## New Systems and Technology

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>ADVANCED GROUP RAPID TRANSIT (AGRT)</b>					
Phase IIB AGRT Development	WA-06-0011	\$28,082,000	Sept. 1979-	Boeing Aero- space Co.; Otis Elevator Co.	Robert Hoyler (202) 426-0090
	CO-06-0011	\$25,248,000	Sept. 1985		
	WA-06-0014	\$3,939,000			
Technical Studies in Safety and Dependability	IT-06-0190	\$712,000	July 1979- Oct. 1983	Battelle Columbus Laboratory	Robert Hoyler (202) 426-0090
Technical Studies in Magnetic Levitation	VA-06-0067	\$186,000	Oct. 1980- Sept. 1983	MITRE Corp.	Robert Hoyler (202) 426-0090
<b>OTHER PROJECTS</b>					
Accelerating Walkways	IT-06-0126	\$3,386,000	Aug. 1976- Sept. 1983	Tri-State Regional Planning Commission, N.Y.; Port Authority Of New York and New Jersey	Robert Hoyler (202) 426-0090
Cold Weather Transit Technology Program	IN-06-0009	\$11,000,000	Jan. 1980- Oct. 1983	University of Notre Dame	Ronald Kangas (202) 426-9264

## Bibliography

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Additional reports relating to the research described in this chapter may become available in the near future. For the most recent information or suggestions for additional reference materials regarding specific projects, call or write to the person listed as the technical contact in the Project Summary Table.

## **ADVANCED GROUP RAPID TRANSIT (AGRT)**

### **Executive Summary, Cold Weather Transit Technology, Phase II Summary**

Vol. I  
Proj. IN-06-0009-83-1, PG 84-191-618

### **Transit System Survey**

Vol. II  
Proj. IN-06-0009  
Vought Corporation  
May 1983, PB 83-219-527

### **Investigation of the High Incidence of Rail Pull Aparts on Continuous Welded Rail**

Vol. III  
Proj. IN-06-0009  
Vought Corporation  
May 1983, PB 83-218-263

## **COLD WEATHER TRANSIT TECHNOLOGY PROGRAM**

### **Investigation of Rail Heater Reliability**

Vol. III  
Proj. IN-06-0009  
Vought Corporation, PB 84-155-381

### **Third Rail Deicing System Research**

Vol. V  
Proj. IN-06-0009  
Vought Corporation, PB 84-159-982

### **Winterization of Self-Ventilated Traction Motors on Rail Transit Vehicles**

Vol. VI  
Proj. IN-06-0009  
Vought Corporation  
Nov. 1983, PB 84-136-753

### **Track Switch Deicing System Research**

Vol. VII  
Proj. IN-06-0009  
Vought Corporation, PB 84-155-407

### **Bus Wheel Housing Deicing Project**

Vol. VIII  
Proj. IN-06-0009  
Vought Corporation  
Nov. 1983, PB 84-137-462

### **Ice Formulation Precursor Research**

Vol. IX  
Proj. IN-06-0009  
Notre Dame University

### **Composite Rail and Associated Surface Phenomenon**

Vol. X  
Proj. IN-06-0009  
Notre Dame University

### **Prediction of Ice Formation**

Vol. XI  
Proj. IN-06-0009  
Notre Dame University, PB 84-159-995

### **Study of Laser Deicing**

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# Service and Methods

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## Trends and Highlights



The purpose of UMTA's Service and Methods Demonstrations (SMD) is to improve the quality and efficiency of urban transportation by sponsoring the implementation of new transportation management techniques and innovative transit services. The program focuses on strategies that utilize existing transportation technology to provide improvements requiring relatively low levels of capital investment and able to be implemented in a short time frame.

During the past year a major activity area has been the dissemination of information from the program. A major training and technical assistance contract was signed and the Public Transportation Network (PTN) was launched. PTN will consist of a facilitator in each of the ten Federal regions who will receive requests for information and match these with available resources such as consultants or professionals in other urban areas who have experience with a similar problem. Two regional facilitators were selected in the fall of 1983. Other information dissemination activities include the establishment of the resource center on transit pricing to provide technical assistance for transit operators on pass programs, fare setting and type of fare systems. Also, a video teleconference on transit pricing was held in February of 1983.

Another area receiving increased emphasis is rural transportation. UMTA has taken over responsibility for the Section 18 Rural Transportation Program from the Federal Highway Administration, and the SMD rural program will support the new UMTA office. There will be a strong emphasis on technical assistance and training, but demonstrations will be conducted to develop lower cost transportation alterna-

tives for rural areas utilizing existing providers.

Recent program results include project findings which demonstrated low cost service alternatives to fixed route transit in low density areas, self-service fare collection, and pass programs.

A new area of study is the management of transportation systems. This is being investigated in the CBD through projects in Hartford and Denver and in suburban areas where site specific projects are being developed. The objective is to bring the public and private sectors together in a collaborative effort to manage transportation resources including mass transit, ridesharing, privately owned services, streets and highways and parking. These Transportation Management Organizations (TMOs) will seek to make a more rational use of transportation investments and mitigate the negative affects of the automobile.

## Information Dissemination and Technical Assistance

In recent years the SMD program has focused most of its resources on developing, implementing and evaluating demonstrations of innovations in mass transportation. From these efforts a substantial body of knowledge has been developed encompassing a wide range of service and fare options available to local decision makers and planners. As financial resources become more limited at the local level and as federal funds for operating assistance decrease, local com-

munities have a growing need to improve productivities and efficiencies. By providing information about the range of options available and by providing technical assistance to implement these improvements, SMD can enable localities to make the best use of limited resources.

A major project (IT-06-0284) in this area has been the establishment of the Public Transportation Network (PTN). PTN is a broad based technical assistance program designed to encourage the adoption of improved practices within the transportation community through a peer to peer matching program. The PTN is organized into two major areas, Regional Facilitators and Developer-Demonstrators. This peer to peer exchange of ideas is the cornerstone of the PTN program. In order to become a Developer-Demonstrator an individual must be certified by UMTA through the Dissemination Review Panel. Regional Facilitators will also help communities identify and work in conjunction with other UMTA technical assistance programs.

The International City Management Association (ICMA) project (DC-06-0425) is to promote awareness and adoption of innovative cost effective techniques to city managers and local elected officials and will be accomplished through workshops, peer exchanges and reference materials in order to build a resource of information.

Another project (DC-06-0450) will continue three key facets of the Technical Assistance program: the SMD Briefs, and SMD Host program and national conferences and workshops. The SMD Briefs are one page summaries of current activities of active demonstration projects. The SMD Host program allows indi-

viduals to visit various demonstration projects in order to learn about their implementation and operation first hand. Two national conferences, one on timed transfer applications and the other, a video teleconference, on pricing strategies were held in FY 1983.

The West Virginia University project (WV-11-0003) is developing course modules in various transportation techniques that may be taught on the undergraduate or graduate level as part of a current transportation curriculum. Currently work is being completed in the areas of paratransit, marketing and brokerage.

Under a program support contract, a set of analogous planning aids incorporating the results and lessons from the demonstration program are being developed. This contract also provides for demonstration project development and technical assistance to recipients of SMD demonstration funding.

The Transportation Systems Center (MA-06-0049) has continued the work of evaluating ongoing demonstration projects. In addition, special studies, case studies and cross cutting studies of innovative transportation projects are also being conducted. Recently, a user side subsidy implementation planning manual has been developed.

In addition to these more broadly based technical assistance efforts, there are several other projects that are aimed at a more specific target audience. These include the pricing resource center (MD-06-0093) and the rural technical assistance projects (DC-06-0406, MD-06-0093). A series of audio visual presentations on the brokerage concept are available on loan from the University of Tennessee (TN-06-0012). A contract was



awarded to disseminate cost effective methods of providing transportation to persons with special needs (MA-06-0157). The International City Management Association, in conjunction with the National League of Cities, is disseminating information about transportation for handicapped persons (DC-06-0393). More detail on these projects may be found in other sections of this chapter.

## Transportation Services for Special User Groups

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. In addressing the problem of transportation for elderly and disabled persons, it has become evident that there is no single solution for every individual or locality. Thus, a range of service options has been tested, evaluated and documented. Local officials now have at their disposal information on a wide range of approaches, from which they can select the ones most suited to their particular environment.

Transit buses equipped with lifts to provide access for wheelchair users and others who cannot use steps are now in operation throughout the United States, in cities with widely varying characteristics. The early technological problems which prevented consistent operation of the lifts have been surmounted, but costly maintenance, problems of service reliability, and low ridership characterize many of these services.

The qualified success of the accessible fixed-route services is contrasted to the number and variety of paratransit programs being conducted. These range from user subsidy programs to transportation brokerage systems. The private transportation provider, whether taxi, van operator or private nonprofit provider, has emerged as a key participant in specialized paratransit services. Emphasis is now being placed on enhancing paratransit service productivity.

With the reduction in many human service agency budgets, the efficient use of transportation funds becomes even more imperative. Coordination of funding and services in urban areas is being demonstrated in a number of ways. These efforts involve such things as interagency referral of transportation information, joint purchasing arrangements, and consolidation of equipment and transportation services. Some agencies can now purchase transportation from other providers to serve their clients. In other efforts the local transit authority acts as a broker, matching the demand for special services with available supply from both public vehicles and private companies.

### Coordinated Services for the Elderly and Handicapped

In many cities and regions, special transportation services for the elderly and handicapped are provided or funded by a variety of social service agencies and organizations. Often the agencies in a particular locality are not as a whole 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. Experienced transportation providers such as taxi operators are often overlooked when new services are established.

A coordinated transportation program, utilizing public and private transportation firms in conjunction with social service agencies, could provide at least a partial solution to the problem of limited mobility 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 varying sizes. These include consolidating services under one central provider, developing multifunded neighborhood-based paratransit, and an approach in which a transportation broker matches individual and agency needs with the most appropriate provider.

A planning project (RI-06-0012) conducted by the Rhode Island DOT will design a new organizational model for a statewide coordination center. A brokerage function will seek to facilitate the efficient use of all public and specialized service within the state through incremental coordination.

### User Subsidy Demonstrations

Another approach which UMTA has fostered to improve transportation for the elderly and handicapped in various cities is to directly subsidize the cost of trips purchased by those users, rather than subsidize the transportation providers. In this manner, a city can choose for whom and at what level to subsidize transportation. User subsidies in the form of dis-



*Private providers can play an important role in providing special user transportation services.*

counted rates for bus or taxi fares through the use of tickets or voucher systems have been tested by UMTA in a number of cities.

Two current user subsidy demonstrations are operating in San Diego, California (CA-06-0170) and Northern Virginia (VA-06-0104), to test the feasibility of using this concept as the catalyst for coordinating social service transportation services. Agencies will purchase ride tickets from the city and distribute them to their clients according to their own criteria. The tickets can then be used on vehicles owned by any eligible provider. Administrative, operational and service aspects of the project will be evaluated. The San Diego project is also an example of a large city converting an existing dial-a-ride to a user side subsidy. Based on the experience from past user subsidy demonstrations, a planning handbook focusing

on how to implement a local user subsidy has been published.

### **Other Activities**

A grant was awarded to the International City Management Association (ICMA) in conjunction with the National League of Cities (NLC) to prepare readings, articles and other information dissemination pieces on cost-effective ways of providing transportation for handicapped persons (DC-06-0393). These articles and readings will be broadly distributed to ICMA and NLC membership.

In September 1982 a contract was awarded (DC-06-0417) to investigate the extent of volunteer use in transportation programs for the elderly and handicapped. A grant was also made in September to the Vera Institute of Justice (NY-06-0096) to plan a demonstration of rides to work for handicapped persons. This

grant, matched by IBM, is one of a number of private/public sector initiatives.

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. One of the objectives of the project is to encourage active participation by neighborhood residents in both the planning and operation of the service. Extensive market research in the community during 1983 to determine needs for both internal community circulation and employment travel. The resulting plan focuses on introducing shared ride taxi services and improving information through establishment of neighborhood based transit information agents. Through its ongoing brokerage demonstration, the Greater Bridgeport Transit District will also integrate east side paratransit needs with other services sponsored by the transit district.

In May of 1983 a contract was awarded (MA-06-0157) to: develop a how-to manual for providers of transportation service to handicapped persons, based on previous unpublished work; provide case studies of hands on technical assistance to providers of transportation service to handicapped people; and to develop a demonstration plan for a travel and transit information service for handicapped people. The goal of these efforts are to help local agencies to help themselves and to fulfill UMTA's objective of improving the mobility of handicapped persons.

## Fare and Pricing Policies

The main objective of exploring variations in fare pricing policies is to increase transit ridership and revenues, and to reduce operating costs. Current pricing research examines the impact of fare and service strategies directed toward particular market segments that have a high potential for increased ridership.

Information on fare incentives helps specify marketing strategies that stimulate the private sector to share the cost of transit and carpools. Fare incentives can promote ride sharing and provide alternatives to subsidized parking. Other public/private co-ventures are being examined with the aim of facilitating transit improvements, generating additional revenues and improving service productivity.

Transit fare prepayment techniques, applied through programs sponsored by employers and merchants, help to penetrate specific markets. Such diversification requires improved fare collection techniques. More comprehensive fare policies that also simplify collection and distribution of revenues are needed. In addition, conventional transit pricing strategies are being used to analyze the integration of paratransit services through transportation brokerage.

By clarifying the impacts of fare and service changes on demand and revenues, guidelines for planning for fare variations can be provided to the transit industry. This is done through seminars for general managers and board members in which the results of operational and research experience in multi-modal pricing and related service improvements are discussed.

## 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. Past demonstration and evaluation projects have provided information regarding the costs and benefits of fare incentive programs.

In this past year additional results were obtained from a downtown fare free zone in Albany, N.Y. (NY-06-0064). This project has shown remarkable ridership increases by tripling pre-fare free levels. A major impact of fare abolitions was an increase in the frequency of individual transit trips by different groups. In Albany, it was possible to assess the effect of improving downtown mobility on retail economic activity. The study indicates that downtown retail sales increased by approximately 10 percent while countywide sales decreased by 3 percent. The greatest impact on retail sales occurred for merchants located on transit routes and during the Christmas season.

One of the major findings of the fare free demonstrations was that a certain proportion of new riders is retained following the termination of free service. 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. The question of whether this period is sufficient to engender a long-term change in transit users' habits is being addressed in

ongoing demonstrations and evaluations. Also being explored is the question of whether sufficient additional revenue accrues to compensate for promotional price reductions.

A technical support study (PA-06-0056) is providing technical assistance in a demonstration to show that public/private cooperative efforts can increase transit revenues and also enhance economic stability.

The Metropolitan Transit Commission in St. Paul has begun a demonstration (MN-52-0001) that will test a variety of fare incentives and marketing techniques on selected transit routes. The overall goal of this project is to generate increased ridership using fare discounting operations and marketing information specific to the individual bus routes. Residents along the five test routes will be mailed a mini-newspaper with specific route information and a single ticket good for one ride on any MTC bus. Merchants along these routes will be allowed free advertising space in the papers in exchange for selling fare discount cards that feature six rides for the price of five.

## Transit Fare Prepayment (TFP) Options

Transit fare prepayment programs can be an effective means of implementing fare policies for managing transit demand and cost. Most transit properties offer some form of prepaid fares, but transit operators have only recently begun to actively promote transit fare prepayment strategies. The interest in the initial Service and Methods Demonstration (SMD) projects on TFP strategies involving reduced price promo-

tion and employer programs has provided a basis for identifying new opportunities for TFP programs targeting specific markets.

The employer-sponsored TFP demonstration in Sacramento, Calif. (CA-06-0102) made possible the targeting of employer-initiated TFP promotions to employees and has since been amended to test a variety of TFP distribution systems designed to make them more easily available to current and potential users. Pass sales were the highest when the pass was reasonably discounted by the transit operator or the employer. Pass sales tripled during the discount period, with about a 50 percent retention of new pass purchasers. There was an approximate 10 percent transit ridership increase among employees. The cost of the program among participating employers, estimated at approximately 50 cents per pass sold, was considered marginal compared with the benefits received.

An amendment to the Sacramento demonstration is evaluating the cost and public acceptance of a variety of methods for distributing TFP instruments. These methods are conventional business outlets, employer based distributions, mail order, pre-authorized payments through banks (PAFT), automatic telephone transfer payments through banks (ATP), telephone ordering and vending machines. Final cost comparisons will not be available until after the installation, testing and operation of the vending machines in 1984. Nevertheless, some preliminary findings are evident. In terms of cost as a percentage of revenue, conventional outlets are least expensive, followed by mail order, telephone order ATP and PAFT. This finding is somewhat distorted by the

low volume of sales through ATP and PAFT which are potentially the most efficient of the new methods.

A manual of the implementation and marketing procedures of employer pass programs has been developed (VA-06-0072) based on several case studies of local programs. Written for board members and other community leaders, transit operators and staff, and interested employers, the manual delineates the promotional, operational, and cost/benefits of these employer co-ventures. The logistics of program implementation and maintenance are specified, accompanied by marketing and accounting materials.



***Innovative pass program techniques relating to pricing, administration and distribution are being demonstrated through the SMD program at various systems.***

TFPs 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 multi-jurisdictions.

San Francisco, Calif., has studied transit fare prepayment in order to encourage intermodal/interagency coordination. The primary objective of this study was 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 was used to enable transit patrons to transfer between modes or operators without having to pay an additional fare. Fares varied according to distance traveled, regardless of which modes or lines within the combined network were used. The study of fare integration options has been completed and SMD will continue to monitor the program and report the results to the transit community.

In Bridgeport, Conn. (CT-06-0008) a new TFP strategy is being tested where a "Farecutter" card can be purchased for \$15 per month. With the card, patrons have unlimited use of transit at only 25 cents per trip, as opposed to the usual charge of 60 cents. A commuter pass is also available at \$23 per month, good only during rush hours. It is expected that the additional trips taken over and above the break-even trip rates will generate sufficient revenue to compensate the operator for pass discounts and promotions.

In Cincinnati, Ohio (OH-06-0036), a locally instituted monthly pass plan has been evaluated to determine the costs of

implementing such a program at a site without previously existing TFP plans. The key findings focus on the areas of sales and marketing strategies, travel behavior impacts, and economic impacts. Because the monthly pass plan was introduced shortly before the start of demonstration activities, the project results may be different from those in another city with an established monthly pass program. There are a number of findings that are transferable to other cities, however. The most cost effective approach to advertising transit passes is through on-bus advertising. Television is also effective but much more expensive. A special discount period can be an effective marketing tool in attracting and retaining new pass buyers; such a discount, however, can result in "lost" revenue and therefore requires clearly defined objectives on the part of the operator. Individuals generally will not purchase a transit pass unless they already make at least the breakeven number of transit trips. Market penetration is aided by a variety of outlets, particularly through employers, and a variety of purchase and payment options such as mail, automated banktellers, telephone, and credit cards.

### Fare and Service Management Strategies

While the pricing demonstrations are indicating the kinds of fare incentives and fare payment strategies required to increase ridership and better manage revenue producing transit markets, more information is needed regarding fare policy decision making as it relates to service levels. Evaluation reports of the impact of fare increases in Fort Worth, Tex., New-

port, Ky., Rochester, N.Y., Erie, Pa., and Jacksonville, Fla., are available.

In addition, a study (PA-06-0054) is being conducted of fare policy decision making within the transit community. The study's objective is to prepare an industrywide profile of how transit systems currently develop and implement fare policies. Reflecting a cross section of the transit industry, twelve transit systems have been selected because of their fleet size and composition, service area size and complexity, and sources of local funds. The case studies will focus on the policy considerations that enter into fare changes.

A demonstration underway in Bridgeport, Conn. (CT-06-0008) is showing the effectiveness of a variety of concepts designed to increase the service, patronage, and efficiency of the public transportation services. The activities which comprise the Bridgeport program are similar to those which should theoretically be conducted by public transportation agencies. The primary difference is that the demonstration framework in Bridgeport permits more extensive planning, monitoring and evaluation than would be found in the typical system.

The pricing aspect of the program is designed to exemplify the role of the pricing manager and show the potential benefits of having at least one individual in a transit operation whose full time duties relate to tailoring the price of transit and paratransit to specific services and markets. The pricing demonstration enumerates specific projects which the pricing manager is to undertake, or in which he/she is to be involved. The pricing manager is a functional resource available to all elements of the Greater Bridgeport

Transit District (GBTD), providing specialized advice and assistance on the pricing aspects of all GBTD actions. Specific pricing initiatives implemented in Bridgeport so far include a distance-based fare prepayment system for commuter service, nondiscounted pass and token sales with promotional coupons for merchant discounts ("Value Fare"), and employer subsidized passes for employees.



**Both downtown merchants and the transit system can benefit from techniques used in the Bridgeport Value Fare program which links merchant discount coupons to full-priced pass and token sales.**

Attempts at experimentation with fares and services have focused on separate independent experiments in either pricing strategies or service im-

provements. The lack of an integrated approach to the coordination of fares and services has resulted in a number of missed opportunities for increasing patronage while staying within the bounds of deficit or subsidy constraints. These opportunities arise from the fact that while transit demand is inelastic with respect to both fares and services, service elasticities are generally two to three times greater than fare elasticities.

Although a service improvement may not be self-financing, it may be possible to cover the marginal cost through relatively small fare adjustments, i.e., by a combination of fare increases or decreases, and service improvements or reductions.

Data drawn from 40 months operating experience on the San Diego (Calif.) Transit Corporation bus system were analyzed. The study used only the same kind of operating statistics that transit authorities normally assemble in the course of their operations. The analysis showed that it is possible to use this information in more sophisticated ways in order to obtain more precise relationships—as, for example, to assess patronage as a function of level of service. As more transit operations adopt computerized transit information systems, such analyses can be made more easily.

Two demonstrations, in Omaha, Neb. 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 com-

munity for effecting service and fare policy decisions in medium-sized cities.

In the first phase of the Omaha effort, the computerized data base will be used to integrate analysis among different productivity levels for service, maintenance and patronage. In the second phase, existing computerized techniques developed by other offices in UMTA and elsewhere will be integrated with data bases developed in the first phase. A final report is expected by late 1983.

In Columbus, the first phase has produced productivity criteria and performance measures related to a set of transit board approved goals and objectives for transit service delivery. An extensive data base has been developed with current information on ridership, costs, and revenues. The second phase, now in progress, will examine each element of the transit service to see if it meets the approved standards, and alternative improvements will be developed for those routes which do not. In addition, three innovative productivity enhancement models will be tested and applied to Columbus Ohio Transit Authority's (COTA) service planning process. A comparison of the different approaches to productivity improvement will be made along with a before/after assessment of changes actually implemented, to determine if predicted impacts have occurred. A computerized data base management system also will be tested in the second phase.

### **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 is being 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-06-0157) will include wayside vending of tickets and a complete self-service fare collection system.

Self-service fare collection, which has 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 transit users and inefficient in producing revenues commensurate with service provided. Distance based fare structures, on the other hand, pose problems with administration and fare collection. A cooperative agreement has been developed with the State University of New York in Albany (NY-06-0086), to implement a distance-based fare structure in Kingston, NY, and to analyze its impact on costs and revenues, ridership, and user equity. The new

fare policy will more accurately reflect the service provided. A fare collection procedure is being tested that simplifies the collection of the variable fares characteristic of distance based systems.

In Vancouver, Wash., onboard pass sales for premium express fixed-route service were tested. Pass sales and express transit use increased appreciably.

In Portland, Oreg. (OR-06-0008), an extensive program of self-service fare collection is currently in operation. This system of fare collection features all door boarding, with each passenger responsible for purchasing and validating the proper fare instrument (single ticket, multiple ride ticket or pass). Fare inspectors are empowered to fine transit riders who cannot exhibit proper fare documentation. Initial results show a high degree of acceptance by transit riders.



***The results of Portland, Oregon's self-service fare demonstration should provide useful information to the industry in determining the feasibility of this innovative method of fare collection.***

San Diego, Calif., has begun operating a light rail transit line using self-service fare collection. This operation is being evaluated in terms of vending machine performance and public acceptability. This study will examine the first U.S. implementation of self-service fare collection and will provide valuable information for other cities. A final report is expected by the spring of 1984.

### **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 single occupant auto work trips through control of parking capacity as well as pricing, it should be possible to increase the efficiency of the existing transit system and reduce the negative impact 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.

The City of Eugene, Oreg. (OR-06-0010) has also initiated an innovative set of parking management techniques in a neighborhood area situated between the CBD and the University of Oregon. This demonstration will address the chronic shortages of on-street parking for use by local residents and retail establishment customers. The project will include such parking management strategies as residential parking permits, mechanisms for utilization of private off-street parking facilities, and the use of metered, short-term parking zones.

The use of residential parking permits is an effective technique commonly

used to restrict commuter parking in residential neighborhoods. This technique has been applied in two recreational settings to test its effectiveness in controlling parking and traffic congestion caused by nonresident users of beaches located in residential areas. Such programs are designed to be financially self-supporting with revenue from the sale of nonresident permits paying for alternative shuttle bus service and parking enforcement.

In Santa Cruz, Calif., the program (CA-06-0129) had its third full summer of operation in 1983. Some conclusions have been drawn from this project that are transferable to other sites: parking programs of this type require large amounts of lead time between planning and implementation due to political battles and the need for hiring and training personnel; parking programs should be confined to the areas and times with the largest impacts; the effectiveness of park-and-ride shuttle bus systems is determined by maintenance of short headways and travel times and use of vehicles designed for the specific purpose; parking permit enforcement is critical for an effective program; parking spillover to areas adjacent to the restricted zone can be held to a minimum relatively easily by careful planning of zonal boundaries; areas planning similar programs should carefully consider the possible negative impacts of some adverse public reaction among local merchants and non-resident beach users and reduced beach usage. The permit parking program was very successful in reducing traffic and parking congestion near the beach, and this project has shown that the permit program can be financially self-supporting by using permit and citation revenues and through

careful allocation of personnel and program hours.

Another pricing disincentive technique, road pricing, is being considered in Honolulu, Hawaii (HI-06-0004). An initial workshop was held to adopt a plan for developing publicly acceptable alternative road pricing strategies. 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. A consulting firm has been selected to carry out the research and consensus building among interested groups necessary for the development of feasible alternative road pricing options.

## Private Sector Involvement

There has been a major growth of private sector interest in actively participating in public transportation demonstration projects supported by UMTA. A similar interest has been documented for private sector participation in capital intensive joint development transit projects. However, the data from demonstration projects indicate that the private sector's interest in public transportation extends beyond local capital investment strategies to the provision of community-based public transportation accessibility in order to promote business activities.

In particular, employers have in-

itiated ride sharing and transit pass distribution programs for the benefit of their employees, as a means of reducing commuting costs, alleviating parking shortages and costs, and providing a reliable supplement to auto travel in view of an energy uncertain future. Merchants have initiated promotional transit incentives to attract off peak retail patronage. Land developers are implementing local ride sharing and transit circulation service to reduce the costs of zoning-regulated parking space. Private operations are emerging for paratransit and premium fixed-route services that are near break-even or profitable. These and other innovative approaches to private sector involvement have been documented within SMD demonstrations and local initiatives. By pulling together private sector experience from past and ongoing demonstrations, the SMD program plans to study comprehensive approaches to private sector involvement. Previous discussions have already dealt with innovative ways for providing promotional fare reductions with employer and merchant assistance (Scranton, Pa.), reinforcing continual off peak transit use with merchant discounts (Spokane, Wash.), and initiating employer pass programs (Sacramento, Calif.).

Other private sector participation activity currently underway includes demonstrations in Hartford, Conn. (CT-06-0014), and Denver, Colo. (CO-06-0013). The local private ride-sharing agency in Hartford is providing the means for developing a Transportation Management Organization to coordinate transportation system improvements in the downtown; Denver Civic Ventures will establish a transportation management entity to



**Road pricing strategies may be one auto management technique that can increase the efficiency of transit as well as reduce the negative impacts of single occupant auto use.**



assess and develop new techniques for resolving the transportation problems in downtown Denver.

## Marketing Techniques

Programs in marketing were designed to develop and demonstrate transit marketing techniques for improved system productivity, and to assist transit operators in understanding and successfully applying these techniques.

The Transit Marketing Information Exchange Project (IT-06-0238) is an ongoing project designed to 1) facilitate the exchange of existing transit marketing material within the transit community, 2) plan a clearinghouse for the material and 3) eliminate excessive expenditures of time, effort and money on the part of transit operators in the investigation of state-of-the-art programs and techniques.

A project with the Birmingham-Jefferson County Transit Authority (AL-06-0008) is designed to conduct an innovative marketing program and to design paratransit services for various sections of the system. This project will be exploring various marketing techniques needed for ridership enhancement.

In an effort to test the effectiveness of various marketing techniques in small cities, a grant was awarded to the Arkansas State Highway and Transportation Department (AR-06-0002). This project will explore a wide variety of marketing promotional techniques as applicable to the marketing of fixed-route public transit services in cities of less than 20,000. The grantee will explore the

advantages and disadvantages of having a single operator institute and market, in one overall marketing plan, fixed-route public transit programs in three separate but adjacent cities.

The objective of a grant to the Western Reserve Transit Authority (OH-06-0038) is to conduct a management assessment of the authority and to implement an innovative marketing program to enhance ridership. The project is designed to address peak and off-peak service planning and means of increasing adult, senior and youth ridership. In addition, Saturday ridership enhancement development will be explored. Micro-computer design will be utilized in developing marketing models.

## Conventional Transit Service Innovations

The cost of providing transit service has increased significantly over the past decade, due largely to higher fuel and labor costs. Transit agencies around the country are facing financial crises. As a result, they are cutting service, and/or raising fares.

Service and Methods Demonstrations have focused renewed attention on those techniques that will aid transit agencies to reduce costs. There has been a shift of emphasis away from projects involving the introduction of new transit services toward projects that are designed to improve productivity on existing systems. Most notable in the area of productivity improvement are two Computerized Rider Information System projects. These projects will test the feasibility of a computerized information system to

attract new riders to transit. Other efforts directed toward improving productivity include studies of articulated buses, timed transfer systems and route restructuring.

## Auto Restricted Zones

The auto restricted zone (ARZ) is an area, generally in the central business district, in which vehicle traffic is restricted. An ARZ can be created through the use of either parking restrictions, barriers to traffic, or prohibition of all automobile traffic. Three ARZ projects (Boston, Mass., Memphis, Tenn., and Providence, R.I.) have been constructed or are in the final stages of planning.

An ARZ was developed in Boston to demonstrate the feasibility of the concept. In this program, limited 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. Evaluation of the project indicates 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 to conduct and evaluate a program that combines the development of an ARZ with improvements to the Memphis transit system. These improvements will include the upgrading of transit stops, development of a downtown transit terminal, and institution of 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 revitali-

zation program which began with a locally sponsored pedestrian mall.

The city of Providence, R.I. is developing an ARZ in conjunction with the revitalization of the central business district (CBD) 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, the city will construct a large pedestrian plaza. In addition, transit service improvements will be made, including a revamped bus routing system to allow routing through the CBD, and the construction of a major 12-berth downtown bus terminal and a small transit mall. Construction for the ARZ and transit improvement project is scheduled to begin in 1984.

A study conducted by Pennsylvania State University (PA-06-0073) will evaluate the impact of auto restricted zones that have been implemented throughout the U.S. The study will report on the institutional problems of implementation.

### Priority Treatments for High-Occupancy Vehicles

Many groups and individuals have voiced concern over the need to reduce government expenditures. This concern has led federal, state, and metropolitan governments to develop plans for encouraging 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 strategies has been to improve transit services by giving preferential

treatment to buses and carpools, both on major highways and on city streets.

Several SMD projects to facilitate the use of high-occupancy vehicles have been initiated in recent years in St. Louis, MO, and Philadelphia, PA. The St. Louis CBD Transit Priority 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 facilitate the movement of buses. The Philadelphia project (PA-06-0053) includes the provision of signal preemption for trolley buses along Frankfort Avenue. This project will also provide additional overhead trolley wire to accommodate 50 peak period express trips.



***UMTA is evaluating Pittsburg's Martin Luther King Busway; it follows the route of an unneeded railroad bed and gives eastern suburbs dramatically improved access to downtown for a relatively small investment.***

I-66 in the Northern Virginia suburbs of Washington, D.C. is being constructed to standards of a fourlane parkway. Use of the road is limited during the peak period to vehicles carrying four or more persons. There is a significant improve-

ment in travel time and reliability for these vehicles. The changes in transportation service and public reaction to it will be evaluated (DC-06-0402). The newly opened 6.7 mile East Busway in Pittsburgh is also being evaluated (PA-06-0081).

### General Transit Improvements

In Brevard County, Fla. (FL-06-0036), the Brevard County Transportation Authority is improving commuter service by enlisting the support of private employers in providing express bus and vanpool service. This will allow the county to enjoy the benefits of transit service without incurring the costs of providing the service with full-time employees.

The private sector will play a larger role in providing transit service in a Fort Lauderdale, Fla., area project (FL-06-0034). This service will be directed primarily at intercity commuters not usually served by local transit service. The project will develop a reasonably priced alternative to the automobile, capable of operating on a continuing basis. Another project in Orlando, Florida, is testing the market for commuter and special attraction services (FL-06-0037).

A new management tool, Automated Vehicle Monitoring (AVM), has been developed to locate buses and automatically collect a variety of data from them. An AVM system has recently been developed at the Southern California Rapid Transit District (SCRTD) in Los Angeles. An SCRTD project (CA-06-0171) will develop improved methods of using this AVM system. Anticipated benefits include collection and analysis of data for scheduling, real time reliability control,

driver monitoring and emergency calls.

The Institute of Transportation Studies at the University of California, Irvine, is studying the empirical impacts of the use of part time drivers (CA-06-0187).

### **Transit Reliability**

SMD sponsored a transit reliability project (MN-06-0011) in Minneapolis-St. Paul, Minn., which began 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 costs or other adverse effects. This project is expected to demonstrate the effectiveness of schedule changes in improving reliability.

Rensselaer Polytechnic Institute (NY-06-0097) is conducting a study of bus service reliability techniques that will be tested through the demonstration program. These techniques, which include improved use of street supervisors and better real time management of buses, should be inexpensive and easy to implement.

The Municipal Railway of San Francisco is developing several management techniques to improve on street reliability (CA-06-0194). The most significant of these are ways to improve driver performance.

### **Transit Information**

A major demonstration (PA-06-0058) is underway in Erie, Pa., where a Computerized Rider Information System (CRIS) will be tested. CRIS 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. Similar demonstrations are planned for Pittsburgh, Pa. (PA-

06-0066) and Albany, N.Y. (NY-06-0092). Evaluations are also being conducted of locally implemented projects in Salt Lake City, Utah and Columbus, Ohio.

Under the Automated Transportation Information System (ATIS) Program, demonstrations were completed on two computerized systems for responding to telephone inquiries about the availability of transit services. These ATIS systems are now in successful daily operation at WMATA and SCRTD. A final report evaluating their effectiveness is available (MA-06-0126).

## **Paratransit Services**

Paratransit as a service concept has apparently come of age and 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. Another reason is the need 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 is possible under conventional fixed-route systems.

### **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.

The software perfected under an earlier demonstration in Rochester, N.Y., is being applied in Orange County, Calif. (CA-06-0097), which has developed a program to provide community demand-responsive service. The software system is currently being used for dispatching throughout the entire county. The computer system is also being used to match potential commuter pools, develop bus routes, and schedule buses.

Several other projects are examining the effects of using taxis as feeders to fixed-route bus service in a low density area. These projects, which began operating in San Diego, Calif. (CA-06-0165) in July 1982, Memphis, Tenn. (TN-06-0013) in early 1983, and Dade County, Florida (FL-06-0023) in December 1983, will measure the cost of the feeder service compared to conventional fixed-route operations and will test the willingness of the public to use the feeders and transfer to and from line haul routes. If enough demand develops, it may be possible to substitute fixed-route service for the feeder service. One more taxi feeder project is planned in Columbus, Ohio.

A demonstration project (FL-06-0023) to integrate a complex of transit and paratransit services is underway in Dade County, Fla. Major elements of the project include a range of paratransit services such as the taxi feeder service to fixed-route transit described above, low density community service contracted with a taxi operator, and taxis substituting for fixed-route service during off peak hours. The project will also strengthen coordination of social service agency transportation in the county. A major

component will be a computer-assisted routing, scheduling, dispatching and management information system which is currently being developed. In conjunction with the demonstration, the county has adopted extensive changes in the taxi regulatory climate which should enable the taxi industry to provide innovative taxi service. A final element of the project is to coordinate county commuter ride-sharing services.

The Port Authority of Allegheny County (PAT) is conducting a design study for a demonstration of service for suburban and low density areas (PA-06-0074). Paratransit options for serving areas which cannot be covered economically with conventional transit are being explored. Improvements to existing bus routes will also be considered. A workshop on low density alternatives was held in May 1983 to familiarize PAT staff with the service concepts.

### **Transportation Brokerage**

Transportation brokerage has become a widely accepted means of improving transportation services, especially in small and medium sized communities, and has gained new prominence in large cities. A public transportation broker views the transportation system as a variety of markets which are matched with both existing and new services. Brokerage has proved to be an effective means of involving private transportation providers in the system.

Differences in urban areas require variations in transportation brokerage models. Depending upon existing circumstances, the broker's duties include contracting with private operators, mod-

ifying existing transit services, establishing carpool and vanpool programs, and coordinating social service agency travel. The broker acts as coordinator and tries to implement more efficient use of existing vehicles.

During FY 1983, the City of St. Louis completed a planning study for a brokerage project (MO-06-0012). Many of the elements proposed in the plan have been implemented by other local and regional agencies - particularly social service agency coordination, ridesharing, and computer assistance for both coordination and ridesharing.

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 Greater Bridgeport Transit District (GBTD) is operating the fixed-route transit system and working in other areas such as ride sharing, coordination of social agency transportation, taxi/transit integration, suburban and inner-city community transit service, commuter subscription service and economic development. Pricing and marketing also play an important part in the demonstration, as described in other sections of this chapter.

The Human Services Transportation Consortium (HSTC), which was formed with assistance from the GBTD, is now an independent entity that coordinates the paratransit services provided by a group of social agencies and towns. The GBTD has begun working actively with private taxi operators and city and business leaders to develop shared-ride taxi service for several market segments.

### **Checkpoint Demand-Responsive Services**

The checkpoint concept provides the promise of productivity improvements over traditional demand-responsive service by reducing dwell times and/or by grouping passengers. The service operates as demand-responsive services have in the past except that vehicles stop only at designated checkpoints instead of taking passengers from door-to-door, thereby increasing productivities. It appears particularly suited for low-demand, low-density areas. The concept has been applied successfully in Europe. Two demonstrations were funded to test the operational feasibility of the concept in the United States. In both Glendale, Ariz. (AZ-06-0013), and in a six-city subregion of the Twin Cities area in Minnesota, consultants were hired to conduct final feasibility studies and design detailed implementation plans.

During 1983, local communities decided not to implement a manually dispatched route deviation checkpoint concept recommended in the consultant's final report for the Twin Cities project. In Glendale, manually dispatched checkpoint service was implemented in one service area during 1982. Other service areas are under consideration for expansion. Unless demand increases significantly, computerization is not anticipated.

### **Other Paratransit Innovations**

Widespread adoption of computer ride-sharing programs by both private and public sectors highlights an increased interest in low-cost alternatives to fixed-route bus service. Due in large part to

successful SMD demonstrations, information on the range of alternatives is now available to local decision makers as they face critical choices on the future of local transportation services. The following studies undertaken under the paratransit program are intended to provide planning and technical assistance to paratransit operators or to test other promising paratransit innovations.

The California DOT completed a feasibility study and project design of a demonstration of shared use of motor vehicles in large, high-density residential complexes (CA-06-0166). Based on the positive results of the feasibility study, the consultant who conducted the work decided to implement a pilot project as a private venture, without any public funds. Operations will begin early in 1984. The project, known as STAR (Short Term Auto Rental), will be evaluated by UMTA.

In the STAR program rental cars will be owned by a third party and users will be charged only for the actual costs of their use of fleet vehicles. This will enable users to choose the most suitable vehicle for any particular trip. For example, a van for commuting, a subcompact for errands, a large sedan or a recreational vehicle for family vacations. Participants in the project could no longer need more than one vehicle to meet their traveling needs and might be able to forego owning a car altogether (at the Parkmerced apartment complex where the test will take place, transit service is very good).

Purdue University Research Foundation is also exploring shared fleet approaches to urban mobility in a project funded late in FY 82 (IN-06-0012). This study focuses primarily on the application

of the concept to neighborhood transportation. A workshop was held in April 1983 to study neighborhood transportation concepts.

The city of Huntsville, Ala. (AL-06-0007) is developing neighborhood transportation services utilizing volunteers. Under the demonstration, the city is giving used 15-passenger vans to neighborhood associations to help meet local transportation needs. These volunteer-operated services are directed principally at the transportation disadvantaged, such as elderly persons, and at others, such as school children, without adequate transportation. The city provides the vans and insurance, while the neighborhoods are responsible for operating the vans. The city views the service as the most cost-effective means of providing transportation to these communities. It is able to provide a higher level of service at a lower cost than is possible with fixed-route bus service.

A demonstration in the San Francisco, Calif., area (CA-06-0163) implemented a back-up system to the existing ride-sharing program operated by the Golden Gate Bridge, Highway, and Transportation District. The project tested the feasibility of attracting additional commuters to ride sharing by having a back-up system available. A sizable number of commuters are reluctant to ride share because of the possibility that they may occasionally work late or have other variations in their work schedule. Back-up vans are driven by commuters who currently have unusual work hours such as 10:00 a.m. to 7:00 p.m. Drivers receive a free ride and riders pay a per trip fee based on round-trip mileage.

A second component of the project was the establishment of a Project Information Coordinator to test innovative approaches to disseminating information and providing technical assistance to other communities. A set of information



***A promising approach to providing needed transportation services is being demonstrated in Huntsville where the city supplies the vehicles and neighborhood groups operate them.***

dissemination strategies was developed to increase information flow.

A project has been implemented by the Los Angeles County Transportation Commission (CA-06-0184) to establish a local technical assistance office. With the passage of Proposition A, local jurisdictions within the county are examining service options for implementation in their community. The technical assistance office will be utilizing the recently developed SMD Short Range Planning Guidelines to provide advice and information on the wide range of alternatives developed and evaluated through the SMD program. The project will also evaluate the impact of the fare decrease mandated under Proposition A.

Projects in San Diego, Calif. (CA-06-0127), and Seattle, Wash. (WA-06-0019), evaluated the impact of recent regulatory reforms affecting the local taxi industry. The revisions eased entry requirements, implemented competitive pricing, and allowed competition with fixed-route public transit. The project focused on the taxi industry, users, institutional issues, and impacts on the urban transportation system. Currently, three taxi regulatory studies are being conducted including: the legal aspect of regulation, the economic impacts of open entry and fare setting and a crosscutting study of the results of taxi regulatory case studies.

A project in Boston, Mass. (MA-06-0144) studied the feasibility of implementing shared-ride taxi services for the general public. The study is concentrated on a pilot neighborhood and examined institutional and regulatory barriers, fare structure, driver and user acceptance, and dispatching problems.

A project in Ann Arbor, Mich. (MI-06-0028) demonstrated the feasibility of contracting with private taxi operators to provide service during late night hours when conventional transit is uneconomical. Door-to-door taxi service is provided by a city-licensed taxi operator with dedicated vehicles within the city limits of Ann Arbor from 11:00 p.m. to 6:00 a.m. Ridership and productivity reached impressive levels, while passenger subsidies were low. The project is continuing with local funds following completion of the demonstration in 1983.



***The share-a-cab trial program at LaGuardia airport will help the industry assess the impacts of this type of service on the overall surface transportation network.***

## Rural Transportation

Activities undertaken in this area are designed to explore the long neglected

transportation needs of non-urbanized communities throughout the nation. Projects are structured to assess all aspects of rural transportation, including regulatory, cooperative, paratransit and marketing issues, as well as implementation feasibility.

Another project (DC-06-0406) will assess the applicability of the cooperative concept to rural transportation needs and determine the feasibility of using alternative methods in a coordinated manner to enhance the development of passenger transportation schemes within the rural community. The project will also examine and build upon existing private sector initiatives, and upon institutional resources that combine passenger service with the hauling of freight, mail delivery and the movement of consumer goods.

The Tuskegee, Ala., transportation assessment study (AL-06-0010) will explore the transportation needs of Tuskegee with regards to specific user needs and service area requirements. This project will also assess the negative impact that lack of adequate transportation has on its citizens in such areas as employment, health care and social functioning. In a related effort (MD-06-0093), SMD is developing a rural transportation data base. The project is designed to coordinate and review all existing transportation elements in 2-3 rural areas of Alabama, Florida, Georgia and Kentucky. The project will review both local and state regulatory issues and explore private sector employment ventures.

A project in Fayette, Miss. (MS-06-0004), is demonstrating the ability of a single fleet of paratransit vehicles to service a low-density, highly impoverished

county. The needs of Jefferson County citizens will be met by a combination of fixed-route, subscription and demand-responsive services.

A joint agency project with the Department of Agriculture (DC-06-0392) is examining the potential for passenger development in conjunction with the movement of freight. In addition to freight/passenger service, the project will study the potential uses of existing or new cooperative organizations, the availability of existing private or public vehicles, and the impact of intercity bus deregulation on rural passenger transportation needs.

## Service and Methods

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
<b>INFORMATION DISSEMINATION AND TECHNICAL ASSISTANCE</b>						
Public Transportation Network	IT-06-0284	\$1,240,000	Feb. 1983- Feb. 1986	Crain & Associates	Cambridge Systematics	Larry A. Bruno (202) 426-4984
Local Government Options	DC-06-0425	\$100,000	July 1983- Jan. 1983	International City Management Association	N/A	Larry A. Bruno (202) 426-4984
Demonstration Information	DC-06-0450	\$120,000	May 1983- June 1984	Public Technology, Inc.	N/A	Larry A. Bruno (202) 426-4984
Transportation Curriculum Development	WV-11-0003	\$50,000	Feb. 1983- Feb. 1984	West Virginia University	N/A	Larry A. Bruno (202) 426-4984
Technical Support and Evaluation	MA-06-0049	\$2,000,000	Jan. 1983- Sept. 1984	TSC	N/A	James Bautz (202) 426-4984
Demonstration Project Development and Assistance	IT-06-0217	\$950,000	1978-1984	The Urban Institute	N/A	Larry A. Bruno (202) 426-4984
<b>TRANSPORTATION SERVICES FOR SPECIAL USER GROUPS</b>						
<b>Coordinated Services for the Elderly and Handicapped</b>						
Rhode Island Coordination Planning Project	RI-06-0012	\$70,000	Oct. 1981- April 1981	Rhode Island DOT	N/A	Patricia Cass (202) 426-4984
<b>User Subsidy Demonstrations</b>						
Private-Public Sector Integration	CA-06-0170	\$175,000	May 1982- May 1984	City of San Diego, Calif.	Crain and Associates	Larry A. Bruno (202) 426-4984
User Subsidy Coordination	VA-06-0104	\$156,000	June 1983- June 1985	Northern VA Planning District Commission	N/A	Larry A. Bruno (202) 426-4984



## Service and Methods

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
<b>TRANSPORTATION SERVICES FOR SPECIAL USER GROUPS (CONT.)</b>						
<b>Other Activities</b>						
Local Government Options in Providing Transportation for the Disabled	DC-06-0393	\$300,000	Aug. 1982- Dec. 1983	International City Management Association	N/A	Patricia Cass (202) 426-4984
Use of Volunteers in Providing Transportation for the Handicapped	DC-06-0417	\$80,000	Oct. 1982- April 1983	Del Green Associates	N/A	Patricia Cass (202) 426-4984
Ride to Work for the Handicapped	NY-06-0096	\$30,000	April 1983- Aug. 1983	Vera Institute	N/A	Patricia Cass (202) 426-4984
Inner City Mobility	CT-06-0010	\$360,000	Sept. 1980- Sept. 1984	GBTD COMSIS Corp.	TSC	Mary Martha Churchman (202) 426-4984
Information Dissemination on Cost Effective Methods of Providing Transportation to Handicapped Persons	MA-06-0157	\$100,000	May 1983- May 1984	Harold Russell Associates	N/A	Patricia Cass (202) 426-4984
<b>FARE AND PRICING POLICIES</b>						
<b>Promotional Fare Incentive Strategies</b>						
CBD Off-Peak Fare-Free Transit	NY-06-0064	\$407,380	June 1978- June 1984	Capital District Transportation Authority, Albany, N.Y.	TSC; Cambridge Systematics, Inc.	Roger Tate (202) 426-4984
Promotional Pricing Research Assistance	PA-06-0056	\$85,000	March 1980- March 1984	Pennsylvania State University	N/A	Roger Tate (202) 426-4984
Marketing/Variable Fare Demonstration	MN-52-0001	\$234,584	Jan. 1983- July 1986	MTC, ST. Paul	N/A	Stewart McKeown (202) 426-4984
Price Incentives Transit Operator Coordination	WA-06-0018	\$550,976	April 1982- Nov. 1985	TSC; City of Spokane, Wash.	TSC; SYSTAN, Inc.	Roger Tate (202) 426-4984

## Service and Methods

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
<b>FARE AND PRICING POLICIES (CONT.)</b>						
<b>Transit Fare Prepayment (TFP) Options</b>						
Transit Fare Prepayment Through Employers	CA-06-0102	\$470,997	June 1977- June 1984	Sacramento, Calif. RTA	N/A	Stewart N. McKeown (202) 426-4984
Technical Support Services	VA-06-0072	\$146,569	Jan. 1980- Aug. 1984	SG Associates	N/A	Roger Tate (202) 426-4984
Brokerage Demonstration: Pricing	CT-06-0008	\$501,002	Oct. 1979- June 1984	GBTD	TSC; COMSIS Corp.	Roger Tate (202) 426-4984
TFP Pricing Methodology	OH-06-0036	\$133,448	Nov. 1981- Nov. 1983	Queen City Metro, Cincinnati, Ohio	TSC	Stewart N. McKeown (202) 426-4984
Promotional Fare Incentives for Increasing Ridership and Promoting Private Sector Involvement	PA-06-0055	\$235,671	Jan. 1980- Jan. 1983	COLTS, Scranton, Pa.	TSC; Crain and Associates	Roger Tate (202) 426-4984
<b>Fare and Service Management Strategies</b>						
Technical Support Services	PA-06-0054	\$105,255	Jan. 1980- June 1984	Booz, Allen and Hamilton, Inc.	N/A	Roger Tate (202) 426-4984
Brokerage Demonstration: Pricing	CT-06-0008	\$501,002	Oct. 1979- June 1984	GBTD	TSC; COMSIS Corp.	Mary Martha Churchman (202) 426-4984
Transit Resource Productivity Demonstration	OH-06-0027	\$752,000	Oct. 1978- May 1985	Central Ohio Transit Authority	TSC; COMSIS Corp.	Stewart N. McKeown (202) 426-4984

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PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
<b>FARE AND PRICING POLICIES (CONT.)</b>						
<b>Fare and Service Management Strategies (Cont.)</b>						
Fare and Service Demonstration Design and Resource Center	MD-06-0093	\$399,978	Sept. 1982- Sept. 1985	Ecosometrics, Inc.	N/A	Stewart N. McKeown (202) 426-4984
National Study of Peak/off-Peak Fare Programs	CA-06-0182	\$69,936	Aug. 1982- Aug. 1983	University of California at Berkeley	N/A	Stewart N. McKeown (202) 426-4984
Microcomputer Application of Pricing Techniques	VA-06-0102	\$353,430	June 1983- Dec. 1984	Technology Research and Evaluation Corp.	N/A	Stewart N. McKeown (202) 426-4984
Rationalizing Service and Fare Policies	NJ-06-0017	\$84,771	Sept. 1982- Dec. 1983	Rutgers University	N/A	Stewart N. McKeown (202) 426-4984
Determining Alternative Transit Fare Policies	IL-06-0054	\$59,999	Sept. 1982- Oct. 1983	Northwestern University (Ill.)	N/A	Stewart N. McKeown (202) 426-4984
<b>Fare Collection Techniques</b>						
Automated Billing and Self-Service Fare Collection	CA-06-0157	\$466,059	Sept. 1981- July 1985	Santa Cruz County, Calif.	N/A	Stewart N. McKeown (202) 426-4984
Distance Based Fare Demonstration	NY-06-0086	\$154,710	March 1983- Oct. 1984	State University of New York, Albany	N/A	Stewart N. McKeown (202) 426-4984
Self-Service Fare Collection	OR-06-0008	\$1,218,350	Sept. 1981- March 1983	City of Portland, Oreg.	N/A	Stewart N. McKeown (202) 426-4984
Self-Service, Automatic Fare Billing Demonstration Design	VA-06-0099	\$726,377	Dec. 1981- July 1984	MITRE Corp.	N/A	Stewart N. McKeown (202) 426-4984
Automated Transit Fare Billing System	MA-06-0147	\$416,557	Sept. 1982- Sept. 1984	Merrimack Valley (Mass.) RTA	N/A	Stewart N. McKeown (202) 426-4984

## Service and Methods

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
<b>FARE AND PRICING POLICIES (CONT.)</b>						
<b>Auto Management Techniques</b>						
Eugene, Oregon Parking	OR-06-0010	\$293,260	May 1983- June 1985	City of Eugene, Oreg.	N/A	Roger Tate (202) 426-4984
Permit Parking and Transit Improvement Program	CA-06-0129	\$420,599	July 1979- Oct. 1982	Santa Cruz County, Calif.	TSC; Crain and Associates	Stewart N. McKeown (202) 426-4984
Road Pricing Feasibility Study	HI-06-0004	\$117,200	Oct. 1979- June 1984	Hawaii DOT	N/A	Stewart N. McKeown (202) 426-4984
Technical Support Services	IT-06-0233	\$382,856	Jan. 1980- Jan. 1983	Urban Institute	N/A	Roger Tate (202) 426-4984
<b>Private Sector Involvement</b>						
Public/Private Trans- portation Management	CT-06-0014	\$222,000	Oct. 1982- Oct. 1984	Greater Hartford Ridesharing Agency	N/A	Stewart N. McKeown (202) 426-4984
Private/Public Trans- portation Management Initiative for Downtown Denver	CO-06-0013	\$300,000	Sept. 1982- Sept. 1984	Denver Civic Ventures	N/A	Stewart N. McKeown (202) 426-4984

## Service and Methods

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
<b>MARKETING TECHNIQUES</b>						
Transit Marketing Information Exchange Project	IT-06-0238	\$225,000	Sept. 1983- Jan. 1985	Expand Associates	N/A	Roger Tate (202) 426-4984
Transit Marketing Program for Birmingham, Alabama	AL-06-0008	\$150,000	Aug. 1982- Mar. 1984	Birmingham-Jefferson County Transit Authority	N/A	Roger Tate (202) 426-4984
Demonstration Project for Arkadelphia, Malvern and Benton, Arkansas	AR-06-0002	\$150,000	Aug. 1982- June 1984	Arkansas Highway and Transportation Dept.	N/A	Roger Tate (202) 426-4984
Transit Management	OH-06-0038	\$163,500	Jan. 1983- June 1984	Western Reserve Transit Authority, Youngstown, Ohio	N/A	Roger Tate (202) 426-4984
Transit Awareness	IL-06-0050	\$135,000	June 1983 June 1984	Dellingham Associates, Inc.	N/A	Roger Tate (202) 426-4984
<b>CONVENTIONAL TRANSIT SERVICE INNOVATIONS</b>						
<b>Auto Restricted Zones</b>						
Memphis Auto Restricted Zone	TN-06-0008	\$1,025,000	Sept. 1978- Sept. 1983	City of Memphis, Tenn.	TSC; Charles River Associates	Joseph Goodman (202) 426-4984
Providence Auto Restricted Zone	RI-06-0010	\$960,000	June 1981- June 1984	City of Providence, R.I.	TSC; Charles River Associates	Joseph Goodman (202) 426-4984
Impact of UMTA Auto Restricted Zone Program	PA-06-0073	\$85,000	Sept. 1982- Aug. 1983	Pennsylvania State University	N/A	Joseph Goodman (202) 426-4984

## Service and Methods

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
<b>CONVENTIONAL TRANSIT SERVICE INNOVATIONS (CONT.)</b>						
<b>Priority Treatments for High-Occupancy Vehicles</b>						
St. Louis CBD Transit Priority Project	MO-06-0010	\$374,000	Sept. 1979- March 1984	Bi-State Development Agency, Mo.	TSC; Crain and Associates	Roger Tate (202) 426-4984
Philadelphia Signal Preemption	PA-06-0053	\$1,028,080	Sept. 1979- July 1984	SEPTA	TSC; Multi- systems, Inc.	Joseph Goodman (202) 426-4984
I-66 Evaluation	DC-06-0402	\$63,000	May 1982- Oct. 1984	Washington Metropolitan Area Council of Governments	TSC	Joseph Goodman (202) 426-4984
Evaluation of PAT East Busway	PA-06-0081	\$120,000	Oct. 1982- June 1985	PAT	TSC; Crain and Associates	Joseph Goodman (202) 426-4984
<b>General Transit Improvements</b>						
Coordination of School and Public Transportation Services	CA-06-0180	\$151,650	Sept. 1982- Aug. 1984	South Lake Tahoe, Calif.	TSC; Crain and Associates	Joseph Goodman (202) 426-4984
Commuter Express Bus and Vanpool Services	FL-06-0036	\$500,000	Sept. 1982- March 1985	Brevard Transportation Authority, Fla.	TSC; Cambridge Systematics, Inc.	Joseph Goodman (202) 426-4984
Intercity Bus Demonstration	FL-06-0034	\$220,000	Sept. 1982- Aug. 1984	Florida DOT	TSC; Cambridge Systematics, Inc.	Joseph Goodman (202) 426-4984
Southwest Corridor Project	FL-06-0037	\$70,000	Jan. 1983 Jan. 1985	Orange-Seminole- Osceola TA	TSC; Multi- systems, Inc.	Joseph Goodman (202) 426-4984
Reliability and Productivity Improvements	CA-06-0171	\$332,500	Jan. 1982- Jan. 1985	SCRTD	TSC; Multi- systems, Inc.	Joseph Goodman (202) 426-4984
Part Time Labor Study	CA-06-0187	\$91,345	March 1983 Aug. 1984	University of California, Irvine	N/A	Joseph Goodman (202) 426-4984
Section 4(i) Program	MD-06-0098	\$125,000	July 1983 June 1985	COMSIS	N/A	Joseph Goodman (202) 426-4984
<b>Transit Reliability</b>						
Minneapolis Transit Reliability	MN-06-0011	\$239,630	Sept. 1979- July 1982	Metropolitan Transit Commission, Minn.	TSC; Multi- systems, Inc.	Joseph Goodman (202) 426-4984

## Service and Methods

<b>PROJECT TITLE</b>	<b>NUMBER</b>	<b>FUNDING</b>	<b>SCHEDULE</b>	<b>AGENCY/ CONTRACTOR</b>	<b>EVALUATION</b>	<b>TECHNICAL CONTACT</b>
<b>CONVENTIONAL TRANSIT SERVICE INNOVATIONS (CONT.)</b>						
<b>Transit Reliability (Cont.)</b>						
Empirical Methods for Bus Reliability	NY-06-0097	\$58,768	Sept. 1982- Aug. 1983	Rensselaer Polytechnic Institute	N/A	Joseph Goodman (202) 426-4984
Inner City Transit Improvement	VA-06-0079	\$591,536	Nov. 1980- Nov. 1981	Penntan, Hampton, VA	TSC; Peat, Marwick, Mitchell and Co.	Joseph Goodman (202) 426-4984
Management Techniques to Improve Reliability	CA-06-0194	\$153,000	July 1983- July 1986	MUNI	TSC, Multisystems, Inc.	Joseph Goodman (202) 426-4984
<b>Transit Information</b>						
Computerized Rider Information System	PA-06-0058	\$1,230,024	Oct. 1980- Sept. 1984	Erie (Pa.) MTA	TSC; Charles River Associates	Larry A. Bruno (202) 426-4984
Computerized Rider Information System	PA-06-0066	\$627,000	Sept. 1981- Sept. 1984	PAT	TSC; Crain and Associates	Larry A. Bruno (202) 426-4984
Computerized Rider Information System	NY-06-0092	\$576,000	Sept. 1982- Sept. 1985	Capital District Transit Authority, Albany, N.Y.	TSC	Larry A. Bruno (202) 426-4984
Feasibility Study Computerized Information System	CA-06-0184	\$119,000	Sept. 1982- Oct. 1984	City of San Rafael, Calif.	N/A	Larry A. Bruno (202) 426-4984
Assessment of ATIS Impacts at WMATA and SCRTD	MA-06-0126	\$165,000	April 1980- Dec. 1983	TSC; Wilson-Hill Associates, Inc.	N/A	John Durham (202) 426-9267
<b>PARATRANSIT SERVICES</b>						
<b>Integration of Paratransit and Fixed Route Systems</b>						
Orange County Computerized Demand-Responsive Transit	CA-06-0097	\$2,833,431	May 1978- June 1983	Orange County (Calif.) Transit District	TSC; Crain and Associates	James A. Bautz (202) 426-4984
San Diego Taxi Feeder	CA-06-0165	\$360,000	Oct. 1981- March 1985	San Diego (Calif.) Transit Authority	TSC	Larry A. Bruno (202) 426-4984

## Service and Methods

<b>PROJECT TITLE</b>	<b>NUMBER</b>	<b>FUNDING</b>	<b>SCHEDULE</b>	<b>AGENCY/ CONTRACTOR</b>	<b>EVALUATION</b>	<b>TECHNICAL CONTACT</b>
<b>PARATRANSIT SERVICES (CONT.)</b>						
<b>Transportation Brokerage</b>						
Memphis Taxi Feeder	TN-06-0013	\$640,000	Sept. 1982- April 1984	Memphis Area Transit Authority	TSC	Larry A. Bruno (202) 426-4984
Dade County Integrated Transit	FL-06-0023	\$700,000	Sept. 1981- Sept. 1984	Dade County (Fla.) Office of Transportation Administration	TSC; Charles River Associates	Mary Martha Churchman (202) 426-4984
Low Density Design Study	PA-06-0074	\$60,000	Oct. 1982- Sept. 1984	PAT	N/A	Mary Martha Churchman (202) 426-4984
St. Louis Brokerage	MO-06-0012	\$140,000	Aug. 1981- Jan. 1983	City of St. Louis, Mo.	N/A	Mary Martha Churchman (202) 426-4984
Brokerage Demonstration	CT-06-0008	\$999,205	Aug. 1978- Dec. 1984	GBTD	TSC; COMSIS	Mary Martha Churchman (202) 426-4984
Audiovisual Brokerage Presentations	TN-06-0012	\$24,935	Sept. 1981- Dec. 1984	University of Tennessee	N/A	Mary Martha Churchman (202) 426-4984
<b>Checkpoint Demand-Responsive Services</b>						
Checkpoint Dial- A-Ride Demonstration	AZ-06-0013	\$85,000	Jan. 1981- June 1982	City of Glendale, Calif.	To Be Determined	Larry A. Bruno (202) 426-4984
<b>Other Paratransit Innovations</b>						
Shared Fleet Urban Mobility Study	IN-06-0012	\$95,000	Dec. 1982- Jan. 1984	Purdue University Research Foundation	N/A	Mary Martha Churchman (202) 426-4984



## Service and Methods

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
<b>PARATRANSIT SERVICES (CONT.)</b>						
<b>Other Paratransit Innovations (Cont.)</b>						
Neighborhood Volunteer Vans	AL-06-0007	\$60,000	Sept. 1982- Sept. 1983	City of Huntsville, Ala.	TSC; COMSIS	Roger Tate (202) 426-4984
Ride Sharing Back- Up System	CA-06-0163	\$100,000	Oct. 1981- Sept. 1983	Golden Gate Bridge, Highway, and Transporta- tion District, Calif.	Crain and Associates	Larry A. Bruno (202) 426-4984
Local Technical Assistance	CA-06-0184	\$275,000	Aug. 1982- Aug. 1984	Los Angeles County Transportation Commission	TSC; Charles River Associates	Larry A. Bruno (202) 426-4984
Shared Ride Taxi	MA-06-0144	\$90,000	March 1982- Jan. 1984	City of Boston, Mass.	TSC; Multisystems, Inc.	Larry A. Bruno (202) 426-4984
Late Night Taxi	MI-06-0028	\$78,000	March 1982- Sept. 1983	Ann Arbor Transportation Authority	TSC; Multisystems, Inc.	Mary Martha Churchman (202) 426-4984

## Service and Methods

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	EVALUATION	TECHNICAL CONTACT
<b>RURAL TRANSPORTATION</b>						
Rural Transportation Cooperatives	DC-06-0406	\$230,000	May 1982- Sept. 1984	Rural America, Inc.	N/A	Roger Tate (202) 426-4984
Assessment of Rural Transportation Needs	AL-06-0010	\$160,000	Dec. 1982- March 1984	City of Tuskegee, Ala.	N/A	Roger Tate (202) 426-4984
Development of a Rural Non-Urbanized Data Base for Public/Private Sector Transportation Initiatives	MD-06-0093	\$15,000	Aug. 1983- June 1984	Ecosometrics, Inc.	N/A	Roger Tate (202) 426-4984
Integrated Paratransit Coordination	MS-06-0004	\$440,200	Nov. 1982- Dec. 1985	Medgar Evers Fund, Inc.	TSC; Crain and Associates	Roger Tate (202) 426-4984
Assessment of Cooperative Rural Passenger Transportation	DC-06-0392	\$98,000	July 1983- July 1984	U.S. Department of Agriculture	N/A	Roger Tate (202) 426-4984

### Bibliography

A list of recent reports follows. Please consult previous editions of this Directory for earlier reports. If available, a document number assigned by the National Technical Information Service (NTIS) is listed.

Reports which have not been assigned an NTIS number may not have been published in sufficient quantity for

general distribution. Single copies and other information may be available from the issuing agency or organization.

Additional reports relating to the research described in this chapter may become available in the near future. For the most recent information or suggestions for additional reference materials regarding specific projects, call or write to the person listed as the technical contact in the Project Summary Table.

### Service and Methods Demonstration Program Reports

Proj. MA 06-0049  
Transportation Systems Center  
December 1981, PB 82-190050 and 82-178633  
(Summary Report)

### TRANSPORTATION SERVICES FOR SPECIAL USER GROUPS

Mercer County (NJ)

**Coordination/Consolidation  
Demonstration**

**Project, Final Report**

Proj. NJ-06-0008  
Daniel Fleishman  
March 1982, PB 82-237645

**A Handbook Describing Low Cost  
Concepts  
and Techniques to Make Public  
Transportation More Accessible for  
Visually and Hearing Impaired Persons**

Proj. DC-06-0349  
Crain and Associates, Inc.  
April 1982, PB 83-125526

**A Taxi Scrip Program in Seattle,  
Washington, Final Report**

Project. MA-06-0049  
David Koffman  
September 1982, UMTA MA-06-0049-82-2

**The Milwaukee County User-Side Subsidy  
Program: A Case Study, Final Report**

Proj. MA-06-0049  
Mary Lovely  
September 1982; PB 83-144089

**National User-Side Subsidy Inventory,  
Final Report**

Proj. MA-06-0049  
Crain and Associates, Inc.  
May 1982

**Trip: The Transportation Renumeration  
and Incentive Program In West Virginia,  
1974-1979, Final Report**

David A. Curry  
Proj. WV-06-0008  
July 1982, PB 83-144055

**Recreational Transit Service to the  
California Santa Monica Mountains, Final  
Report**

Proj. CA-06-0142  
Peter Webb  
April 1982, PB 82-230483

**Fixed-Route Accessible Bus Service in  
Connecticut: A Case Study**

Proj. MA-06-0049

Charles River Associates  
July 1981, UMTA-MA-06-0049-81-5

**The Accessible Fixed-Route Bus Service  
Experience**

Proj. MA-06-0049  
Transportation Systems Center  
May 1981, PB 81-238-990

**User-Side Subsidies for Taxis and Buses  
in Montgomery, Alabama: Final Report**

Proj. AL-06-0003  
Charles River Associates  
February 1983, PB 83-191-270

**The Point-to-Point Club: An Elderly and  
Handicapped Service Based in Ardmore,  
Pennsylvania**

Proj. MA-06-0049  
Daniel Fleishman  
March 1983, PB 83-209-171

**User-Side Subsidy Programs for Special  
Needs Transportation: A Planning  
Handbook**

Proj. MA-06-0049  
Transportation Systems Center  
June 1983, DOT-TSC-UMTA-83-35

**Transportation Brokerage Demonstration,  
Bridgeport, Connecticut - Case Study:  
Human Service Transportation  
Consortium**

Proj. CT-06-0008  
J. Richard Kuzmyak  
(To be published FY 1984)

**FARE AND PRICING POLICIES**

**Albany CBD Fare-Free Demonstration:  
Final Report**

Proj. NY-06-0064  
Cambridge Systematics, Inc.  
October 1981, PB 82-185-034

**Findings of Preliminary Analysis of the  
Trenton Off-Peak Fare-Free Transit  
Demonstration: Final Report**

Proj. NY-52-0001  
Transportation Systems Center  
September 1981, PB 298-893

**Demonstration of Transit Fare Prepayment  
Promoted by Employers in Jacksonville,  
Florida: Final Report**

Proj. FL-06-0016  
Transportation Systems Center  
July 1981

**The Costs of Transit Fare Prepayment  
Programs: A Parametric Cost Analysis -  
Executive Summary**

Proj. MD-06-0031  
Ecosometrics, Inc.  
February 1983.

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Final Report**

Proj. MD 06-0031  
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**Patronage Impacts of Changes in Transit  
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Ecosometrics, Inc.  
February 1983, PB 81-167-652

**Self Service Fare Collection: Canadian  
Experience and U.S. Implications**

Proj. VA-06-0049  
Mitre Corporation  
April 1982

**Evaluation of the Washington, D.C.  
Parking Enforcement Program**

Proj. MA-06-0049  
Peat, Marwick, Mitchell & Co.  
September 1982, PB 83-153-536

**Parking Permit Demonstration Project  
Santa Cruz, California - Final Report**

Proj. CA-06-0129  
Crain and Associates, Inc.  
May 1983

**Self Service Fare Collection on the San  
Diego Trolley - Final Report**

Proj. CA-06-0158

Crain and Associates, Inc.  
November 1983

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Proj. OH-06-0036  
Multiplications, Inc.  
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Proj. MN-06-0013  
Charles River Associates, Inc.  
September 1983

**CONVENTIONAL TRANSIT SERVICE INNOVATIONS**

**Downtown Crossing: Auto Restricted Zone in Boston**

Cambridge Systematics, Inc.  
May 1982, UMTA-MA-06-0049-82-3

**Houston North Freeway Contraflow Zone Demonstration**

Cambridge Systematics, Inc.  
June 1982, UMTA-MA-06-0049-82-12

**The Coordination of Pupil and Non-Pupil Transportation**

Proj. MA-06-0049  
Multisystems, Inc.  
January 1982, UMTA-MA-06-0049-81-13

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Proj. MA-06-0049  
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May 1982, UMTA-MA-06-0049-82-1

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Proj. VA-06-0052  
MITRE Corporation  
February 1981

**Analysis of Commuter Rail Costs and Cost Allocation Methods**

Proj. MA-06-0049

Peat, Marwick, Mitchell and Company  
July 1983, PB 84-102-318

**Timed Transfer - An Evaluation of Its Structure, Performance and Cost**

Proj. MA-06-0049  
SYSTAN, Inc.  
August 1983, PB 83-264-036

**Automated Transit Information Systems (ATIS)**

**Mechanization Concepts for Improved Responsiveness**

Proj. DC-06-0295  
National Capital Systems  
April 1981

**Integration of ATIS with Current Automated Transit Systems**

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MITRE Corporation  
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**Technical Study of the Need and Feasibility of an Integrated Transit Information System for the New York/New Jersey Metropolitan Region**

Proj. NY-06-0077  
Port Authority of New York and New Jersey  
October 1981

**Airport ATIS Feasibility Study**

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**The North Eastern Illinois RTA Decentralized Paratransit Brokerage Program, Final Report**

Proj. IL-06-0038  
William C. Nevel  
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Peat, Marwick, Mitchell & Co.  
September 1982, PB 83-146183

**Commuter Connection: Flexible Ride-Sharing in Marin County, CA: Final Report**

Proj. CA-06-0128  
Edith Dorosin  
December 1981, PB 82-184672

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Edith Dorosin  
September 1982, PB 83-145425

**Shared-Ride Taximeters: State-of-the-Art and Future Potential**

Proj. MA-06-0049  
Newman, D.A. and Lave, R.E.  
May 1982, PB 82-258708

**Taxi Regulatory Revision in San Diego, CA: Final Report**

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Pat Gelb

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Pat Gelb

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Marcom Associates  
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R.L. Knight, F. May, and D. Koffman

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**Impacts and Effectiveness of Third-Party  
Vanpooling - A Synthesis and Comparison  
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Proj. MA-06-0049-82-6

Carla Heaton, et al.

March 1983, PB 83-207-936

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(To be published in FY 1984)

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Multisystems

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# Planning and Analysis

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## Trends and Highlights



The work described in this chapter provides essential support for UMTA's planning, operating and capital grant assistance programs. The continuing goal of these efforts is to develop and disseminate analytical techniques for use by federal, state and local agencies in planning, programming, budgeting and implementing improvements in their transportation systems.

A primary product of this program has been the Urban Transportation Planning System (UTPS). UTPS is a coordinated collection of mainframe computer software, technical manuals and training materials developed and distributed by UMTA and the Federal Highway Administration (FHWA). Training courses, publications and technical assistance on an individual basis are available on UTPS applications and performance of sound transportation planning analysis. UTPS is now used by over 300 planning agencies.

Recent emphasis has been placed on providing transit and paratransit operators with analysis support and on helping them to exploit the rapidly evolving computer technologies, particularly microcomputers. Training courses, publications and individual technical assistance are available on the use of computerized tools in transit and, more generally, on transit planning and management analysis.

A category of projects called Special Planning Studies supplements UMTA's Technical Studies by focusing on local planning issues with national significance, or on procedures with wide application in the transit industry. Areas investigated include service, land use and energy planning, elderly and handicapped accessibility, and Transportation Systems Management Planning (TSM).

# Transportation Planning Analysis Methods

The transportation planning portion of the program has two related purposes. The first is to provide technical assistance to federal, state and regional planners, especially in cities where plans for major capital transit investments may involve UMTA capital grants. The second is to develop analytical methods which improve the planning process, and to package those methods in a form which is both understandable to planners and useful in a variety of urban settings and planning studies.

Technical assistance to the planning community, the most important activity in support of transportation planning analysis, varies considerably in content, form and degree of detail. Intensive support is given to regional agencies and transit operators that have applied for major capital grants. Technical documents addressing a variety of planning issues—ranging from guidelines on Environmental Impact Statement (EIS) preparation to course lecture guides on several UTPS programs—are published and distributed. Courses are offered in planning methods and, when the nature of the study warrants such involvement, on-site assistance is offered to state or regional agencies.

The UTPS Support Center disseminates expert information about UTPS and other planning topics in both written and oral form. The Support Service now has a toll-free telephone number at the disposal of agencies with specific questions about program operation or performance. A

document distribution center maintains address lists of planning agencies, transit operators, and consultants, and fills requests for the many manuals, users' guides and planning documents developed by UMTA.

A microcomputer planning support center at TSC disseminates information about the use of microcomputers in transportation planning. It also serves as a software clearinghouse by distributing public-domain planning software to anyone requesting it. Most of this software has been contributed by planners from around the country who developed the software for their own use. Some of the software distributed was developed by UMTA in response to specific needs not met by commercial or contributed software.

In conjunction with the FHWA, a weeklong introductory UTPS transportation planning course is taught several times a year. Also offered is a seminar in which experienced UTPS users are given the opportunity to learn about the latest tools available from UMTA, and to interact with one another in sharing ideas and solutions to UTPS related problems.

## Transit Operations Analysis Methods

The objective of transit operations support is to provide improved tools, technical information and training for transit and paratransit operators. Improved tools often involve the use of computer systems to assimilate the vast quantity of information which transit operators must deal with on a daily basis. Automation in the transit industry is advancing at a rapid

rate, particularly in the area of microcomputers. Operators need to be kept abreast of the latest software and hardware available to meet their needs.

### Fixed Route Operations

To control rising deficits in fixed-route service, transit managers must have the capability to analyze the causes of changes in revenues and cost. Methods to assess the impact of service changes, work rules, and rates of employment and inflation are needed. In addition, operators require assistance in determining what kind of sampling allows for the most cost-effective collection of fixed-route ridership data.

A two day introductory microcomputer course offered through UMTA regional offices covers hardware characteristics, commercial software, and criteria to be considered when selecting a system. The course also includes a discussion of software currently being used by transit agencies, and computer demonstrations.

Other support activities include a national microcomputer in transit user support center at the Rensselaer Polytechnic Institute, the publication of a quarterly newsletter about microcomputer applications, and the exchange of information and public-domain software.

Microcomputer software is being developed in the areas of financial forecasting, route performance reporting, and scheduling and run cutting. This will be applicable to a wide number of transit agencies, and able to run on numerous different computer systems.

Two series of publications concerned with microcomputers, "Software and Sourcebook" and "Selected Read-



***UMTA encourages the use of computers in transit management and planning through various channels including the publication of newsletters and software reference guides, course offerings and software development.***

ings", have been initiated. The first offers descriptions of transportation software and references, while the second is a series of publications, each presenting information on a particular subject area.

A one week transit operations planning course is offered for professionals new to a transit agency. The course covers operating cost estimation techniques, service design concepts, demand and

revenue estimation, and fixed-route service area considerations. New courses in financial forecasting, management auditing and scheduling are planned.

### **Paratransit Operations**

The demand for paratransit services such as dial-a-ride, shared-ride taxi, car and vanpooling, subscription services and special services for the elderly and hand-

icapped continues to grow throughout the United States. UMTA sponsors research, development and deployment of communications and computer technologies which have the potential for making operational improvements, reducing costs, improving levels of service and management, and coordinating and integrating paratransit with conventional transit.

Computer techniques and software are being developed to provide the needed tools for successful management, operation and planning of flexible paratransit services, and for their coordination with conventional fixed-route, fixed-schedule mass transit systems.

A low-cost ride-sharing computer system was developed to support Knoxville's ride-sharing programs (TN-06-0010). This microcomputer assists the transportation coordinator by matching transportation services with market demand. Documentation and software are available from the Knoxville Computer Pool of the University of Tennessee.

A relatively large but low-cost computer-assisted routing, scheduling, dispatching and management information system is being developed in Dade County, Fla., and should be available by May 1984 (FL-06-0018). This is a brokerage type of system for coordinating transportation for social service agencies and elderly and handicapped persons. The sources utilize contracted shared-ride taxi as well as vehicles owned by local service agencies. Work is also underway at the Transportation Systems Center in the application of low-cost, computer-assisted graphic systems (MA-06-0054) to the solution of dispatching and scheduling problems for the elderly and hand-



icapped. This work is being done in cooperation with Brockton, Mass., which has field tested the system. The completed system should be available by April 1984.

The Paratransit Handbook, which provides a comprehensive review of all aspects of paratransit, is being updated and should be available by March 1984.

## Technology Assessments

The Technology Assessments program is investigating the applicability of new technology and design techniques to urban transportation. The work includes the technical and socio-economic assessment of newly installed guideway transit systems, as well as studies addressing the design requirements and cost-effectiveness of new technology applications to transit. The goal of this work is to provide an information base containing a wide range of data which can be used by planners of new systems.

One typical project just recently completed is the assessment of the new San Diego light rail system. This \$85.8 million 25km system opened for service in July 1981, and has been very well received in the San Diego area. The assessment project has studied and documented all aspects of the system for the benefit of other cities who may wish to consider a similar type system. The report includes a description of the system, a review of technical subsystems, an evaluation of system performance, system costs, and implementation history. The data was collected through literature surveys, site visits, interviews, and re-



**Computer graphics programs were successfully applied to the planning, dispatching and scheduling of special needs services at Brockton Area Transit.**

views of operating and maintenance logs.

Another report, the International Transit Compendium contains concise descriptions, photographs and data on 34 AGT Systems around the world. These systems are either presently in service, under construction or under full scale development. This report replaces a previous version which is now obsolete due to advances in technology. Ultimately, other volumes will be prepared covering transit concepts other than AGT. Because of its international coverage, the Compendium is written in three languages: English, German, and French.

Additional projects include studies of recently installed transit systems such as airport AGT systems, subsystem technology such as guided bus concepts, basic design approaches such as the use of fiber/epoxy composite materials for lightweight structural elements, and methods for effective dissemination and integration of new transit technology data into the transit industry.

A number of reports have been published over the past fiscal year, and several more are in process. These are listed at the end of this section. Reports published prior to 1982 are not included.

## Special Planning Studies

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 technical studies grants by allowing the study of local issues with national significance, and the development of widely applicable procedures and methods.

In FY 83, a number of special planning studies were initiated to address continuing concern over the increasing cost of providing transit services. This concern indicated the need for improved tools to aid local operators in making short-range planning decisions.

The high cost of energy and the potential for disruption in energy supplies suggest the continued need for studies designed to enable transit operators to plan for improved energy management. The requirements for handicapped accessibility also necessitate improved planning methods for transit management.

Other continuing projects include studies to provide better information on the impact of major transit investments, and studies to assist local areas to address TSM planning needs. Approximately two-thirds of the special study projects were undertaken by local government agencies.

## Rapid Rail Transit Impact Studies

In recent years, UMTA has provided funds for the development of relatively new rapid rail transit systems. An assessment of how these new systems affect regional development and the institutional environment is useful for future local level and UMTA planning decisions.

The Washington Metropolitan Area Transit Authority (WMATA), Washington, D.C., Impact Study has continued to examine travel behavior, activity and development, and policy interpretation (IT-09-0086, IT-09-0097, DC-09-7001, DC-

09-7002, DC-09-7003 DC-09-7005, DC-09-7008, DC-09-7010). 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. Midday travel changes and "induced" travel are also being considered. 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



*A series of reports assessing the various impacts of WMATA on the region will be of interest to those involved in planning new systems nationwide.*

study will attempt to catalogue the transportation-related goals and expectations of citizens, planners and local officials.

Working papers have recently been prepared in several of these impact assessment areas. The first major product of this effort, an extensive document covering in detail the impact of the initial Red and Blue line segments, was completed in September 1981. A second report, describing trends prior to the advent of Metro, was completed in July 1982.

The Metropolitan Atlanta Rapid Transit Authority (MARTA), Atlanta, Ga., Impact Study (GA-09-0037, GA-09-0038, GA-09-7001, GA-09-7002, GA-09-0057, GA-09-0063) has two components. The main component, a comprehensive assessment of the economic impact of transportation on land use, is being conducted by the Atlanta Regional Commission (ARC). A second study being undertaken by MARTA itself, with funding passed through ARC, is designed to assess the institutional experiences of MARTA in all phases of implementation.

Work has been completed on a detailed study design, broadening its focus 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 from the time the system began operation in 1979 has been initiated. Initial analysis reports were released in 1981, and in 1982 a key report on work-trip use of the system was completed.

The San Diego area recently completed construction of a new light rail transit system using only local funds. The 16 mile line was opened in July 1981 and extends from downtown San Diego, Calif., to the Mexican border.

In order to evaluate the impact of this system and to assess the impact of systems deployed without federal funds, a project has been initiated by the San Diego Association of Governments. The project will assess implementation and decision-making processes, line and user characteristics, and impact of the overall transportation system and travel behavior. An initial report on trends prior to the system's implementation was completed in July 1982.

In addition, an informal conference of Impact Study participants was held in late 1981. A report summarizing the proceedings, completed in March 1982, provides a good summary of Impact Studies findings to date (CA-09-7006).

### **Transportation System Management Planning (TSM)**

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. These strategies would increase the efficiency of their transportation systems by 1) identifying institutional arrangements which facilitate effective TSM planning and programming, 2) identifying important factors in the implementation of TSM projects and 3) developing technical tools for use in TSM planning.

As circumstances surrounding the planning, programming and implementation of transportation improvements have changed, it has become increasingly clear

that TSM issues must be considered in the long-range as well as in the short-range planning processes. Such long-range planning considerations as funding limitations and energy supply restrictions should also be taken into account. In order to assess this problem in greater detail, a prototype planning study was initiated at the North Central Texas Council of Governments (TX-09-0181). This study will address these issues and attempt to determine a means by which local planning agencies can take account of such constraints in their long-range planning efforts.

Many TSM strategies have significant impacts on local neighborhoods. In addition, a number of strategies are designed to help reduce the neighborhood impact of transportation facilities, services and operation. To assist local jurisdictions in planning such strategies, the District of Columbia DOT is undertaking a prototype study designed to demonstrate how better to address these problems. The study (DC-09-7006) focuses on ways of insuring adequate and knowledgeable participation in the planning process by neighborhood residents.

An altogether different issue, but still a part of TSM, is strategic planning. The purpose of strategic planning is to identify significant future trends in order to allow an organization to position itself to address the resulting problems and opportunities. WMATA is conducting a prototype study (DC-09-7007) to demonstrate public transit agency application of this concept, which has in the past been confined primarily to private sector corporate planning.



### **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 addressing this issue is an im-

portant aspect of each area's local urban transportation planning process. Thus, local agencies must be able to identify the location and transportation needs of elderly and handicapped persons and to develop services to meet those needs. Former regulations also required local areas to make fixed-route services accessible to handicapped persons. Although these regulations have been rescinded, many local areas have purchased or are planning to purchase lift-equipped line haul buses. These vehicles may be integrated into local fleets with minimum disruption if certain considerations are taken into account. Guidance on planning methods to accomplish this is being developed for use by local areas.

A number of special studies designed to assist localities in meeting elderly and handicapped planning requirements have been initiated. The specific aims of these studies are to 1) identify 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 buses.

A major study in the first area, Data Collection System for Planning Services for Elderly and Handicapped Persons (IT-09-9009, DC-09-9049), has as its goal the development of practical and effective data collection procedures to facilitate the ongoing planning of special services for elderly and handicapped persons, and in particular wheelchair users and semi-ambulatory persons. The specific objectives of the study include 1) specifying information requirements for special efforts planning, 2) determining what portion of planning can be satisfied through inexpensive data-gathering methods and self-identification techniques and 3) determining the primary data collection needed for special efforts planning. The data collection system developed by this study was tested by the Montgomery-Greene County Transportation Planning Program in Ohio (OH-09-7001). The final product of this effort, a manual on an effective and simple data collection method is now available.

A related study addresses the problem of the barrier to coordination of special transportation services presented by inconsistent data and reporting requirements. In this project, a consortium of six states is attempting to develop a simpli-

fied, coordinated system of billing and accounting to meet the needs of all federal and state programs which typically support special services. The results of this project (MI-09-7001) could then be used by coordinated service providers in local areas to insure that all of these needs are met with a minimum of cost and inconvenience.

### **Energy Planning Studies**

Recent shifts in federal policy on energy have changed the focus of transportation planning in regard to energy. Petroleum decontrol has several implications for transit, which now has no guaranteed emergency fuel supply or regulated price controls. These factors make it extremely important that transit operators prepare contingency plans for possible energy emergencies. The possibility that energy costs will remain high indicates that transportation decisions must be made to insure maintenance of mobility at minimum cost to system users. Studies in this area are designed to develop planning tools for local application.

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 realities, a Prototype Energy Management Planning Study was initiated in Seattle, Wash. (WA-09-0034). This study developed a number of products useful in both contingency and conservation planning. The study updated an existing contingency plan, and in doing so documented the process used. Studies on fuel stockpiling were also conducted. A detailed transit operations energy audit tool was developed and tested. This tool should be useful to other operators

wishing to make a comprehensive study of their system in order to reduce fuel consumption. A number of reports have been published as a result of this study.

A related effort involves preparation of a number of reports on transit fuel procurement issues. These reports (DC-09-9035, DC-09-9044) deal with the general transit fuel situation and the prognosis for the fuel market in emergencies, taking into account both the termination of price controls and allocation rules, and the feasibility of diesel fuel futures as a means of mitigating the impact of emergency price increases.

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 additional guidance on this matter, a grant has been made to the New York State DOT (NY-09-8006). Issues addressed include data collection methodology, the role of transit in energy conservation, the sensitivity to energy constraints of work and nonwork travel, the energy impact of TSM actions, and the energy costs involved in implementing various transportation measures and projects. A number of reports covering results in these areas are in preparation. One report, providing detailed manual methods for calculating the energy impacts of various TSM actions, was completed in October 1981.

### **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 existing systems. This change in emphasis requires transit operators to make planning decisions in a manner quite different from that of the past. The operator must have a much wider range of accurate and current information to allow continuing evaluation of existing systems.

Projects in this study area are designed to assist in transit planning by providing methods for data collection and analysis, and by developing training material for transit operators and 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 patronage data (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 such data collection is limited. Little is known about the type, method and frequency of data collection required, or of 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: to develop a model monitoring system which will facilitate ongoing evaluation of existing

transit services, and to demonstrate the practicality and effectiveness of the model monitoring system in obtaining current service performance information.

A major interim product of this research effort was a monitoring manual providing a step-by-step procedure for implementing and maintaining the monitoring system. Details for estimating manpower and cost requirements of the system are also included. Efforts to improve and expand the applicability of the system are currently underway.

The proposed system design was tested and validated by the contractor at the Chicago Transit Authority (CTA) and the Regional Transportation Authority (RTA), Chicago, Ill. The contractor was responsible for the overall design of the system demonstration. Grants (IL-09-7001, IL-09-7002) were made to both transit systems to help defray testing costs.

The bus transit surveillance prototype studies at Boston, Mass. (MA-09-7001), Albany, N.Y. (NY-09-0054), Bridgeport, Conn. (NY-09-0064), and Houston, Tex. (TX-09-0158), have been initiated to provide transit operators with a systematic evaluation method to measure existing service performance, identify new potential areas of transit, and provide insight into the analysis of service alternatives. In addition, a similar study covering rail transit operations has been initiated in Washington, D.C. (DC-09-0007).

An effective transit planner needs a good working knowledge of all areas of transit operations, including 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. Coordinated training courses need



***Training courses give transit planners needed expertise in transit operations to better accomplish short-range transit planning tasks.***

to be developed to provide new planners with basic knowledge and an understanding of transit operations.

The purpose of the Transit Operations and Planning Course project (IT-09-9011) is to develop a training course which will provide necessary background knowledge and understanding of transit operations for individuals in entry level transit planning positions, and to demonstrate the practicality and effectiveness of the training course method. The work is in two phases. In the first phase, the needs of new transit planners have been

determined and a course outlined to meet these needs. A report describing currently available training courses has been prepared. In the second phase, materials for the course were developed. These materials have been tested and validated by the contractor through a trial course. The course is now available on a regular basis through UMTA's Technical Assistance Program.

Estimating costs of proposed service changes is critical to planning improvements of transit services. Unfortunately, state-of-the-art cost estimation tech-

niques are limited. Available methods involve either complex and expensive analyses or simpler, easily applied models that are less expensive but subject to critical theoretical shortcomings which detract from their usefulness.

Thus, the objectives of the Cost Estimation Techniques Study (IT-09-9014) are to develop inexpensive, readily applicable cost estimation techniques that are both theoretically sound and accurate in their forecasts, and to demonstrate the effectiveness and practicality of these techniques by on-site testing. The final product of this project is a report covering the state-of-the-art in cost estimation, the techniques developed by the study, procedures for application of the techniques, and estimated costs involved in use of the proposed methods. A review panel was formed to assist in the study and to review its products, insuring their usefulness to local transit operators. Interim reports describing existing techniques and the proposed new approach are available.

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, it will not be possible to measure the total impact on system finances. Unfortunately, little is known about the impact of different service variables—e.g., headway, travel time, or socioeconomic factors such as age or income—or about how a transit operator might develop models applicable to a specific system. Because of this, route patronage modeling studies have been initiated by the Greater Cleveland Regional Transit Authority, Cleveland, Ohio (OH-09-7002), the Southern

California Rapid Transit District (SCRTD), Los Angeles, Calif. (CA-09-0099), the Tri-County Metropolitan Transportation District of Oregon, Portland, Oreg. (OR-09-7001), and Albuquerque Transit, Albuquerque, N. Mex. (NM-09-7001).

These projects are designed to develop patronage models which can be applied at a route level, and to demonstrate that patronage models can be developed within a local transit operating environment. The report produced as a result of these studies is designed to serve as a model by which other local transit operators can develop their own patronage models; simple, easily applicable methods were given primary attention. An interim report describing current demand modeling techniques is presently available as well as final reports from Cleveland and Portland. Technical assistance for this work is being provided by TSC (MA-09-9009).

A key factor in bus service reliability 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 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 maintenance planning practices.

Labor accounts for approximately 85 percent of transit costs. In many cases,

labor contract provisions governing such factors as spread time maximums and penalties, overtime requirements and straight shift requirements, strongly affect these costs and the ability of transit planners to develop service changes. Transit planners need tools which can help them assess the impact of labor contract provisions on alternative service cost proposals. A project (CA-09-0109) has been initiated to develop such a tool at the SCRTD. A report will be produced describing the methods developed, the results of method application and the implications for service planning of these results. The report is due in 1984.

As transit operating costs continue to rise, it has become increasingly important to insure that transit operator management is as efficient and effective as possible. One way to accomplish this is through the conduct of periodic management assessments. In order to demonstrate the process by which this may be accomplished, a set of three management planning prototype studies has been initiated. These three projects, in Salt Lake City, Utah (UT-09-0015), Kansas City, Mo. (MO-09-0034), and Pittsburgh, Pa. (PA-09-7003), will assess such factors as organizational structure, management information systems, financial procedures and internal planning to determine what improvements are needed. These three reports should serve as useful tools to other operators interested in conducting similar studies.

One of the most important activities conducted by transit operators is scheduling the assignment of vehicles and drivers to routes and runs. While computerized systems are now available to do this (RUCUS), these systems are primarily ap-



***The maintenance facility study will present useful guidelines for the optimal design and planning of new maintenance facilities.***

plicable to larger agencies. Many operators must still perform this function manually. In 1947, the American Transit Association, forerunner of the American Public Transit Association, developed a report on methods for manual scheduling. Though it does not reflect some of the changes undergone in transit since it was developed, this report is still basically valid and, in order to assist the larger number of operators who still use manual scheduling methods, it has been reprinted.

Most public transit is supported, in part, by public subsidies. In many cases, these subsidies must come from the local jurisdictions served by the operator. In such situations, methods must be developed for subsidy allocation to each jurisdiction involved. This process is often controversial. Local transit planners who

must develop and defend alternative arrangements for subsidy allocation are not generally aware of all possible approaches to this problem, or of the advantages and disadvantages of each. A study has therefore been initiated to inventory and evaluate the various methods used (IT-09-9019). The resulting report is believed to be useful to transit planners faced with this problem.

Transit involves a significant investment in capital assets in order to function effectively. These assets, including vehicles and maintenance facilities, must themselves be maintained and periodically replaced. Recently, the Metropolitan Transportation Commission (MTC) in the San Francisco, Calif., area conducted a study of the facilities and capital stock of the transit operators in the Bay Area. This study pointed out a number of areas in which improved management of capital assets was needed. A grant was made to the MTC (CA-09-7008) to document the study findings and describe in detail the process followed. The resulting report is designed to help operators to evaluate their own efforts in this area.

### **Disadvantaged Business Enterprise**

This area of the Special Planning Studies program derives from the continuing need to involve Disadvantaged Business Enterprises (DBEs) in the planning and programming phases of transit project development. It is designed to help involve DBEs in new areas of transit activity, such as transit-related economic development, and to avoid heavy reliance on grant sanctions to facilitate DBE representation.

Two special studies, one a contract

with Comprehensive Technologies International (DC-09-9063) and another, a cooperative agreement with the National Association of Real Estate Brokers (DC-09-7012), will provide technical assistance and advocacy support to minority entrepreneurs in gaining access to development and related opportunities in real estate projects around transit facilities. A small project in Frenchtown, a minority section of Tallahassee, Florida (FL-09-0159), is designed to promote the revitalization of the minority business community through the work of a minority community economic development agency on planning transit improvements as well as service improvements, through the local transit agency.

Two other projects - a DBE advocacy project run by the Florida NAACP and a project to establish voluntary guidelines among major transit prime suppliers (FL-09-7006), are intended to complement existing DBE regulations by providing "up front" technical assistance. The NAACP project has helped several Florida localities with low DBE goals to increase their DBE participation and learn how to operate a successful DBE program.

The Latin American Manufacturers Association project (DC-09-7011) will serve to help prime suppliers to the transit industry develop voluntary guidelines and DBE programs so that, when called upon by transit vehicle manufacturers, they can adequately meet stipulated contract goals.

Another study, conducted by Mason-Tillman Associates (CA-09-9005), will develop mechanisms for verification of the data received by the Office of Civil Rights.



## **Public Transportation for Minorities and Other Transit Dependents**

The journey to work is the main-spring of public transportation. Travel-related population and employment characteristics have changed in many ways in the last ten years. Significant population movements have occurred in urban, suburban, and exurban areas while rates of population growth have slackened, resulting in smaller households and an aging population. Employment has also experienced geographical shifts and shifts among the various economic sectors. While the 1980 census provides good information on the commuting patterns of the general population, current information is lacking on the commuting patterns of the most transit dependent groups. Demographic shifts of the last decade including black migration back to the South, population movements to the Southwest, and population and employment movements from the inner cities to the suburbs needs to be taken into account when assessing the journey to work of minorities and other transit dependents.

Funds were provided to the Joint Center for Political Studies (DC-09-7009) through a cooperative agreement for the purpose of identifying demographic variables which clearly have affected urban travel demand since 1970. An analysis was made of the work trip travel behavior of transit riders with emphasis on the transit dependent, i.e., economically disadvantaged urban minorities, women, elderly, and the young. A data base management information system was developed to assist in further analysis and evaluation.

## Planning and Analysis

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>TRANSPORTATION PLANNING ANALYSIS METHODS</b>					
Census Data Package for Urban Transportation Planning	DC-06-0311	\$25,000	Mar. 1983- Mar. 1984	FHWA	Edwin I. DeLong (202) 426-9271
Developmental Support in Transportation Planning - Microcomputer Technical Support - Operations Research	MA-06-0039	\$230,000	Open-ended	TSC	Granville E. Paules (202) 426-9271
Implication of Alternative Transit Access Coding Techniques	MD-06-0103	\$60,000	Nov. 1983- Nov. 1984	Baltimore Regional Planning Council	James Ryan (202) 426-9271
Analysis of Mode of Access to Fixed-Route Transit	DC-06-0311	\$50,000	Nov. 1983- Nov. 1984	Metropolitan Washington COG	James Ryan (202) 426-9271
Improved Statistical Tests of the Performance of Mode Choice Models	IA-06-0004	\$41,000	Sept. 1983- Sept. 1984	University of Iowa	James Ryan (202) 426-9271
Update of "Characteristics of Urban Transportation Systems"	MA-06-0039	\$45,000	Aug. 1983- Aug. 1984	TSC	A. Joseph Ossi (202) 426-9271
Update of "Characteristics of Urban Transportation Demand"	MA-06-0039	\$65,000	Aug. 1983- Aug. 1984	TSC	A. Joseph Ossi (202) 426-9271
Case Studies of TSM Planning on Microcomputers	AZ-06-0015	\$280,000	Nov. 1981- Nov. 1984	Arizona DOT	James Ryan (202) 426-9271
Microcomputer Access to GBF/DIME Files	CA-06-0148	\$50,000	Sept. 1980- Sept. 1984	Santa Clara County, CA	Edwin I. DeLong (202) 426-9271

## Planning and Analysis

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>TRANSIT OPERATIONS ANALYSIS METHODS</b>					
<b>Fixed Route Operations</b>					
Computerized Bus Monitoring System	MA-06-0123	\$125,000	Oct. 1982- July 1983	Multisystems, Inc.	Brian E. McCollom (202) 426-9271
Standardization and Documentation of TRANES	WA-06-0022	\$149,820	Aug. 1982- Jan. 1984	Puget Sound COG, Seattle, Wash.	Thomas J. Hillegass (202) 426-9271
Route Data Evaluation Study	PA-06-0079	\$100,000	Oct. 1982- Oct. 1983	PAT	Brian E. McCollom (202) 426-9271
Microcomputers in Transit Timekeeping and Parts Inventory	IT-06-0286	\$140,000	Mar. 1983- Sept. 1984	Washington Consulting Group	Thomas J. Hillegass (202) 426-9271
Portable Microcomputer Applications in Transit and Transportation Planning	MA-06-0165	\$31,993	Aug. 1983- Aug. 1984	University of Massachusetts	Thomas J. Hillegass (202) 426-9271
Microcomputer Course for Transit Operations	NY-06-0104	\$78,623	May 1983- June 1984	Rensselaer Polytechnic Institute	Ron Jensen-Fisher (202) 426-9271
Integrated Application Package Demonstration	MA-06-0039	\$50,000	Sept. 1983- May 1984	William G. Barker & Associates	Ron Jensen-Fisher (202) 426-9271
Demonstration of Microcomputer Accounting	MA-06-0039	\$50,000	Sept. 1983- Sept. 1984	Peat, Marwick & Mitchell	Ron Jensen-Fisher (202) 426-9271

## Planning and Analysis

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>TRANSIT OPERATIONS ANALYSIS METHODS (CONT.)</b>					
<b>Paratransit Operations</b>					
Paratransit Planning Methods	NH-06-0002	\$95,435	Nov. 1981- Mar. 1984	Dartmouth College	Thomas J. Hillegass (202) 426-9271
Low Cost Ride-Sharing Computer System Support	TN-06-0010	\$61,000	Oct. 1982- Oct. 1983	University of Tennessee, Knoxville	Edward G. Neigut (202) 426-9271
Operational Software Packages and Support	DC-06-0261	\$1,177,000	July 1979- July 1983	National Bureau of Standards	Edward G. Neigut (202) 426-9271
Computer-Assisted Shared-Ride Taxi and Social Services Coordination System	FL-06-0018	\$900,000	Oct. 1979- May 1984	Dade County, Fla.	Edward G. Neigut (202) 426-9271
Computer-Assisted Graphics Research	MA-06-0054	\$318,000	April 1980- April 1984	TSC	Paul J. Connolly (617) 494-2205
Scheduling Algorithms Research	MA-06-0071	\$66,000	Oct. 1980- Oct. 1984	Massachusetts Institute of Technology	Edward G. Neigut (202) 426-9271
Color Graphics Scheduling	CA-06-0189	\$200,000	Oct. 1983- Oct. 1984	COMSIS	Edward G. Neigut (202) 426-9271
<b>TECHNOLOGY ASSESSMENTS</b>					
Guided Bus Survey	IT-06-0247	\$162,000	March 1982- March 1984	Multisystems	Robert Hoyler (202) 426-9267
AGT Cost-Effectiveness Study	IT-06-0197	\$220,000	Aug. 1978- Dec. 1983	SYSTAN	Robert Hoyler (202) 426-9267
Assessment of Transit Technologies	IT-06-0248	\$474,000	July 1981- July 1984	NDL Transportation Research Corp.	Robert Hoyler (202) 426-9267
Technology Transfer	MD-06-0095	\$50,000	Sept. 1982- March 1984	Automated Sciences Group	Robert Hoyler (202) 426-9267
AGT Guideway Study	IT-06-0311	\$10,000	Sept. 1983- March 1984	N.D. Lea	Robert Hoyler (202) 426-9267

## Planning and Analysis

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>SPECIAL PLANNING STUDIES</b>					
<b>Rapid Rail Transit Impact Studies</b>					
Washington Metropolitan Area Transit Authority (WMATA) Impact Study	DC-09-7001	\$2,081,705	May 1977- Dec. 1984	Metropolitan Washington (D.C.) Council of Governments	Richard Steinmann (202) 426-6385
	DC-09-7002				
	DC-09-7003				
	DC-09-7005				
	DC-09-7008				
	DC-09-7010				
	IT-09-0086				
Metropolitan Atlanta Rapid Transit Authority (MARTA) Impact Study	GA-09-0037	\$1,137,394	Sept. 1977- July 1984	Atlanta (Ga.) Regional Commission	Richard Steinmann (202) 426-6385
	GA-09-0038				
	GA-09-0063				
	GA-09-7001				
	GA-09-7002				
	GA-09-0057				
San Diego Light Rail Transit Impact Study	CA-09-7006	\$202,320	Aug. 1981- July 1984	San Diego (Calif.) Association of Governments	Richard Steinmann (202) 426-6385
<b>Transportation System Management Planning (TSM)</b>					
Integrating TSM Consideration into the Long Range Planning Process	TX-09-0181	\$51,200	Sept. 1981- April 1984	North Central Texas Council of Governments	Richard Steinmann (202) 426-6385
TSM in Neighborhoods: Involving Citizens in the Planning Process	DC-09-7006	\$136,000	July 1982- July 1984	District of Columbia DOT	Richard Steinmann (202) 426-6385
Strategic Planning at Transit Operators	DC-09-7007	\$162,750	Sept. 1982- Sept. 1984	WMATA	Richard Steinmann (202) 426-6385

## Planning and Analysis

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>SPECIAL PLANNING STUDIES (CONT.)</b>					
<b>Planning Transportation For Elderly And Handicapped People</b>					
Data Collection System for Planning Services for Elderly and Handi- capped Persons	IT-09-9009 DC-09-9049	\$305,000	Nov. 1977- Dec. 1983	Peat, Marwick, Mitchell and Co.	Richard Steinmann (202) 426-6385
Data Collection System Trials	OH-09-7001	\$121,360	July 1979- July 1981	Montgomery- Greene County Transportation Planning Program, Ohio	Brian E. McCollom (202) 426-9271
Development of Unified Billing and Accounting Systems for Special Services	MI-09-7001	\$100,000	Feb. 1981- July 1983	Michigan DOT	Norman Paulhus (202) 426-4208
<b>Energy Planning Studies</b>					
Seattle Metro Transit Operations Energy Planning Prototype	WA-09-0034	\$222,463	July 1980- July 1982	Municipality of Metropolitan Seattle, Wash.	Richard Steinmann (202) 426-6385
Guidance for Transit Operators on Energy Issues	DC-09-9035 DC-09-9044	\$20,000	Sept. 1981- Feb. 1983	Cabot Consulting Group	Richard Steinmann (202) 426-6385
New York State Energy Conservation Technical Guidance Study	NY-09-8006	\$375,000	July 1980- July 1983	New York State DOT	Richard Steinmann (202) 426-6385

## Planning and Analysis

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>SPECIAL PLANNING STUDIES (CONT.)</b>					
<b>Short-Range Transit Planning</b>					
Bus System Monitoring System	IT-09-9008	\$300,000	Jan. 1978- Sept. 1983	Multisystems, Inc.; ATE Management and Service Co.	Brian E. McCollom (202) 426-9271
Bus System Monitoring System Trials	IL-09-7001 IL-09-7002 MN-09-7002 MN-09-7004	\$503,164	April 1979- Sept. 1983	CTA, Chicago, Ill.; N.E. Illinois RTA; Metropolitan Transit Commission, Minn.	Brian E. McCollom (202) 426-9271
Transit Surveillance Prototype Study: Boston, Mass.	MA-09-7001	\$130,400	June 1978- Jan. 1983	MBTA	Brian E. McCollom (202) 426-9271
Service Evaluation Prototype Study	TX-09-0158	\$60,000	March 1981- Dec. 1982	Houston (Tex.) MTA	Brian E. McCollom (202) 426-9271
Transit Surveillance Prototype Study: Albany, N.Y.	NY-09-0059	\$48,000	May 1980- Jan. 1983	Capital District TA, Albany, N.Y.	Brian E. McCollom (202) 426-9271
Transit Surveillance Prototype Study: Bridgeport, Conn.	NY-09-0064	\$54,199	June 1980- Jan. 1983	GBTD	Brian E. McCollom (202) 426-9271
Rail Transit Performance Indicators and Evaluation System Study	DC-09-0007	\$136,400	March 1981- May 1983	WMATA	Brian E. McCollom (202) 426-9271

## Planning and Analysis

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>SPECIAL PLANNING STUDIES (CONT.)</b>					
<b>Short-Range Transit Planning (Cont.)</b>					
Course in Transit Operations and Planning	IT-09-9011	\$247,405	Sept. 1978- July 1983	Booz, Allen and Hamilton, Inc.	Brian E. McCollom (202) 426-9271
Cost Estimation Techniques for Bus Service Planning	IT-09-9014 MN-09-7003	\$175,000	April 1979- Dec. 1982	Booz, Allen and Hamilton, Inc.	Brian E. McCollom (202) 426-9271
Route Patronage Modeling Prototype Study: Cleveland, Ohio	OH-09-7002	\$60,000	Sept. 1979- May 1983	Greater Cleveland (Ohio) RTA	Brian E. McCollom (202) 426-9271
Route Patronage Modeling Prototype Study: Los Angeles, Calif.	CA-09-0099	\$20,000	July 1980- May 1983	SCRTD	Brian E. McCollom (202) 426-9271
Route Patronage Modeling Prototype Study: Portland, Oreg.	OR-09-7001	\$60,000	July 1980- May 1983	TRIMET	Brian E. McCollom (202) 426-9271
Route Patronage Modeling Prototype Study: Albuquerque, N. Mex.	NM-09-7001	\$50,000	June 1981- May 1983	Albuquerque (N. Mex.) Transit System	Richard Steinmann (202) 426-4004
Route Patronage Modeling Technical Assistance	MA-09-9009 MA-09-9013	\$550,000	March 1980- Jan. 1983	TSC	Brian E. McCollom (202) 426-9271
Maintenance Facilities Planning Guides	IT-09-9018	\$150,000	May 1980- Dec. 1983	S.G. Associates	Brian E. McCollom (202) 426-9271



## Planning and Analysis

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>SPECIAL PLANNING STUDIES (CONT.)</b>					
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Modeling the Cost of Alternative Labor Contract Provisions	CA-09-0109	\$67,200	June 1981- Dec. 1982	SCRTD	Brian E. McCollom (202) 426-9271
Management Planning Prototype Studies	UT-09-0015 MO-09-0034 PA-09-7003	\$280,000	Sept. 1981- March 1983	Utah Transit Authority; Kansas City (Mo.) Area Transit Authority; PAT	Brian E. McCollom (202) 426-9271
Planning Methods for Allocation of Transit Subsidies	IT-09-9019	\$50,000	Sept. 1981- Dec. 1982	To Be Determined	Brian E. McCollom (202) 426-9271
Transit Investment Analysis	CA-09-7008	\$20,000	Sept. 1981- March 1982	Metropolitan Transportation Commission, San Francisco, Calif.	Brian E. McCollom (202) 426-9271
<b>Disadvantaged Business Enterprise</b>					
Minority Joint Development Manual	DC-09-9063	\$160,000	Oct. 1983- May 1984	Comprehensive Technologies International, Inc.	Wallace Katz (202) 426-0096
Minority Joint Development Technical Assistance	DC-09-7012	\$70,000	Sept. 1983- Feb. 1984	National Association of Real Estate Brokers	Wallace Katz (202) 426-0096
Frenchtown (Tallahassee) Planning Study	FL-09-0159	\$20,000	Sept. 1983- March 1984	Frenchtown Area Development Authority	Roger Krahl (404) 881-7875
Florida MBE Advocacy	FL-09-7006	\$99,000	Sept. 1983- Sept. 1984	Florida State Conference, NAACP	Roger Krahl (404) 881-7875
Prime Supplier Voluntary Guidelines	DC-09-7011	\$80,000	Sept. 1983- July 1984	Latin American Manufacturers' Association	Wallace Katz (202) 426-0096
Data Verification Study	CA-09-9005	\$98,186	Sept. 1983- Sept. 1984	Mason Tillman Associates	Robert Owens (202) 426-4018
<b>Public Transportation for Minorities and Other Transit Dependents</b>					
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A list of recent reports follows. Please consult previous editions of this Directory for earlier reports. If available, a document number assigned by the National Technical Information Service (NTIS) is listed. Reports may be obtained from NTIS by using the order blanks provided at the end of this document.

Reports which have not been assigned an NTIS number may not have been published in sufficient quantity for general distribution. Single copies and other information may be available from the issuing agency or organization.

Single copies of reports marked with an asterisk (\*) are available by sending a self-addressed mailing label to:

Technology Sharing Program (I-30)  
Office of the Secretary of  
Transportation  
Washington, D.C. 20590

Additional reports relating to the research described in this chapter may become available in the near future. For the most recent information or suggestions for additional reference materials regarding specific projects, call or write to the person listed as the technical contact in the Project Summary Table.

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Transportation Systems Center  
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DOT-P-30-79-08

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DOT-P-30-79-09

**The Local Implications of BART Development**

DOT-P-30-79-11

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**Planning for the Phase-in of Fixed-Route  
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# Management Resources

## Trends and Highlights



In the field of management resources, UMTA projects are designed to improve the internal management of the nation's mass transit systems, and to contribute to a more efficient and productive operation. They include development of a wide range of instructional courses primarily for management and professional transit employees, design and deployment of maintenance training materials, and development of operations and maintenance systems.

A series of technical assistance briefs called *Transit Actions* is published, describing or providing updates on specific UMTA or industry-sponsored innovative management developments. Human resource projects authorized by Section 6 focus on research into industry-identified personnel problems, and on the development of new approaches and training courses for adoption by the industry. New initiatives are being undertaken to include input from labor leadership in projects dealing with increased worker performance and productivity.

Managerial training is authorized by Section 10 of the Urban Mass Transportation Act. It authorizes UMTA to provide grants to local agencies to assist in the training of managerial, technical and professional personnel. It is described in the second section of this chapter.

The activities described in this chapter are by no means a comprehensive listing of UMTA-supported training. Short-term technical training is most frequently offered as an integral part of programs for the introduction of improved service methods, planning methods, or new equipment and facilities. The University Research and Training Program, autho-

ized by Section 11 of the Act, is described in Chapter 11.

## Human Resources Development

Activities included in UMTA's Human Resources Program in FY 83 reflected an effort to include input from labor on projects dealing with increased worker performance and productivity. Projects in Miami, Fla. (FL-06-0031), and Philadelphia, Pa. (PA-06-0072), involved labor union representation in both developmental and implementation stages.

In Philadelphia, the Southeastern Pennsylvania Transportation Authority (SEPTA) is developing a set of classroom and shop training materials for use by the entire bus maintenance staff. In Miami, plans have been made to coordinate all training and development activities of the Metropolitan Dade County Transportation Agency as a means to upgrade the performance of both salaried and hourly personnel.

Work is continuing on a major project in the San Francisco area concerning bus operator stress and hypertension problems (CA-06-0160). This research will provide valuable insight into worker disability, absenteeism, and other symptoms of low performance and productivity.

The Transportation Systems Center conducted workshops on Bus Operator Training (MA-06-0135), using material previously developed by the AFL-CIO Appalachian Council. Through a contract to Urban Resources Inc., training material for productivity workshops at smaller

transit agencies was modified, and training sessions were planned.

UMTA, in cooperation with transit labor and management, developed and conducted a second National Transit Labor/Management Relations Conference in Miami, Fla., sponsored by Florida International University (FL-06-0030). These conferences provide labor, management and government with a forum for addressing common problems affecting the future of transit.

A project awarded to Morgan State University (MD-06-0097) brought together a diverse group of individuals to discuss urban public transportation and the challenge of the 1980's for minorities. The National Urban League is developing a program to provide basic skills improvement for transit employees in reading and math to increase their opportunities for upward movement in transit. (NY-06-0110, NY-20-6001) Additional training sessions for transit management concerned with the employment and retention of handicapped persons (MA-06-0149) were begun, with sessions to be completed in 1984.

## Management Training Courses

As authorized by Section 10 of the Urban Mass Transportation Act, UMTA provides grants to state and local public bodies to assist in the training and development of managerial, technical and professional personnel employed in public transportation. During a period of spiraling costs, increased operating deficits and changing technology, the demand for

trained, competent personnel is increasing. Requirements for improved transit performance and productivity mandate that human resources be upgraded through training and development.

UMTA provides financial assistance for transit personnel attendance at UMTA endorsed training courses in order to stimulate training and training program development among transit operators. This in turn encourages transit agencies to make a commitment to managerial and technical personnel development and insures that effective training takes place on a locally determined basis.

In the last two years, over 1000 managerial employees of the U.S. transit industry have benefited from residential courses of study. These courses have been from two to six weeks in duration, and have involved extensive classroom work, coupled with discussions and seminar activity. In 1981, the program was expanded and it now encompasses approximately 30 courses, located at institutions across the nation. In addition, a single agency grant activity was inaugurated in Section 10 whereby a grant is awarded to a specific transit agency to fund a number of managerial training programs which are important to the agency's development.

The establishment in 1982 of the University Centers for Transit Research and Management Development added a new dimension to the management training program. Funds were made available under Section 11 to the Centers to provide an academic base for developing educational opportunities in management and to expand the scope and number of training activities for transportation pro-



professionals. A variety of Section 10 endorsed short courses and other training activities are offered by the Centers to the transit industry.

A list of UMTA endorsed management training course providers appears below. Individual employees interested in furthering their professional development should contact the institutions for detailed information on specific courses offered, fellowship eligibility and Section 10 grant application forms. Upon acceptance into a course, the agency by which the student is employed submits the grant application to UMTA; grant awards are made directly to the agency. Section 10 grants covers 50 percent of course-related costs.

### **Management Training Course Providers**

University of California at Irvine  
Contact: Dr. G.J. Fielding  
(714) 856-5985

New York Institute of Technology  
Contact: Dr. Richard Dibble  
(516) 686-7722

Portland State University  
Contact: Dr. Kenneth Dueker  
(503) 229-4042

Texas Southern University  
Contact: Dr. Naomi Lede  
(713) 527-7282

Florida A&M University  
Contact: Dr. Shirley Mallory-Smith  
(904) 599-3597

University of Michigan  
Contact: Dr. Cyrus Ulberg  
(313) 764-0248

Indiana University  
Contact: Dr. George Smerk  
(812) 335-8143

National Mass Transit Institute  
Contact: Dr. William Montgomery  
(412) 562-9668

Northeastern University  
Contact: Dean Malcolm Campbell  
(617) 329-8000

University of Wisconsin-Milwaukee  
Contact: Dr. Edward Beimborn  
(414) 963-4978

Consult Limited  
Contact: Mr. William Fay  
(312) 346-1567



***Under Section 10, UMTA provides financial assistance for transit personnel to attend UMTA endorsed training and development courses held across the country.***

## Operations and Maintenance Support

One of the promising new projects aimed at improving productivity is the development and evaluation of an Automatic Bus Diagnostic System (IT-06-0102). The demonstration has been completed and the evaluation report was published in May 1983.

Another project, Maintenance Manual Specification, developed criteria for maintenance manuals, or Job Performance Aids, to improve maintenance productivity and reduce repair errors. Based on these specifications, a companion project (MI-06-0023) is developing a maintenance manual for a particular bus model and testing its effects in a real maintenance environment.

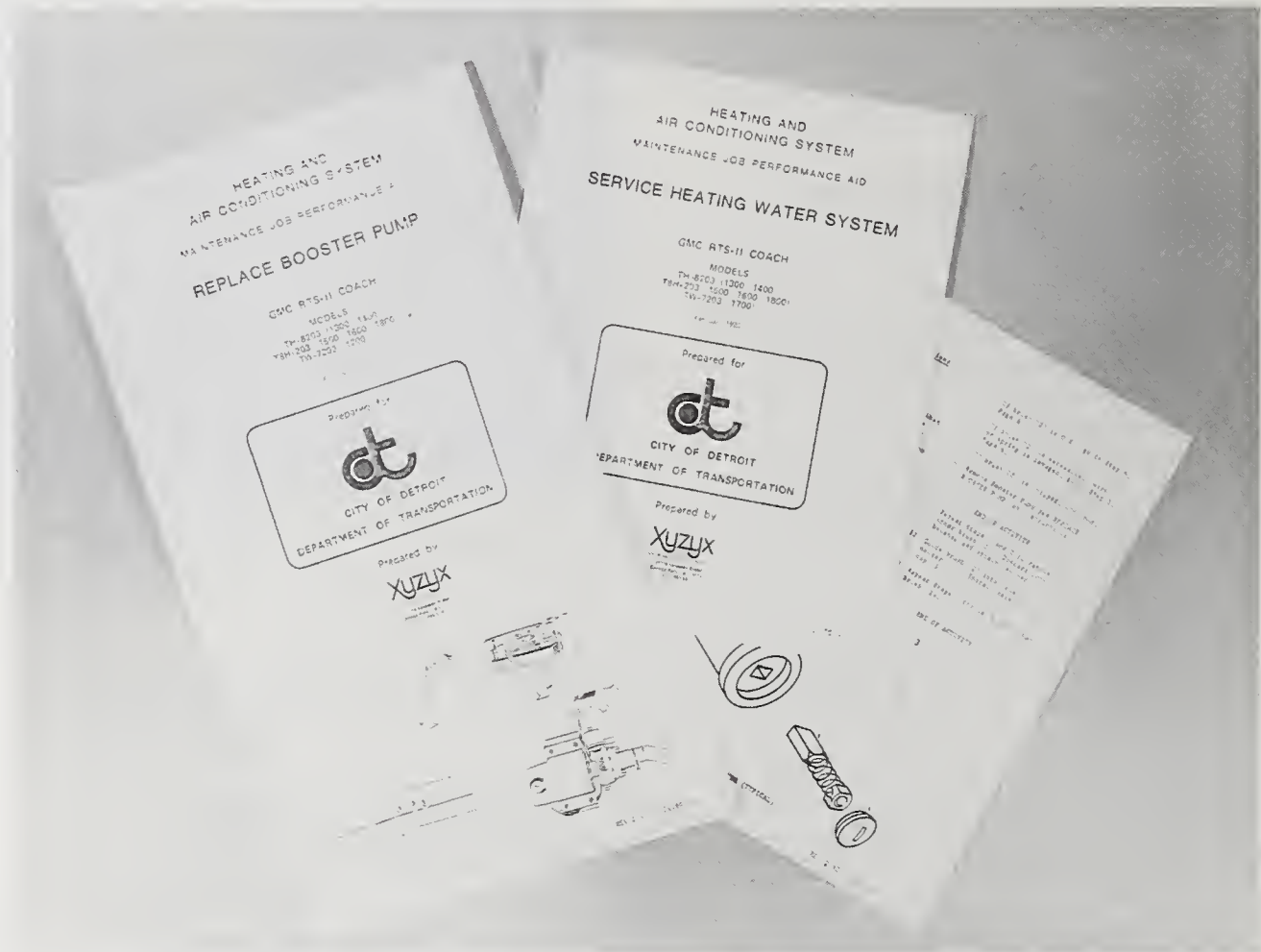
A computer software project entitled RUCUS-II Development produced a software system providing transit operators with an improved automated system for vehicle scheduling and driver run-cutting. The RUCUS-II system applies advances in computer hardware and software within an interactive framework to provide greater control of the entire scheduling process, more efficient processing, and increased effectiveness. The RUCUS-II Test Deployment and Evaluation project (PA-06-0065) will conduct a rigorous testing and evaluation of the RUCUS-II system prior to a general industry release. The demonstration will involve operations from several garages, housing a total of some 500 buses, with-

in the Southeastern Pennsylvania Transit Authority operation.

The 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. This system integrates the service module of SIMS with an automated data collection system for capturing vehicle fuel, oil, torque fluid, and coolant usage information. The project has been

completed and a project report was made available in 1983.

The Transit Management Incentive Contract project (IT-06-0246) to develop and evaluate various incentive contract arrangements for transit systems entering into contract management was completed, and a final report was provided. A contract was awarded (DC-06-0440) to identify barriers in the transit industry to the introduction of innovative developments. A series of workshops for small



**Job Performance Aids explain bus repair procedures in simple terms to help increase maintenance staff productivity and reduce repair errors.**

and medium-sized transit operators (DC-06-0418) to aid in improving performance and productivity was initiated in 1983, with sessions to be completed in 1985. A number of individuals concerned with the maintenance of transit buses were brought together to develop recommendations on issues that UMTA should consider addressing to assist in improving the maintenance of transit buses (DC-06-0442). A project with the Commonwealth of Massachusetts (MA-06-0018) will provide states with methods for using Section 15 data to measure performance of transit services and make peer comparisons.

## Management Resources

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>HUMAN RESOURCES DEVELOPMENT</b>					
Human Resources Mgmt. Demonstration	FL-06-0031	\$362,159	May 1982- May 1984	Miami-Dade County Transportation Authority	Charles T. Morison, Jr. (202) 426-0080
Maintenance Training Demonstration	PA-06-0072	\$600,000	July 1982- June 1984	SEPTA	Charles T. Morison, Jr. (202) 426-0080
Bus Operator Stress/ Hypertension Project	CA-06-0160	\$750,000	Aug. 1981- Ongoing	Regents of University of California	Charles T. Morison, Jr. (202) 426-0080
Bus Operator Instructor Training	MA-06-0135	\$150,000	June 1981- Ongoing	TSC	Charles T. Morison, Jr. (202) 426-0080
Labor/Management Relations Conference	FL-06-0030	\$139,000	Feb. 1982- Annual	Florida International University	Charles T. Morison, Jr. (202) 426-0080
Symposium on the Role of Minorities in Transit: Challenges of the 1980's	MD-06-0097	\$130,000	Jan. 1983- Sept. 1983	Morgan State University	Alice Royal (202) 426-0080
Transit Readiness/Skills Development	NY-06-0110 NY-20-6001	\$250,000	Sept. 1983- June 1984	National Urban League	Alice Royal (202) 426-0080
Employment of the Handicapped	MA-06-0149	\$77,000	Sept. 1983- Oct. 1984	Harold Russell Assoc., Inc.	Alice Royal (202) 426-0080
Absenteeism Reduction Demonstration Project	PA-06-0067	\$303,000	Ongoing	PAT	Alice Royal (202) 426-0080
Board Member Training	FL-06-0033	\$77,032	Sept. 1982- June 1983	University of North Florida	Charles T. Morison, Jr. (202) 426-0080

## Management Resources

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>OPERATIONS AND MAINTENANCE SUPPORT</b>					
Development and Demonstration of Bus Maintenance Repair Aids	MI-06-0023	\$1,500,000	Sept. 1979- Jan. 1984	City of Detroit, Mich.	Shang Q. Hsiung (202) 426-9274
RUCUS II Test Deployment and Evaluation	PA-06-0065	\$200,000	Jan. 1982- Ongoing	TSC; SEPTA	Shang Q. Hsiung (202) 426-9274
Development of a Transit Management Incentive	IT-06-0246	\$98,000	Nov. 1981- March 1983	Booz, Allen and Hamilton, Inc.	Philip G. Hughes (202) 426-9274
Barriers to the Introduction of Innovations in the Transit Industry	DC-06-0440	\$175,000	Sept. 1983- June 1984	Granville Corp.	Alice Royal (202) 426-0080
Productivity Workshop Update for Small Operators	DC-06-0418	\$50,000	Sept. 1983- June 1985	Urban Resources Consultants	Alice Royal (202) 426-0080
Transit Industry Management Board	DC-06-0442	\$13,000	July 1983- Dec. 1983	James V. Clark Assoc., Inc.	Philip G. Hughes (202) 426-9274
Develop Performance Measures for Statewide Evaluation of Transit Service	MA-06-0018	\$8,700	Oct. 1980- Oct. 1984	Commonwealth of Massachusetts	Shang Q. Hsiung (202) 426-9274

## Bibliography

A list of recent reports follows. Please consult previous editions of this Directory for earlier reports. If available, a document number assigned by the National Technical Information Service (NTIS) is listed. Reports may be obtained from NTIS by using the order blanks provided at the end of this document.

Reports which have not been assigned an NTIS number may not have been published in sufficient quantity for general distribution. Single copies and other information may be available from the issuing agency or organization.

Additional reports relating to the research described in this chapter may become available in the near future. For the most recent information or suggestions for additional reference materials regarding specific projects, call or write to the person listed as the technical contact in the Project Summary Table.

### **Guide to Employing Handicapped Persons in the Transit Industry**

Proj. MA-06-0105

Harold Russell Associates, Inc.

September 1981, UMTA-MA-06-0105-81-1

### **Review and Evaluation of the Use of Bus Operator Testing Procedures in the Personnel Selection Process Within the Transit Industry**

Proj. IT-06-0252

Jordan-DeLaurenti, Inc.

December 1981

### **Transit Management Incentive Contracts**

Proj. IT-06-0246

Booz Allen & Hamilton, Inc.

June 1983, PB 84-125038

# Information Services

## Trends and Highlights



UMTA's information services projects collect and publish statistical information on national transit for use by local officials, transit managers and other industry decision-makers in planning, managing and evaluating their operations. Other information services projects assist the industry by disseminating new information on management methods and technologies.

The fourth annual *National Urban Mass Transportation Statistics* (Section 15) report was prepared by UMTA's Office of Technical Assistance. The Office also prepared a supplement to the third Section 15 Annual Report which contains transit operating statistics used in computing FY 83 Section 9A apportionments. Similar statistics used for allocating FY 84 Section 9 funds have been incorporated directly into the fourth annual report.

UMTA's program of communications and technology sharing is designed to accelerate the interchange of managerial and technical information within the transit community. During FY 82, emphasis was placed on the production of technical briefs and on the rapid dissemination of interim and less formal technical reports.

To make detailed technical information more accessible to the transportation community, UMTA has initiated a computer based system called the Urban Mass Transportation Information Service (UMTRIS). UMTRIS provides on-line retrieval services, batch mode literature searches and urban transportation abstracts for administrators, engineers, economists, planners, researchers and local/regional officials..

## Section 15 Information

Section 15 of the Urban Mass Transportation Act requires beneficiaries of Section 5 and 9 assistance grants to conform to a uniform system of accounts and records and to report operating and financial data for inclusion in a computerized reporting system. This system is designed to assist in meeting the need of public mass transportation systems, federal state and local levels of government and the public, for basic service and planning information. It contains information appropriate to assist in formulating public sector investment decisions at all levels of government. Some of the data are used to allocate federal assistance under the Urban Mass Transportation Act, as amended by the Surface Transportation Act of 1982.

The system generates routine and ad hoc reports from the raw data. Using these reports as an aid, individual and comparative analyses can be performed with selected performance indicators.

A cooperative working arrangement has developed between the transit industry and the Federal Government on the Section 15 data collection and reporting system. The private and public sectors have recognized the importance of and need for timely, accurate, and uniform data with which to assess the progress of the nation's mass transportation system. Grantees submit their reports to UMTA on an annual basis. This information is reviewed for accuracy and consistency (IT-06-0310) before being put into the data base. The data base is then translated into an annual report (MA-06-0107). Annual production of the data base and Section 15 annual reports is per-

formed by TSC. These activities will be incrementally transferred to a private contractor during fiscal year 1984-1986.

The first (FY 79) annual report, published for national distribution in 1981, covers transit financial and operating data reported for agency fiscal years ending between July 1, 1978 and June 30, 1979. Subsequent reports have been issued for FY 80, FY 81 and FY 82. In addition, the supplement to the FY 81 report, containing statistics used for computing Section 9A apportionments, was published in July 1983. The Section 15 system performance is being objectively evaluated, and recommendations will be adopted by UMTA.

The Section 15 Reporting System Advisory Committee was appointed and the first meeting held in FY 1983. Functioning in an advisory capacity to UMTA, its objective is to investigate the quality and usefulness of the Section 15 Reporting System in providing financial and operating data for the analysis of the transit industry. Committee meetings are announced in the *Federal Register* at least 15 days prior to the meeting date. The Office of Technical Assistance provides support for committee operations; the Office is assisted by a private consultant who provides technical support for administering several aspects of the Section 15 program (DC-06-0383).

## Technical Information Services

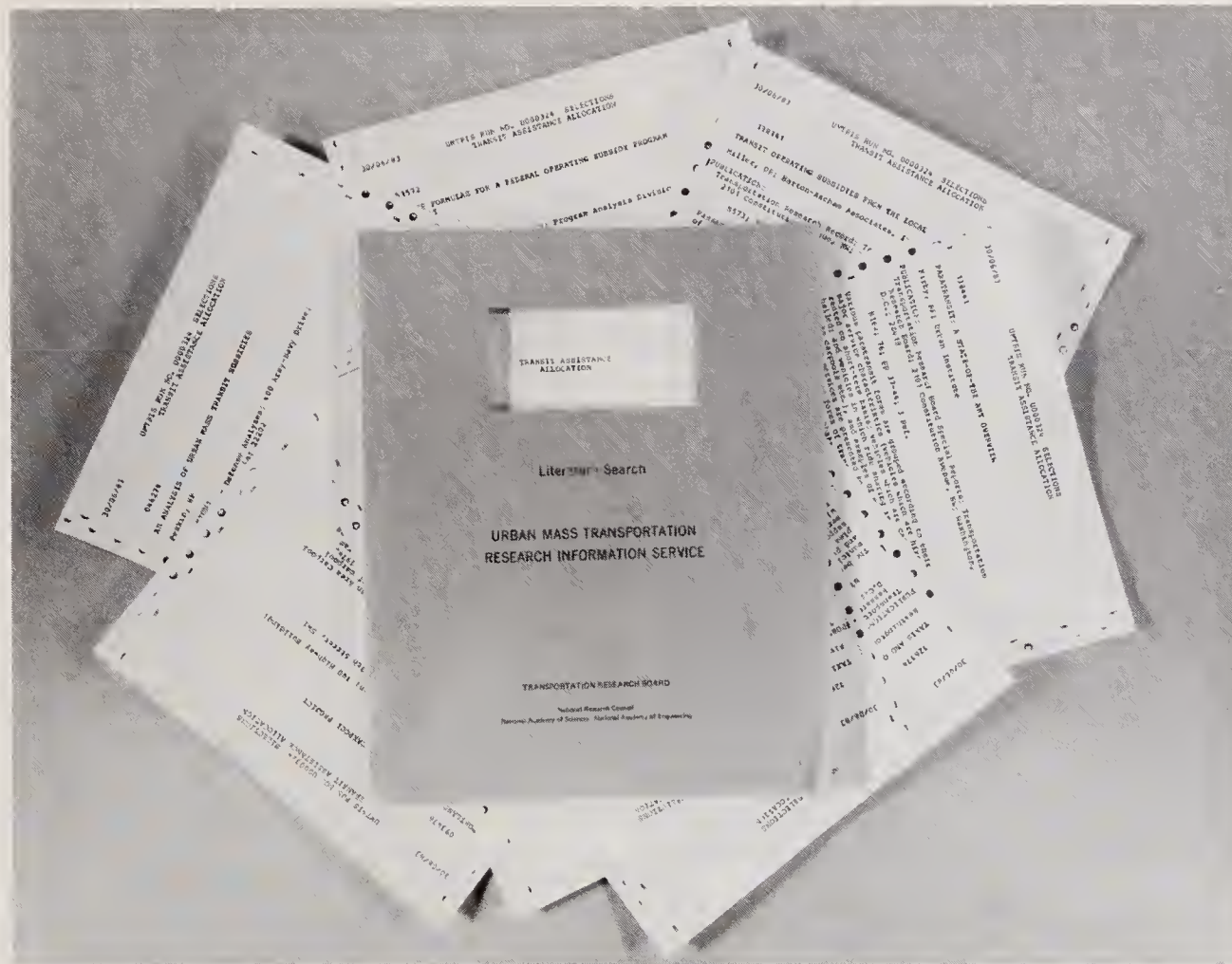
For the transit industry to take advantage of improvements in management and technology, transit and local government personnel at all levels must

be aware of potential advantages and costs. Initiative must also develop to bring about change. This process often requires a considerable amount of information and other forms of technical assistance.

Communications are an integral part of all technical assistance projects. Some functions, however, can best be performed centrally for UMTA as a whole. For example, centralized communications functions can facilitate awareness among potential users of research results as well as assist in the coordination of information outreach efforts to reduce overlap of research efforts. Dissemination of formal technical reports resulting from the various projects described in this directory is another example. The UMTA Office of Technical Assistance regularly selects, abstracts and processes technical reports for inclusion in the National Technical Information Service (NTIS). The NTIS system, which distributes announcements, abstracts and reports nationally, assures that detailed technical information will be stored and kept available for researchers in public or private institutions.

To aid the technical community in locating relevant information, a project (DC-06-0285) has been funded with the Transportation Research Board (TRB) to maintain a comprehensive, computer based Urban Mass Transportation Information Service (UMTRIS). UMTRIS covers all phases of conventional public transportation from worldwide sources, and also has references to all types of advanced guideway systems. UMTRIS can provide transportation administrators, engineers, economists, planners, researchers, and local/regional officials with direct access to information about





**An UMTRIS/TRB batch-mode literature search contains citations and abstracts of transit related projects within the larger TRIS database.**

ongoing and completed transit and transit-related information on transportation projects, research, and innovations.

UMTRIS is a subfile of the larger coordinated database known as the Transportation Research Information Service (TRIS) which includes citations for other modes such as highway safety, railroads, marine, and aviation. It is possible to obtain references that cover any or all these modes in a single literature search

because they are maintained in a common magnetic-tape file. UMTRIS database may be searched online through DIALOG Information Services, a private research service in Palo Alto, California. It is available to online users, for a nominal fee, in the United States and Canada. In addition to online DIALOG retrieval services, UMTRIS batch-mode literature searches are available, on a limited basis from TRB. TRB employs transportation specialists who screen the retrieved in-

formation and produce customized outputs.

Information in UMTRIS consists of 1) abstracts of technical papers (including locally-sponsored projects), journal articles, research reports, computer program descriptions and statistical sources that involve the planning, constructing, operating, and marketing of public transportation systems. Many modes of transportation are covered including buses, trolley buses, streetcars, light rail, rapid transit, paratransit, taxis, demand-responsive, and elderly/handicapped transport, and advanced guideway systems; and 2) summaries of ongoing transportation projects and research activities that provide the description and objectives of each project, including the names of sponsors, performing agencies, responsible individuals, funding, and scheduling information. About 2000 new citations are added to the database annually. Each citation in the UMTRIS file is completely indexed for easy retrieval and is classified in one of the UMTRIS subject areas.

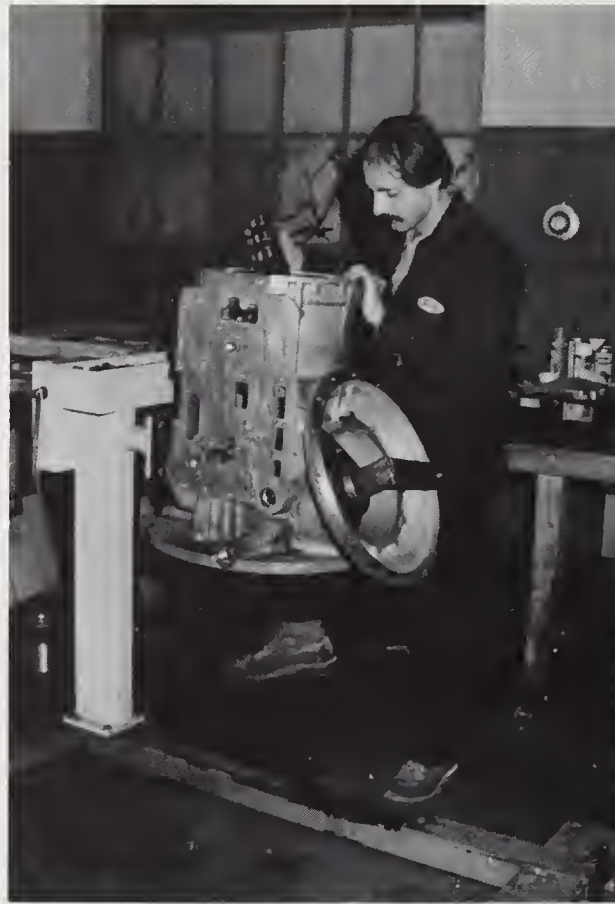
Input to UMTRIS comes from domestic and foreign sources. The primary sources are the federal agencies such as UMTA, Federal Highway Administration, Transportation Systems Center, Transportation Test Center, and Federal Railroad Administration, along with the American Public Transit Association (APTA), individual transit operators, transit suppliers, universities, research institutes, and regional and state organizations. Secondary sources include the National Technical Information Service (NTIS), Engineering Information, Inc., International Road Federation, International Road Research Documentation/Organiza-

tion for Economic Cooperation and Development, and International Union of Public Transport.

Besides providing online retrieval services through DIALOG, and batch-mode literature searches through TRB, UMTA publishes the semiannual *Urban Transportation Abstracts*. The Abstracts list all the new references added to its database during the preceding six months and contain two major sections. The first contains abstracts of reports, journal articles, and computer program descriptions; the second contains progress reports of ongoing research. Annual subscriptions are available and will ensure regular delivery of the copies of this valuable reference as soon as they are published. For further information about UMTA call or write to:

Urban Mass Transportation Research Information Service  
Transportation Research Board  
National Academy of Sciences  
2101 Constitution Avenue, N.W.  
Washington, DC 20418  
(202) 334-3251  
TELEX (710) 822-9589

To communicate more directly with transit agencies and local governments, UMTA maintains other projects designed to accelerate the two-way flow of information on near-term technical and management problems and solutions. The Technology Sharing Project with the Transportation Systems Center (MA-06-0086) helps UMTA familiarize industry with its technical assistance programs through workshops and publications such as this directory. The communication mediums employed—overviews, digests,



***One mission of the Technology Sharing Program is to disseminate information on successful local solutions to operating and maintenance problems.***

factsheets and other documents—serve to condense and translate technical information on both locally developed and UMTA sponsored innovations into forms appropriate to technical and nontechnical audiences alike. This project also provides for direct dissemination of several types of informal and interim technical reports among transit agencies and state and local governments.

A second program at Public Technology, Inc. (DC-06-0409) provides condensed results of innovative projects in

newsletter format. Publications include Transit Technology Briefs, Transit Actions (management innovations), SMD Briefs (service and methods innovations) and Planning Briefs. These are designed to convey technical news and provide essential information for follow-up. They are not periodical publications but are prepared as need and opportunity arise. For information on how to obtain copies, call or write to:

Public Technology, Inc.  
1301 Pennsylvania Avenue, N.W.  
Washington, DC 20004  
(202) 626-2465

## Information Services

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>SECTION 15 INFORMATION</b>					
Provide Technical Support for Administration of Section 15	DC-06-0383	\$1,394,000	Sept. 1981- Oct. 1984	Washington Consulting Group	Rhoda Shorter (202) 426-9157
Evaluate Section 15 Data Base and Generate Output Records	MA-06-0107	\$3,620,800	Sept. 1979- Ongoing	TSC	Rhoda Shorter (202) 426-9157
Provide Data Validation, Data Base Maintenance and Annual Report Production for Section 15 Program	IT-06-0310	\$3,035,689	Oct. 1983- Oct. 1986	Technology Applications, Inc.	Rhoda Shorter (202) 426-9157
<b>TECHNICAL INFORMATION SERVICES</b>					
Develop and Maintain UMTRIS	DC-06-0285	\$913,025	Oct. 1981- Oct. 1984	TRB	Marina Drancsak (202) 426-9157
Technical Sharing Support	MA-06-0086	\$310,000 (FY 82)	Continuing Multi-year	TSC	Helen Tann (202) 426-9157
Technical Assistance Briefs	DC-06-0409	\$373,086	Oct. 1982- Sept. 1983	Public Technology, Inc.	Helen Tann (202) 426-9157

### Bibliography

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Additional reports relating to the research described in this chapter may become available in the near future. For the most recent information or suggestions

for additional reference materials regarding specific projects, call or write to the person listed as the technical contact in the Project Summary Table.

### SECTION 15 INFORMATION

**National Urban Mass Transportation Statistics, First Annual Report: Section 15 Reporting System**  
Proj. MA-06-0107

Transportation Systems Center  
May 1981, GPO-050-014-00021-5

**National Urban Mass Transportation  
Statistics, Second Annual Report:  
Section 15 Reporting System**

Proj. MA-06-0107  
Transportation Systems Center  
June 1982

**National Urban Mass Transportation  
Statistics:**

**1981 Section 15 Report**

Proj. MA-06-0107  
Transportation Systems Center  
November 1982

**Supplement to National Urban  
Mass Transportation Statistics:  
1981 Section 15 Report**

Proj. MA-06-0107  
Transportation Systems Center  
July 1983

**National Urban Mass Transportation  
Statistics:**

**1982 Section 15 Annual Report**

Proj. MA-06-0107  
Transportation Systems Center  
December 1983

**TECHNICAL INFORMATION SERVICES**

**A Directory of Regularly Scheduled, Fixed  
Route, Local Rural Public Transportation  
Service**

UMTA Technical Notice 1-81  
Office of Transportation Management  
February 1981

**A Directory of Regularly Scheduled, Fixed  
Route, Local Public Transportation  
Service in Urbanized Areas Over 50,000  
Population**

UMTA Technical Notice 2-81  
Office of Transportation Management  
August 1981

**Urban Mass Transportation Abstracts:  
January - February 1983**

**March - April 1983**

**May - June 1983\***

**July - August 1983**

**September - October 1983**

**November - December 1983\***

Office of Technical Assistance, Information  
Service

(\*Includes semi-annual Keyword Index)

**Urban Mass Transportation Cumulative  
Bibliography, 1974-1980**

**Vol. I, Abstracts**

**Vol. II, Index**

Proj. DC-06-0258  
Transportation Research Board  
April 1982

**Urban Transportation Abstracts, Summer  
1982**

**Vol. I, No. 1**

Proj. DC-06-0258-82-3  
Transportation Research Board  
August 1982

**Innovation in Public Transportation  
Fiscal Year 1979: A Directory of  
Research, Development and  
Demonstration Projects**

Proj. MA-06-0086  
Transportation Systems Center  
1980

**Innovation in Public Transportation  
Fiscal Year 1980: A Directory of  
Research, Development and  
Demonstration Projects**

Proj. MA-06-0086  
Transportation Systems Center  
1981

**Innovation in Public Transportation  
Fiscal Year 1981: A Directory of  
Technical Assistance Programs**

Proj. MA-06-0086  
Transportation Systems Center  
1982

**Innovation in Public Transportation  
Fiscal Year 1982: UMTA Technical  
Assistance Program Directory**  
Proj. MA-06-0086  
Transportation Systems Center  
1983

# National Cooperative Transit Research And Development Program

## Trends and Highlights



The National Cooperative Transit Research and Development Program (NCTRP), which was initiated in FY 79, was developed to provide UMTA's primary constituents—the transit industry, cities, counties and states—an opportunity to participate collectively in identifying and resolving near-term transit research and development problems. The program is conducted cooperatively by the Transportation Research Board (TRB) of the National Academy of Sciences, the American Public Transit Association (APTA), the Urban Consortium for Technology Initiatives/Public Technology, Inc., and UMTA.

Each year, beginning in January, the NCTRP solicits new research ideas from the transit industry. A technical steering group then reviews industry-recommended ideas, identifies priority topics and establishes an annual agenda of research. The TRB executes this research agenda by further defining specific research projects and by subcontracting work to organizations with expertise in the particular topics.

An important practical outcome of NCTRP has been to create a closer working relationship between government agencies and transit operators and suppliers, supplementing UMTA's efforts to make research results more readily available to the users. UMTA allocates approximately \$1 million annually for this program.

In the first four years of this program, 400 research ideas have been submitted by industry. As of this reporting period, 26 projects have been selected for the NCTRP, and 23 research contracts have been awarded. During FY 83, seven projects were completed. Reports from two projects, one dealing with Federal grant requirements and one concerned with improving energy management for

electric rail transit systems, have been widely distributed to the industry. Reports from the other five projects will be distributed early in FY 84.

## Research Topics and Proposals

NCTRP topic selection begins with the receipt of good ideas about near-term research needs in transit, submitted voluntarily by individuals and organizations with an interest in public transportation. Requiring only a brief problem statement by the initiator, the NCTRP offers an independent channel for acting on research needs that are not funded under other ongoing UMTA activities. For more information on submitting topics to NCTRP, contact Mr. Frank Cihak, APTA, (202) 828-2800.

The NCTRP also offers qualified individuals and organizations a chance to conduct research on topics that have been previously approved by the technical steering group. For more information on submitting research proposals to NCTRP, contact Mr. Kreiger Henderson, TRB, (202) 344-3224.

An additional eight to ten projects are added to the program each year, based on topic priorities established by the technical steering group, and on the level of funding available from UMTA. In the past, about ten percent of research ideas submitted by the industry have been acted upon favorably.

## Active NCTRP Projects

The projects described in this section represent the active NCTRP program. Final reports for projects com-

pleted during FY 83 and to be released in FY 84 appear in the bibliography at the end of the chapter. In the following paragraphs, each of the active NCTRP projects is related to an important issue facing the industry. The discussion illustrates the breadth of disciplines necessary to address priority problems of the industry.

One of the important decisions facing both rural and urban transit decision-makers is whether to invest scarce funds in more expensive or in less expensive small transit buses. The complexity of needs and possible solutions has led to many poor choices of buses for specific

duties. No guidelines exist to help transit providers seeking to purchase or replace small buses to make objective decisions concerning the best bus type to be procured. In response to this problem, a project (30-1) is underway which will develop a workbook-style manual for local transit operators and will identify key recommendations that could feasibly be taken up by transit operators, local governments, states and UMTA to substantially improve procurement, operation and maintenance procedures for small transit buses.

Some bus operators possessing the basic skills necessary for vehicle opera-



*The Small Buses Manual will provide guidance for selecting the appropriate vehicles for an agency's operations.*

tion may still be unable to perform their job satisfactorily because of an inability to cope effectively with the public. No amount of training and disciplinary action is of use when the individual hired lacks the psychological strengths necessary to deal effectively with continuous public contact. The resulting stress may lead to more workers' compensation claims as well as to more accidents, absenteeism, and personnel turnover. A project (33-1) to develop an evaluative device or questionnaire for use as part of the bus driver selection process is well underway. This device would be a valid indicator of the applicant's susceptibility to stresses likely to affect job performance. Another human resources development project (33-2) will assess the applicability of job enrichment programs throughout a transit agency's organization. The final reports from these projects will be available early in 1984.

Management tools which can be used to plan and evaluate transit systems continue to be the focus of the research needs expressed by transit managers. One project nearing completion (36-1) responds to the need for an evaluation of UMTA's "Alternatives Analysis" process and will provide recommendations for improvements to promote more effective local, state and federal decisions regarding major capital investments. The project is examining actual experience and assessing the degree to which analytical requirements have provided appropriate information at key decision points.

Three other projects currently underway are also directed at the problems faced by local managers. The National Transit Computer Software Directory Project (38-1) will develop and pilot-test

an automated system for maintaining up-to-date information on software suitable for use by transit agencies of all sizes. To assist in improving route productivity, an assessment of passenger counters, fare-box recorders, location detecting devices and other automated data collection systems has been undertaken. The objective of this study (39-1) is to define a set of modules that will allow transit managers to choose the level and type of hardware needed for the data they require. Another project (40-1) is developing guidelines which can be used by nontechnical people to generate and present cost benefit and alternatives analysis data for smaller cities. This research addresses the need for a technically based but simple analytical tool for use in the public decision-making process. Most available methods are too data-intensive for easily comprehensible public presentation or for use in small cities.

Rail transit operators have expressed the need for a means of detecting power leakages which reduce the safety and performance of their systems. Electrical faults that are not indicated by the circuit breakers are particularly difficult to correct because the characteristics of a fault current resemble those of train and power switching operations. A project (43-1) is being undertaken to seek a practical solution to this problem.

Although bus transit operators are evaluating bonded brake linings and other commercially available means to extend brake life, significant improvements may depend on a more fundamental look at the problem. An NCTRP project (47-1) is examining brake operating temperatures, identifying heat dissipation techniques, and reviewing alternative friction mate-

rials. The brake wear problem is costly as well as universal with heavier modern buses.

Increased energy costs are also having a major effect on rail transit systems. An NCTRP project (54-2) to develop methods for forecasting, monitoring and controlling peak electric energy demand has been completed. The peak demand component of electricity rates is directly related to facility costs, and transit operators are subject to allocated costs associated with those facilities. The objective of this research was to evaluate load management techniques and other efficiency measures, and to assess their effectiveness in reducing peak demand and energy costs. This report will be available early in FY 84.

Two of the seven reports completed during FY 83 were from a continuing activity (60-1) under which the NCTRP produces short-term syntheses of information on transit problems selected by the technical steering group. The objective of this effort is to consolidate existing (but undocumented or fragmentary) knowledge, thereby making it more readily available to the industry. These widely distributed synthesis reports include summary information on fuel additives and fuel grades (TS-3) and guidelines for allocating maintenance time in bus operations.

A major report (31-1) concerning the impact of Federal grant requirements on transit agencies was distributed in FY 83. This report was generated by growing concerns on the part of transit agencies about the costs and effects of grant requirements. A Section 3 grant application for a new bus purchase, for instance, requires approximately 21 exhibits to com-

ply with UMTA regulations. This report provides information on the costs and effects that federal legislation, regulations, UMTA circulars, administrative letters and formal administrative guidelines have on the Section 3 capital grant application process, and makes recommendations for its improvement. The study results can be used by 1) transit agencies in making the decision to apply for Federal grants, 2) legislators in drafting legislation and 3) the Urban Mass Transportation Administration in amending requirements.



***A report on energy use management explores a variety of methods for reducing peak demand and energy costs for rail transit systems.***



## National Cooperative Transit Research and Development Program (NCTRP)

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
NCTRP Program Management and Evaluation	MD-06-0053 DC-06-0230 DC-06-0231 DC-06-0232	\$1,000,000 (total annual allocation)	March 1979- Continuing	TRB; APTA; Public Technology, Inc.	John Durham (202) 426-9267
Small Transit Buses: A Manual for Improved Purchasing, Use, and Maintenance	NCTRP 30-1	\$300,000	Nov. 1982- Aug. 1984	Arthur D. Little	R. Ian Kingham (202) 334-3224
Impacts of Federal Grant Requirements on Transit Agencies	NCTRP 31-1	\$50,000	Complete	Booz, Allen and Hamilton, Inc.	R. Ian Kingham (202) 334-3224
Transit Bus Operator Selection and Training for Dealing with Stress	NCTRP 33-1	\$150,000	Complete	Group Associated Mgmt. Services, Inc.	Robert E. Spicher (202) 334-3224
Assessment of Job Enrichment Programs for the Transit Industry	NCTRP 33-2	\$100,000	Complete	Public Administration Assoc.	Crawford F. Jencks (202) 334-3224
Public Transit Bus Maintenance Manpower Planning	NCTRP 33-3	\$100,000	Nov. 1983- Oct. 1984	Fleet Maintenance	Harry A. Smith (202) 334-3224
Improving Decision-Making for Major Urban Transit Investments	NCTRP 36-1	\$150,000	Complete	System Design Concepts, Inc.	R. Ian Kingham (202) 334-3224
National Transit Computer Software Directory	NCTRP 38-1	\$100,000	Jan. 1983- April 1984	COMSIS Corp.	Harry A. Smith (202) 334-3224
A Modular Approach to On-Board, Automatic Data Collection Systems	NCTRP 39-1	\$150,000	Nov. 1982- April 1984	MITRE Corp.	Crawford F. Jencks (202) 334-3224
Simplified Guidelines for Evaluating Transit Options in Small Urban Areas	NCTRP 40-1	\$150,000	Oct. 1982- Apr. 1984	Barton-Ashman	Robert E. Spicher (202) 334-3224
Estimating Incremental/ Cost of Bus-Route Service Changes	NCTRP 40-2	\$150,000	Nov. 1983- Aug. 1985	System Design Concepts	R. Ian Kingham (202) 334-3224

## National Cooperative Transit Research and Development Program (NCTRP)

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
Strategies to Implement Benefit-Sharing for Fixed Transit Facilities	NCTRP 40-3	\$100,000	Nov. 1983- Feb. 1985	S.G. Associates	R. Ian Kingham (202) 334-3224
Detection of Low-Level Fault Currents on Rail Transit Systems	NCTRP 43-1	\$100,000	Jan. 1983- April 1984	Charles T. Main, Inc.	Harry A. Smith (202) 334-3224
Single Cable Communication Technology for Rail-Transit Systems	NCTRP 46-1	\$150,000	To Be Determined	Polytechnic Institute of NY	Crawford F. Jencks (202) 334-3224
Improved Service Life of Urban Transit Coach Brakes	NCTRP 47-1	\$300,000	Dec. 1981- May 1984	Battelle Memorial Institute	Harry A. Smith (202) 334-3224
Energy Management of Electric Rail Transit Systems	NCTRP 54-2	\$150,000	Oct. 1981- Dec. 1983	Carnegie-Mellon University	Harry A. Smith (202) 334-3224
Conversion to One-Person Operation of Heavy-Rail Rapid-Transit Trains	NCTRP 55-1	\$150,000	To Be Determined	Battelle Memorial Institute	Harry A. Smith (202) 334-3224
Synthesis of Information Related to Transit Problems	NCTRP 60-1	\$460,000	Nov. 1980- Continuing	Transportation Research Board	Robert J. Reilly (202) 334-3224

## **Bibliography**

A list of reports prepared during FY 83 and to be released in 1984 follows. NCTRP reports are available from the Transportation Research Board, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

### **Impacts of Federal Grant Requirements on Transit Agencies**

Proj. 31-1  
Booz, Allen and Hamilton, Inc.  
January 1983, Report 2

### **Transit Bus Operator Selection and Training for Dealing with Stress**

Proj. 33-1  
GAMS Inc.  
May 1984, Report 6 (Tentative)

### **Assessment of Job Enrichment Programs for the Transit Industry**

Proj. 33-2  
Public Administration Services  
March 1984, Report 5

### **Improving Decision Making for Major Urban Transit Investments**

Proj. 36-1  
System Design Concepts  
March 1984, Report 4

### **Energy Management of Electric Rail Transit Systems**

Proj. 54-2  
Carnegie-Mellon  
February 1984, Report 3

### **Effects of Fuel Additives and Alternative Fuel Grades for Transit Buses**

Proj. TS-3  
Southwest Research Institute  
February 1984, Synthesis 3

### **Guidelines for Allocation of Time for Transit Coach Maintenance Functions**

Proj. TS-4  
XYZYX Corp.  
February 1984, Synthesis 4

# Safety And Security

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## Trends and Highlights



The UMTA transit safety and security program consists of three major elements: 1) system safety and security, 2) information collection and processing, and 3) generic research. All three of these elements are interdependent. The program emphasizes voluntary initiatives on the part of transit systems in implementing safety, security and related system assurance programs. UMTA monitors these programs with the support of other organizations such as the Transportation Systems Center (TSC), the American Public Transit Association (APTA) and the Transportation Safety Institute (TSI). The Safety and Security Staff has expanded its role of technical assistance and research, especially in the realm of transit security. Highlights of the year include initiation of a voluntary safety information reporting system for rapid rail transit operations and well attended UMTA sponsored safety and security training courses for representatives of federal, state and local agencies.

## System Safety and Security

System safety and security, the most significant element of the UMTA rail transit safety program, involves developing and conducting programs and activities focused on the elimination or control of hazards and the prevention of accidents. These programs and activities can be applied throughout the life of a transit system so that it can systematically achieve the highest practical levels of safety without depending only upon information gained after accidents.

UMTA is helping rail and bus transit agencies to develop system safety pro-

gram plans. These plans provide transit authorities with a way to document their safety program and to display their commitment to safety. They also provide a means of conducting audits, reviews and evaluations of the property's safety program.

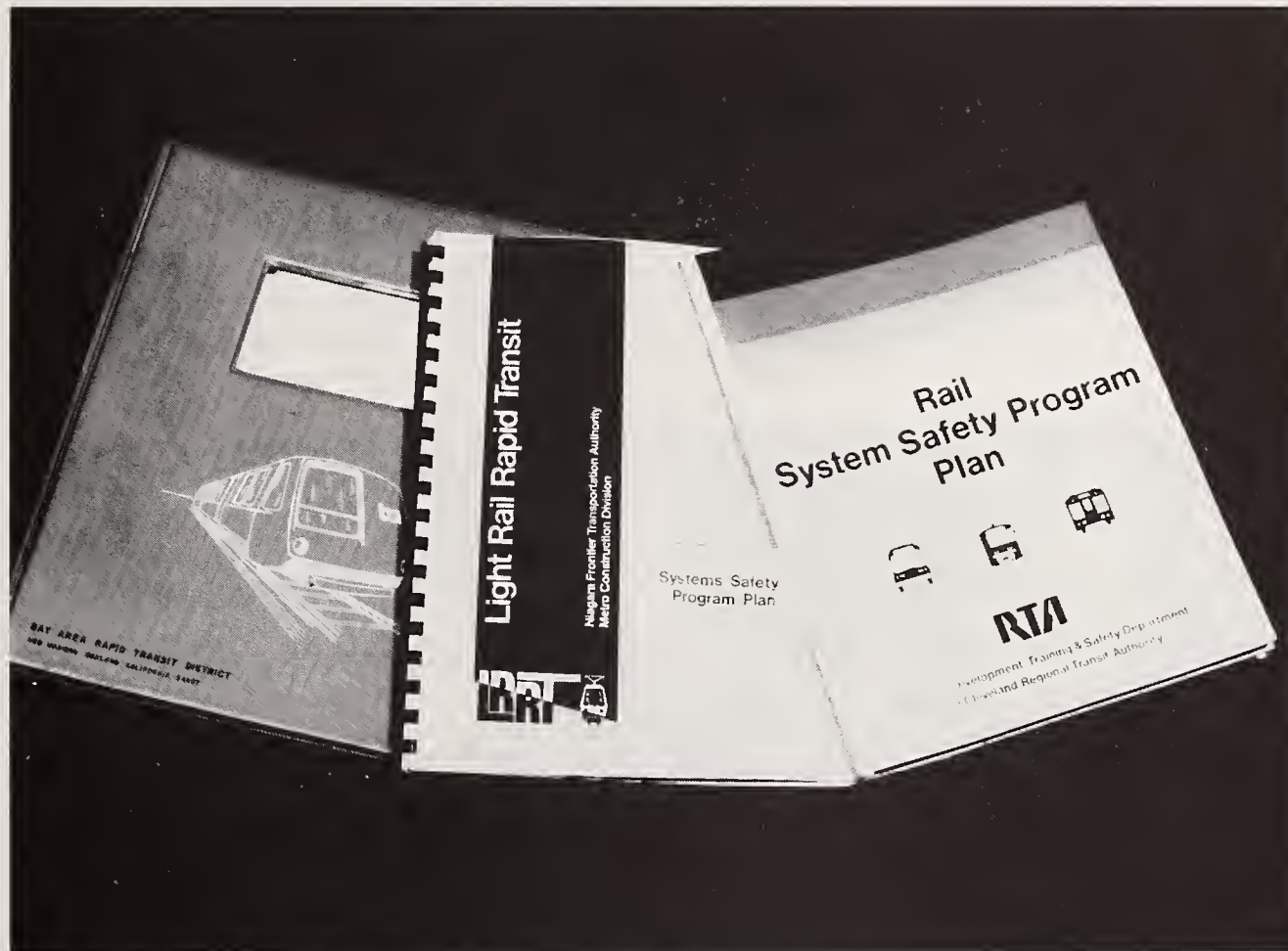
system assurance matters during the preliminary engineering phase of the system. The topics of the review were design and operational safety requirements, safety programs, and safety analysis methodology. APTA's Executive Board approved an agreement between UMTA

TSI. NYCTA experienced safety problems with the trucks, handbrakes and DC power cables on its R-46 cars. UMTA officially closed this investigation when NYCTA completed the removal and replacement of the original R-46 trucks in 1983.

System safety and security education and training for the transit community is another program activity. Since 1976, UMTA has funded the development and presentation of several safety, security and system assurance courses held at TSI in Oklahoma City. These courses were identified, developed and conducted through the cooperative efforts of UMTA, TSI, APTA and representatives from the transit industry. During the past year, courses on mass transit security, bus accident investigation and system safety, rail accident investigation and system safety analysis, were held at TSI. Seminars on explosives management and bus accident investigation were presented in various cities.

UMTA also responds to inquiries about safety from the public, local officials and the Congress. Among the subjects of inquiries received in FY 83 were verification of the safety and reliability of computer microprocessors used in rail systems and the toxicity of transit materials. Each of the inquiries was acted upon to insure that technical assistance in these areas will be provided.

Program support for UMTA system safety activities is provided under continuing reimbursable agreements with two DOT offices. One of these agreements is with TSI at Oklahoma City (DC-06-0215) under which TSI provides personnel and facilities support to UMTA for system safety and security education and training. The other agreement is with TSC



**System safety plans, being developed by transit agencies with the help of UMTA, function as working documents for administering and improving public transport safety.**

UMTA participated in a safety review for the Santa Clara County Transportation District rail transit development in San Jose, California. An APTA Safety Review panel provided knowledge, expertise and experience in the review of safety and

and transit industry representatives for this joint peer review process.

An unsafe condition investigation was carried out by UMTA at the New York City Transit Authority (NYCTA) in FY 81, with the support of FRA, TSC and

in Cambridge, Mass. (MA-06-0152), which provided support to UMTA in fire/life safety activities, safety training and security activities.

Technical support was provided to the UMTA system safety activities under an APTA contract, through which APTA gathered information and provided technical expertise on transit safety issues (DC-06-0366). Additional program support for UMTA is being provided by a reimbursable agreement with the Federal Emergency Management Agency (FEMA), U.S. Fire Academy (DC-06-0367). FEMA is providing fire safety expertise to UMTA and is assisting in developing fire emergency and life safety training for rapid rail transit personnel. Specific training to improve local fire service response has been identified.

A project initiated in FY 82 with the Metropolitan Dade County (Fla.) Transit Authority (FL-06-0025) entails the use of undercover police officers on the bus system. The overall objective of this anti-crime demonstration is to develop a transit security program and a system security program plan.

## Safety Information

Part of UMTA's responsibility for the safety of both rapid and light rail transit systems was to develop a new rapid rail transit accident/incident reporting system, under the title Safety Information Reporting and Analysis System (SIRAS). SIRAS became operational on February 1, 1983, with the rapid rail systems voluntarily supplying UMTA with their accident/incident data. Prior to that, the rapid rail transit systems reported into the existing

FRA system (DC-06-0390). Annual reports have been published for the data gathered for the years 1978-1983. A cooperative effort is underway with light rail operators to include them in the reporting system. Program support for SIRAS is provided under an agreement with TSC (MA-06-0080).

UMTA currently has no mechanism for collecting and analyzing safety data on transit bus operations. Furthermore, no national data base of transit bus accidents and injuries suitable to meet UMTA safety information 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. Definitions of accidents and casualties differ among the various information collection sources. A feasibility study (MO-06-0096) is underway to determine the state of transit bus safety, evaluate current systems for collecting data on transit bus accidents and injuries, and assess the feasibility of an UMTA transit bus reporting system.

## Safety Research

The UMTA safety research program is directed toward significant and critical safety problems which are generic rather than site-specific. At present, the project



**Fire safety countermeasures include guidelines for the selection of fire resistant materials in transit car construction.**

with the highest priority for UMTA and the industry is the development of preparedness guidelines for rail transit emergencies. TSC is preparing a document of emergency preparedness guidelines produced through a cooperative effort by UMTA and the transit industry. These guidelines incorporate the APTA preliminary emergency preparedness guidelines, research such as the UMTA/FEMA fire and life safety effort, and other related guidelines and standards. Another project is the development of a generic automatic response system for improving rail operators' preparedness for responding to emergency situations.

As part of the continuing fire safety practices effort with TSC to reduce the threat of transit system fires (MA-06-0152), fire safety countermeasures recommendations were developed for rail transit materials selection, and published in the Federal Register. Technical support to the Bay Area Rapid Transit (BART) continues to assess the system's rail vehicle fire hardening program and the fire safety aspects of its new rail vehicle under procurement.

Work on plans and procedures for emergency evacuation of elderly and handicapped people, and research on transit passenger slips and falls are continuing. A corrosion control manual was completed and published early in FY 83. A study on extreme environmental conditions that affect rapid transit systems was completed and a report published (VA-06-0086).

## Safety and Security

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>SYSTEM SAFETY AND SECURITY</b>					
Program Support	DC-06-0215	\$1,509,502	Nov. 1977- Continuing	TSI	Gwendolyn R. Cooper (202) 426-2896
	MA-06-0152	\$802,000	Oct. 1982- Sept. 1983	TSC	Lloyd G. Murphy (202) 426-2896
Technical Support	DC-06-0366	\$300,000	Jan 1982- Continuing	APTA	Gwendolyn R. Cooper (202) 426-2896
Fire Safety Support	DC-06-0367	\$159,000	Sept. 1981- Continuing	Federal Emergency Management Agency	Gwendolyn R. Cooper (202) 426-2896
Metropolitan Data County Anti-Crime Demonstration	FL-06-0025	\$730,000	Feb. 1982- Continuing	Dade County, Fla.	Gwendolyn R. Cooper (202) 426-2896
<b>SAFETY INFORMATION</b>					
Information Processing	DC-06-0390	\$30,000	Oct. 1980- Feb. 1983	FRA	Lloyd G. Murphy (202) 426-2896
Rail Transit Safety Information Reporting and Analysis System	MA-06-0152	\$90,000	Oct. 1982- Sept. 1983	TSC	Lloyd G. Murphy (202) 426-2896
Feasibility Study of a Bus Safety Information System	MA-06-0096	\$242,000	Jan. 1983- March 1984	Automated Sciences Group	Lloyd G. Murphy (202) 426-2896
<b>SAFETY RESEARCH</b>					
Rail and Bus Safety R&D	MA-06-0152	\$559,000	Oct. 1982- Sept. 1983	TSC	Roy Field (202) 426-2896
Extreme Conditions Impact on Rapid Transit Systems	VA-06-0086	\$99,000	Sept. 1981- Dec. 1982	Technology Research and Analysis Corp.	Abdo S. Ahmed (202) 426-2896



## **Bibliography**

A list of recent reports follows. Please consult previous editions of this Directory for earlier reports. If available, a document number assigned by the National Technical Information Service (NTIS) is listed. Reports may be obtained from NTIS by using the order blanks provided at the end of this document.

Reports which have not been assigned an NTIS number may not have been published in sufficient quantity for general distribution. Single copies and other information may be available from the issuing agency or organization.

Additional reports relating to the research described in this chapter may become available in the near future. For the most recent information or suggestions for additional reference materials regarding specific projects, call or write to the person listed as the technical contact in the Project Summary Table.

### **Rail Transit Safety Annual Report, 1980**

Proj. MA-06-0098  
Transportation Systems Center  
September 1981, PB 82-142-530

### **Annotated Bibliography of Rail Transit Safety, 1975-1980, with Emphasis on Safety Research and Development**

Proj. MA-06-0098  
Transportation Systems Center  
September 1981, DOT-TSC-UMTA-81-56

### **Rail Transit Safety Annual Report, 1981**

Proj. MA-06-0060  
Transportation Systems Center  
October 1982, PB 83-145-110

### **Assessment of BART Fire-Hardening Programs**

Proj. MA-06-0060  
Transportation Systems Center  
November 1982, UMTA-MA-06-0060-82-3

### **Extreme Conditions Impact on Rapid Transit Systems: Effect on Automatic Train Control**

Proj. MA-06-0086  
Technology Research and Analysis Corp.  
December 1982, UMTA-VA-06-0086-82-1

### **A Corrosion Control Manual for Rail Rapid Transit**

Proj. DC-06-0152  
National Aeronautics and Space Administration  
Urban Mass Transportation Administration  
March 1982, UMTA-DC-06-0152-83-1

### **Fire and Life Safety Training Needs of Rail Rapid Transit System and Fire Service Personnel**

Proj. MA-06-0098  
Transportation Systems Center  
May 1983, UMTA-06-0098-83-1

# Policy and Program Development and Strategic Planning

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## Trends and Highlights



UMTA's policy and program development activities provide information for the planning, coordination and evaluation of UMTA programs, as well as development of its budget. The program also includes policy analysis used in the formulation of national transportation legislation and major DOT and UMTA policies, regulations and directives.

The basic goal of this research is to promote the most efficient and effective use of federal resources supporting private and public sector provision of urban mass transportation. To this end, UMTA conducts and monitors research on the transit industry's economic and financial condition, and on its existing and projected needs.

During FY 1983, the Office of Budget and Policy initiated a new effort designed to provide for research in longer range strategic issues related to the UMTA program. This new Strategic Planning activity is intended to develop information on important external forces having an impact on the market for transit and to assess a variety of long range internal issues. In addition, the activity also includes responsibility for preparation of reports to Congress on transit performance and needs in accordance with Section 310 of the Surface Transportation Assistance Act of 1982.

## Policy Development

Current policy development initiatives include work on program investment policies, procedural policies, private enterprise policy and paratransit policy. Also underway are a review of state and local dedicated revenue sources, examination of innovative financing techniques, increased opportunities for pri-

vate sector participation in planning and providing mass transportation services, and refinement of the UMTA decision-making process for policy-related issues.

A joint FHWA/UMTA project was implemented which establishes a center for Urban Mobility Research. The Center's task is to facilitate the combined efforts of federal, state and private entities to identify and assess various techniques for encouraging public/private provision and financing of urban public transportation services (TX-06-0041).

## Strategic Planning

One key long range issue related to the future of the UMTA program is state and local finance. A continuing effort involving an interagency agreement with the Advisory Commission on Intergovernmental Relations (DC-06-0379) is assessing this equation.

Because such a large proportion of the transit buses produced in the United States are acquired using UMTA funds, UMTA programs and policies have a large impact on the bus manufacturing industry in the U.S. To assess this impact and to recommend ways in which UMTA policies can be sensitive to concerns about the health of bus industry, a study was initiated (IT-06-0294).

One of the most important changes to transit which may occur in the future would be an increase in the involvement of the private sector in the provision of transit services. Many impediments in the form of government rules and regulations exist, however. In order to assess what might be done to address this issue, a study to identify these impediments is underway (MA-06-0146).



***The methods to evaluate cost/benefit tradeoffs in rail modernization plans will assist systems in making better transit investments.***

Much of the nation's rapid rail and light rail systems were built many years ago and are currently in need of modernization. In the past, decisions about when and where to undertake improvement projects did not always reflect full consideration of the costs and benefits of the project alternatives. One reason for this has been a lack of consistent specification of what these costs and benefits might entail. A study (IL-06-0055) was initiated to develop a hierarchical benefit framework which could be used to consistently assess what the benefits of a set of rail modernization alternatives would be.

One of the most difficult decisions made by UMTA, and one with some of

the most long-lasting impact, concerns major investments in fixed guideway facilities. Much as been done to assess how to make these decisions on a cost-effective basis between one city's alternatives. However, in choosing between alternatives presented by a long list of urban areas, little information is available. A study was initiated to address this problem (IL-06-0057).

In Section 310 of the Surface Transportation Assistance Act of 1982, Congress has required the Secretary to report every two years on transit performance and needs. The first report is due in January 1984. A number of projects (IT-06-0293, MA-06-0169, MA-06-0161) were initiated to provide technical support for this effort. This includes assistance in developing a study design, data collection, data analysis and development of tools for assessing important travel demand questions related to future facility sizing.

## Policy Development and Strategic Planning

PROJECT TITLE	NUMBER	FUNDING	SCHEDULE	AGENCY/ CONTRACTOR	TECHNICAL CONTACT
<b>POLICY DEVELOPMENT</b>					
Development of an Urban Mobility Research Center	TX-06-0041	\$150,000	Sept. 1982- Sept. 1983	Rice Center	James S.K. Yu (202) 425-4060
Issues in Taxi-Based Specialized Transit Service	CA-06-0153	\$50,000	Sept. 1980- Jan. 1982	University of California at Irvine	Douglas M. Birnie (202) 426-4060
Technical Assistance for Small Taxi Operators	NC-06-0005	\$28,200	Oct. 1980- April 1983	University of North Carolina	Douglas M. Birnie (202) 426-4060
Recent Efforts to Enact Dedicated Revenue Sources	DC-06-0429	\$9,350	Oct. 1982- April 1983	Jeffrey A. Parker	Robert Martin (202) 426-4060
Obstacles to Private Enterprise Participation	TN-06-0011	\$62,300	Aug. 1980- July 1983	Ground Airport Transportation Association	Douglas M. Birnie (202) 426-4060
<b>STRATEGIC PLANNING</b>					
State and Local Finance	DC-06-0379	\$200,000	Dec. 1981- April 1984	Advisory Commission on Intergovernmental Relations (ACIR)	Fred Williams (202) 426-6385
Bus Industry Analysis	IT-06-0294	\$43,790	Dec. 1982- July 1984	Charles River Associates	Richard Steinmann (202) 426-6385
Impediments to the Provision of Urban Transit Services by the Private Sector	MA-06-0146	\$187,500	Sept. 1982- April 1984	H.C. Wainwright and Co., Economics	Fred Williams (202) 426-6385
Rail Modernization Costs and Benefits	IL-06-0055	\$42,542	Nov. 1982- March 1984	Consortium of Governmental Counselors, Inc.	Fred Williams (202) 426-6385
Major Investment Criteria	IL-06-0057	\$100,000	July 1983- June 1984	Consortium of Governmental Counselors, Inc.	Richard Steinmann (202) 426-6385
Technical Support for Transit Performance and Needs (Section 310) Report	IT-06-0293 MA-06-0169	\$215,000	Dec. 1982- Mar. 1985	Charles River Associates; Peat, Marwick Mitchell	Richard Steinmann (202) 426-6385
Report Transit Policy Support	MA-06-0161	\$100,000	May 1983- May 1984	TSC	Milton Brooks (202) 426-6385

## Bibliography

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Additional reports relating to the research described in this chapter may become available in the near future. For the most recent information or suggestions for additional reference materials regarding specific projects, call or write to the person listed as the technical contact in the Project Summary Table.

### **Issues in Taxi-Based Specialized Transit Service**

Proj. CA-06-0153  
University of California at Irvine  
January 1982

### **Recent Efforts to Enact Dedicated Revenue Sources**

Proj. DC-06-0429  
Jeffrey A. Parker  
September 1982

### **Urban Decline and the Future of Large American Cities**

Proj. DC-06-0221  
Brookings Institute  
May 1982

### **Paratransit Services for the Handicapped Individual**

Proj. DC-06-0150  
Multisystems, Inc.  
April 1982, DOT-I-82-18

### **Free Enterprise Urban Transportation**

Proj. DC-06-0150  
Council for International Urban Liaison  
June 1982

### **The European Paratransit Experience**

Proj. FN-06-0004  
Ecoplan International  
October 1981, DOT-I-82-14

### **Paratransit for the Work Trip: Commuter Ridesharing**

Proj. DC-06-0150  
Multisystems, Inc.  
January 1982, DOT-I-82-16

### **Paratransit in Rural Areas**

Proj. DC-06-0150  
Multisystems, Inc.  
April 1982, DOT-I-82-17

### **General Community Paratransit Service in Urban Areas**

Proj. DC-06-0150  
Multisystems, Inc.  
January 1982, DOT-I-82-15

### **Local Parking Management Policies and Practices**

Proj. DC-06-0225  
Public Technology, Inc.  
September 1981

### **States in Public Transportation: An Analysis Based on Nine Case Studies**

Proj. MA-06-0109  
Fred Williams, UMTA  
December 1981

### **Assessment of Federal and State Administration of UMTA Section 16(b)(2) Program**

Proj. MA-06-0109  
Transportation Systems Center  
October 1981

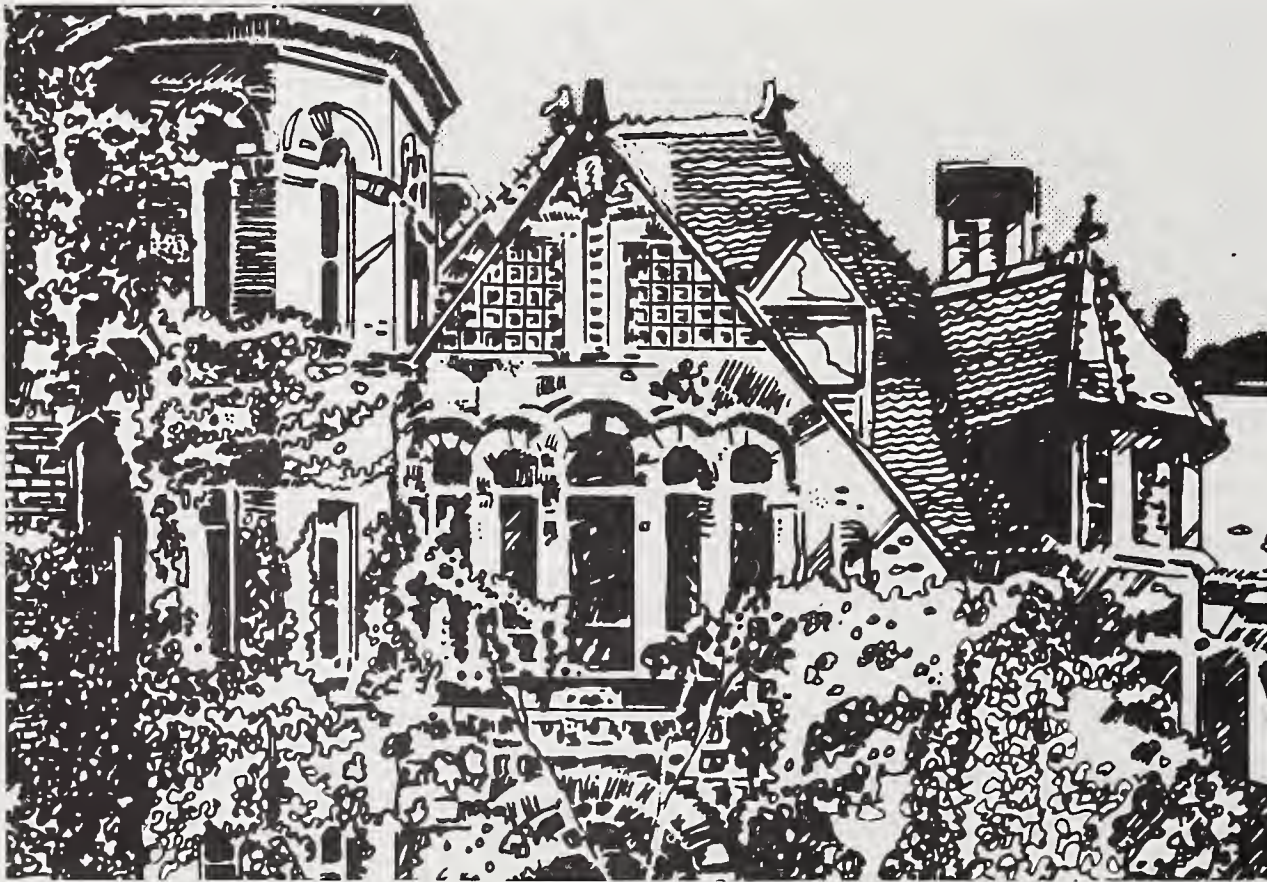
### **Urban Initiatives Program Evaluation**

Proj. TX-06-0028  
Rice Center  
November 1981

# University Research and Training Grant Program

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## Trends and Highlights



The UMTA University Research and Training Program, authorized by Section 11(a) of the Urban Mass Transportation Act, is designed to take advantage of and to enrich the research and training capabilities of the academic community. By promoting university research and training, and by encouraging and supporting increased interaction between universities and local transportation and planning agencies, UMTA hopes to enhance state and local ability to plan, build and operate transportation systems and services.

Program activities range from theoretical research aimed at advancing basic knowledge to the provision of educational and training opportunities for both students and practicing professionals. Study and research results are used in the solution of urban transportation problems by transportation and planning agencies, UMTA, state DOTs and consultants. Reflecting an increased concern for the supply of professional transit personnel, the training and educational aspects of the program are intended to encourage students to pursue undergraduate and graduate studies leading to careers in urban transportation. Students take an active role in the research and training activities, and intern programs enable students to acquire transit-related work experience while still in school.

A portion of the Section 11 funds is used toward research and training grants awarded in an annual competitive process that in FY 1983 resulted in 23 grants totaling \$1,569,000. In addition, nine University Centers for Transit Research and Management Development have been established to make available a broad spectrum of expertise to the transit industry in its efforts to increase productivity and efficiency. The

Centers' activities supplement other federally funded programs by providing short-term management and technological support, while also offering long-term management, research and academic opportunities to the transit community. Also, the Centers conduct continuing-education courses for transit officials on various management and operations issues, industry-approved professional certification programs, as well as undergraduate and graduate programs, which are responsive to transit management needs.

In order to expand the capabilities and participation of minority colleges and universities in urban transportation research and training, four summer workshops have been held to provide faculty from such institutions with urban transit research experience. A total of 57 academicians have participated to-date in these intensive training exercises and have returned to their institutions to initiate various transit-related research activities.

## University Centers for Transit Research and Management Development

As UMTA seeks to enhance transit research and management development capabilities at the university level, the "Centers" concept has been selected as a promising mode for the utilization of multi-disciplinary experiences. It is also a means by which: 1) UMTA's University Research and Training Program (Section 11) and its Management Training Program (Section 10) can be more fully de-

veloped and; 2) state and local agencies including transit operators can become actively involved in all aspects of the Centers' operations.

UMTA's financial support to nine universities provides the means whereby each institution has created, operated and financed a transit research and management development center. Each institution has identified various independent sources of funding to supplement, and ultimately replace, UMTA support and to provide a much needed longevity for transit-related research and training activities. By drawing upon the unique resources within the academic community, the Centers are responsive to the training, operational and technological needs of the nation's public transportation systems. By undertaking a combination of research projects, training programs and information dissemination activities, the Centers are contributing toward effective utilization of technical and human resources within the transit industry.

### The Centers

University of California at Irvine  
Irvine, CA 92717  
Principal: Dr. G.J. (Pete) Fielding  
(714) 856-5448

New York Institute of Technology  
Old Westbury, NY 11568  
Principal: Dr. Richard Dibble  
(516) 686-7722

Portland State University  
Portland, OR 97202  
Principal: Dr. Kenneth Dueker  
(503) 229-4043

University of Pennsylvania  
Philadelphia, PA 19104  
Principal: Dr. W. Bruce Allen  
(215) 898-7676

Texas Southern University  
Houston, TX 77004  
Principal: Dr. Naomi Lede  
(713) 527-7282

Florida A&M University  
Tallahassee, FL 32307  
Principal: Dr. Shirley Mallory-Smith  
(904) 599-3600

University of Michigan  
Ann Arbor, MI 98109  
Principal: Dr. Cyrus Ulberg  
(313) 764-0248

Indiana University  
Bloomington, IN 47405  
Principal: Dr. George Smerk  
(812) 335-8143

University of Wisconsin  
Madison, WI 53201  
Principal: Dr. Edward Beimborn  
(414) 963-4978

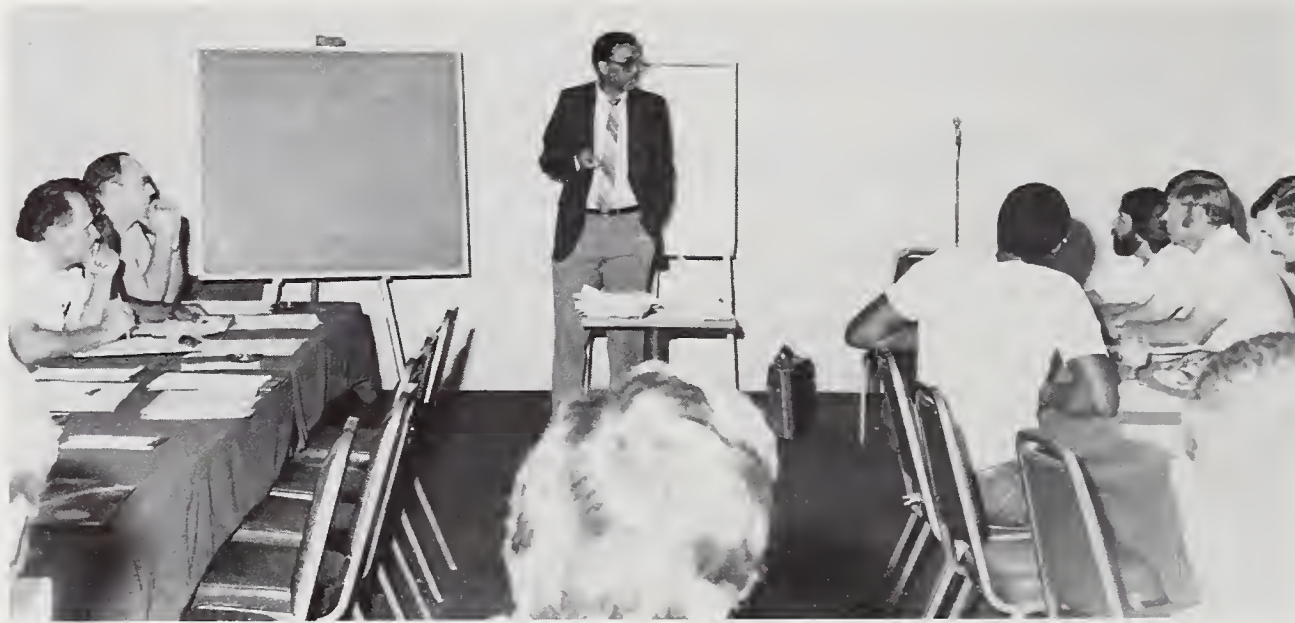
### Areas of Emphasis

University of California at Irvine

Develop analytical techniques to facilitate access to Section 15 data base; analyze impact of ownership and management forms on transit operator performance and productivity; training activities for middle managers, industrial relations managers, operations supervisors and smaller transit system operators.

Florida A&M University

Management strategies to identify and implement training programs responsive to needs of industry; integration of



***The University Research and Training Program brings valuable knowledge and skills directly to the transit industry in the form of research projects, classes and workshops.***

university academic programs into industry human resources requirements; research role of public transit in economic development of Southeastern U.S.; and profile paratransit and small urban area issues.

#### Indiana University at Bloomington

Professional development seminars in financial management, labor relations, and managerial techniques; micro-computer research techniques; and technology transfer in financial management strategies.

#### University of Michigan

Research on instrumentation of maintenance problem detection; acquisition of maintenance data; optimization of

equipment replacement strategies; micro-computerization of traffic engineering methods; and information transfer on Section 15 data analysis and operations.

#### New York Institute of Technology

Undertake a management development program to assist transit operators in the upgrading of their workforce; initiate labor relations training for transit managers and supervisors; develop a transportation management degree/certificate program; deliver technical and maintenance training packages for transit systems operators; and identify and implement internship and cooperative education positions with private and public transportation agencies and companies in New York City regional area.

#### University of Pennsylvania

Research factors which influence the transfer of training; study managerial productivity and efficiency; and examine strategies to reduce bus operations costs.

#### Portland State University

Research transit career patterns, experiences and training needs; cost effectiveness of articulated buses; private-public cooperation in the delivery of transit services; training activities in labor-arbitration matters, innovative transit services and small city transit management techniques; and clearinghouse function in technology transfer among regional transit operators and universities.

#### Texas Southern University

Develop and implement graduate and undergraduate curriculum leading to M.Sc. in transportation; provide continuing education and training courses for industry employees; establish internship and co-op activities; identify and conduct interdisciplinary research projects; and, assist region or state in exchange of research information.

#### University of Wisconsin

Development of interactive training packages for route level analysis; enhancement of the Transit Route Forecasting Model; conduct a Rural Transit Conference; development of a management workshop for small urban, rural and specialized transit systems; establish a Transit Market Research Information Exchange.



## FY 83 Project Grants

Descriptions of project grants awarded by the program during FY 83, appear below. Reports published in FY 83 as part of the University Research Program are listed at the end of the Chapter.

### Efficiency and Productivity

#### Factors Affecting the Incidence and Perception of Bus Crime in Los Angeles

(CA-06-0195)

Funding: \$84,187

Schedule: July 1983-November 1984

Grantee: University of California at

Los Angeles

(Dr. Ned Lebine, Dr. Martin Wachs)

Technical Monitor: Abdo Ahmed  
(202) 426-2896

#### Structuring the Transit Service Planning Process to Improve Productivity

(MA-11-0041)

Funding: \$40,000

Schedule: July 1983-August 1984

Grantee: Massachusetts Institute of

Technology

(Dr. Nigel Wilson)

Technical Monitor: Brian McCollom  
(202) 426-9271

#### Development of a Management Techniques Guide for Bus Fleet Managers

(OK-11-0004)

Funding: \$82,798

Schedule: July 1983-July 1984

Grantee: University of Oklahoma

(Dr. Thomas Maze)

Technical Monitor: Philip Hughes  
(202) 426-9274

#### Analysis of Bus Maintenance Operations

(VA-11-0012)

Funding: \$81,262

Schedule: July 1983- August 1984

Grantee: University of Virginia

(Dr. Michael Demetsky)

Technical Monitor: Philip Hughes  
(202) 426-9274

#### The Influence of Financial Incentive Programs on Employee Performance and Organizational Productivity Within Mass Transit

(VA-11-0013)

Funding: \$45,556

Schedule: July 1983-August 1984

Grantee: Virginia Polytechnic Institute

and State University

(Dr. K. Dow Scott)

Technical Monitor: Philip Hughes  
(202) 426-9274

#### Marketing and Ridership

#### 1980 Census Information: Analysis for Use in Small City Synthetic Transportation Planning Models

(AL-06-0012)

Funding: \$84,820

Schedule: July 1983-July 1984

Grantee: Auburn University

(Mr. Darrell Meyer)

Technical Monitor: Fred Ducca  
(202) 426-0182

#### Development of Time Series Based Transit Patronage Models to Assist Decision-Makers in the Evaluation of Alternative Service Level and Fare Strategies

(IA-11-0005)

Funding: \$82,218

Schedule: July 1983-August 1984

Grantee: University of Iowa

(Dr. James Stoner)

Technical Monitor: Tom Hillegass  
(202) 426-9271

#### The Potential of Private Sector Commuter Clubs to Increase Public Sector Efficiency

(IL-06-0058)

Funding: \$77,294

Schedule: July 1983-August 1984

Grantee: University of Illinois at

Chicago

(Dr. Robert Paaswell)

Technical Monitor: Mary Martha Churchman

(202) 426-4984

#### New Approaches to Circuity in Ridesharing: The Individual's Travel Decision

(IN-11-0010)

Funding: \$35,287

Schedule: July 1983-August 1984

Grantee: Purdue University

(Dr. Jon Fricker)

Technical Monitor: Mary Martha Churchman

(202) 426-4984

#### Assessment of Transit User Marketing Tools and Techniques

(MD-11-0006)

Funding: \$42,917

Schedule: July 1983-August 1984

Grantee: Morgan State University

(Dr. Willamae Abrams)

Technical Monitor: Bert Arrillaga  
(202) 426-4984

**Developing an Approach for the Analysis of the Long-Range Future of Public Transportation in Large Cities**

(NY-11-0032)

Funding: \$36,772

Schedule: July 1983-February 1984

Grantee: New York University  
(Dr. Dick Netzer)

Technical Monitor: Judy Meade  
(202) 426-0080

**Equity and Sensitivity: Elements to Improve Ridership and Marketing for Low Income Citizens**

(VA-11-0014)

Funding: \$82,916

Schedule: July 1983-September 1984

Grantee: Norfolk State University  
(Dr. Melvin Smith)

Technical Monitor: Harry Takai  
(202) 426-2285

**Training Courses**

**Functional Training Courses**

(FL-11-0011)

Funding: \$71,733

Schedule: July 1983-August 1984

Grantee: Florida Memorial College  
(Mr. Oscar DeShields)

Technical Monitor: Frank Enty  
(202) 426-9274

**Transit Operations Institute: A Management Development Seminar for Women in the Transit Industry**

(GA-11-0015)

Funding: \$74,607

Schedule: July 1983-July 1984

Grantee: Georgia Institute of Technology  
(Dr. Catherine Ross)

Technical Monitor: Judy Meade  
(202) 426-0080

**Transit Agency Management**

**A Project to Study the Use of Microcomputer Technology in Planning and Operation of Small City Transportation Systems**

(AL-06-0011)

Funding: \$39,432

Schedule: July 1983-July 1984

Grantee: Tuskegee Institute  
(Dr. Tejinder Sara)

Technical Monitor: Ed Neigut  
(202) 426-9271

**A Profile and Analysis of Transit General Managers and Assistants Including Relationships with their Governing Boards**

(GA-11-0014)

Funding: \$84,341

Schedule: July 1983-August 1984

Grantee: Atlanta University  
(Dr. Irvin Brown)

Technical Monitor: Alice Royal  
(202) 426-0080

**Transit Industry Microcomputer Exchange (TIME) Support Center**

(NY-06-0109)

Funding: \$78,623

Schedule: July 1983-August 1984

Grantee: Rensselaer Polytechnic Institute  
(Dr. Mark Abkowitz)

Technical Monitor: Ron Jensen-Fisher  
(202) 426-9271

**Transportation Financing and Pricing The Development and Impacts of**

**Dedicated Funding Sources for Public Transit Systems**

(NC-11-0013)

Funding: \$80,903

Schedule: November 1983-August 1984

Grantee: North Carolina A&T State University

(Mr. Erskine Walther)

Technical Monitor: Ed Thomas  
(202) 426-9267

**Feasibility and Impacts of Returning Transit to Private Ownership**

(NY-06-0108)

Funding: \$76,600

Schedule: July 1983-July 1984

Grantee: Polytechnic Institute of New York  
(Dr. Louis Pignataro)

Technical Monitor: Nat Jasper  
(202) 426-0080

**A Bi-Level Optimization Model for Integrating Fare and Service Structures to Minimize Urban Transit Operating Deficits**

(UT-11-0003)

Funding: \$83,918

Schedule: July 1983-August 1984

Grantee: University of Utah  
(Dr. Jason Yu)

Technical Monitor: Ron Jensen-Fisher  
(202) 426-9271

**Labor-Management Relations**

**Cooperative Initiatives in Transit Labor-Management Relationships**

(FL-11-0009)

Funding: \$83,865

Schedule: July 1983-August 1984

Grantee: University of North Florida  
(Dr. Jay Smith)

Technical Monitor: Connie Perin  
(617) 494-2076

### **Minority Business Enterprise**

#### **An Analysis of the Barriers to Minority Businesses in Obtaining UMTA Funded Procurement Contracts at State and Local Levels**

(FL-11-0010)

Funding: \$54,907

Schedule: July 1983-August 1984

Grantee: Edward Waters College  
(Mr. Vincent Jackson)

Technical Monitor: Gene Jackson  
(202) 426-2285

### **Bibliography**

This list identifies final research reports published by UMTA's University Research and Training (URT) Program through September 1982 and not included in the December 1979 Supplement to Abstracts for "University Research Projects." A National Technical Information Service (NTIS) order number is indicated for each report.

Reports may be obtained from NTIS by using the order blanks provided at the end of this document

### ***Energy and Environment***

#### **Development and Implementation of Dynamic Methodologies for Evaluating Energy Conservation Strategies**

Proj. MN-11-0004-82-2

University of Minnesota

April 1982, PB 82-240763

#### **An Evaluation of Energy Emergency Contingency Planning**

Proj. GA-11-0012-83-1

Atlanta University  
March 1983, PB 83-255786

#### **Identification and Ranking of Transportation Cost Reductions through Energy Conservation Strategies**

Proj. UT-11-0002-83-2

University of Utah

January 1983, PB 83-25182

### ***Fares/Pricing and Service Innovations***

#### **A Study of Pricing Structures and Fare Collection Systems for Integrated Local Transit Systems**

Proj. WV-11-0003-83-1

West Virginia University

January 1983, PB 83-252403

### ***Financing***

#### **Intergovernmental Responsibilities for Financing Public Transit Services**

Proj. CA-11-0023-82-2

University of California at Berkeley

November 1982, PB 83-147520

#### **Public Transportation in the 1980's: Responding to Pressures of Fiscal Austerity**

Proj. MA-11-0035-82-1

Massachusetts Institute of Technology

February 1982, PB 83-149682

#### **Redesigning Federal Transit Subsidies to Control Costs and to Increase the Effectiveness of the Transit Program**

Proj. NJ-11-0011-82-2

Rutgers University

December 1982, PB 83-155366

#### **State and Local Financing of Public Transit Systems**

Proj. NC-11-0009-83-3

North Carolina A&T State University

June 1983, PB 83-261065

### ***Non-Urban and Low Density Area Transportation***

#### **Problems and Obstacles Facing Paratransit Operators in a Small Urban Area**

Proj. AL-11-0002-83-1

Alabama A&M University

July 1982, PB 83-189035

#### **Transportation Needs of the Elderly and Handicapped in a Small City**

Proj. AL-11-0001-83-1

Tuskee Institute

September 1982, PB 83-253284

### ***Paratransit Systems and Services***

#### **Decision Procedures for Paratransit Market Selection and Service Evaluation**

Proj. VA-11-0010-82-2

University of Virginia

May 1982, PB 82-259268

#### **Cooperative Forms of Organization in the Taxicab Industry**

Proj. NC-11-0009-83-4

University of North Carolina at

Chapel Hill

June 1983, PB 83-253237

### ***Planning, Policy and Program Development***

#### **Long Range Prospects and Requirements of Urban Public Transportation**

Proj. PA-11-0019-82-2

University of Pennsylvania

June 1981, PB 83-230855

#### **Application of Section 15 Census Data to Transit Decision Making**

Proj. KY-11-0002-83-1

University of Kentucky

August 1983, PB 84-102649

#### **The Role, Function and Effectiveness of Metropolitan Planning Organizations**

Proj. PA-11-0025-83-1

University of Pennsylvania

January 1983, PB 83-256982

**The Role of Economic Assessment in Selecting Among Mass Transit Construction Alternatives**

Proj. MA-11-0039-83-1  
Tufts University  
June 1983, PB 83-263244

**Transit Information and Transit Knowledge: The Chicago Experience**

Proj. IL-11-0028-83-4  
University of Illinois at Chicago  
May 1983, PB 83-262659

***Political Processes and Legal Affairs***

**The Effect of Organizational and Technological Characteristics on Driver Wage Rates in Urban Passenger Transport.**

**Volume Two**  
Proj. PA-11-0027-83-3  
University of Pennsylvania  
April 1983, PB 83-252304

**Planning, Implementing and Maintaining Accessible Access Ways to and from Bus Stops: Existing Problems and Possible Solutions for the Wheel Chair Traveler**

Proj. NY-11-0023-83-1  
Polytechnic Institute of New York  
July 1983, PB 83-252023

***Socioeconomics***

**Market Segmentation of the Transportation Handicapped: An Assessment of Their Needs**

Proj. NC-11-0009-83-1  
North Carolina A&T State University  
June 1982, PB 83-251231

**The Nonutilization of Special Transport Services by the Elderly in Urban Areas: A Case Study of Washington, D.C.**

Proj. DC-11-0012-83-2  
University of the District of Columbia  
August 1982, PB 83-252239

***New Systems and Automation***

**Integration of AGT Systems with Other Transportation Models**

Proj. WV-11-0003-82-2  
West Virginia University  
December 1981, PB 82-255621

**Power and Energy Measurement on Morgantown People Mover System**

Proj. WV-11-0003-82-1  
West Virginia University  
December 1981, PB 82-255647

***Transportation of Disadvantaged/Special-User Groups***

**Quality of Service in Special Transportation for the Elderly and Handicapped**

Proj. IL-11-0028-83-2  
University of Illinois at Chicago  
May 1983, PB 83-255612

**A Study of Wheel Chair - Bus Operations in a Suburban Environment: An Identification of Factors Inhibiting Usage and Estimates of Impacts**

Proj. NY-11-0023-83-2  
December 1982, PB 83-252031

***Transportation/Transit Management***

**Large Scale Implementation of a Time Oriented Vehicle Scheduling Model**

Proj. FL-11-0005-83-1  
University of Miami  
October 1982, PB 83-169276

**An Analysis of Total System Costs Related to Bus Garage and Network Configurations**

Proj. MI-11-0005-83-1  
Wayne State University  
January 1983, PB 83-256248

**The Feasibility and Desirability of Privately-Provided Transit Services. Volume One**

Proj. PA-11-0027-83-2  
University of Pennsylvania  
November 1982, PB 83-252296

**Management Tools for Bus Maintenance Current Practices and New Methods**

Proj. IL-11-0028-83-6  
University of Illinois at Chicago  
April 1983, PB 83-251116

**1982 Summer Research and Development Workshop for Faculty from Minority Institutions**

Proj. DC-11-0013-83-1  
Howard University  
April 1983, PB 83-252411

# Appendixes

# APPENDIX A

## Sources of Technical Assistance Information

### National Technical Information Service

Many of the reports on UMTA R&D described in this volume are available for purchase from the National Technical Information Service (NTIS). NTIS is the principle repository and disseminating agency for all reports issued in conjunction with federal research and development activities.

NTIS will fill orders for publications in stock within three days; documents which must be reprinted will be mailed within two weeks. Most reports in NTIS are also available on microfiche.

A copy of the NTIS mail order form appears at the end of this document and should be used for ordering reports from NTIS. Information on how to purchase documents may be obtained by calling (703) 487-4650 (regular orders) or (703) 487-4700 (rush orders) or by writing to:

U.S. Department of Commerce  
National Technical Information  
Service  
5285 Port Royal Road  
Springfield, VA 22161

### Transit Research Information Center

Another repository for UMTA reports is the Transit Research Information Center (TRIC), located within UMTA's Office of Technical Assistance. TRIC maintains a collection of most UMTA-sponsored Section 6, 8 and 11 reports and provides, upon request, a one-page technical ab-

stract of any available report. It is also possible to request abstracts of UMTA reports related to a specific topic.

Through 1980, TRIC published annual compendiums of reports pertaining to work performed under UMTA Research, Development and Demonstration (RD&D) grants and contracts, technical studies grants, and university research and training grants in a document entitled *Urban Mass Transportation Abstracts*. These Abstracts include condensed descriptions of UMTA reports available for purchase through NTIS. Each volume is indexed by title, individual and corporate author, geographic area, project number and subject. These reports are available from NTIS beginning with Volume I, (1972) through Volume VII (1980).

Since 1980 this information has been transmitted to the TRB-administered Urban Mass Transportation Information System (UMTRIS) data base. UMTRIS first published the *Urban Mass Transportation Abstracts - Cumulative Bibliography 1974-1980*, in April 1982. It includes the UMTA reports submitted by TRIC as well as research reports from other sources. Installments of the bibliography, available from TRB, are published semi-annually. For information pertaining to the UMTRIS data base, contact:

Fred M. Houser  
Transportation Research Board  
2101 Constitution Avenue, N.W.  
Washington, DC 20418  
(202) 334-3251

The bimonthly edition of UMTA Abstracts, listing the most recent UMTA reports, is still issued through TRIC. A cumulative retrieval term index appears

at the end of every third bimonthly abstract. The UMTA Abstracts may be obtained from:

Marina Drancsak or Winnie Muse  
U.S. Department of Transportation  
Urban Mass Transportation  
Administration  
Office of Technical Assistance  
Transit Research Information Center,  
Rm 6419  
400 Seventh Street, S.W.  
Washington, DC 20590  
(202) 426-9157

## Technology Sharing

Several offices within the U.S. Department of Transportation sponsor technology sharing programs to assist state and local governments, transportation agencies, industry, the research community and the public. Workshops and training programs are sponsored and conducted, and documents containing information drawn from a variety of sources are issued. These activities are designed to help local agencies in the evaluation and introduction of new methods and technologies as well as to provide opportunities for representatives of the transit industry to discuss successful and unsuccessful experiences in problem solving.

Reports prepared for UMTA by the Office of Technology Sharing at the Transportation Systems Center (TSC) in Cambridge, Mass., are free upon request while copies are available. When supplies are exhausted, reprints may be ordered through NTIS, or in some cases from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The TSC Office of Technology Sharing has two toll-free numbers to call for current information. These are:

(800) 842-1151 (for calls within Massachusetts)  
(800) 225-1612 (for calls outside Massachusetts)

Documents may be ordered by title from:

U.S. Department of Transportation  
Transportation Systems Center  
Office of Technology Sharing,  
DTS-31  
Kendall Square  
Cambridge, MA 02142

Other technology sharing publications are available from the U.S. Department of Transportation's Office of Technology Sharing and Planning Assistance. Copies of these documents may be obtained by calling (202) 426-4208 or by writing to:

U.S. Department of Transportation  
Office of the Assistant Secretary  
to Governmental Affairs  
Office of Technology Sharing and  
Planning Assistance, I-30  
400 Seventh Street, S.W.  
Washington, DC 20590

On October 1, 1983, the Urban Mass Transportation Administration (UMTA) assumed overall responsibility for the rural and small urban transportation program authorized by Section 18 of the Urban Mass Transportation Act of 1964, as amended. This program provides planning, capital, operating and administrative assistance for public transportation services in areas with a population of under 50,000. Grants are made by the UMTA

Regional Offices to State transportation agencies based on a statewide annual program of projects. UMTA's ongoing technical assistance efforts have been expanded to address the needs in rural and small urban areas. These activities are concentrated primarily in UMTA's Office of Technical Assistance. General information about the Section 18 program can be obtained from:

Office of Grants Management  
Urban Mass Transportation  
Administration  
400 Seventh Street, S.W.  
Washington, DC 20590

The Urban Mass Transportation Act of 1964, as amended, authorizes the Urban Mass Transportation Administration (UMTA) to make capital grant funds available to private nonprofit organizations for the purchase of vehicles and related equipment to provide special transportation services to elderly and handicapped persons.

Grants are made under Section 16(b)(2) of the Act, a supplemental program which offers the same type of capital assistance, but which is open only to private nonprofit organizations. These funds are only made available through state agencies, which receive and process applications on behalf of UMTA.

### **UMTA Public Information Service**

UMTA conducts an active public information program through its Office of Public Affairs. Press releases and brochures describing various UMTA programs and policies are available upon request from:

U.S. Department of Transportation

Urban Mass Transportation  
Administration  
Office of Public Affairs  
400 Seventh Street, S.W.  
Washington, DC 20590

UMTA activities are also reported regularly in a magazine published by the U.S. Department of Transportation entitled *Transportation USA*. This magazine is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

### **Congressional Hearings**

An abundance of factual and statistical data concerning the current UMTA program and plans for the future is submitted each year to the U.S. Senate and House of Representatives Appropriations Committee(s). This material, plus a transcript of additional information obtained in hearings, constitutes a comprehensive record of UMTA activities. Copies may be obtained from:

U.S. Senate  
Committee on Appropriations  
Subcommittee on Transportation  
Washington, DC 20510

and

U.S. House of Representatives  
Committee on Appropriations  
Subcommittee on Transportation  
Washington, DC 20515

### **U.S. Department of Transportation (DOT) Library**

The DOT library houses all reports published by UMTA and contains approximately 500,000 books and other documents, and some 170 drawers of vertical

file material. More than 1500 periodicals are received annually. Most materials are available through interlibrary loan. The library is located in the main building of the U.S. Department of Transportation at 400 Seventh Street, S.W., Washington, DC 20590.

### **UMTA Files**

In conformance with the Freedom of Information Act, UMTA has established a facility for document inspection within the Office of Public Affairs, open to the public during normal working hours. The following records are available for inspection:

- Final opinions and orders made in the adjudication of cases and issued within UMTA;
- Any policy or interpretation issued by UMTA, if that policy or interpretation can reasonably be expected to have value as a precedent 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 (and, in the case of photocopies, the appropriate fee) to:

U.S. Department of Transportation  
Urban Mass Transportation  
Administration  
Director of Public Affairs, Rm 9314  
400 Seventh Street, S.W.  
Washington, DC 20590

### **Correspondence**

UMTA is responsive to letters of inquiry. Communications addressed to the UMTA Administrator will be routed to the appropriate offices for reply. Communications should be sent to:

U.S. Department of Transportation  
Urban Mass Transportation  
Administration  
Office of the Administrator  
400 Seventh Street, S.W.  
Washington, DC 20590



# APPENDIX B

## Urban Mass Transportation Grants and Contracts: Application and Procurement Procedures

### Introduction

The U.S. 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 pamphlet is not a substitute for the official rules and regulations governing procurement, but presents useful background information and serves as an initial guide to DOT procurement policies.

The document is available free of charge from:

U.S. Department of Transportation  
Office of the Secretary  
Procurement Division, M-43  
400 Seventh Street, S.W.  
Washington, DC 20590

### Grants and Cooperative Agreements

Grants, which are usually awarded 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 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.

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.

Those interested in applying for a grant or conducting a cooperative agreement should follow the guidance provided by 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 by calling or writing to:

U.S. Department of Transportation  
Urban Mass Transportation  
Administration  
Office of Administrative Services,  
UAD-12  
400 Seventh Street, S.W.  
Washington, DC 20590  
(202) 426-4865

A reading copy is available in the UMTA Office of Public Affairs at the same address.

### Contract Procurement

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 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 obtained at nominal cost from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

In contract procurements, 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) as well as any other known suppliers of the procurement, and placing notice of the procurement in public places, including the U.S. Department of Commerce publication, *Commerce Business Daily*.

### 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 Bidders' Mailing List which identifies the equipment, supplies, materials or services that vendors have available to sell.

To be placed on the Bidders' Mailing List, contractors (other than Architectural 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 they wish to bid. A&E firms desiring to do work for DOT should submit a Standard Form 254, U.S. Government Architectural and Engineering Questionnaire, to:

U.S. Department of Transportation  
Office of the Secretary  
Director of Installations and  
Logistics, M-60  
400 Seventh Street, S.W.  
Washington, DC 20590

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 brochure, *Contracting with the Department of Transportation* (see the Introduction to this Appendix).

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:

U.S. Department of Transportation  
Urban Mass Transportation  
Administration  
Program and Operations Support  
Division, UAD-42  
400 Seventh Street, S.W.  
Washington, DC 20590

All Requests for Proposals (RFP) are sent to firms which have claimed special skills or resources closely related to the topics covered by the RFP. All RFPs are recorded in the *Commerce Business Daily*, described below.

### **Commerce Business Daily**

The *Commerce Business Daily* is designed to help American business firms keep abreast of federal government procurements and general contracting activity. It is published Monday through Friday, except on federal holidays. It lists, by

commodity and service, U.S. 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, U.S. Government Printing Office, Washington, DC 20402. Subscription blanks may be obtained from:

U.S. Department of Commerce  
U.S. Foreign Commercial Service  
Washington, DC 20230

or from the nearest U.S. Department of Commerce field office.

### **Subcontracting**

Another possible means of participating in UMTA procurements is by subcontracting. In many instances, an UMTA prime contractor uses another firm for professional services, construction or equipment. If a firm considers itself qualified to perform one aspect or part of a project for which another firm has been chosen, the prime contractor can be approached and offered 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.

### **Unsolicited Proposals**

Prospective DOT contractors can make their new ideas 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 Bidders' Mailing List to submit an unsolicited proposal.

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 is the fact that a procurement follows receipt of, or is based on, an unsolicited proposal, in and of itself sufficient to justify sole source procurement. 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 must be followed.

### **Minority Business Enterprise (MBE)**

DOT actively supports the minority business enterprise (MBE) 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 insure 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:

U.S. Department of Transportation  
Office of the Secretary  
Director of Installations and  
Logistics (M-60)  
400 Seventh Street, S.W.  
Washington, DC 20590

## **Cost Sharing**

In some cases when a grant or procurement contract is awarded, financial participation by the performing organization may be required. 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.

## **UMTA University Research and Training Grants**

University Research and Training Grants are made to public and private nonprofit institutions of higher learning to assist in carrying out research on problems in urban transportation and to provide professional training in the field of urban transportation analysis, planning, management and operations.

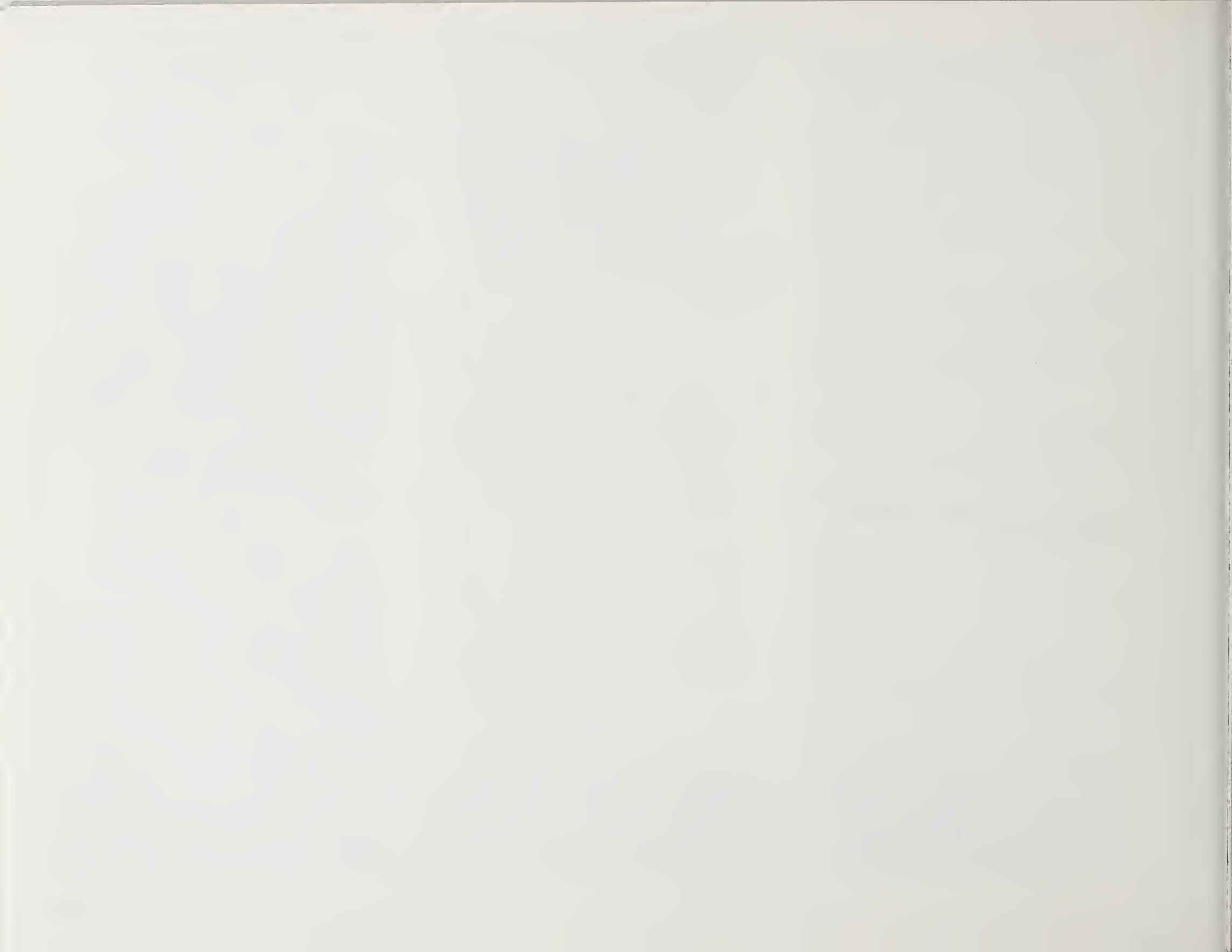
## **University Research and Training Grant Applications**

In the late summer, UMTA normally issues a notice in the *Commerce Business Daily* inviting submittal of grant applications.

A formal grant application must contain a detailed outline of the proposed research or training project, as well as a delineation of the project's organization, staff, faculty and budget. When necessary, UMTA personnel can provide informal assistance in interpreting the guidelines and preparing the formal application. An Annual Announcement including "Instructions for the Preparation of Applications to the University Research and Training Program" is available from:

U.S. Department of Transportation  
Urban Mass Transportation  
Administration  
Office of Technical  
Assistance  
University Research and  
Training Program, URT-33  
400 Seventh Street, S.W.  
Washington, DC 20590

Additional information about the University Research and Training Program may be obtained by calling (202) 426-0080.



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