INNOVATION

IN PUBLIC TRANSPORTATION

A DIRECTORY of RESEARCH, DEVELOPMENT and DEMONSTRATION PROJECTS

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

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Introduction

This annual publication contains descriptions of current research, development and demonstration (RD&D) projects sponsored and funded by the U.S. Department of Transportation's Urban Mass Transportation Administration (UMTA).

These projects are conducted under the authority of Section 6(a) of the Urban Mass Transportation Act of 1964, as amended (78 Stat. 302, 49 U.S.C. 1601 et. seq.). This statute authorizes the Secretary of Transportation "to undertake research, development, and demonstration projects in all phases of urban mass transportation . . . which he determines will assist in the reduction of urban transportation needs, the improvement of mass transportation service, or the contribution of such service toward meeting total urban transportation needs at minimum costs."

This activity includes "the development, testing and demonstration of new facilities, equipment, techniques and methods." Projects may be conducted in-house, by public bodies through grants, through contracts with private firms, or through working agreements with other Federal departments and agencies. UMTA generally initiates and plans these RD&D projects and performs analytical tasks as well.

Research projects are intended to produce information about possible improvements in urban mass transportation. The products of research projects are reports or studies.

Development projects involve fabrication, testing, and evaluation of new equipment, facilities, systems or methods. The products of development projects include prototype hardware, test results, and reports.

Demonstration projects introduce, on an experimental basis, new methods, equipment or systems of urban mass transportation into a representative urban environment. This permits measurement of passenger and community acceptance of the innovation, collection and evaluation of operating and financial statistics to ascertain economic viability, and an evaluation of the operational performance of new methods or equipment in daily public service.

It is UMTA's policy to make available to the public as readily as possible information about research, development and demonstration activities conducted under the Urban Mass Transportation Act of 1964, as amended. The principal method of reporting is through annual publication of the compilation of reports on the status of individual projects.

The volume dated June 30, 1972 constituted an historical record of all projects funded under the Act to that point as well as projects funded earlier under authorization of the Housing Act of 1961. This volume is available from the National Technical Information Service (NTIS), access number PB-213-228.

Volumes of fiscal years 1973, 1974 and 1975 serve as supplements to the comprehensive 1972 volume since they contain only updated descriptions of those projects active in the fiscal year cited in addition to projects initiated or completed during that year. Copies of these volumes are available from the U.S. Superintendent of Documents.

Most of the completed projects included in this volume have reports already published or in the publication process. *The Urban Mass Transportation Administration does not distribute these reports unless so indicated.* They are available from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia, 22161. Details on ordering appear in Appendix 2 in the back of this volume.

Additional information about UMTA's RD&D activity also appears in Appendix 2.

UMTA's research, development and demonstration activities are conducted in the areas of policy, technology and service methods and techniques. Several of UMTA's component offices are involved in such research: Transportation Management and Demonstrations, Policy and Program Development and Technology Development and Deployment (limited research also is directed by UMTA's Office of Civil Rights).

This directory is divided into subject areas according to the UMTA office which directs those projects. The first five chapters—dealing with bus and paratransit, rail, new systems and automation, socio-economic and special projects, and safety and product qualification—detail research and development activities of the Office of Technology Development and Deployment. Chapter 6, Service and Methods Demonstrations, details projects conducted by the Office of Transportation Management and Demonstrations; Chapter 7, Policy and Program Development, details projects conducted by the office of the same name.

Note:
The dates listed under the "Schedule" section of project descriptions usually indicate the period of time from approval by the UMTA Administrator to receipt of a draft of the final report. The "Funding" section represents, except when otherwise indicated, Federal money provided by UMTA. This volume focuses on activity during the period July 1, 1975-September 30, 1976. Funding recipients are listed as 'contractor' although some may in fact be grantees.

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Chapter 1:
BUS AND PARATRANSIT

Bus and paratransit vehicles carry far more passengers in urban areas than do all other mass transit modes combined—in fact, four times the number of passengers carried by urban rail. As a result, UMTA has directed its research and development activity in this area to the development of vehicles and systems that increase the safety, efficiency, comfort and acceptability of public transportation using buses and paratransit vehicles. These projects also address special efforts to reduce petroleum fuel use, improve air quality and accommodate elderly and handicapped riders.

Transbus prototype vehicles were built by (l. to r.): GMC, Rohr Industries and AM General.

Bus and Paratransit Technology

Bus and paratransit technology involves three program areas: Bus vehicle development; paratransit development and energy conservation; and operational technology development.

Bus vehicle development projects range from improvements in existing buses to the development and testing of completely new bus designs.

Paratransit developments and energy conservation projects include modification of existing taxicabs to reduce petroleum fuel use; design, construction and testing of two low-pollution paratransit vehicles; and the development and testing of energy storage flywheels designed to conserve the energy required to operate buses and paratransit vehicles.

Operational technology developments are designed to increase the operational efficiency and level of service provided by bus systems and demand-responsive paratransit service through the use of vehicle monitoring and control systems.

Design of a Modern 40-Foot Transit Bus (TRANSBUS)

Project: FL-06-0012, IT-06-0025, MO-06-0009, NY-06-0045
Funding: $28,684,000
Schedule: November 1971 - November 1976
Contractor: Booz Allen and Hamilton
Subcontractors: Rohr Industries, Inc.; AM General Corporation, General Motors Corporation

A fundamental UMTA objective is the diversion of travellers from their private autos for commuter and urban travel to mass transit, but such persuasion necessarily depends in part upon the attractiveness and improved characteristics of the mass transit vehicle. For many years, the market for transit buses had not caused a manufacturer to develop and introduce an improved transit bus; the present "standard" bus design, for example, was introduced in 1959 and has not been significantly changed since then.

UMTA's TRANSBUS program was designed to achieve the most advanced bus design practicable within the state-of-the-art. The particular areas of improvement emphasized were: Comfort and ride quality; improved safety for passengers, pedestrians and occupants of other vehicles; reduced maintenance; and lower floor, better access and interior arrangements which would better accommodate the elderly and handicapped.

The prototype phase of the TRANSBUS program is now nearing completion. Designs have been developed, prototype vehicles fabricated, and the designs have been evaluated, following both proving ground and transit in-service tests. From the evaluation of the prototype designs, a technical specification has been developed for a production TRANSBUS. A production version of any one of the three different prototype designs could meet this specification.

In addition to the prototype designs which will be represented by a "design data package" for each manufacturer's design, reports will have been developed covering a variety of subjects. Those of only interim significance, i.e., test plans, evaluation plans, and other interim reports are not listed. The procurement documents are subject to constant revision and are intended for use in the bus procurement process. Persons and organizations which need these documents may request them directly from UMTA. The prototype design data packages will be maintained by the Transportation Systems Center (TSC), and persons or organizations who wish to review or obtain these data should contact TSC directly.

Reports from this project are listed in Appendix I

Small Bus Requirements, Concepts and Specifications

Project: IT-06-0074
Funding: $300,000
Schedule: December 1974 - October 1976
Contractor: RRC International Inc.

A small bus suitable for use in urban mass transit applications is increasingly needed but essentially unavailable. Although there are a number of small buses on the market, most are conversions of vehicles designed for other uses and not suitable for the intended use.

The small bus project is designed to: 1) Examine small bus operations and projected desirable operations in the U.S.; 2) Define needed and desired operating features for small buses; 3) include in these features considerations for the elderly and handicapped, including wheelchair travelers; 4) produce conceptual

Accessibility for elderly and handicapped persons is an important part of the small bus program; in these pictures, volunteers test accessibility on a full scale transit bus mockup with varying floor heights, ramp slopes and door widths.

small bus designs to meet the operating features; and 5) establish a specification for a small bus suitable for mass transit service in the U.S.

A contract modification was made in 1976 to incorporate mock-up work to permit evaluation of the effect of varying such factors as floor height, ramp slope, and interior dimensions on access by wheelchair passengers and other handicapped persons. Volunteer subjects with different handicaps have participated and assisted in this evaluation. Summary results will be contained in the project's final report.

Reports from this project are listed in Appendix I

Wheelchair Access to Current Buses

Project: MI-06-0017
Funding: $110,000
Schedule: May 1976 - February 1977
Contractor: AM General Corporation

There is a need to add wheelchair access to buses. Although many manufacturers offer a wheelchair lift mechanism which can be added to almost any bus, no manufacturer offers a wheelchair option in a full-size transit bus as original equipment.

This project was established to determine whether it is feasible to incorporate a wheelchair access option in the current bus design which would be built in at the time of manufacture. Contracts were offered to the three manufacturers of full-size transit buses; AM General has undertaken the work under contract. A final report is due about March, 1977.

Evaluation of the Florida Hybrid Bus

Project: FL-06-0014
Funding: $25,000
Schedule: July 1975 - November 1976
Contractors: Florida Department of Transportation, University of Florida

The Florida State Department of Transportation has sponsored the University of Florida in the development of a small bus based on the hybrid principle. The basic vehicle is a standard Electrobus, normally furnished by the manufacturer with only electric battery power (which is severely limited in range). In the hybrid version, a small diesel engine with an electric generator is added to charge the batteries. The diesel engine is run at optimum conditions to achieve fuel economy and low emissions and is not subject to the stop-and-go operation of normal transit service.

Through a grant to the Florida DOT, UMTA has provided support of tests by the University to evaluate general performance, including acceleration, top speed, endurance, emissions, fuel consumption, and power transmission efficiency. These tests have been completed and a report is expected in October 1976.

Through the Transportation Systems Center, the bus will be operated in simulated transit service to obtain more definitive data. The bus, instrumented and carrying a simulated passenger load, will be operated in conjunction with a transit bus in regular service. Upon completion of the tests in simulated service, it is anticipated that the U.S. Environmental Protection Agency will conduct emissions testing at Ann Arbor, Michigan. This testing will provide a significant input because the emissions measurements taken in Florida proved inconclusive.

Reports from this project are not yet available.

Special wheelchair lift or ramp mechanisms, such as this Transbus feature, are being considered for use as optional original equipment on current design buses.

Low Pollution Paratransit Vehicle

Project: NY-06-0043, MA-06-0052, CA-06-0079, CA-06-0080 and IL-06-0037.
Funding: Transportation Systems Center: $660,000; Museum of Modern Art: $60,000; AMF: $1 million; Steam Power Systems: $1 million; International Taxicab Association: $16,000.
Schedule: March 1975 - December 1976
Contractors: AMF, Inc.; Advanced Systems Laboratory; Steam Power Systems, Inc.

"Paratransit" is the collective term for those forms of urban passenger transportation which fall between private cars and fixed-route, fixed-schedule mass transit, such as taxicab, dial-a-ride, jitney and subscription service. Vehicles presently available for paratransit service are, for the most part, slightly modified versions of vehicles designed for other purposes. They fall short of ideal characteristics for paratransit service and are particularly lacking in adequate design for entering and exiting—an especially critical problem for the aged and the handicapped.

Congress has expressed a special interest in improving taxi vehicles. In its "Report on Department of Transportation's 1973 Appropriation Bill," the House Committee provided a separate budget item "for the devel-

The AMF model (above) and Steam Power Systems model (below) developed under the low-pollution paratransit project received considerable acclaim at the Metropolitan Museum of Art's taxi exhibit in 1976.

opment of an improved, efficient, quiet, non-polluting taxi." The Pratt Institute in Brooklyn, the New York City Taxi and Limousine Commission and the Museum of Modern Art in New York (MOMA) have all made efforts to improve the design of vehicles for taxi service.

The objective of this project is the development and evaluation of a low-pollution paratransit vehicle in the weight and size class of a compact passenger car and with a novel approach to space utilization. The vehicle demonstrates the feasibility of combining several desirable features in one vehicle, such as clean and quiet engine, maneuverability in urban traffic, easy entry and exit for elderly and handicapped, to the point of accommodating a wheelchair passenger, and a degree of space utilization not now available in production vehicles.

The vehicles fabricated under this project were exhibited to the public during the City Taxi Exhibition which the Museum of Modern Art (MOMA) held June-September 1976. The exhibition generated an extremely favorable response to the passenger and driver oriented features of the vehicles by the general public, the handicapped community and the paratransit operators. Industry, too, has been stimulated to seriously consider production paratransit vehicles incorporating the concepts and innovations of the exhibited vehicles.

Two contracts were let in March 1975 for the design and fabrication of engineering prototypes which would meet the above objectives and be true paratransit vehicles rather than modifications of existing vehicles. UMTA partially funded the City Taxi Exhibition conducted by MOMA; the Department of Transportation's Transportation Systems Center also has been funded to provide technical support and to conduct the vehicle tests through an independent laboratory, focusing on the accessibility, handling and ride comfort of the vehicles, particularly for handicapped riders. UMTA also has made a grant to the International Taxicab Association to evaluate the vehicles from the viewpoint of the paratransit and taxicab operating industry, identifying those features which are necessary for actual in-service use of the vehicle.

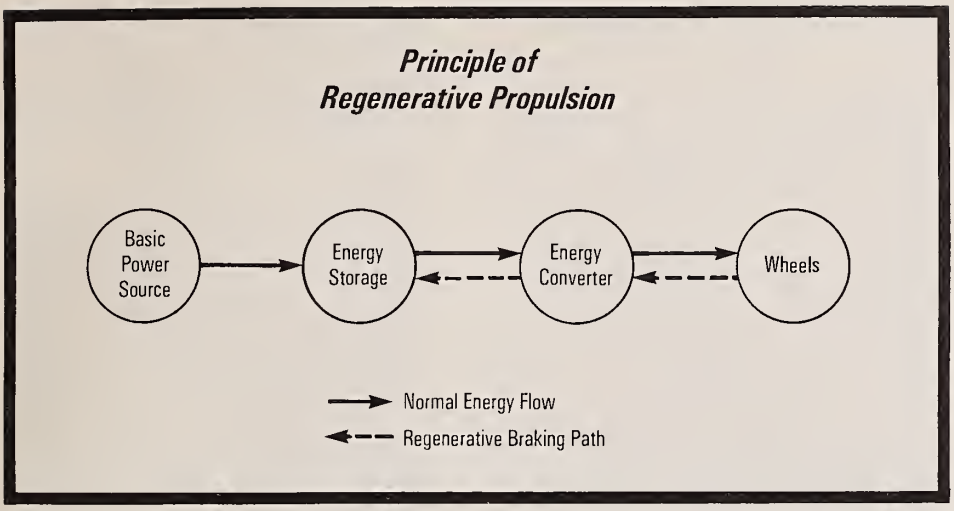
Reports from this project are listed in Appendix I.

Flywheel Energy Storage Systems

Project: IT-06-0117
Funding: $500,000 for FY 1977
Schedule: Phase I - September 1976 - June 1977
Contractors: Garrett AiResearch, General Electric Company's Corporate Research Center

The primary goal of the UMTA Flywheel Energy Storage Program is to reduce the mass transit operator's dependency on petroleum fuels, while maintaining the route flexibility inherent in the motor bus. A trolley coach not dependent all the time upon an overhead wire system, for example, could accomplish this goal.

The theortical principles involved in storing energy aboard a ground transportation vehicle as kinetic energy are sound and have already been demonstrated. Theoretical principles further substantiate that the mass transit vehicle, because of the inherent multi-stop driving cycle and heavier gross vehicle, renders it as the most promising type vehicle for successful application of these principles using state-of-the-art

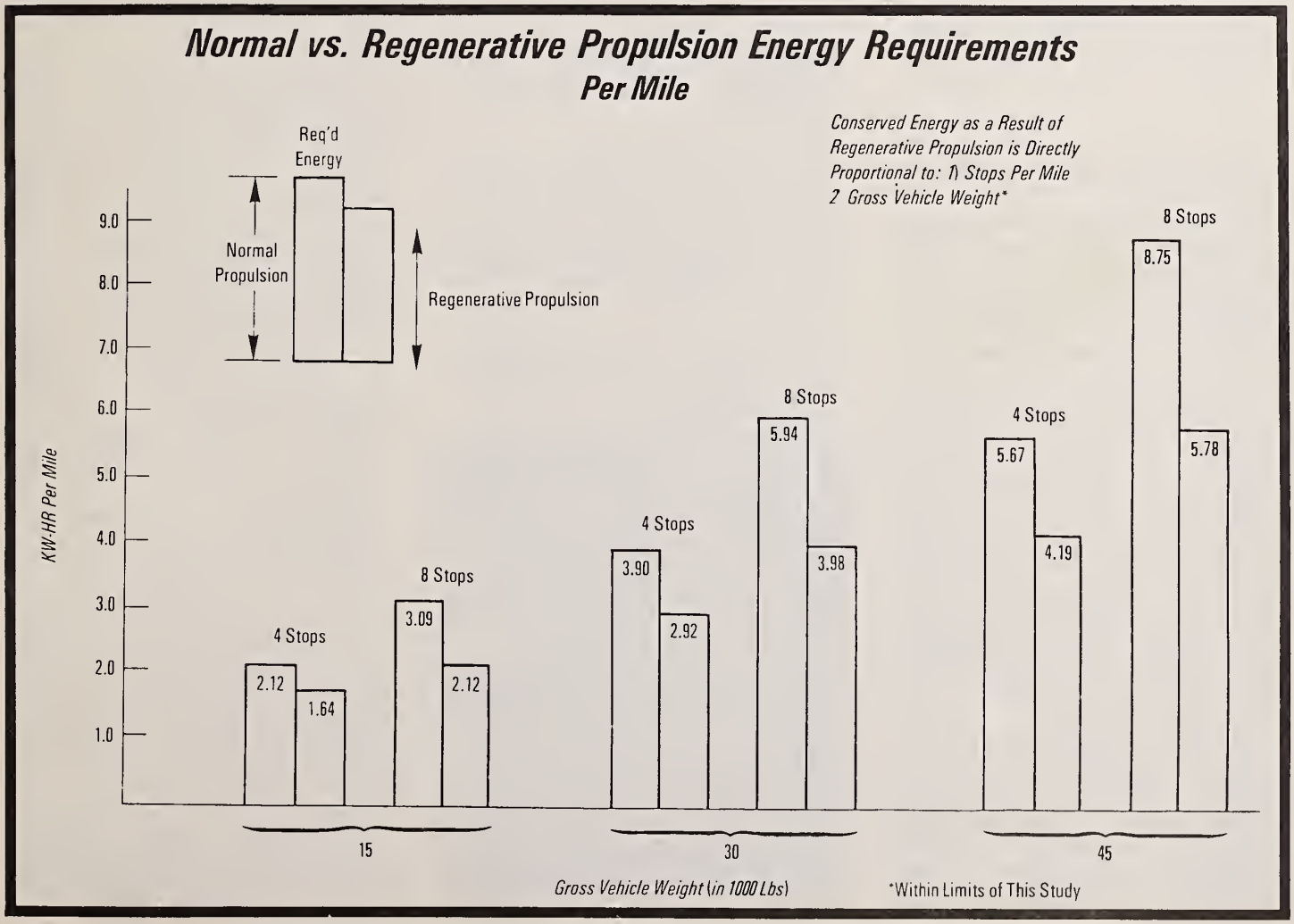


technology. More explicitly, the key to more efficient multi-stop driving is to incorporate a means of recapturing and storing braking energy to be reused during subsequent vehicle acceleration periods, a concept termed "regenerative propulsion." Actually, the higher the vehicle stop-and-go rate per mile, the more favorable the concept appears.

On-board energy storage devices will store the kinetic energy recaptured from braking and will permit subsequent high power extraction for acceleration. This characteristic would overcome more than one of the principal deficiencies of mass transportation vehicles now operating on the streets of our cities. For example:

- The diesel engine powered vehicle uses an oversized, power plant to meet the acceleration requirements, and dissipates the braking energy as heat.
- The trolley coach is burdened with expensive capital installation cost for the wayside or overhead wire, lack of route flexibility, aesthetic and safety problems.
- Battery-powered vehicles are used for mass transportation in a few places in the U.S. and somewhat more commonly in Europe. Their limitations, however, are well known: They suffer from high battery weight to gross vehicle weight ratios and their acceleration rate is limited in order to maximize range between battery recharges. Much of the braking energy is again lost as heat because of the inability of the battery to accept the charge fast enough.

An interim payoff in the longer range goal of developing electric flywheel coaches is the potential of developing a diesel/flywheel hybrid



that would substantially increase the diesel bus fuel mileage. This approach would also improve both noise and emission levels.

The project exploring such potential fuel-saving and other advantages is planned as a multi-year program divided into three phases:
Phase I: Preliminary conceptual design studies
Phase II: Systems design, fabrication, test and evaluation
Phase III: Limited on-road demonstration

Phase I will determine and categorize the users' requirements and identify a design concept that can: 1) Be applied to a spectrum of urban transit vehicles; 2) meet varying requirements using a modular assembly approach; 3) use proven materials and processes without compromise to safety; 4) identify growth plans through continuing research; and 5) sustain a cost-benefit ratio better than that of current propulsion systems. Phases II and III of the program will be pursued only if at least one application concept is proven viable by cost-benefit analysis.

Reports from this project are not yet available.

Evaluation of Diesel Propulsion in Fleet Taxicabs

Project: NY-06-0049, MA-06-0066
Funding: $480,000 UMTA; $300,000 U.S. Department of Transportation
Schedule: June 1976 - August 1978
Contractors: Pace Project Inc., Bronx, N.Y. and New York Metropolitan Taxicab Board of Trade

This project is designed to collect and analyze data on diesel and gasoline-powered taxi vehicle fleets to determine relative fuel efficiency, maintenance and repair requirements. The project also will attempt to assess driver and passenger reactions to diesel-powered vehicles and generalize the findings to project suitability and advantages of diesel propulsion for application to other paratransit vehicles and to private automobiles.

The project is expected to demonstrate the diesel-powered vehicle's better fuel economy, fewer engine repairs, lower exhaust emission pollution, and reduced vehicle downtime. In quantitative terms, expectations are based on experience gained from manufacturer testing of two prototypes - a Checker Marathon with a 6-cylinder Perkins diesel engine and a Dodge Coronet with a 6-cylinder Nissan diesel; these cars achieved more than 20 miles per gallon in tests, compared to the taxi industry's average of 9.5 miles per gallon for gasoline engines. Despite the proven advantages of diesel engines, few such engines have been used in lighter weight vehicles of the type used for paratransit service.

A contract was awarded to Pace Project, Inc., of New York City. Sixty-six pairs, each consisting of one gasoline-powered and one diesel-powered Dodge Coronet taxi, will be procured and put in operation for over 8,000 hours of operation over a 24-month period. The first of the diesel taxis went into operation in September 1976, with all sixty-six pairs to be on the road in November 1976.

Reports from this project are not yet available

Automatic Vehicle Monitoring (AVM) and Communications Systems

UMTA's research and development efforts in automatic vehicle monitoring (AVM) and communications systems encompass projects aimed at demonstrating managerial and rider benefits stemming from currently available vehicle-location technology and the development and testing of advanced location technologies suitable for multi-user vehicle systems.

Automatic vehicle monitoring represents an electronic means of ascertaining the location and status of land-based vehicles. Such knowledge permits a dispatcher to exercise effective authority and thus complete the command and control loop that started with the installation of two-way radios in vehicles.

AVM is expected to result in better service to passengers because buses will adhere more closely to schedules and headways; greater operational efficiency because better schedule adherence may be translated into fewer buses required to maintain a given level of service and data for management purposes can be automatically collected; and greater passenger and operator security because a silent alarm activated by the operator can notify the dispatcher of an emergency so police can be alerted to the bus location.

Studies indicate that AVM can substantially improve police effectiveness by permitting the dispatch of the car closest to the scene of an emergency. AVM also offers benefits to demand-responsive transit operations, taxi service, delivery services, Postal Service operations and other vehicle fleet applications.

Essentially, an AVM system consists of four subsystems: Location, communications, data processing and control. The locations subsystem consists of the equipment used to generate a position fix. The communications subsystem relays location data from the vehicle to the control center where data processing is performed. Finally, vehicle location information will be automatically compared by computer to schedule information and presented to the dispatcher who will than be able to more effectively manage the fleet.

There are three basic location technologies - proximity, dead reckoning and radio frequency - with several categories within each technology. Proximity can include radio frequency, laser or radar scanning, magnetic and buried resonant loop methods; dead reckoning can include the use of computer-stored map updates and signpost updates; and radio frequency can include LORAN-C, pulse trilateration, OMEGA, trilateration using AM broadcast signals, triangulation, satellite systems and hybrid systems. In addition, a hybrid system might combine two or more of the above technologies.

UMTA plans to develop, test, and evaluate an advanced, area-coverage AVM system that potentially can satisfy the requirements of multiple users, many of them governmental services. By accommodating the requirements of diverse users with a single system, cities will be able to install and maintain a single system and thus preclude the need for installing systems for each user.

The Chicago Transit Authority implemented an AVM demonstration project using a relatively simple location technology capable of

providing the location of a bus involved in an emergency situation.

A related project conducted several years ago provided hard data on the capacity, accuracy, costs and radio frequency requirements of different techniques proposed for electronic location and tracking of vehicles operating in an urban environment on non-fixed routes. Field tests conducted in Philadelphia in 1971 and 1972 demonstrated that the availability of such location systems makes it possible to extend AVM to vehicle fleets used in law enforcement, taxi operations, demand-responsive transit operations, commercial delivery and even marine operations.

Reports from an earlier AVM project (IT-06-0041 /IT-06-0046 /IT-06-0047/ IT-06-0048) are listed in Appendix 1.

Advanced Area-Coverage Automatic Vehicle Monitoring

Project: MA-06-0041
Funding: to be determined
Schedule: June, 1975 - July, 1980
Contractor: to be selected

UMTA's area coverage AVM program consists of two phases: In Phase I, requests for proposals were issued and four contractors selected to test the feasibility of their location subsystem approach. Philadelphia, the site of previous tests, was selected as the Phase I test site because it represents a typical urban environment with high rise buildings and harsh electromagnetic interference. The four contractors and their basic location subsystem approach are:

Fairchild Space and Electronics Company, Germantown, MD. (Microwave Signpost)

Hazeltine Corporation, Greenlawn, N.Y. (Pulse Tri-lateration)

Hoffman Information Identification, Inc., Fort Worth, Texas (Radio Frequency Signpost)

Teledyne Systems Company, North Ridge, CA (LORAN-C)

In testing, each contractor will deploy the necessary location equipment and a single vehicle will drive through the test area taking location data. The data will be recorded on magnetic tape and analyzed on a computer to determine the accuracy of each system. Finally, based on the contractor's system proposal as confirmed in the Phase I tests, a single contractor for Phase II will be selected.

Phase II will develop, deploy, operate and evaluate a fully functional area-coverage AVM system in a representative transit and police environment. After an extensive evaluation involving 15 cities, Los Angeles was selected as the test site. In Phase II, UMTA will evaluate AVM, determine its actual costs and benefits, and measure the improvements in operational control and effectiveness. Six to eight bus routes and a six square mile area will be equipped for AVM operation during the Phase II experiment that will involve up to 200 fixed-route transit buses and 50 random route vehicles, probably police and transit supervisor vehicles.

Reports from this project are not yet available

Dial-A-Ride Systems and Areawide Demand-Responsive Transit

Dial-a-ride provides effective, dynamic scheduling of small vehicles to meet real-time passenger demand. Its appeal lies in the ability to serve low demand/density areas such as the suburbs, which typically have inadequate public transportation if any at all. The door-to-door service and new buses tend to attract more passengers than conventional modes for equivalent levels of service. Also, dial-a-ride is an effective way of providing public transit to the poor, elderly, handicapped and others without access to private automobiles.

The highly successful Haddonfield (N.J.) Dial-A-Ride project prompted the implementation of at least 20 other demand-responsive systems throughout the country.

UMTA has played a major role in transforming dial-a-ride service from an attractive theoretical concept to a working reality by supporting the research that made computerized dispatching possible and by conducting the first major pilot experiment. The field experiment in Haddonfield, New Jersey attracted increased patronage with every increase in the service area. Of more than 70 demand-responsive systems that are either in the planning or operational stages, UMTA has identified 20 that are directly derivative from the Haddonfield project.

UMTA's Office of Technology Development and Deployment is supporting an UMTA-sponsored demonstration of integrated dial-a-ride fixed route service in Rochester, New York by managing the development of computer software for scheduling and dispatching dial-a-ride vehicles. During FY 1977, that computer system will be completed, and the computer software documented for use by transit agencies and private enterprise.

Research and development on dial-a-ride will focus on the integration of dial-a-ride services with conventional fixed-route services in areawide transit systems. Dial-a-ride can serve as a feeder to conventional services in low density suburbs and provide better, more economical service during off-peak hours by replacing lightly used fixed-route service in low density areas.

Areawide Demand Responsive Transit will develop planning models, economic data, computer scheduling software, and automatic communications for an orderly, evolutionary upgrading of today's conventional transit systems via the integration of demand responsive service. Case studies will assist in disseminating lessons learned from locally initiated integration of demand responsive and fixed-route services; economic studies will address the effects on transit subsidies, and simulations will determine the operational tradeoffs between demand responsive and fixed-route modes. Design handbooks will be developed to assist localities in estimating demand, fleet size, costs,

and in determining the best location of demand responsive modes for areawide systems.

During FY 1977, a comprehensive system design handbook, planning guidelines and a simulation model will be developed to assist localities in starting pilot systems of up to 75 vehicles. A thorough assessment of the many small systems now operating will summarize lessons already learned. A computer control system will be developed to increase the productivity of taxis via ride-sharing. This computer will be low cost in response to taxi industry needs, and will be designed to integrate taxi services with local transit services. More comprehensive computer software integrating several paratransit and transit modes will be developed to schedule fleets of at least 75 vehicles. This software will be developed from computer programs now being used in Rochester.

Cost-benefit studies of the potential of areawide systems in providing more equitable public transportation service at today's mode split will be completed. Assessments of the potential for reducing subsidies and alleviating the adverse effects of heavy automobile usage at higher mode splits also will be carried out.

Techniques for scheduling shared-ride taxi service are being defined and developed. Considerations such as the equitable distribution of passengers to drivers distinguish taxi scheduling from public transit scheduling. Computer scheduling software will be developed, tested, and automatic vehicle monitoring technology incorporated. Computer support to improve subscription bus services will also be developed and tested.

Rochester Demonstration Computer Software Support

Projects: MA-06-0071, DC-06-0141, and DC-06-0099-02, 04, 05
Funding: $1,240,000
Schedule: September 1974 - September 1977
Contractors: Massachusetts Institute of Technology, First Data Corporation

This project provides computer software development support to UMTA's Dial-A-Ride demonstration in Rochester, New York. This work expands and enhances the Haddonfield, New Jersey demonstration software through:

1) expansion to more than one suburb with 20 vehicles;

2) transfers between suburbs and between Dial-A-Ride and fixed route vehicles;

3) differential priorities assigned to various types of customers, e.g., advanced callers, transfers, handicapped;

4) fully automated communications between the driver and computer;

5) more true-to-life modelling of customer preferences in computer scheduling decisions;

6) consideration of transferability of the software and a computer-independent system design in the choice of software language and time-sharing processing.

Reports from this project are not yet available

Transfer points between fixed-route buses and dial-a-ride systems is an important feature of the demand-responsive service in Rochester, New York.

Dial-A-Ride Systems Analyses

Project: VA-06-0024
Funding: $245,000
Schedule: June 1975 - August 1976
Contractor: MITRE Corporation

This project completed the Haddonfield, New Jersey Dial-A-Ride Demonstration surveys and adapted the operational analysis software for use in the Rochester, New York demonstration. Existing dial-a-ride systems were analyzed to provide guidelines for starting up and improving the operations of Dial-A-Ride systems. Such guidelines include planning considerations, data base gathering, and vehicle productivity improvement strategies.

Reports from this project not yet available.

Cost Benefit Studies for Areawide Demand Responsive Transportation

Projects: IT-06-0150, MA-06-0054
Funding: to be determined
Schedule: June 1976 - July 1978
Contractors: Transportation Systems Center, others to be determined

This project does cost benefit analyses on the effect of various transit and auto mixes in medium to large urban regions. The transit modes being considered include demand-responsive as well as fixed route services with the hardware innovations of computers, automatic communications, and the available variety of buses and vans. The cost analysis will include funding sources. Potential benefits include impacts on the level of service given to the public, the environment, particularly on congestion, energy, and established travel modes. The settings will vary by geographic conditions, population densities and travel patterns. The reports from these studies will assess whether better service at lower cost can be achieved through optimum mixing of demand-responsive and fixed route transit for urban areas and their suburbs.

Reports from this project are not yet available

Chapter 2:
RAIL TRANSIT

UMTA's activities in urban rail transportation research and development involve development, testing and evaluation of new vehicles, subsystems, other transit system elements, and a continuing effort to develop supporting technology and test facilities. UMTA's rail transit research and development efforts are categorized by rapid rail vehicles and systems, commuter rail vehicles and systems, light rail vehicles and systems, and rail supporting technology.

The first vehicles produced under UMTA's Urban Rapid Rail Vehicles and Systems Program were the "State-of-the-Art Cars" (SOAC). The SOAC cars, representing a baseline of what is possible with currently available technology, have demonstrated in tests their suitability for cities planning new or extended rail rapid transit systems.

At the same time, design and development of a future generation transit car, the Advanced Concept Train (ACT-1), is essentially complete. ACT-1 will be thoroughly tested and demonstrated on operating rail systems just as SOAC has been.

Under another major program element, the Advanced Subsystem Development Program (ASDP), other promising and minimum risk hardware is being developed for test and evaluation on existing railcars. The first phase of this program will involve the integration of advanced propulsion, truck and brake systems on the SOAC truck.

In the area of rail supporting technology, UMTA continues to use and expand its facilities at the Department of Transportation's Transportation Test Center at Pueblo, Colorado. A comprehensive program of research and testing is addressing key problems in existing rail systems and is evaluating the extent to which new urban railcars meet specifications. In addition to Pueblo activities, directed research is underway in tunneling, crashworthiness, noise abatement, track geometry and safety technology.

The State-of-the-Art Car (SOAC) demonstrated the latest in existing rapid rail technology.

Rapid Rail Vehicles and Systems

Rapid rail systems characteristically operate underground, at grade or on elevated guideways at speeds up to 80 mph and with station spacing ranging from ½ mile to several miles. Currently, there are nine U.S. cities that have rail rapid transit systems in operation, under construction or in final engineering: San Francisco, Chicago, Cleveland, Philadelphia, New York, Boston, Washington, Baltimore and Atlanta. These systems carry the bulk of mass transit passengers in those cities. Together with commuter railroads, rail rapid transit systems carry more than 2 billion passengers annually, or 1/3 of all mass transit riders.

There is a widespread and growing interest in upgrading and extending existing rapid rail systems and several cities are planning new systems. Replacing old equipment or acquiring new rolling stock offers opportunities to apply advanced technology in their production. Through grants and contracts, UMTA is designing, developing and demonstrating the best rail transit cars that current technology can provide, and ultimately will produce advanced transit cars using innovative concepts. Design and hardware specifications for these new cars will be made available to the cities for use in replacing old or acquiring additional rolling stock.

By providing railcar builders and transit operators with tested and proven prototypes, UMTA will make available to our ultimate customers, the riders, more comfortable and more esthetically pleasing cars to complement new routes and service now being planned. Operators will benefit by having more efficient and economical equipment; suppliers will benefit by being able to produce reliable equipment at a profit, and the community will benefit from advanced, pollution-free, environmentally acceptable transportation.

The practical experience gained from the UMTA-sponsored Prototype Car Program for the San Francisco Bay Area Rapid Transit

The Advanced Concept Train (ACT-1) is being developed as a baseline vehicle for future rapid rail cars.

system (BART) is proving to be valuable for every transit property purchasing new vehicles. Ten prototype cars built by the Rohr Corporation were engineered, manufactured, tested and evaluated under a joint UMTA/BART program. Demonstration and monitoring of these cars suggested improvements for the BART revenue service fleet and generated data for development of UMTA's SOAC cars and Advanced Concept Train.

UMTA is using the services of Boeing-Vertol, a systems manager contractor, to develop the advanced rapid transit cars. Two SOAC cars built by the St. Louis Car Division of General Steel Industries, incorporating the best existing technology (with BART as a baseline), completed extensive demonstrations in New York, Boston, Cleveland, Chicago and Philadelphia. SOAC featured a DC chopper control propulsion system by Garrett AiResearch, new air ride trucks, and innovative styling by Sundberg-Ferar for high density urban and medium density suburban service. SOAC began revenue service operation in September 1976 on PATCO's Lindenwold High Speed Line in the Philadelphia region.

Other advanced propulsion systems also are being developed and tested as part of the rapid rail research and development program. In one UMTA project, the Garrett Energy Storage Propulsion System is being tested on two New York Metropolitan Transportation Authority rapid transit cars. Under this concept, braking energy usually dissipated as heat is stored in onboard flywheels. During acceleration, the flywheel-stored energy is used to help accelerate the car, thereby reducing peak power requirements. This project is expected to reduce propulsion energy requirements by perhaps 20 - 30 percent while also reducing the waste heat released in subway tunnels. Thus, additional power requirements imposed by air conditioning and the need for faster, more frequent trains will be able to be met by present power supply systems. In addition, the Energy Storage System can propel a car to the next station in the event of a power failure and passengers can be unloaded safely in emergencies.

The Advanced Concept Train (ACT-1) is being produced by Garrett AiResearch Corporation. The ACT vehicles represent the next generation of rapid transit cars and their test and evaluation on operating transit systems will lead to the upgrading and replacement of existing obsolete rail vehicles. The ACT, which will be capable of operating over the same transit lines as the SOAC cars, was derived from a unique industry-wide design and specification development competition.

Urban Rapid Rail Vehicles and Systems Program
Project: IT-06-0026
Funding: $27,000,000
Schedule: June 1971 - June 1977
Contractor: Boeing-Vertol Company
Subcontractors: St. Louis Car Division of General Steel, Garrett AiResearch (SOAC, ACT-1)

Ten prototype cars for San Francisco's Bay Area Rapid Transit (BART) were engineered, produced, tested and evaluated; these were the

ADVANCED SUBSYSTEM DEVELOPMENT PROGRAM SYNCHRONOUS BRAKE SYSTEM

EFFECT OF SLIP-SLIDE EFFICIENCY ON STOPPING DISTANCE

SLIP-SLIDE EFFICIENCY	STOPPING DISTANCE FROM 60 MPH
100%	1,500 FT
95% ASDP SPEC	1,580 FT
70% TYPICAL	2,150 FT
40%, LOCKED WHEELS	3,760 FT

AVAILABLE ADHESION, μ = 0.08

basis for subsequent production of BART cars. Boeing-Vertol Company, the systems manager, reviewed the demonstration and monitored the progress of the BART prototype cars in early revenue service and recommended methods for incorporating improvements appropriate to the development of State-of-the-Art and Advanced Concept Train Cars.

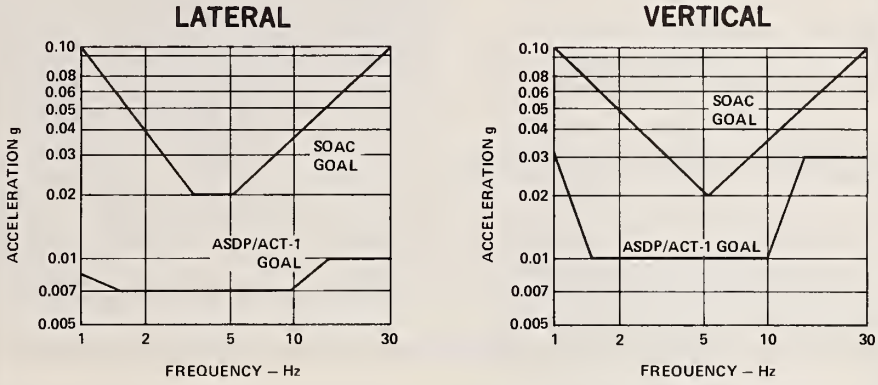
Two new State-of-the-Art Cars (SOAC) were built, incorporating the best in existing technology, and tested in New York, Boston, Cleveland, Chicago and Philadelphia. Passenger convenience and operating efficiency were the primary goals set for these cars. Boeing-Vertol conducted technical tests and directed their operational demonstration in the five cities. The SOAC's operated in 20,000 miles of revenue service and carried 312,500 passengers. An extended revenue service operation of SOAC on PATCO's Lindenwold High Speed Line in the Philadelphia area will begin in late 1976.

As a long-range goal, an Advanced Concept Train (ACT) is being developed as a baseline vehicle for future rapid rail cars. Many of the features incorporated in the ACT will upgrade and replace existing obsolete rail vehicle equipment. The operation and evaluation of the ACT vehicles on transit properties will demonstrate its improved performance and design.

The ACT cars, capable of operating over the same transit lines as the SOAC cars, are being built under the direction of Boeing-Vertol. A design and specification development competition for alternate concepts representative of the next generation of rapid rail cars was the basis for selecting the Garrett design.

Features of the ACT train include a new lightweight, easy-maintenance monomotor truck using automotive concepts such as split axles, bolt-on ring-damped wheels, and copper disc brakes; an advanced flywheel energy storage propulsion system, eliminating major high-power electronics; all major auxiliaries driven from the flywheel, eliminating many electric motors; an air cycle air conditioning system; an aluminum frame with composite panel carbody for easy manufacturability; an energy-absorbing system for low-speed impact control; modular interiors for demand-tailored applications; and reduced life cycle cost of ownership and operation.

SOAC AND ASDP/ACT-1 RIDE QUALITY GOALS



The assembly of the first of two vehicles is scheduled for completion by December 1976, at which time the vehicle will be shipped to the Transportation Test Center (TTC) for extensive testing and evaluation. The second vehicle will be delivered in March 1977 and after TTC testing of both vehicles, a five city demonstration is planned.

Concurrent with the development of the Advanced Concept Train is the Advanced Subsystems Development Program (ASDP), under which a number of promising subsystems designed for near-term applicability either to existing or planned rapid transit vehicles are being developed. The objective of this program is to develop subsystems that are responsive to the needs and desires of the transit industry and that have the capability of being retrofitted into existing vehicles or incorporated into a new car with minimal risk. UMTA has initiated work on an AC propulsion system, a monomotor truck and a synchronous brake system to be fitted onto the SOAC cars for testing and demonstration.

The AC propulsion system is being developed by the Delco Division of General Motors Corporation. It features liquid-cooled brushless "squirrel cage" motors and solid state control. The system holds the promise of cost savings through reduced maintenance compared to DC systems, and through regenerative energy capability wherein braking energy is returned to the third rail. The monomotor truck is being developed by the Budd Company. It features a lightweight steel design with a unique suspension design, resulting in ride quality equal to the ACT-1 vehicle.

A synchronous brake system will complete the ASDP package to be installed on SOAC. The new brake system will sense wheel spins and slides virtually as they occur and will apply the proper force to correct these conditions more rapidly than do present systems. The result will be an increased stopping capability and more consistent stopping distances for rail transit cars. In addition, a split disc configuration will result in improved maintainability.

In the future, ASDP work will extend to subsystems installed on various transit cars in service. These subsystems may include inverter propulsion, multiplex train lines, solid state auxiliary power, etc. In all cases, an experimental design will be implemented to assure proper comparison among various subsystems. Thus, for example, data on many current generation propulsion systems will be available from a single source.

Reports from this project are listed in Appendix I

Stored Energy (flywheel) Propulsion for Rapid Rail Cars

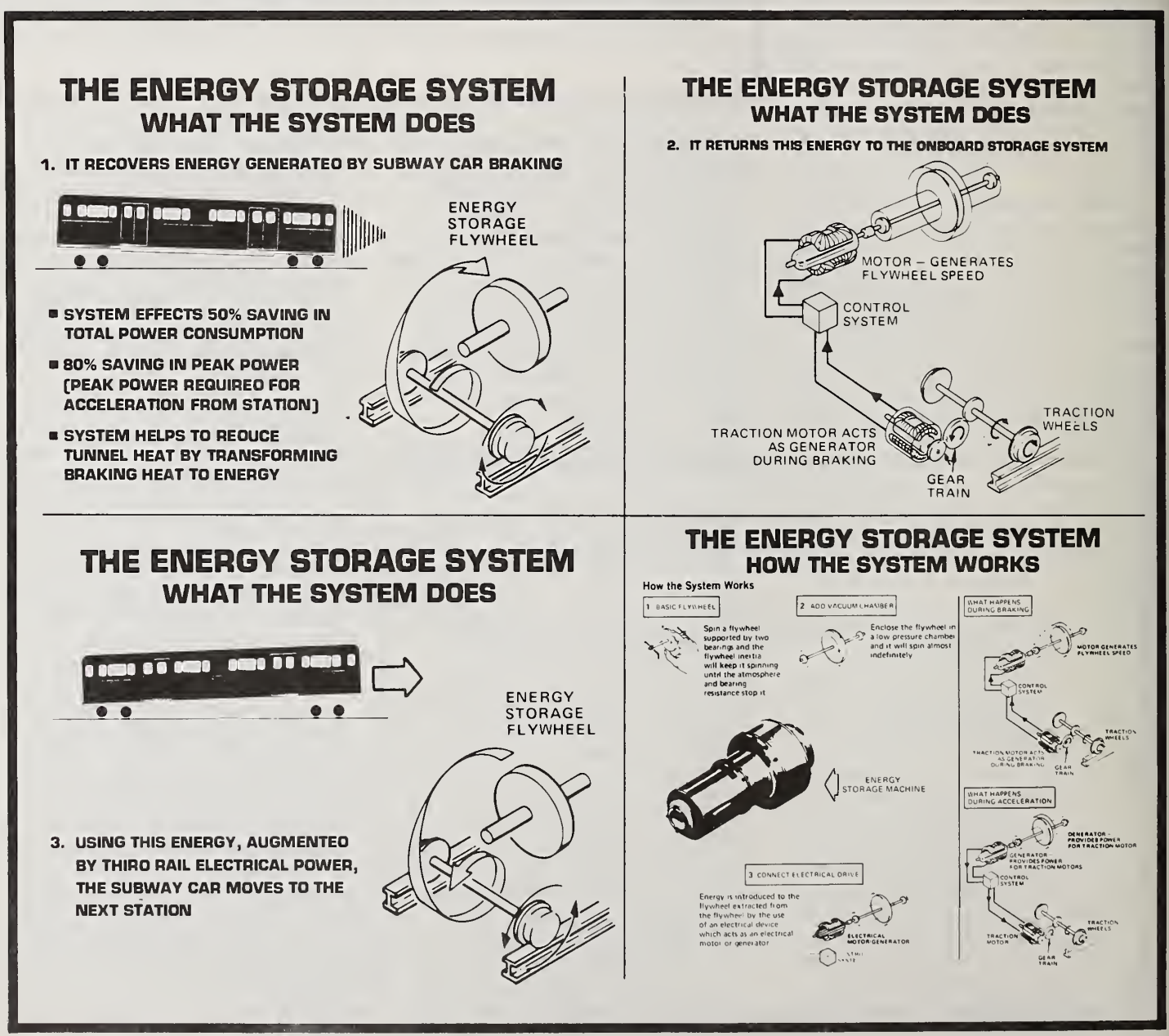
Project: NY-06-0006
Funding: $1,264,000
Schedule: June 1971 - October 1976
Contractor: New York City Metropolitan Transportation Authority
Subcontractor: Garrett AiResearch Corporation

While flywheel technology is not new, it has never before been applied to the rapid transit operating environment. It has, however, the potential for significantly reducing power consumption, costs and the amount of heat released in subway tunnels during the braking cycle.

The energy storage system works as follows: During the braking process, energy normally dissipated as heat through the resistor grids will spin-up the flywheels through a motor/generator. During acceleration, the spinning flywheels will be used to produce electricity through the motor/generator to assist in driving the traction motors. The result is a reduction in peak power demand from the third rail during acceleration and less wasted heat during braking. A DC chopper system, first developed for UMTA's State-of-the-Art Car, is the heart of the solid state control system.

One of the most significant benefits of the project will be improved safety. In the event of a power failure, a train will ordinarily stop and the passengers have to walk along the tracks to the nearest station. Using the stored energy principle, the train will be able to travel to the station even after electrical power has been interrupted. Thus, passengers will be spared this potential hazard.

Two conventional New York City Transit Authority R-32 cars were retrofitted with the energy storage system. The cars underwent performance and other tests at the Pueblo (Colorado) Transportation Test Center in 1974 and are being tested and evaluated for nine months on the New York City rapid transit system. A second generation energy storage system is incorporated into the ACT-1 vehicles now under construction.



The Garrett energy storage cars underwent testing on New York City Transit Authority lines during the winter of 1975-76.

SPECIFICATIONS

Energy storage units per car	2
Flywheel discs per unit	4
Diameter of flywheel	20"
RPM maximum	14,000
Disc material	9 Ni
Operating stress	64 KSI
Useable energy	3.2 Kw hours.
Energy storage unit weight (with attenuator)	4985 lbs.
Energy storage unit weight (without attenuator)	4705 lbs.
Disc weight	600 lbs.

Reports from this project are listed in Appendix I.

Railcar Standardization

Project: IT-06-0131
Funding: $86,572
Schedule: May 1976 - August 1976 (Phase I)
Contractor: International Research and Technology Corp.

Because of requirements for increasingly complex equipment, lower reliability of newly delivered cars, and the trend toward customized transit car design, it has become necessary to study the potential benefits of railcar standardization. The small volume of typical car procurements and increasingly stringent contractual terms and conditions have also contributed to higher car prices.

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

The street railway industry first approached the problem of standardization during the development of the PCC car in the 1930s. Variations in size, door placement, etc., were accommodated in a standard design which resulted in thousands of such vehicles operating on many systems in the U.S. and Canada. Worldwide, many more thousands of PCC car descendents continue to be manufactured and operate in daily service.

UMTA first approached the problems of standardization when, in cooperation with the rail transit operators, it developed the *Guideline Specification for Urban Railcars* (Report No. UMTA-IT-06-0027-73-1). The *Guideline* represents an attempt to standardize the manner in which new car procurements are described by providing a common format in which to specify technical requirements.

A two-phase project has been developed with the first phase objective of determining the feasibility of standardization. Assuming some degree of standardization is found to be feasible, a second phase will produce a specification document for use in future railcar procurements. As associated contract with the American Public Transit Association will assist the contractor in providing necessary operating industry data during the study and specification development process.

Reports from this project are listed in Appendix I

Commuter Rail Vehicles and Systems

Commuter rail systems operate generally on railroad rights-of-way with railroad equipment in service extending as far as 100 miles from city centers. Commuter rail service presently exists in the New York-New Jersey metropolitan area, Philadelphia, Boston, Chicago, Cleveland, Detroit, Pittsburgh, Washington and San Francisco.

In the commuter rail area, UMTA has concentrated its efforts on the development of a new vehicle and propulsion system suitable for operation on combinations of electrified and non-electrified trackage. This vehicle, the Gas Turbine Electric or GT/E, is described on the following pages. UMTA also directed a feasibility study of restructuring and expanding commuter rail service in the Washington, D.C. metropolitan area.

Dual-Power Gas Turbine/Electric Commuter Rail Cars

Project: NY-06-0005
Funding: $7,400,000 UMTA; $7,400,000 local
Schedule: June 1971 - November 1977
Contractor: New York Metropolitan Transportation Authority
Subcontractor: Garrett AiResearch Corporation; General Electric Corporation

This project is an outgrowth of UMTA's previous work under Project IT-06-0015 (page 97 of RD&D Projects, 1972). Under a grant to the Tri-State Transportation Commission, a Budd long-distance coach was equipped first as a turbine/mechanical lab car (GT-1) and then as a turbine/electric lab car (GT-2). Once feasibility was determined, the next step was the development, test

The General Electric Gas Turbine/Electric prototype car is equipped with a slide-out turbine engine for easy maintenance.

and evaluation of revenue service gas turbine/electric (GT/E) cars.

In order to accomplish the project objective, two 4-car gas turbine/electric trains were constructed, one by Garrett AiResearch and the other by General Electric, under contract to the New York MTA. The MTA and its consultants are implementing an UMTA-developed experimental design to measure comparative performance and economics of the Garrett and GE designs, and of both types of turbine cars with diesel and electric equipment. A cost/benefit analysis will indicate under what conditions either GT/E or electrification is justified; rider reaction will be assessed regarding the comfort of the cars.

Reports from this project are not yet available

Light Rail Vehicles and Systems

Light rail transit (LRT) is defined as modern rail vehicles operating on predominantly reserved but not necessarily grade-separated rights-of-way. Electrically propelled rail vehicles operate singly or in trains. LRT provides a wide range of passenger capacities and performance levels at moderate cost. In some European cities, light rail is introduced as "pre-metro" for future upgrading to standard rapid transit. Light rail transit may be considered as an outgrowth of street railway technology.

The light rail area presents a particular challenge to UMTA and the transit industry. There had been no new development in U.S. light rail technology since the Presidents' Conference Committee (PCC) car was introduced in 1935 and no production of PCC vehicles since 1952. Existing streetcar fleets, therefore, are economically and physically obsolete.

Several light rail properties are committed to retaining and modernizing their systems, and the need for a replacement vehicle is of paramount importance. Because of the limited size of the market, it is to the operators', manufacturers' and UMTA's advantage to produce as nearly standard a vehicle as possible while simultaneously using technological advances that have been made elsewhere.

The Massachusetts Bay Transportation Authority (MBTA), working with the San Francisco Municipal Railway, the Southeastern Pennsylvania Transportation Authority and other U.S. and Canadian transit authorities, developed a standard specification for new light rail vehicles under UMTA funding. As a result, some 275 new Standard Light Rail Vehicles (SLRV's) are now in production for Boston MBTA and San Francisco MUNI. The *Standard Light Rail Vehicle Specification* may be ordered from NTIS, PB-220-748 (technical section) and PB-220-747 (contract section).

UMTA also sponsored research into the generic concept of light rail and issued a report entitled *Light*

The new Standard Light Rail Vehicle, the first new light rail car produced since 1952, went into service on the Massachusetts Bay Transportation Authority lines in December 1976.

Rail Transit Systems, A Definition and Evaluation, available from NTIS, PB-213-447.

Two light rail projects are under development in addition to those already mentioned. One is intended to develop a device to allow elderly and handicapped persons to board the SLRV more easily. The other is designed to test and evaluate the SLRV in four cities contemplating replacement of PCC cars: Philadelphia, Pittsburgh, Newark and Cleveland.

Urban Rail Supporting Technology

The Urban Rail Supporting Technology (URST) program is directed toward systematic study and advancement of urban rail technology. Transit properties, UMTA and the U.S. Department of Transportation's Transportation Systems Center (TSC) in Cambridge, Massachusetts have identified primary system and technology objectives; new and existing technology and methods are being evaluated and noteworthy items are recommended to UMTA for proof of concept.

TSC is the systems manager for the URST program; other agencies involved are the Federal Railroad Administration and the Federal Highway Administration. The URST program, initiated in 1970, is organized into five major project areas:

Program Management provides overall program plans and engineering direction, establishes resource requirements and test and demonstration schedules, identifies industry interfaces, assesses accomplishments, recommends implementation and reports results.

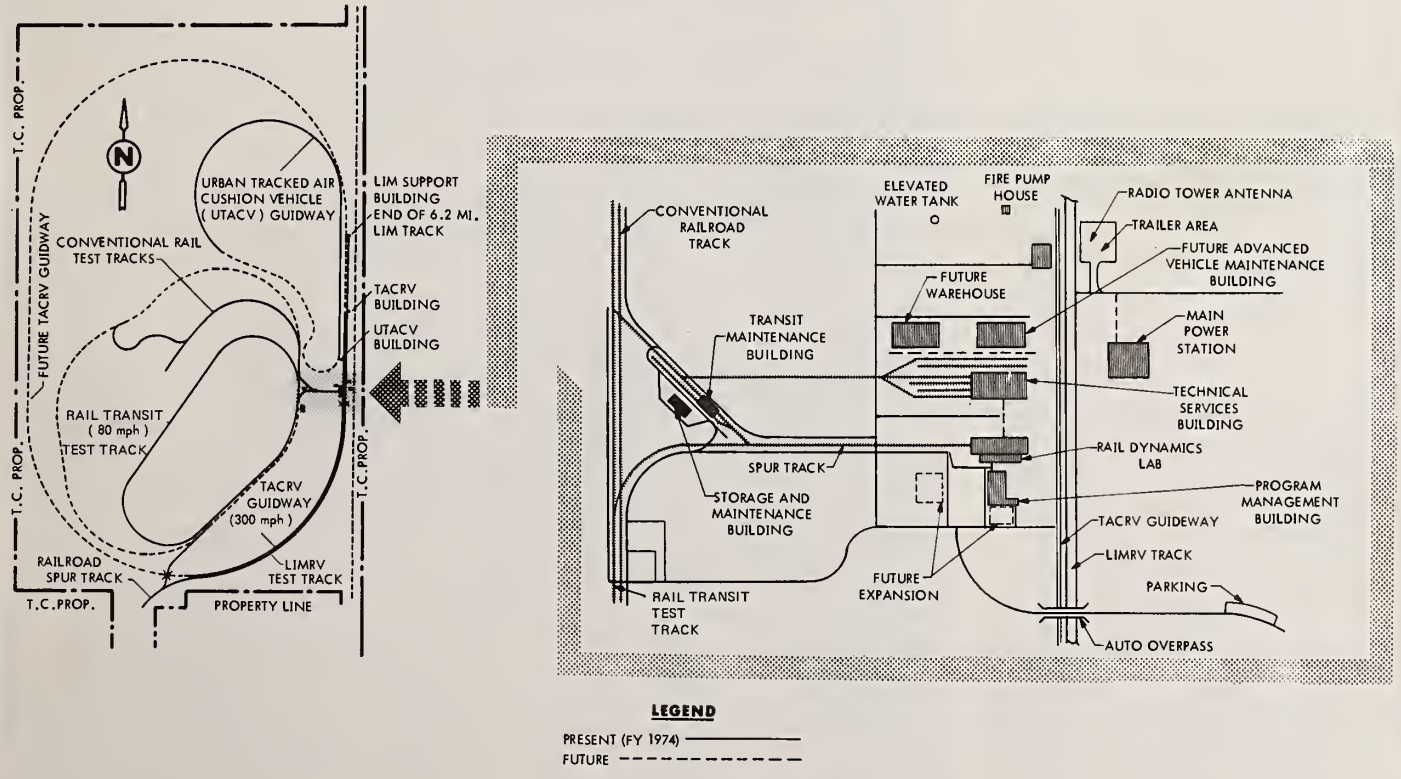
Applications Engineering and Technical Support provides technical support to UMTA, provides assistance to UMTA for other program activities, and provides interface with industry to apply research and development results.

The main thrust of the applications engineering and technical support activity is to provide overall technical support for UMTA rail programs and to propose and coordinate the development of selected technology, equipment, specifications and procedures for industry-wide application. Close coordination is maintained with the American Public Transit Association, and various industry ad-hoc committees, in order to identify the needs of individual transit operators and coordinate R&D implementation plans for industry-wide application.

Facilities Development provides technical support for the design, construction and operation of facilities and equipment needed to conduct a comprehensive program of

DEPARTMENT OF TRANSPORTATION

PUEBLO, COLORADO



TRANSPORTATION TEST CENTER

test and evaluation of urban rail cars and car systems, track structures and structural components, power systems, and signal systems for train operation and control.

UMTA's test facilities are located at the U.S. Department of Transportation's Transportation Test Center (TTC), located about 25 miles northeast of Pueblo, Colorado. The 5-½ by 9-mile TTC site is DOT's test center for all ground transportation systems.

The formal mission of TTC, managed by the Federal Railroad Administration, is to operate and administer an intermodal center for comprehensive testing, evaluation and associated development of ground transportation systems and their components by DOT organizations, other government agencies and related elements of the private sector.

The urban rail test facilities at the TTC consist of a 9.1 mile oval electrified Rail Transit Test Track, the power system for energizing that track, repair, maintenance and support facilities.

The Rail Transit Test Track is designed for the test and evaluation of urban rail vehicles—light, rapid and commuter rail.

A secondary purpose of the track is the development, test and evaluation of the state-of-the-art and advanced track structures.

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

There also is a Rail Dynamics Laboratory (RDL), designed to simulate rail dynamics for rail vehicles. The primary purpose of the RDL Component/Vehicle Preliminary Evaluation System (C/VPES) is the study of periodic and random excitation of rail vehicles.

Test and Evaluation provides plans and conducts system testing and operational evaluations; establishes test objectives, constraints, criteria and procedures; provides measurement instrumentation and data acquisition and processing equipment; and prepares final reports and recommendations.

The objective of the urban rail test and evaluation activity is to collect and disseminate data that can be used by the manufacturers, transit system operators and municipal governments, in addition to meeting UMTA's needs for data. To date, the test and evaluation effort has emphasized vehicle testing. The first tests carried out at Pueblo were in 1971, using two New York City Transit Authority R-42 vehicles. These early tests formed a data base for development of test procedures, instrumentation specifications and facilities requirements.

In 1972, TSC published a document, *General Vehicle Test Plans for Urban Rapid Transit Cars,* which provided a consistent specification for evaluative tests that have been carried out at Pueblo on the State-of-the-Art Cars, the Energy Storage Cars and the Standard Light Rail Vehicles.

The rail transit test track provides an ideal facility for putting a great number of miles on new vehicles to evaluate system reliability and to get through the "infant" mortality stage. The track also has been used occasionally by non-urban rail systems during off-hours to test such vehicles as the Canadian Government's Light Rapid Comfortable Train and Amtrak's new Amfleet cars.

Technology Development provides research, development and evaluative testing directed toward the introduction of improved technology in urban rail system applications. Current major technology efforts include noise abatement, tunneling, safety and reliability.

Noise Abatement

The noise abatement technology efforts are distinguishable in three distinct disciplines: Assessment of existing conditions, in-service test and evaluation of existing technologies, and the development of new technologies.

In 1972, TSC began a pilot noise assessment study of the Massachusetts Bay Transit Authority rapid transit lines, deriving noise level data along the wayside, in stations and in the transit cars. Known costs and effectiveness of available noise control treatments were used to estimate cost to attain each of several quieter noise levels.

In FY 1975, TSC developed the basic plan and requirements for tests of the most promising commercially available treatments to control wheel-rail noise at the source. The specific treatments to be tested on the Southeastern Pennsylvania Transit Authority's Market-Frankford Line include resilient wheels, damped wheels, wheel truing and rail grinding.

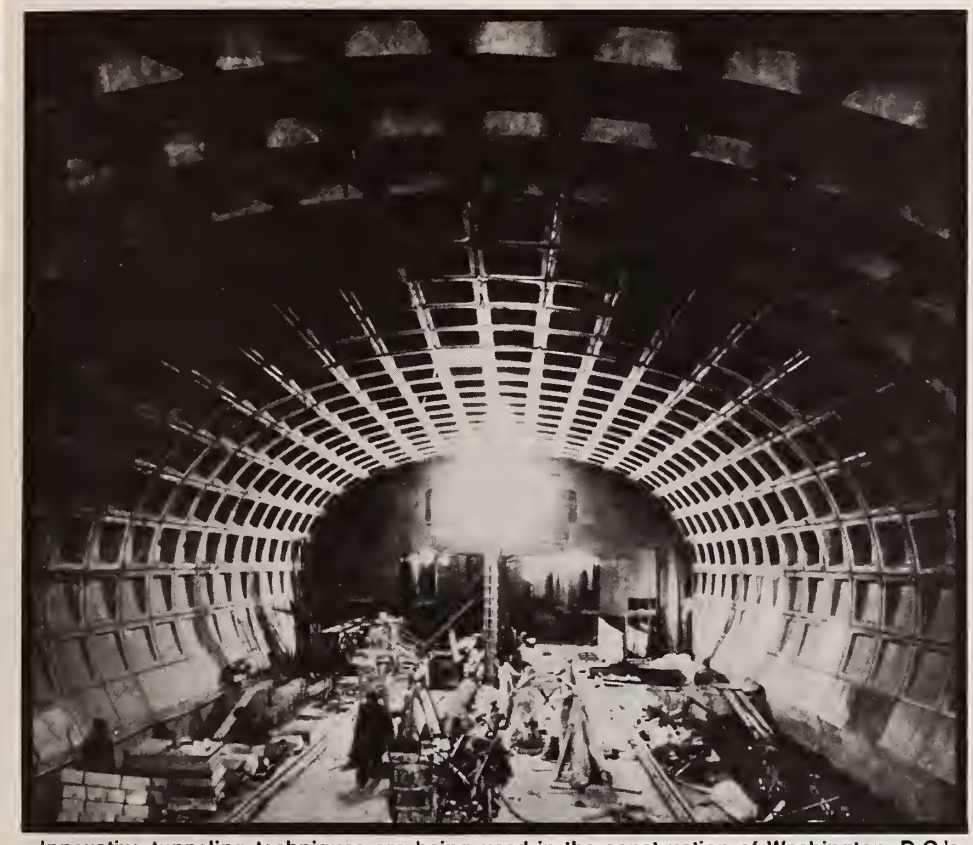
Contracted research with Bolt Beranek and Newman, Inc., has led to improved understanding of wheel-rail noise generation mechanisms for screech, impact and rolling noise. A remaining activity under this contract was the testing of experimental wheels made from Incramute, a new high-strength metal alloy with high internal damping. The next phase of this work will be development and testing of innovative treatments for reduction of wheel rail noise.

The vibration and noise radiation from urban rail transit elevated structures has been cast in a coherent analytic framework under contracted work performed by Cambridge Collaborative, Inc. The next phase of this work anticipates use of the theory of elevated structure noise together with the considerable data that has been gathered in experiments by other countries to develop practical design guidelines appropriate to U.S. systems. Of primary significance in the immediate future are the APTA working sessions with the Noise-Abatement Advisory Board.

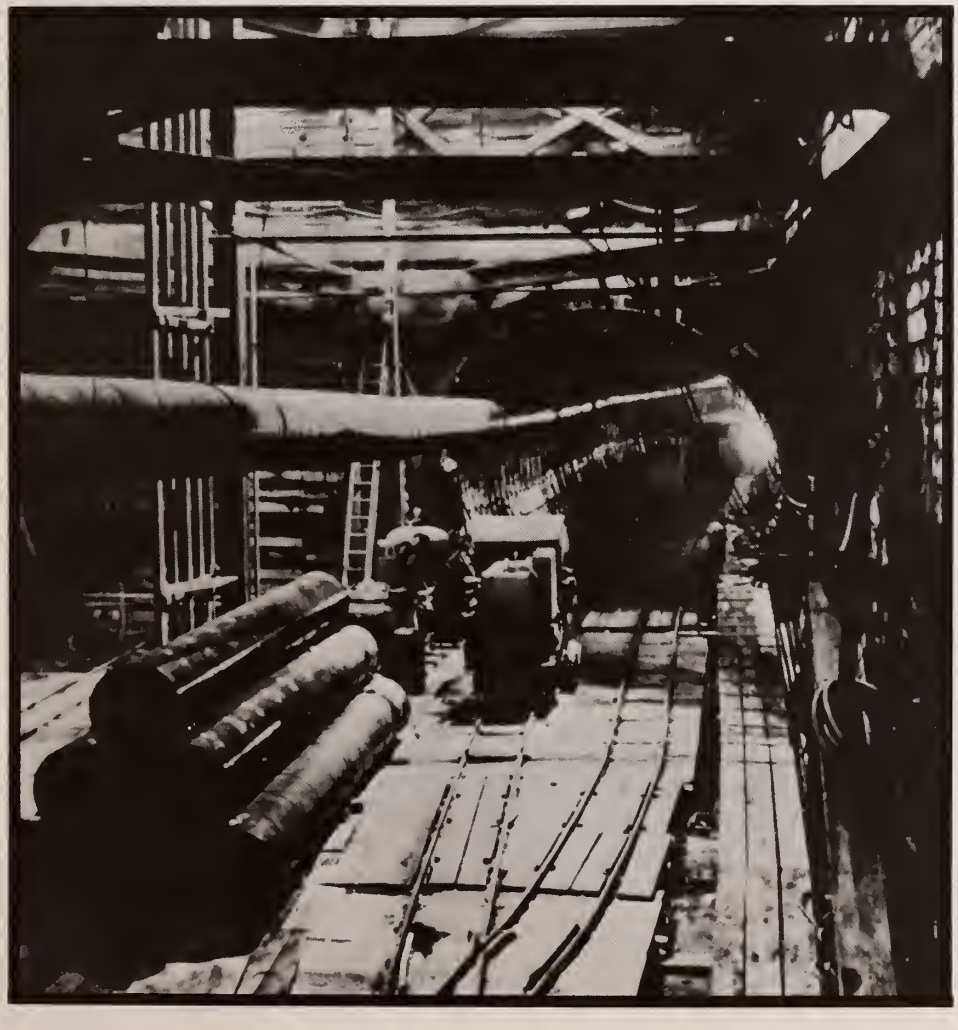
Tunneling. The UMTA tunneling program is conducted in support of the U.S. Department of Transportation Tunneling Program Plan. This departmental program plan is a 10-year effort initiated in FY 1973 to reduce the costs of urban underground construction by 30 percent, to accelerate the rate of construction by 100 to 200 percent, to educate planners in advantages of proper use of tunnels, and to optimize the use of tunnels in urban transportation systems.

Within the departmental tunneling program, UMTA has the responsibility for sponsoring research in the following categories: Interactions with Society, Materials Handling, Maintenance, Ground Control, and Modal Problems.

Interactions with Society includes projects to develop guidelines for selecting of cost effective insurance programs for construction of urban



Innovative tunneling techniques are being used in the construction of Washington, D.C.'s new rapid rail system.



subway systems, to study improved construction management procedures for urban underground transportation systems, to identify the disruptive effects of underground construction and the existing means of measuring the effects, to develop guidelines for safety and environmental impact as they relate to subway construction, and to improve methods of estimating underground construction costs based on historical data and site conditions.

Materials Handling involves activities to conduct a field test program of a pneumatic muck transport pipeline system, to improve the cost performance analysis of a hydraulic pipeline and an extensible component tunnel muck transportation system, and to identify current and potential uses of excavated material (muck) from tunnels to provide both economic and environmental benefits.

The Maintenance activity is directed at an in-depth study to determine methods for detection of deterioration, methods for evaluating or measuring the degree of deterioration, and methods for repairing and improving the quality of existing tunnel systems.

Ground Control activities include a study to devise, fabricate and test circular joint configurations and sealants for future use in soft ground transportation tunnels, and the design of a precast concrete tunnel liner to be used in a test section in the Baltimore Region Rapid Transit System.

Modal Problem activities are directed to those areas of major concern to the transit mode of transportation and include a study to assess the relative values of the alternate techniques of subway station construction and to establish a set of conditions under which each method becomes cost effective.

Implementation of tunneling R&D results is currently underway with muck utilization and precast concrete liners demonstration projects in the Baltimore Region Rapid Transit System. A Muck Utilization Coordination Committee, comprised of various state and local agencies, was formed in Baltimore to develop muck utilization alternatives. Development activities of the precast concrete tunnel liner demonstration included the design of the precast concrete liner and the prep-

aration of an evaluation program for the lining system performance. This test section will be the first use of precast concrete lining in a U.S. transit tunnel.

Safety and Reliability

To provide both passengers and crews with increased safety and reliability, the URST Program is conducting research, development and demonstration efforts directed toward achievement of lighter, safer, more reliable and economical rail vehicles. Current efforts include collision avoidance, improved vehicle crashworthiness, improved material characteristics, and reliability data bank.

Both to avoid accidents and to minimize their effect, should they occur, a number of areas of investigations are being pursued. Among them is the potential for using surface electromagnetic wave (SEW) propagation along the rails to detect obstacles in order to avoid derailment. Also, train collision mechanics are being studied to gain insight into the mechanism of railcar motion during impact.

Vehicle crashworthiness is a major area of activity and is directed both at existing and future vehicles. During FY 1974, Calspan Corporation assessed the crashworthiness of existing urban rail vehicle types. Simultaneously, Boeing Vertol Company evaluated the State-of-the-Art Cars for crashworthiness. Recently, the Illinois Institute of Technology Research Institute (IITRI) has undertaken the development of mechanisms for increased rail transit vehicles' crashworthiness in head-on collisions. Complementary efforts are being sponsored by the Federal Railroad Administration. The results generated by these programs will provide the foundation for guidelines to evaluate new railcar designing as well as for the retrofitting of existing cars.

The demand for increased safety is being addressed through an effort that will examine the flammability, smoke and toxic gas emission properties of materials currently available. Particular attention will be given to a study of insulation materials which could be used for signal wire and power cables in vehicles and in wayside installations.

Environmental control in underground rapid transit systems

Project: DC-06-0010
Funding: $3,796,414
Schedule: June 1970 - July 1976
Contractor: Transit Development Corporation
Subcontractors: Developmental Sciences, Inc.; Parsons, Brinkerhoff, Quade and Douglas; DeLeuw, Cather & Company; Henry J. Kaiser Engineers; California Institute of Technology/Jet Propulsion Laboratory

This project was designed to develop a methodology for subway environmental design. Since the first subway systems were built at the turn of the century, "guesstimation" has been the principal ingredient of subway environmental criteria, analysis and control. Although ventilation shafts, including surface property, and station air conditioning represent 8 - 10 percent of the total cost of underground subway construction, there has always been uncertainty in the size, configuration and spacing of vent shafts, plus many unknowns about the interaction between vent shafts and other elements of the total underground environmental systems such as air flow, heat dissipation and requirements for station air conditioning.

This project produced an engineering handbook and a computer program to provide subway system planners, designers and operators with methods for determining answers to complex and interrelated problems of environmental conditions such as temperature, humidity and air movement in subways as related to operating practices. Twelve rapid transit properties in the U.S. and Canada, through the Transit Development Corporation, formulated a detailed 4 - 1/2 year research program to produce the handbook.

The design tools developed in the course of the project received immediate acceptance, and have been used by existing transit systems —including those in New York, Baltimore, Chicago, Washington, D.C.; Atlanta, Montreal, Caracas and Hong Kong.

Reports from this project are listed in Appendix I.

Chapter 3:
NEW SYSTEMS AND AUTOMATION

During the second half of the 20th Century, research and development in several fields (notably space and weaponry) has applied highly advanced technology to operational systems. It has only been a few years, however—less than a decade—that high technology has been recognized as a potential solution for many of the mobility problems in urban areas. UMTA's research and development program has identified several new, unconventional transit systems which promise to provide improved solutions to many urban transportation problems.

The object of the New Systems and Automation Program is to provide a framework for the logical development, test and demonstration of new transit concepts. The resulting system technologies are suitable for urban deployment through the Automated Guideway Transit Applications Program described below.

The major activities in the New Systems and Automation Program are divided into two areas: 1) Automated guideway transit; and 2) Accelerating walkways.

In 1976, UMTA authorized several U.S. cities to proceed with plans to develop Downtown People Mover (DPM) systems.

Automated Guideway Transit (AGT)

The current dominant means of public transportation are transit buses and rapid rail systems. The development of computer and automation technology, particulary in the last decade, however, has led to the formulation of new automated public transportation concepts, such as Shuttle Loop Transit (SLT), Personal Rapid Transit (PRT) and Group Rapid Transit (GRT), which offer the potential of significantly better service than that from existing urban public transportation modes. All of these concepts include the use of vehicles capable of automatic operations on separate roads or guideways and may be classified as automated guideway transit (AGT) systems.

Characteristics of these three classes of transit are:

SHUTTLE LOOP TRANSIT
- Large vehicles—mostly standees
- Little or no switching
- Relatively short guideways
- Long headways—1 minute or more

GROUP RAPID TRANSIT
- Medium sized vehicles—12 to 70 passengers
- Switching to shorten en-route delays
- Scheduled or limited nonstop origin-to-destination trips
- On-line and off-line stations
- Intermediate headways—3 to 60 seconds

PERSONAL RAPID TRANSIT
- Small vehicles—2 to 6 seated passengers
- Nonstop origin-to-destination demand-responsive service
- Off-line stations
- Short headways—0.2 to 3 seconds

A fourth category, Dual Mode Transit (DMT), features SLT-, GRT- or PRT-sized vehicles that are capable of manual operation on conventional city streets and highways as well as automatic guideway operation.

A number of important automated guideway transit system develop-

ments are indicated in Figure 1. The Westinghouse Transit Expressway was the first UMTA-sponsored automated rubber-tired vehicle development and was designed primarily to provide line-haul service. The Transit Expressway concept has since been applied at the Tampa and Seattle-Tacoma airports and was followed by the Dallas-Fort Worth Airport, Morgantown, West Virginia, TRANSPO 72 and Advanced GRT system developments.

Automated guideway transit systems will improve urban transit in two significant areas: service and operating costs. Service can be improved by reducing total trip time. Automated guideway transit systems reduce trip time by operating on exclusive running surfaces or guideways to avoid traffic congestion and by using off-line stations, small vehicles and sophisticated automation techniques to reduce or eliminate intermediate stops and transfers. Wider guideway deployment, coupled with less expensive stations relatively close to the majority of trip origins and destinations, will result in improved levels of access compared with rapid rail systems and further reductions in trip time.

Reductions in operating costs are achieved through automation and careful design to assure that the savings achieved through automation are not lost as a result of high maintenance costs.

Automated guideway transit systems, like other exclusive guideway urban transportation systems, are characterized by high capital cost; the most expensive components of such systems are the guideway and station structures. The cost of vehicles and command and control generally is a small percentage of the total sytem cost. By using small vehicles on light guideway structures, AGT may realize significant economies in guideway and station cost compared with rapid rail. Because of the cost of urban installation, the development of less expensive, readily deployed unobtrusive guideway and station structures for AGT is an important objective.

Two important areas where improvements in AGT performance can be achieved are passenger-carrying capacity and capital cost. Capacity is defined as the number of passengers a system can move past a fixed point per unit time per lane of guideway. The capacity is proportional to the size of the AGT vehicles (number of seats) and inversely proportional to the minimum spacing in time (seconds) between the passage of separate vehicles on the same lane. The temporal spacing is usually called the headway.

Figure 1

AUTOMATED VEHICLE SYSTEM DEVELOPMENTS

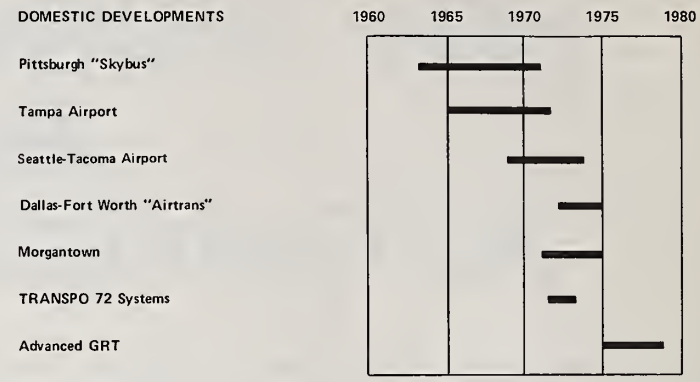
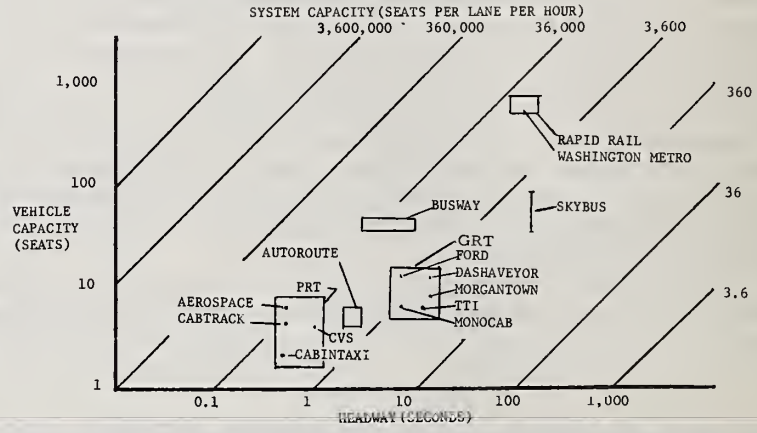


Figure 2

Vehicle capacity versus operating headway



The capacities and headways of a variety of transportation systems are summarized in Figure 2. Current operational AGT systems achieve relatively modest capacities (3,000 - 5,000 seats per lane per hour) as a result of small vehicle size (six - 12 seats) and relatively long headways (eight - 18 seconds). While such lane capacities can effectively meet transportation demand in limited configurations, greater capacities are required for more extensive networks in urban areas.

Improved capacity also would assure that AGT systems would realize their potential cost-effectiveness advantages. High capacities permit more revenue passengers to use the expensive guideways and stations, thus increasing return on investment.

The major AGT technology development activities are 1) the Advanced GRT system development program; 2) the Automated Guideway Transit Technology program; and 3) the AGT Applications program.

Advanced Group Rapid Transit System

Project: CA-06-0094, PA-06-0036, CO-06-0008
Funding: $5,400,000
Schedule: 1975 - 1979
Contractors: Boeing Aerospace Company, Otis Elevator Company and Rohr Industries

The goal of the Advanced Group Rapid Transit (GRT) program is the development of an advanced, automated guideway transit system capable of a peak-line capacity of

14,000 seated passengers per lane per hour, using 12-passenger vehicles operating at 3-second minimum headways. Phase I, the concept definition phase, was completed in August 1975; this phase was a design competition under which three contractors produced preliminary designs of their proposed GRT concepts. Specifications for system simulations were also developed under the urban deployability studies element of the program.

Phase IIA, initiated in June 1976, continued the design competition and will include further development of the proposed designs, laboratory evaluation and experimental verification of selected critical subsystems. Phase IIA also includes simulations of the central and local control systems. At the conclusion of Phase IIA, the best system will be selected for implementation in a test track configuration at the DOT Transportation Test Center at Pueblo, Colorado. The installation will include five vehicles, about two lane-miles of guideway and two stations. Fabrication, installation, integration and intensive test of the system at Pueblo will constitute Phase IIB of the program.

The system designed by Boeing uses the Morgantown design as the basic starting configuration. This technology is upgraded to meet the higher performance requirements of the Advanced GRT. The vehicle is rubber-tired and is steered along the guideway by side-mounted steering wheels which guide both the front and rear axles. The guideway is an open U-shaped structure with an overall outside width of 8 feet 8 inches. The vehicles are equipped with a radar detection system which serves as a collision avoidance system and also as a backup vehicle-wayside command control and communications system.

The Otis Elevator Company system uses a vehicle with an air-cushion suspension system and a single-sided linear induction motor (LIM) propulsion system. The LIM primary is on-board the vehicle and the LIM secondary is embedded in the center of the guideway. Here too, the guideway is an open U-shaped design with an overall external width of 7 feet. The vehicle emergency braking system uses a skid-type

Phase I design results

CHARACTERISTIC	BOEING	OTIS	ROHR
Vehicle Type	Rubber tired	Air levitated	Magnetically levitated
Guideway Type	U-shaped	U-shaped	Box-type
Headway	3 sec (brickwall)	3 sec (brickwall)	3 sec (brickwall)
Vehicle Capacity	12 (seated)	12 (seated)	12 (seated)
Guideway Width	9 feet	7 feet	4 feet
Vehicle Size	L 177 in W 80 in H 110 in	L 206 in W 99 in H 108 in	L 264 in W 88 in H 120 in
Type of Control	Quasi-Synchronous	Quasi-Synchronous	Quasi-Synchronous
Switching Type	on-board steering to side wall	on-board	on-board magnetic non-contact with mechanical backup
Maximum System Capacity	14,000 passengers per lane per hour	14,000 passengers per lane per hour	14,000 passengers per lane per hour
Propulsion	DC motor	Linear Induction Motor	Linear Induction Motor

Three companies have developed advanced group rapid transit systems under an UMTA-funded project: (l. to r.) Boeing's Morgantown PRT vehicle; Otis Elevator Company's vehicle; and Rohr Industries' suspended monorail.

brake pad which drops onto the guideway surface under emergency conditions.

The Rohr Industries system is a suspended monorail based on the Monocab design demonstrated at TRANSPO 72. The system is magnetically suspended and propelled; the magnetic force used for suspension is developed by the same linear electric motor that propels the vehicle. The overhead guideway cross-section is about 4 feet by 4 feet and has enclosed sides and top to provide protection from adverse weather conditions.

At the completion of Phase IIB, the Advanced GRT program will provide a proven design suitable for urban deployment in extended configurations. Sufficient data will be available from the test program to resolve all engineering problems; the simulations conducted under the urban deployability studies subprogram will illustrate the effectiveness of the system in a variety of network configurations and demand situations. Cost, service and reliability characteristics of the system will be extensively evaluated.

The following summary reports have been published on the Advanced GRT program:

Advanced Group Rapid Transit System Development Program, Phase I Executive Summary, Boeing Vertol Company

Advanced Group Rapid Transit System, Executive Summary, Phase I - HPPRT System Design, Rohr Industries, Inc.

Executive Summary Report (HPPRT), Otis Elevator Co.

Automated Guideway Transit Technology

Projects: CA-06-0071, CA-06-0088, CA-06-0089, CA-06-0091, DC-06-0142, MD-06-0022, MA-06-0048, VA-06-0025, VA-06-0041, DOT-TSC-1220, others to be assigned

Funding: $13,500,000

Schedule: 1974-1979

Contractors: Boeing Aerospace Corporation, California Institute of Technology Jet Propulsion Laboratory, General Motors Corporation, International Business Machines, Johns Hopkins Applied Physics Laboratory, MITRE, Mobility Systems and Equipment, others to be selected

The Automated Guideway Transit Technology Program is directed toward the development of the critical technologies that provide the foundation for the successful deployment of automated, exclusive-guideway urban transportation systems. This program is not directed toward deployment of complete deployable systems but rather toward system elements that may be used in a variety of advanced urban transportation systems.

The goal of the program is to provide information to system designers, developers and planners that will assist them in the selection of new automated guideway systems for a variety of applications and to reduce the risk involved in the development of such systems.

Previous non-system oriented activities in the new systems research and development program include development engineering and command and control studies. The Automated Guideway Transit Technology Program will expand the scope of these earlier programs and will focus on three areas; system technology, subsystem and component technology and wayside technology. At the system technology level, the major thrusts will be in the area of system simulations and operational analyses, and development of guidelines and standards. The performance of system-level operational analyses, and the determination of design guidelines and requirements will provide the technical and cost data and the analytical tools (such as computer simulations) that will permit local urban planners and governmental officials to evaluate expected technical performance characteristics and to identify and project various cost elements of a proposed automated ground transportation system.

The System Operation Studies will address a wide spectrum of different technologies ranging from large vehicle shuttles to PRT systems and to dual mode transit systems. Both single and trained vehicle configurations will be considered.

System Safety and Passenger Security Studies will be conducted and tests performed to develop and evaluate various methods of minimizing vandalism and of enhancing passenger security and safety in automated systems. Studies will also be conducted to determine design guidelines and requirements for all classes of automated systems. Particular emphasis will be placed on user and non-user impacts, and passenger safety and comfort. In addition, a study will be performed to identify the reliability requirements for critical subsystems and components, and to determine the impact of subsystem reliability on service availability.

The Subsystem and Component Technology area will focus on two key technical areas that are common to all AGT systems: Vehicle Longitudinal Control and Reliability; and Vehicle Lateral Control and Switching.

The Vehicle Longitudinal Control and Reliability project will focus on the improvement of performance, reliability and maintainability of longitudinal systems; the "fail-operational" design concept will receive particular attention. Redundant implementation will provide the key to operations that permits vehicles suffering single failures to continue to the nearest maintenance area, station, or siding. Fail-operational design approaches will significantly improve the mean time between failures leading to vehicle breakdowns on the guideway. The longitudinal control studies also will explore the potential of a variety of control approaches including vehicle-follower and point-follower strategies, and platooning and training to improve system capacity. The longitudinal control system project will include analyses, evaluation, development design, and experimental investigations.

The Vehicle Lateral Control and Switching project will explore techniques to improve reliability, reduce costs and improve performance of electronic "wire-follower" and mechanical "wall-follower" lateral control systems. Reducing the guideway length required to execute switching maneuvers and improving ride comfort will be two major objectives of this program that will feature analyses and tests at the contractor's facility.

All the investigations in this area will be tied to cost and performance goals to assure that the results of the development reflect practical objectives. The work in this area includes review of the status of existing technology, detailed mathematical modeling, analyses and simulation, development of design concepts

and experimental validation of those designs. A small number of independent study contracts also will be awarded to assist UMTA staff in evaluating technical approaches, performing cost analyses and evaluating environmental impacts of AGT systems.

The Wayside Technology program encompasses the Guideway and Station Technology project and will investigate implementation technologies for guideways, stations, power distribution and weather protection concepts. Studies in these areas will emphasize identification (through analyses, modeling, and tests) of new and innovative approaches in construction techniques, material selection, installation and finishing to reduce the costs of ACT system installations. Reduction of the environmental impact of guideways and stations will be stressed and design considerations for all-weather vehicle operation (such as guideway heating or protected designs) also will be addressed.

The output data and analytical tools obtained from each program element will be extensively documented. It is anticipated that some of the results will change the scope and nature of tasks and the correlation between task areas. Annual reports will be prepared to summarize the progress made in the AGT development program and workshops will be conducted, where appropriate, to disseminate the collected data to system designers and urban planners. Data evolving from the program will be applied to a broad spectrum of automated guideway technologies ranging from SLT to GRT to PRT and DMT.

The data obtained from the AGT program also will be used to decrease the technical and cost risks associated with the development and installation of automated guideway systems, including the Advanced GRT system.

During fiscal year 1976 and the transition quarter, competitive requests for proposals were issued for the System Operation Studies, System Safety and Passenger Security, Vehicle Longitudinal Control and Reliability, Vehicle Lateral Control and Switching, and the Guideway and Station Technology Programs.

Reports from this project are listed in Appendix I

The AGT Applications Program

The feasibility of Shuttle and Loop Transit (SLT) systems, or "people movers" as they are commonly called, has been proven in numerous installations operating in sheltered environments such as airports, recreational parks and shopping centers. The Morgantown Personal Rapid Transit (PRT), described below, ventured further toward urban deployment. UMTA then decided to provide a demonstration program that will test the feasibility and public acceptance of SLT in the still more demanding environment of congested central business districts (CBD's), initiating the Downtown People Mover (DPM) project.

The DPM will connect downtown retail stores, government centers, office buildings, tourist attractions and other activity centers, with large fringe parking lots located outside the central business district. Downtown auto congestion should be significantly reduced when auto commuters park at the fringe areas to ride the DPM to their downtown destinations. Bus terminals, commuter rail and rapid transit stations will be located within walking distance of DPM stations so people using other transit modes can transfer to the DPM to shop, work, attend conventions or conduct business in the downtown area.

The DPM should contribute to the economic growth of urban areas by providing attractive, convenient and economical transportation service that encourages people to visit, shop and circulate among the major downtown activity centers.

Morgantown Personal Rapid Transit Demonstration Project *

Project: MA-06-0026, WV-03-0006, WV-06-0003, WV-06-0005, WV-06-0006, WV-06-0007
Funding: $133,600,000
Schedule: June 1969 - April 1980
Contractor: Jet Propulsion Laboratory (1970-71), The Boeing Company (1971 - present)
Subcontractors: The Bendix Corporation, Frederick R. Harris Company, Frank Irey, Jr., Inc.; The Trumbull Corporation, Barnes & Brass

The Morgantown System is an automated self-service transit system operating a fleet of electrically powered, rubber-tired vehicles on a dedicated guideway at 15-second headways (separation), in either a schedule or demand mode. The system provides a safe, comfortable and reliable means of transportation with a high level of availability in terms of passenger service while alleviating congestion, air and noise pollution. The three-station system is capable of transporting 1,000

The Morgantown, West Virginia, Personal Rapid Transit system, one of the most innovative systems in the nation, uses rubber-tired small vehicles that run on elevated fixed guideways.

passengers in 20 minutes between two stations 1.5 miles apart. It can operate 24 hours a day and provide nonstop origin-to-destination service by the use of off-line stations.

The Morgantown PRT vehicles, small by mass transit standards, carry up to 21 passengers—eight seated and 13 standing. The vehicle has been designed to provide economical service during both peak and low demand periods. The vehicle is 15.5 feet long and six feet wide; it weighs 8,600 pounds empty. Speeds of up to 30 mph are provided by a DC motor powered by a three-phase, 575 volt AC distribution system. Rubber tires and an air-bag suspension system provide a quiet and comfortable ride. Unique features include a heated guideway for operation in icing conditions, on-board steering and a synchronous point-follower control system to manage all system operations via computers. Fail-safe design and redundant safety-critical systems enhance reliability and assure passenger safety at all times.

The goal of the Group Rapid Transit (GRT) system is to provide an acceptable and economical alternative to the use of private automobiles in urban areas. Compared with conventional transit systems, the Morgantown system provides increased frequency of service and demand-responsive schedule flexibility. The transportation solutions that have been developed at Morgantown also will be applicable to the transportation problems of urban core areas. In addition, such GRT systems also will be capable of being integrated with existing transit systems.

UMTA's involvement with the Morgantown system began in 1969 when the agency awarded a research study grant. Development and prototype test phases were undertaken and by June 1973 a system of five vehicles, three stations and 2.2 miles of double guideway was constructed and extensively tested. This segment of the project was followed by the production and test phase, during which deficiencies identified during the preceding phase were corrected, a 45-vehicle fleet was produced and a thorough and extensive acceptance test program of the total system was conducted to verify its readiness for

The Morgantown PRT system carries West Virginia University students between the distant points of the campus.

revenue service operation in accordance with rigorous system specifications. Acceptance tests, culminating in a five-day demonstration, were completed early in September 1975.

Since its opening for regular revenue service in October for West Virginia University students, the Morgantown Personal Rapid Transit System has been a great success. MPRT has demonstrated both its reliability and its acceptability as a modern transit alternative to increasing automobile use in a high density urban corridor. In its first year of operation, MPRT registered a total of just over 600,000 vehicle miles traveled and almost 1.2 million passengers carried. In recent months, the weekly average of passengers carried has risen to 65,000. In addition, over the last two quarters, a system availability of 96 percent has been achieved. And perhaps most importantly, there were no passenger injuries associated with MPRT during the entire first year of operation.

Since the system has demonstrated compliance with its specifications and has been accepted by the university, UMTA has approved a capital grant to the West Virginia Board of Regents for Phase II expansion. The grant provides for extending the system another 1.4 miles, adding two new stations and 33 new cars. The old cars in the system will be refurbished and a new power rail installed. Other improvements made in the expanded section, such as improved guidance control, will be incorporated into the present system.

The knowledge gained from building and operating MPRT will be of enormous help in making future automated guideway transit (AGT) systems more reliable. It has shown the technical feasibility and practicality of the AGT concepts of the future, paving the way for things to come.

Reports from this project are listed in Appendix I

*The Morgantown system in reality is a Group Rapid Transit system but is called "Personal Rapid Transit" because the current GRT designation was adopted long after the system had been established.

Downtown People Mover (DPM) Project

Project: To be determined
Funding: To be determined
Schedule: April 1976-December 1981
Contractor: To be determined

Under the Downtown People Mover (DPM) Project, UMTA will provide several urban sites with capital assistance for the preliminary engineering, construction and public operation of a fully automated guideway transit system in a downtown environment. The project is intended to show that fully automated, relatively simple SLT systems can be a reliable urban transit alternative that provides an adequate level of service at a reasonable cost.

This project also responds to one of the broader goals of the UMTA program—to support the effective economic functioning of our central cities. The DPM project will provide operating data, planning tools and experience that other cities can emulate in solving their transportation needs for downtown circulation systems. If such systems can be proven reliable, safe and economical, they could become an imaginative solution to the local circulation problems in congested downtown areas and serve as a revitalizing force for urban centers.

These systems will be completely automated and capable of 24-hour daily operation. It is UMTA's intention that the DPM project make use of existing people mover technologies, with minimum modifications to adapt them for urban deployment.

On April 5, 1976, the UMTA Administrator announced the initiation of the DPM project and invited cities to submit "letters of interest" in the project. UMTA expected at that time to select up to three cities to perform preliminary engineering, with subsequent selection for construction funding, depending on the engineering results and fund availability.

Sixty-five cities submitted letters of interest, with 38 ultimately submitting proposals for a DPM project. After a preliminary screening process in which proposals were evaluated against the established criteria, 19 cities were selected for further detailed evaluation. This evaluation process narrowed the field to 11 candidate cities that then underwent further comprehensive review. In December 1976, the Secretary of Transportation announced that four cities—Cleveland, Houston, Los Angeles and St. Paul, Minnesota—were selected as potential DPM deployment sites. These cities were then invited to submit formal capital grant applications for preliminary engineering.

Reports from this project are not yet available

Accelerating Walkways

Accelerating Walkways (AW) are a promising new means of transporting large volumes of travelers over short distances. These systems address the critical problem of providing fast, cost-effective transportation in the range between what is considered to be the limit of normal walking distance and the distance at which vehicular-based transit services are considered necessary. Because AW's do not have wait times or operators, these systems are expected to compare favorably with vehicular transit in terms of operating cost and travel time over short distances.

AW's hold great promise for improving transportation around activity centers such as transit terminals, CBD's and shopping centers, permitting optimum land-use development in these areas and improving the practicability of auto-free zones.

Several different AW concepts have been developed whereby the normal moving walk entry speed of 1 - 1.5 mph is gradually increased by factors of four to five times, resulting in speeds about double that of normal walking. Gradual deceleration occurs at the discharge end of these systems to provide exit speeds comparable to that of conventional moving walkways. Although several prototype systems such as the Johns Hopkins Applied Physics Laboratory's AW and Dunlap's Speedway have been built, no system has been tested in an urban environment.

Before AW's can be readily deployed, questions concerning their safety, reliability and operating characteristics must be addressed.

Accelerating Walkway System

Project: IT-06-0126
Funding: $600,000
Schedule: 1976 - 1979
Contractor: Tri-State Regional Planning Commission

The Accelerating Walkway (AW) Program's goal is to determine the practicality, reliability and safety of accelerating walkway systems. The high travel speeds (7 - 10 mph) achieved by an accelerating moving walkway permit deployment over longer distances than conventional moving walkways since they are competitive with other urban transit modes. The ability to increase walkway length may result in substantial benefits in intermodal transfer and terminal expansion applications. The high speeds also offer the potential for application in central business districts and other major activity centers. Although several prototype AW's are in existence, no operational system has been installed.

The AW Program provides a phased demonstration program consisting of a feasibility study, technology selection, test and development and public demonstration. The feasibility study will provide a comprehensive overview of the AW technology available, identification of potential applications, detailed cost-benefit studies for a number of selected applications, an independent safety assessment of such systems, and a detailed program plan for implementing and demonstrating an accelerating moving walkway in an urban environment.

The technology selection phase involves the development of functional, performance and service specifications, the selection of technology and detailed demonstration planning. The test and development phase provides for equipment purchase, subsystem testing and development prior to the demonstration. The public demonstration phase provides for a demonstration of an AW of approximately 400 feet in length for a six month period.

Reports from this project are not available

Chapter 4:
SOCIO-ECONOMIC AND SPECIAL PROJECTS

The Socio-Economic and Special Projects Division covers two areas of the UMTA research and development (R&D) program. The special projects area consists of three basic functions: studies in support of policy, systems development projects, and experimental design. The socio-economic analysis area is devoted almost entirely to the automated guideway transit (AGT) mode, although generic comparisons of alternative urban transportation modes also will be conducted during the coming two fiscal years as part of the AGT Socio-Economic Research Program.

Studies in Support of Policy

This category encompasses studies of public transportation technology designed to assist in resolving policy questions affecting UMTA as a whole, as well as to support programmatic decisions concerning R&D projects to be undertaken in the near term by UMTA's Office of Technology Development and Deployment. Technology studies examine the present and expected future needs for improved urban transportation technology and identify solutions which are technologically and operationally feasible. Research conducted in this category includes technological qualifications for new transit equipment, safety, life cycle costing, and the effects of alternative metropolitan development.

Technological Qualifications and Operational Certification Guidelines

Project: MA-06-0064

Funding: $195,000

Schedule: October 1974 - October 1976

Contractor: Transportation Systems Center

This project is designed to establish technological qualifications guidelines for new transit systems or equipment prior to eligibility for UMTA capital assistance, and operational certification guidelines for an entire metropolitan or areawide transit system in its deployed, operational configuration.

Guideline documents for technological qualifications and operational certification will be prepared for bus, rail and AGT systems. In addition, UMTA will develop a recommended set of policies and procedures to implement these guidelines. Reviews will be held throughout the urban transportation community to solicit all viewpoints on the nature and content of these documents.

Reports from this project are listed in Appendix I

Safety in Urban Mass Transportation

Project: RI-06-0005
Funding: $178,000
Schedule: July 1973 - March 1976
Contractors: Naval Underwater Systems Center; Battelle Memorial Institute

This work was designed to examine three major topics: (1) What is the current level of safety in urban mass transportation?; (2) What can be defined as an acceptable level of safety?; and (3) What strategy should be used by UMTA or by a transit operator to achieve the acceptable level of safety decided upon?

To arrive at a judgment about the current level of safety, a study team from Battelle Memorial Institute compared the safety performance of 12 modes, including buses, rail transit, and taxis. The team concluded that "mass transportation, although inherently hazardous, is not troubled by immediate, severe safety problems." The team also concluded, however, that serious safety management problems will confront the industry as it moves into the use of new high-performance technology in the future, where traditional approaches to safety will not suffice.

In studying the question of what is an acceptable level of safety, ("how safe is safe enough?"), Battelle examined the phenomenon of perceived safety (as distinct from statistical safety), looked at the costs transit operators apportion to safety activities, and examined the theories available on the public's willingness to accept risk. Taking perceived safety, costs, and acceptance of risk into account, Battelle suggested that a pragmatic approach to locating an acceptable level of safety would be for a transit company to compare its record with the safety records of similar systems that are successful in meeting safety requirements.

With regard to defining a strategy for achieving the level of safety decided upon, the team recommended a system safety approach. In addition to a report on the team's findings and conclusions, a safety guidelines manual was published to assist members of the urban mass transportation community in setting up system safety programs

Reports from this project are listed in Appendix I.

Life Cycle Costing Feasibility Study

Project: RI-06-0007
Funding: $85,000
Schedule: May 1975 - December 1976
Contractor: Naval Underwater Systems Center; Dudley W. Gill & Associates

Section 6 of the Urban Mass Transportation Act of 1964 directs UMTA to undertake research to provide improved mass transportation to communities at minimum costs. In developing new capital alternatives, however, UMTA often faces difficulties in determining the real total costs that can be expected during the full life of a system from initial conception through development, acquisition, operation and final disposition. The ability to predict life cycle costs would enhance the opportunities to choose wisely in planning and implementation of improvements to existing urban transportation systems.

The purposes of this study are to examine experiences to date and current developments in the concept of life cycle costing, to identify UMTA program activities that might benefit from concept application, to estimate the effects of such application, and to recommend an approach for further study, development or application of life cycle costing to UMTA program activities.

Reports from this project are not yet available

Life Cycle Costing of Large Buses

Project: VA-06-0039

Funding: $24,000

Schedule: February 1976 - July 1976

Contractor: Advanced Management Systems, Inc.

The purpose of this work effort was to provide UMTA with a life cycle cost analysis on three buses—the current models of the buses manufactured by Rohr and AM General Corporation, and General Motors' RTS-2 design. The project provided UMTA with information pertaining to the true life costs of the three buses, including the investments made in acquiring the bus, recurring and nonrecurring support costs, and service operating costs. The effort also included comparing the common equipment of the three buses and formulating contractual language necessary in using life cycle costing as a basis for a competitive procurement.

Reports from this project are listed in Appendix I

Research in Life Cycle Costing (LCC) Application to UMTA Programs

Example—Bus Transit

There are presently several different manufacturers and also several models

Level 0. Which mode (bus or alternative mode) has lowest LCC, given same level of service

Level 1. Which model has lower LCC: (including all manufacturers)

Level 2. For given model: which manufacturer has the least LCC

Level 3. For given model and given manufacturer: how to reduce LCC

Level 4. For given component: for given model and manufacturer: how to reduce LCC

Levels of analysis in considering application of life cycle cost comparisons of alternative bus equipments

Life Cycle Cost Model for Comparing AGT and Conventional Transit Alternatives

Project: CA-06-0090
Funding: $10,000
Schedule: December 1975 - February 1976
Contractor: General Research Corporation

As a focal point for Automated Guideway Transit (AGT) research, UMTA is a logical central repository for life cycle cost data and methodology on AGT and alternative urban transportation modes. The purpose of this project was to establish a useful methodology for life cycle cost analysis of AGT and alternative modes, employing standard engineering-economic analysis techniques for life cycle cost analysis and using such available data as existed for initial examination of comparative results.

Initial AIRTRANS-based AGT and bus data were used in this analysis, although such data were in preliminary form and have since sustained a very significant reduction in AGT operations and management costs based on subsequent operating experience at AIRTRANS. It is believed, however, that the project has created a reference life cycle costing methodology for use in this type of comparative analysis. In addition to the report by the above title, a working computer model is available at TSC for use in subsequent analyses, as needed.

Reports from this project are listed in Appendix I

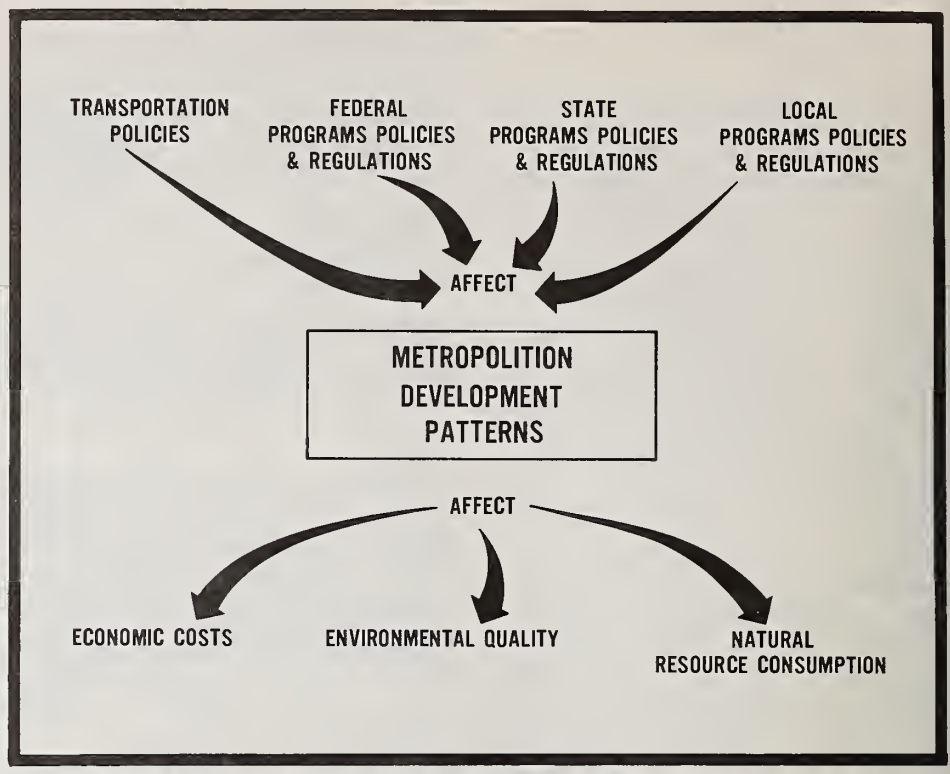
Effects of Alternative Metropolitan Development

Project: IT-06-0129
Funding: $10,000 UMTA; $10,000 Federal Highway Administration; $75,000 U.S. Department of Transportation's Office of Environmental Affairs; $255,000 U.S. Department of Housing and Urban Development, Federal Energy Administration and Council on Environmental Quality.
Schedule: June 1975 - March 1977
Contractor: The Urban Institute

This interagency project is intended to assemble and analyze in a comprehensive and consistent manner the existing knowledge about the way metropolitan development patterns affect economic costs, environmental quality and natural resource consumption; and the way in which these development patterns are affected by varying transportation policies and programs and by other Federal, State and local government programs, policies and regulations.

By identifying the impact of various transportation programs, the study will help refine the rationale for selecting and developing research and development hardware and software packages to fit within or expand the scope of these programs.

Reports from this project are not yet available.



Metropolitan development patterns, the way they are affected by various transportation policies and the way they affect economic costs, environmental quality and natural resources use will be analyzed in a project funded by several Federal agencies.

Systems Development Projects

This category includes management responsibility for generic systems development common to all transit modes or projects which do not fall within the individual modal categories of bus, rail or automated guideway transit.

Systems development and evaluation activities are conducted to achieve a viable R&D product. Planning and implementation of R&D projects, such as automated-assistance transit information system development, elderly and handicapped equipment and systems, and self-cancelling ticket development and testing, are conducted under this category.

At present, on-going projects in this category include: Planning for demonstration of an automated-assistance transit information system; development of a self-cancelling ticket in support of a planned congestion pricing demonstration to enhance the transit market; and survey, assessment, and development of various technological aids to transit use by the elderly and handicapped.

Automated Information Directory System Prototype Development

Project: DC-06-0154
Funding: $435,000
Schedule: September 1976 - September 1978
Grantee: Washington Metropolitan Area Transit Authority (WMATA)

The objective of the Automated Information Directory System (AIDS) prototype development project is to develop, demonstrate and evaluate a prototype computer-assisted transit information system

which can be used by properties with complex transit networks to more effectively respond to telephone requests for information on transit schedules, routes and fares. In using a computer to assist telephone operators in the search for such transit information, the potential exists to significantly lessen the caller's waiting period for receiving information, process more calls per unit time, reduce operator training time and cost, and provide more reliable information at reduced cost per call. In the long run, improving the flow of transit information to the public may result in increased ridership.

Reports from this project are not yet available

Automated Information Directory System Algorithm and Data Base Establishment

Project: MD-06-0013-01
Funding: $90,000
Schedule: August 1975 - September 1976
Contractor: U.S. Department of Commerce's National Bureau of Standards

This project will develop a methodology for use by transit properties in the evaluation of various forms of an Automated Information Directory System (AIDS) for improvement of their telephone information centers and to evaluate various software requirements for an AIDS. An analytic package for use by a transit property in the evaluation of alternative improvements in its telephone information center is expected to be produced.

This program area was formerly called AATIS, Automated Assistance Telephone Information System.

Reports from this project are not yet available

Time-Calibrated Self-Cancelling Ticket

Project: IT-06-0125, RI-06-0009
Funding: $82,000
Schedule: June 1976 - September 1977
Contractor: Arthur D. Little, Inc.

This project will develop an operational prototype of a time-calibrated self-cancelling ticket. The self-cancelling ticket relies on a chemical reaction to trigger a precipitous color change on the face of the ticket after a predetermined length of time. Development of such a ticket will provide new options in road pricing strategies designed to improve transit efficiency in the traffic stream by reducing urban traffic congestion. These strategies include the control of area road use, control of travel on specific highways or roads and the regulation of on-street or off-street parking.

This technology development project directly supports the planned congestion pricing demonstration by UMTA's Office of Transportation Management and Demonstrations (see page 48)

Reports from this project are not yet available.

Elderly and Handicapped Technology - Safety of Wheelchair Loading and Securement Systems

Project: CA-06-0098
Funding: $160,000
Schedule: October 1976 - January 1977
Grantee: California Department of Transportation

This project is intended to (1) develop safety guidelines for wheelchair loading equipment, (2) test wheelchair securement systems to determine their effectiveness and the crashworthiness of standard wheelchairs when secured at different points on the chair, (3) evaluate securement systems for their ease of use, cost, and acceptability to user, (4) recommend design modifications if modifications are found to be needed, and (5) establish the cost effectiveness of securement systems.

Reports from this project are not yet available.

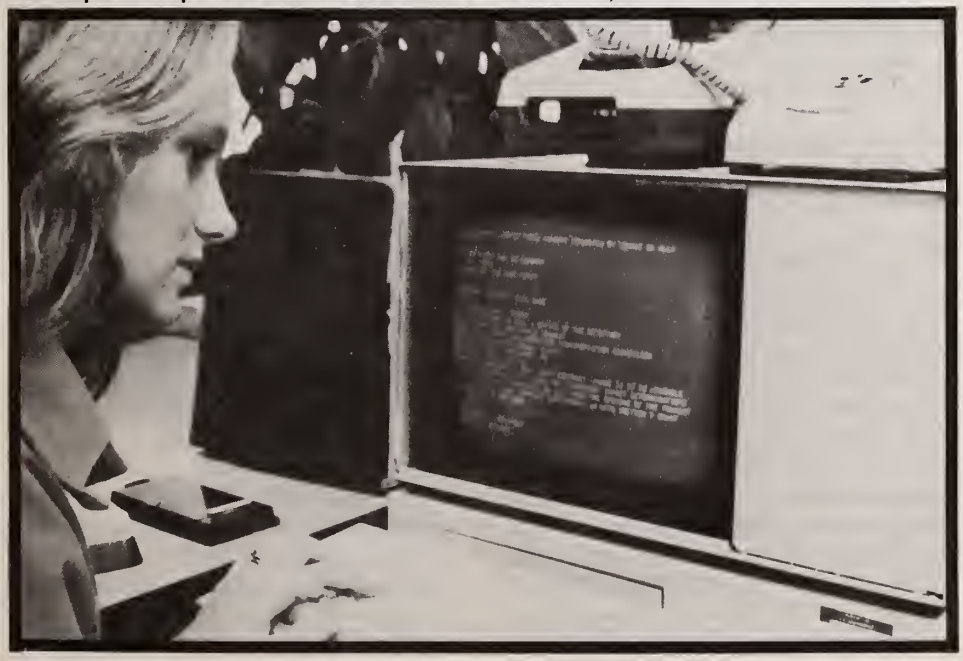
Experimental Design

Each research and development project is formulated in terms of an experimental design which establishes project objectives, formalizes the test and evaluation activities to be conducted and structures the form of the final report to disseminate maximum information for national application from an individual R&D project. An experimental design report for an engineering prototype project contains the stated project objectives, the project results in terms of those objectives and other related information developed during the course of the project.

Experimental Design and Analysis Support

Project: IT-06-0130
Funding: $90,000
Schedule: August 1976 - August 1977
Contractors: Systan, Inc.; Peat, Marwick, Mitchell and Company, Inc.; Canyon Research Associates

Computer-assisted transit information systems help transit operators respond more effectively to telephone requests for information on transit schedules, routes and fares.



UMTA is sponsoring an assessment of existing automated guideway transit systems, both foreign and domestic. Some of the systems being assessed include the Westinghouse Busch Gardens system (top left), the Rohr system at Houston Airport (bottom left), the German Cabinentaxi (top right), and the Ford Fairlane system at Dearborn, Michigan (bottom right).

The purpose of this multiple award contract is to support UMTA's Office of Technology Development and Deployment in the development and implementation of Experimental Design Plans (ExDs) for research and development projects. An ExD is a structural plan used to evaluate a project; it provides well-defined project objectives, a formal statistical or analytic design framework and a methodology for presenting results in a form easily understood by a broad transit audience.

Reports from this project are not yet available

Experimental Design for Pneumatic Transport System in Tunneling

Project: DC-06-0153
Funding: $24,000
Schedule: September 1976 - December 1976
Contractor: Mariscal and Company

This project will develop an Experimental Design Plan (ExD) to evaluate the demonstration of a pneumatic system for the transport of muck in tunneling. The evaluation of the system using the ExD will allow prospective users of these systems to make valid inferences on the costs, benefits, and desired site characteristics for using pneumatic transport equipment

Reports from this project are not yet available

Socio-Economic Analyses

The objectives of this area are: To accurately match the characteristics of each urban transportation technology to specific needs for improved forms of urban transportation; to determine the social, economic, environmental and performance factors which may affect the acceptance of improved or innovative systems; to ascertain the nature and size of the market for these forms of transit technology; to establish an organized central repository of technical, performance and socio-economic information on urban transportation systems through, for example, assessment of existing domestic and foreign automated guideway technology (AGT) installations; and through experimentation and urban simulation to establish service levels and system configurations which will assure local acceptance of new forms of urban transportation.

The AGT Socio-Economic Research Program had a modest beginning in FY 1975 in the form of a macro-level analysis of urban transportation with AGT emphasis and in the conduct of the first of a series of AGT system assessments. (Both projects are described later) In FY 1976, the program area was significantly enlarged.

The thrust of the program is to develop information that will address the fundamental issues pertinent to the significant implementation of AGT in U.S. urban areas. The entire program is structured around

several basic research questions, as follows:

How does AGT compare with other forms of urban transportation? Examination of this question forms the *Generic Alternatives Analyses* activity.

Schedule: December 1976 - June 1978 (Phase I)

This activity will begin by identifying the kinds of present and expected future urban transportation needs which are created by representative U.S. urban forms. A comparative analysis of the ability of existing and developing types of urban transportation systems to fulfill these identified needs will then be conducted, including examination of social, economic, and environmental considerations as well as the operational characteristics associated with each transportation mode. This matching of available urban transportation solutions with existing urban transportation needs will be conducted on a generic basis, thereby specifying the most appropriate domain of application for each mode—bus, rail, paratransit, AGT and the private automobile.

The range of transportation needs which AGT systems can best fulfill will be identified and arrayed against the alternative forms of urban transportation for a comparative evaluation. This activity should establish the spectrum of performance requirements (e.g., the level-of-service necessary for intra-high density area collection and distribution), social requirements (e.g., degree of personal security necessary for automated vehicle acceptance), and environmental requirements (e.g., minimum acceptable along-guideway noise levels) which must be achieved to enable AGT systems to be acceptable in particular urban applications.

How well do existing AGT systems work?
Examination of this question forms the AGT *Assessment* activity.

Schedule: May 1975 - December 1977 (Phase I)

This work is intended to collect, aggregate, and uniformly present the performance and associated socio-economic characteristics from experiences to date with AGT installations operating in public service, as well as to document the implementation history and learning experiences of each major AGT deployment. The operational, economic, environmental, and passenger response data on selected existing domestic and foreign AGT systems will be organized into a central inventory of AGT information.

Assessments are currently underway on a number of AGT systems: AIRTRANS (Dallas/Ft. Worth airport); Jetrail (Love Field, Dallas); and a foreign AGT system (Cabinentaxi, West Germany).

How much do AGT systems cost? Examination of this question forms the AGT *Cost* activity.

Schedule: December 1976 - December 1978 (Phase I)

Throughout the program, all of the activities will include analyses of capital, operating and maintenance, as well as life cycle costs of AGT systems. Cost data will be collected from all existing sources, sensitive to the potential for future cost reductions as AGT technology matures.

How many places want and can use AGT?
Examination of the question forms the AGT *Markets* activity.

Schedule: December 1976 - November 1978 (Phase I)

Examinations of the potential market for the several classes of AGT systems will be based on both generic and site-specific market research activities. During the generic alternatives analyses, particular types of urban application will be identified and defined as to their ability to support or require an AGT system from a transportation need perspective. Subsequent site-specific examinations of sample U.S. urban areas with potential urban applications of AGT systems will further test the feasibility of AGT deployment.

The results of a series of such individual urban area examinations will be aggregated toward establishing a national market estimate for AGT systems by time period in which the mode would be deployed and by subclass (shuttle loop, group rapid, or personal rapid transit). Other parallel market survey efforts outside the public sector will be periodically reviewed and assimilated into the UMTA activity.

Another AGT research activity will involve the dissemination of information to all interested parties and receipt of local expressions of views regarding this mode. This work will form the *Communications* activity.

Schedule: November 1976 - June 1978 (Phase I)

This effort will involve the assembling and synthesizing of results from program research activities to ensure timely dissemination of program data and findings. A central repository of current AGT data, information, and research findings, containing all deliverables prepared throughout the program, will be established. Specific audiences interested in AGT developments will be identified; workshops, conferences, public hearings, exhibits, and demonstrations will be used for communicating the information amassed. The major findings of the entire AGT Socio-Economic Research Program will be disseminated to Congress to help formulate future AGT transportation policy.

The generic alternatives analyses was initiated with the following research investigation.

Analysis of Urban Transportation Needs with Implication for AGT Systems
Project: MD-11-0001
Funding: $83,000 (University research program funds)
Schedule: May 1974 - November 1975
Contractor: Johns Hopkins University

This project was designed to identify evolving urban transportation submarkets and to determine requirements for urban transportation research and development activity. The approach was to perform a macro-analysis of the multinucleated urban area form to identify transportation submarkets, examine the commonality of needs across the nation and select five sample cities to study, representing the range of city-types in the U.S. in terms of urban transportation characteristics and to match existing and developing transit technologies to needs identified with emphasis on AGT system market potential.

Reports from this project are listed in Appendix I

Chapter 5: SAFETY AND PRODUCT QUALIFICATION

UMTA has funded a number of projects dealing with transit system safety; in FY 1976, these activities are combined with a newly established program area concerning product qualification. System safety projects are directed at establishing preventive techniques to reduce the occurrence of accidents, and protective means to minimize the hazards associated with unsafe conditions. The product qualification program will encompass a breadth of projects involving qualification of system hardware for capital grants, reliability and quaiity improvements in transit equipment, test and evaluation of transit vehicles and other operational subsystems, standardization of transit equipment to reduce costs and improve performance, and establishment of operational qualification of critical or vital transit vehicle subsystems, inciuding new technology.

Safety-related projects are described in this chapter; projects concerned with product qualification are being conducted in conjunction with other transit modai offices within UMTA. For example, a project dealing with railcar standardization is described in the chapter on raii transit. Other test and evaluation projects are planned for or are being conducted on raii transit and bus vehicles. These projects wiii be coordinated with the overall safety and qualification programs.

One project of considerable interest, conducted jointly with the rail technology office, is intended to establish contract terms and conditions for transit procurement contracts; this project is nearly complete. Public hearings were scheduled for January 1977; later in the year, a transit system reliability data bank is scheduled for implementation. This system is critically important for assessing reliability deficiencies, improving maintenance and quality, affording better management information and aiding in establishing technical qualification requirements or specifications. UMTA will establish the system but it will be operated by the transit industry, the prime user of the information.

Significant planning activity is underway to establish overall program plans for system safety and for product qualification. This effort is being carried out in consort with pertinent elements of UMTA, the Department of Transportation and outside organizations; it is expected to be completed in mid-1977.

Transit Systems Material Information Bank

Project: MA-06-0051
Funding: $398,000
Schedule: July 1975 - continuing
Contractor: Transportation Systems Center

The project is developing and maintaining an information bank on the various types of structural and non-structural materials used in transit systems with respect to their flammability, smoke production, toxic gas production, and other characteristics related to fire safety. The information bank will include identification of the various types of analyses and tests by which candidate materials may be ranked according to their flammability, smoke and toxic gas production, and development of guideline specifications for materials selection. This project has established a materials consulting service for UMTA and the transit industry.

Material specifications for transit vehicles have become increasingly important because of fires on vehicles. This project will provide technical information to establish new or improved standards for fire safety to be applied to Federally funded procurement of transit vehicles. Guidelines or standards prepared under this project will be coordinated with interested and effected organizations such as the American Public Transit Association and the National Fire Protection Association.

Reports from this project are not yet available.

Safety and System Assurance Training Program

Project: DC-06-0139
Funding: $217,000
Schedule: September, 1975 - continuing
Contractor: Transportation Safety Institute

This project is designed to use the resources of the Transportation Safety Institute (TSI) to assist UMTA in planning, organizing and conducting safety and systems assurance educational courses, activities

and programs for transit industry and government personnel. UMTA continues to encourage, stimulate and improve the application of system-oriented technical management programs and processes to the planning, development and operation of mass transit systems. Tasks under this project include:

- Planning, development and conduct of training programs in safety and system assurance which are responsive to the needs of the transit industry;
- Establishment and use of an associate staff equipped to handle highly technical subjects;
- Provision of consultant services as needed by staff and local agencies with regard to transit safety; accident/incident investigation policy, procedures and techniques; hosting of meetings, seminars and symposiums to exchange information about safety and system assurance; and accident/incident investigation procedures and analysis; and
- Conduct of special projects or reviews in the area of safety and systems assurance as requested by UMTA.

The target group for these training courses includes personnel from transit operators, consultants, supplier organizations, state departments of transportation and the Federal Government. Public offerings of these courses are scheduled for FY 1977. Issues to be addressed in these courses include system safety, security, availability and dependability; equipment reliability and maintainability; quality assurance and human factors.

Reports from this project are not yet available.

Safety and System Assurance Support

Project: DC-06-0123
Funding: $270,000
Schedule: December 1976 - continuing
Contractor: American Public Transit Association

This project draws upon the operational experience and expertise of transit managers to support UMTA in its safety and product qualification programs. In addition to the support furnished, participation in this project should aid in the stimulation of transit management to address safety and system assurance issues. Representative project tasks include:

- Identification of safety priorities in bus and rapid rail systems;
- Compilation and documentation of existing rapid rail system safety programs;
- Development and documentation of the scope and cost of a data system that will maintain pertinent transit safety, security, reliability, maintainability and service dependability data; and
- Provision of support to UMTA in its safety and system assurance activities, to include program reviews, accident/incident investigations, development of safety and system assurance training, and the acquisition of responses to special queries. It is important to have transit industry participation in the UMTA safety and product qualification program, and this project will insure their participation.

Reports from this project are not yet available.

Mass Transit Safety and Systems Assurance

Project: MA-06-0060
Funding: $989,000
Schedule: July 1975 - continuing
Contractor: Transportation Systems Center

The U.S. Department of Transportation's Transportation Systems Center (TSC) support to this program was initiated in July 1974; its primary purpose was to apply Departmental technical and managerial resources to the planning, conduct and evaluation of safety and system assurance programs and activities in support of UMTA programs.

The activities performed by TSC in FY 1976 included transit system guideline specifications development, participation in system safety reviews, evaluation of technical requirements for automatic train control certification and training and education (working with TSI). Future activities will encompass safety-oriented work similar to the above cited tasks but, additionally, TSC will undertake tasks in the product qualification program of UMTA. Typical among these are transit bus quality projects, transit system reliability data bank and information systems, standardization of transit equipment and establishing technical qualification requirements for Federally funded transit hardware procurements.

Reports from this project are not yet available.

Chapter 6:
SERVICE AND METHODS DEMONSTRATIONS

UMTA's Service and Methods Demonstrations Program is intended to develop new techniques for using the current generation of transit equipment in efficiently providing an improved quality and quantity of public transportation. A large number of innovative methods for increasing the level of service and the productivity of transit have been developed both by UMTA and by various transit properties over the past few years. The primary focus of this program is to perform the final developmental steps, where required, and to bring some of these techniques into full operational application.

UMTA sponsors several demonstrations of bus and carpool priority lanes, such as the Los Angeles busway pictured here.

Provision of total coordinated transportation for an entire trip also will be emphasized. The focus will not be on a particular mode (rail or bus), or a portion of the trip (collection, distribution, or line haul) or on a particular destination (downtown). The focus instead will be on providing a means for getting a person from his origin to his desired destination, wherever it may be, as quickly, efficiently and comfortably as possible. In most cases this will require a combination of modes working together in a coordinated fashion in order to provide a variety of services for the various users, trip purposes and routes.

The program is focused primarily on the accomplishment of one or a combination of these objectives:

- Reduce travel time by transit. This is an important factor in increasing transit ridership and improving vehicle productivity.
- Increase the area coverage of transit service. This is important for increasing transit ridership by responding with cost effective approaches for new transit service in lower density suburban areas.
- Improve the reliability of transit service. This is one of the most important factors in maintaining and increasing ridership.
- Increase the productivity of transit vehicles. This is most important in the continuing struggle to reduce operating deficits while maintaining or improving service.
- Improve the mobility of transit dependents. This is important to provide mobility to people without automobiles.

In order to accomplish these objectives, the Service and Methods Demonstrations Program is organized into five major functional areas.

Priority Treatment for Transit and Other High Occupancy Vehicles which involves expediting peak period movement of passengers on surface transit vehicles (bus, light rail and trolley bus). Other multiple occupant vehicles such as shared ride taxis, carpools and vanpools also may be candidates for receiving priority treatment depending on local conditions. Types of projects

generally would include exclusive busways, reserved lanes on freeways, arterials and city streets; signal preemption, transit malls and auto restricted zones.

Paratransit, which includes a broad range of services that occupy the transportation spectrum between conventional transit and the private auto, i.e., dial-a-ride, jitney, vanpools, taxis, subscription buses and other forms of ride sharing. The main intent is to provide improved transportation by increasing vehicle occupancy in a number of ways.

Service for Special User Groups, which seeks to develop specialized services that will provide for the needs of the transit dependent person—the elderly, handicapped, young and poor. These kinds of services include novel methods to improve inner city circulation, "reverse" commuting, testing of specialized equipment for elderly and handicapped, subscription services, demand responsive services and user side subsidies.

Pricing Policy analyses, which focus on experiments to better understand the relationship between increased transit patronage and reduced auto usage through a variety of price-related (i.e., economic) incentives and/or disincentives. These would include methods to simplify and/or reduce transit fare collection, reduced fare and free fare transit, and methods to reduce surplus consumer demand associated with auto use in certain congested areas.

The Service and Methods Demonstration Program element includes a three-stage process from concept development to the distribution of information and policy guidance for general use. This process includes:

Experimental demonstration (first implementation of a new concept). The focus is on testing the validity of a concept, searching for weaknesses or failures and applying corrective actions, if necessary; and documenting the results.

Exemplary demonstrations (the next stage of concept development). The underlying basis is to demonstrate the repeated successful operation of a concept proven in an experimental demonstration so regional and national awareness can be enhanced.

Information dissemination. The final element is formal/informal distribution of findings about the concept through site visits, workshops, conferences, publications, etc.

Priority Treatment for Transit and Other High Occupancy Vehicles

SANTA MONICA FREEWAY CONCURRENT FLOW RESERVED BUS AND CARPOOL LANE—LOS ANGELES, CALIFORNIA

Project: CA-06-0083, CA-06-0086
Funding: $927,800 UMTA; $137,000 Federal Highway Administration; $2,300,000 local
Schedule: June 1975 - June 1977
Grantee: Southern California Rapid Transit District
Subcontractors: California Department of Transportation, California Highway Patrol, Santa Monica Municipal Bus Lines
Evaluation: Transportation Systems Center & SYSTAN, Inc. (Contractor)

This project investigated the feasibility of reserving a concurrent flow freeway lane for the exclusive use of buses and other high-occupancy vehicles such as carpools. Besides reducing travel time for present transit and carpool travelers, the project was designed to improve the schedule reliability of the bus service and likely increase transit productivity by the efficient utilization of buses operating in uncongested lanes with higher occupancies.

Under this project, the left hand lanes in both directions of a 12.6 mile length of the Santa Monica Freeway (I-10) were reserved for buses and high-occupancy vehicles (3 or more persons) during the seven peak hours. Access and egress to/from the reserved lanes were accomplished by weaving across the unreserved lanes to the normal entry and exit ramps. Ramp meters were used to reduce the degree of congestion of the unreserved lanes. In addition, the Southern California Rapid Transit District (SCRTD) and the Santa Monica Municipal Bus Lines (SMMBL) operated 11 new bus routes between the west side of Los Angeles and Santa Monica and the Los Angeles Central Business District (CBD). Three of these routes were from newly established park-and-ride lots on the west side of Los Angeles and Santa Monica which accommodate 600-1,300 automobiles.

Preferential treatment began on March 15, 1976. On April 9, a lawsuit against the preferential lane treatment was filed, claiming that the sponsors had failed to prepare environmental impact statements. On August 9, the U.S. District Court ruled that an environmental impact

The "diamond lanes" on the Santa Monica Freeway provided concurrent flow reserved lanes for bus and carpool vehicles.

report must be filed under both national and state environmental laws. As a result of the court ruling, the lane restrictions were withdrawn, and its eventual resumption is not known.

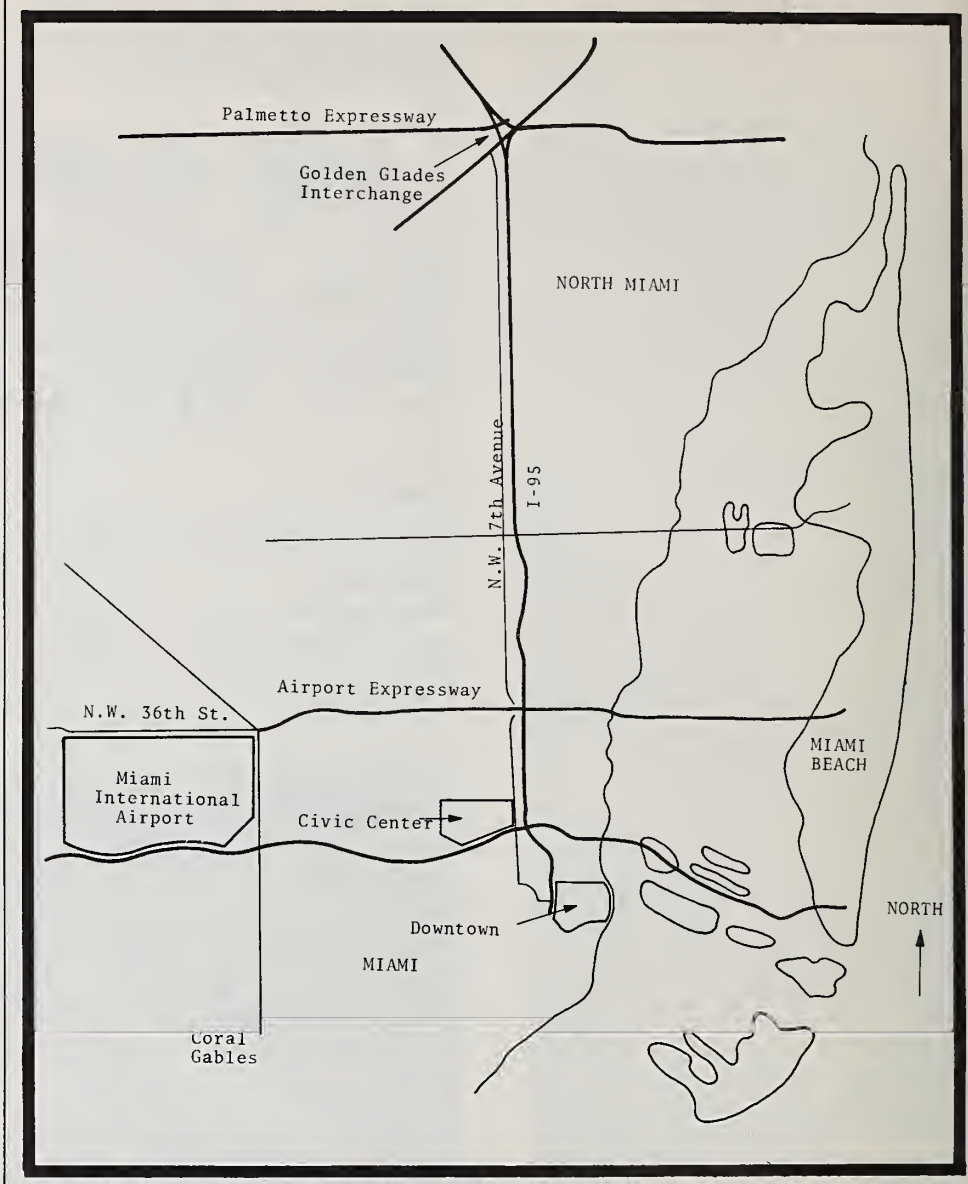
Post-demonstration data is currently being collected and analyzed. Findings indicate that, excluding ramp delays, non-preferential travel times for non-carpoolers were generally less than or equal to pre-implementation travel times with ramp metering. Wait times for non-carpoolers increased at some ramps and decreased at others. At the end of the fifteenth week, the freeway carried nearly the same number of persons while the number of vehicles was reduced by 11 percent. Bus ridership and carpooling on the freeway approximately tripled in the first fifteen weeks of operation. The average number of accidents over this initial period was 2.5 times what it had been before implementation.

Reports from this project are not yet available.

Miami I-95/Northwest 7th Avenue Bus-Carpool Priority System

Project: FL-06-0006
Funding: UMTA R&D - $1,407,000; UMTA Other - $1,400,000; Federal Highway Administration - $13,176,000; Local - $2,030,000
Schedule: January 1972 - December 1976
Grantee: Florida Department of Transportation
Evaluation: Metropolitan Dade County Transit Authority; University of Florida

This two-phase project demonstrates a bus and carpool priority system for the Miami area. In Phase I which was completed in February 1976, express commuter bus service was operated under four different combinations of mixed mode or reserved lane and signal preemption. Under Phase II, two lanes were added to the adjacent I-95 freeway and are reserved for buses and carpools for about 10 miles to and from downtown Miami. Additional bus service was added in the corridor to test the extent to which this type of bus preference will encourage both carpool formation and a modal shift to buses. Express bus service is running from the Golden Glades Interchange park-ride lots to the Miami central business district, airport and Civic Center.



The I-95/NW 7th Avenue corridor's bus/carpool priority system provides quick access to downtown Miami from park-and-ride lots at the Golden Glades Interchange.

Between August 1974 and February 1976, five different bus operating techniques were tested on NW 7th Avenue: Mixed mode with no preferential treatment, mixed mode with signal preemption, reserved lane with bus signal preemption, reserved lane with simple progression of signals, and reserved lane with simple progression and preemption. Average travel times along N.W. 7th Avenue for the first three operating techniques were 30.0 minutes, 22.5 minutes, and 21.0 minutes respectively. Final data for the last two techniques are not yet available.

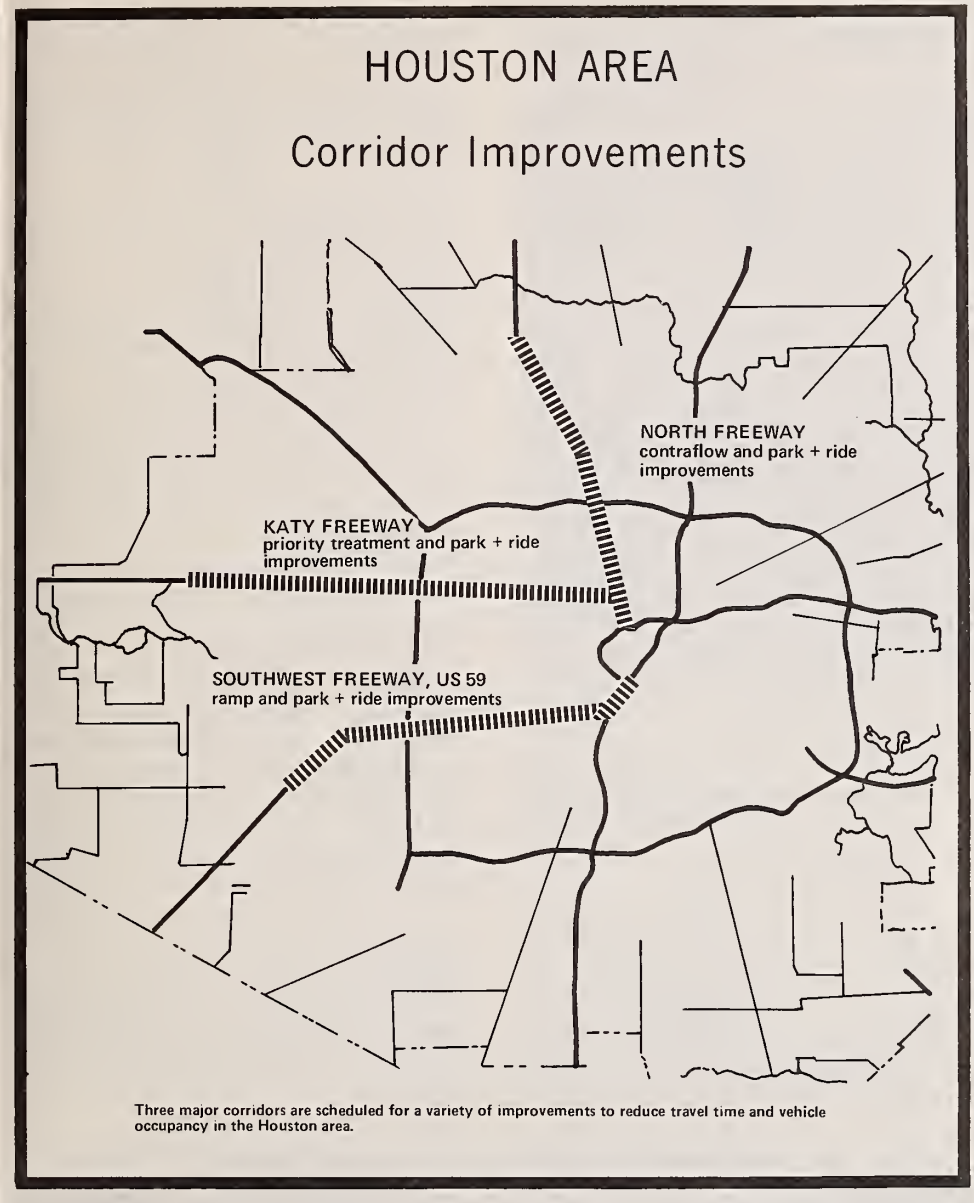
Express bus operations moved from N.W. 7th Avenue to the exclusive lanes on I-95 in March 1976. Bus ridership has increased since the changeover, from around 1600 daily passengers in the fall of 1975 to over 1750 passengers in September 1976.

Reports from this project are not yet available.

Corridor Improvements in Houston, Texas

Project: TX-06-0018
Funding: $680,396
Schedule: July 1975 - June 1977
Grantee: City of Houston, Texas
Evaluation: Transportation Systems Center and Multisystems, Inc. (Contractor)

This project will be implemented by the city of Houston as part of a broad range of improvements in the



Three major corridors are scheduled for a variety of improvements to reduce travel time and vehicle occupancy in the Houston area.

city's transportation system. These improvements will be funded from a variety of sources including the UMTA demonstration program, capital grant program and Section 5 operating funds; Federal Highway Administration programs, and State and local funds.

These funds will support an equipment acquisition program to refurbish and update the bus fleet, the development of new transit facilities, a carpooling program, a downtown circulation system and express bus service. The program of corridor improvements funded through this demonstration will be closely coordinated with other elements of the program funded by FHWA, State and local funds.

Houston, working with the Houston-Galveston Area Council, has identified three major corridors for improvements ranging from metered freeway ramps to contra-flow lanes, all supplemented with park-and-ride facilities. The objective of improvements is to reduce travel time and raise the current vehicle occupancy levels in the corridors. The effect of implementing improvements in a coordinated effort in three corridors will be evaluated to determine the impact on trip time, transit ridership and vehicle occupancy. Detailed designs are currently being developed for priority treatments in the three corridors.

Reports from this project are not yet available.

Auto Restricted Zone/Multi-user Vehicle Systems Study

Project: VA-06-0042
Funding: $600,000
Schedule: July 1975 - June 1977
*Contractor:** Alan M. Voorhees and Associates
Subcontractors: Moore-Heder, Cambridge Systematics

Auto restricted zones are areas in congested portions of cities, such as the central business or shopping districts, where auto traffic is prohibited or restricted. A zone may range in size from a few blocks along adjacent streets to large portions of major activity centers and can be

*The work on urban goods movement by A.T. Kearney is now being integrated with this study (see next project)

An auto-restricted zone system in Nottingham, England.

created through the use of parking restrictions, barriers to through traffic, or prohibition of all automobile traffic.

A multi-user vehicle system can be described as a user-operated taxi in which automobiles, electric autos, electric golf carts, bicycles and motor scooters, for example, can be used to transport people within a specific area. The type of system to be used depends on the number and location of access points and the types of trips permitted; there may be one or several defined terminals where users pick up and drop off vehicles or they may be picked up and left at curbside anywhere throughout the service area (called ubiquitous access).

This project included analyses of auto restricted zones and multi-user vehicles plus an analysis of the multi-user vehicle system operating within an auto restricted zone.

The following tasks have been performed: analysis of the factors that help or hinder implementation and operation of these innovations; development of site selection criteria and selection of five potential demonstration sites for auto restricted zones. Initial demonstration designs are currently being prepared for Boston, MA; Burlington, VT; Providence, RI; Tucson, AZ; and Memphis, TN. In the early part of 1977 a subset of these sites will be selected for implementation funding.

The multi-user vehicle system concept was not found to be feasible from a cost/benefit and operational standpoint and is, therefore, no longer being considered.

Reports from this project are not yet available

Urban Goods Movement Demonstration Project Design

Project: IL-06-0030
Funding: $257,000
Schedule: October 1974 - January 1977
Contractor: A. T. Kearney, Inc.

The purpose of this study is to identify problems inherent in urban goods movement and to formulate and demonstrate solutions to these problems. The study has defined the urban goods movement effect on movement of people, traffic congestion, air and noise pollution, energy consumption, and land use.

The following tasks have been performed:

1. A literature search was conducted.
2. An impact matrix analysis was developed that analyzed the problems of urban goods movement (congestion, air and noise pollution, etc.) on affected groups (commuters, consumers, goods haulers, shippers and receivers, and the general public).
3. A distribution analysis was conducted in which 42 segments of goods or service movements were identified. Using Bureau of the Census and other sources, estimates were developed of the quantities of goods distributed to urbanized areas.
4. Problem/opportunity analyses were made for urban goods movement effects on congestion, energy, pollution, and land use.
5. Potential solutions were developed and rated to single out all short-term, low-capital intensive solutions that could decrease the impact of any one urban goods movement problem.

Current work involves application of what has been learned to the design of the urban goods movement component of the auto restricted zone demonstrations. These demonstrations are being developed under Contract VA-06-0042 at five potential sites: Boston, MA; Burlington, VT; Providence, RI; Tucson, AZ, and Memphis, TN.

Reports from this project are available from UMTA's Office of Service and Methods Demonstrations.

Transit Mall Study

Project: DOT-TSC-0181
Funding: $111,000
Schedule: April 1976 - July 1977
Contractor: Transportation Systems Center, Crain & Associates

This study will evaluate the feasibility and cost-effectiveness of transit malls, based on experience and plans in American cities. The cities in which existing or planned transit malls will be studied are Madison, WI; Minneapolis, MN; Philadelphia, PA; Portland, OR; Denver, CO; and New York (Manhattan).

Transit malls are generally planned as part of a scheme of downtown redevelopment, often including transit improvements focusing on the mall, auto restrictions, and parking modifications. Major issues regarding transit malls include the environmental, aesthetic and safety problems of mixing transit and pedestrian uses, the best physical designs for transit operations, the effects on automobile traffic, and the economic impacts on businesses located on or near the mall.

A transit mall on Oxford Street in London, England.

The evaluation will relate the cost-effectiveness of the projects to explanatory factors in order to give guidance in the planning and design of future malls. Results will be examined against the following objectives of transit malls: improve transit service; increase efficiency of transit operations; encourage transit ridership; discourage auto use; reduce conflicts among autos, transit, pedestrians, and trucks; reduce pollution; create or improve an environment for pedestrian and street activity; and promote economic growth and activity.

Reports from this project are not yet available.

Paratransit

Coordinated Paratransit Service Demonstration Project

Project: TN-06-0006
Funding: $997,959
Schedule: July 1975 - June 1977
Grantee: City of Knoxville, Tennessee
Evaluation: Transportation Systems Center and Multisystems, Inc. (Contractor)

The emphasis of conventional transit systems on fixed-route, fixed-schedule service has led to the underutilization of other important transportation resources such as taxis, charter buses, limousine services, carpools and vanpools—services that fall into a category known as paratransit.

Specialized transportation services have been used successfully for years, particularly to carry people to and from work. However, the application of these services has been limited because they were not viewed as part of the official public transportation system and, consequently, suffered problems of organization, regulation and financing.

This project seeks to eliminate the barriers that have impeded the paratransit service development by coordinating a wide range of transportation modes into an efficient, integrated regional network. A transportation broker identifies and matches transportation needs with transportation providers. The city also works with employers to establish subscription bus and van operations. Vanpools, using vehicles leased by the city, have been formed by several local firms. Taxi feeder service is being coordinated with an express transit route.

Reports from this project are not yet available.

PERT (Personalized Transit) vehicles in Rochester, New York provide demand-responsive transit service that is integrated with the community's fixed-route system.

Paratransit Service Innovations

Project: DC-06-0120
Funding: $248,333
Schedule: July 1975 - May 1977
Grantee: The Urban Institute

The objective of this project is to assess and document promising applications of paratransit services such as dial-a-ride using shared-ride taxis, subscription bus or commuter van services, feeder service to line-haul transit, and jitney service. Since considerable uncertainty exists about the benefits and potential difficulties of implementing these types of services, they are unlikely to be considered by policy-makers, planners, or regulators until their potential is much better understood. Some of these applications are examined through detailed case studies of existing operations, while other applications are being tested in demonstration projects.

For home-to-work travel, two comprehensive reports have been prepared, describing current experience with commuter vanpools. Based on an analysis of more than 30 operations, these documents describe the planning, organization, and operation of this type of service and present detailed guidelines on how to set up and administer employer-based programs.

Reports being developed on innovative services provided by taxi and limousine operators will describe and illustrate new types of services, travel markets, and implementation issues. Particular attention is being paid to existing applications of shared-ride taxicabs for low density travel in small towns or suburban areas and as feeders to conventional transit.

The project is developing experimental demonstrations to investigate the effectiveness of integrating taxis with fixed-route bus service. One experiment recently implemented in St. Bernard, Louisiana, will be evaluated as part of this project. In this evaluation, service quality will be monitored and ridership response to the feeder service in different socioeconomic subareas will be examined.

Reports from this project are listed in Appendix I

Integrated Demand Responsive, Fixed-route Transit Systems

Project: NY-06-0048
Funding: $2,598,200
Schedule: April 1975 - June 1977
Grantee: Regional Transit Service, Inc. (Rochester, New York)
Contractor: Massachusetts Institute of Technology
Evaluation: Transportation Systems Center and SYSTAN, Inc. (Contractor)

The Rochester Integrated Transit Demonstration (RITD) is a comprehensive project to demonstrate the integrated operation of fixed-route bus service with demand responsive and other "personalized" bus services to provide improved transit service. Significant integration innovations include route rationalization (i.e., providing fixed route or demand responsive service where and when each is most effective and efficient), and transfer coordination between demand responsive and fixed-route services. Special prearranged services are available for workers, school children, elderly, and handicapped residents. Computerized scheduling and dispatching in addition to digital communications equipment are being tested to determine their impact on service levels and productivities.

PERT (*PER*sonalized *T*ransit) service in the Rochester suburb of Greece predates the demonstration by more than a year and a half. PERT service was expanded to the suburb of Irondequoit, April 1, 1976 with a mixture of fixed and flexible route bus services. PERT service in Greece underwent a significant redesign in September, 1976. The many-to-many (m-m) dial-a-bus zone is being reduced in size by substituting a route deviation service into parts of the former m-m zone. A fixed route shuttle service was instituted to connect high transit demand corridors with major retail facilities and fixed route transfer points. PERT introduced a zonal fare structure in both Greece and Irondequoit to coincide with the redesign of Greece service.

The First Year Operating Report will be available in early 1977, in addition to an Interim Evaluation Report on PERT services in Greece.

Integrated Taxi/Fixed-route Transit System

Project: CT-06-0007-1
Funding: $610,000
Schedule: July 1976 - July 1978
Grantee: Westport Transit District
Evaluation: Transportation Systems Center, CACI, Inc. (Contractor)

This project is designed to provide integrated transit service to the community of Westport, Connecticut, an upper middle class suburb located an hour's drive north of New York City. The current demonstration is an extension of Project CT-06-0007, a study of integrated taxi/fixed route transit in Westport.

Public transit was initially established in Westport three years ago, after the community instituted a Westport Transit District and implemented a series of fixed route loop buses which meet at a timed transfer point near the center of town. Since then, the Westport residents have heavily patronized the service, and demands for new and expanded services prompted this demonstration.

The major features of the project include expanded fixed service, development of a shared-ride taxi service, implementation of special advance-request demand responsive service for Westport's handicapped and elderly, limited subscription service for special markets, and pursuit of a vigorous carpool and vanpool program for Westport automobile commuters and for downtown Westport employees as well. Annual passes obtained for fixed route service entitle passholders to discounts on other transportation services in Westport.

The Westport Transit District will act as the broker in negotiating and implementing the integrated services. This project will directly impact SMD goals of reducing trip time, increasing transit coverage, and improving productivity. Expanded fixed-route service will begin in January 1977, followed by shared-ride service later. Carpool and vanpool promotional programs are slated to begin during the early part of 1977.

Reports for this project are not yet available.

Ride-sharing Paratransit Agency Study

Project: PA-06-0035
Funding: $63,060
Schedule: May 1976 - February 1977
Grantee: Carnegie-Mellon University

Outside the more central areas of the many major cities the density of trip demand is not sufficient to operate conventional mass transit systems economically; consequently, nearly all trips in these areas occur by private auto. For many

Children and others with limited or no access to other forms of transportation make extensive use of transit services in Westport, Connecticut.

trips, however, it appears that demand densities are high enough to support paratransit or ride-sharing arrangements.

This project, conducted in Pittsburgh, Pennsylvania, is designed to determine the feasibility of introducing a ride-sharing agent into the local institutional structure whose purpose will be to stimulate the demand and supply of paratransit services by consolidating trips currently made via private auto. The study will examine the institutional and regulatory framework into which a ride-sharing agency is to be introduced, design the specific function, services and management structure for the agency; identify potential providers of services and outline a marketing approach.

Reports from this project are not yet available.

Arlington, Virginia Shared-ride Taxi Study

Project: VA-06-0032
Funding: $77,200
Schedule: December 1975 - January 1977
Grantee: County of Arlington, Virginia
Subcontractor: Henry J. Kaufman and Associates

One method of providing improved transportation service, particularly in low density areas, is through the use of the existing taxi fleet. Taxis in conventional operation provide a high quality but expensive transportation service. Funds for subsidizing transportation are limited. Consequently, an approach which lowers the average taxi fare by increasing occupancy would have widespread application since it does not require significant public funding. Shared-ride taxis is one such theme.

In January 1975, Arlington County permitted the operation of shared-ride taxi service for the first time. Although the service was advertised, few riders were attracted. Now under this project, Arlington County will reexamine the market for shared-ride service, completely redesign the zone/fare structure and management of the service, and develop the framework for an advertising campaign.

Reports from this project are not yet available.

Nassau County Shared Taxi Demonstration

Project: NY-06-0059
Funding: $347,000
Schedule: September 1976 - April 1978
Grantee: County of Nassau, N.Y.

The project is designed to improve the productivity of current shared-ride taxi operation in two sections of Nassau County, New York, thus reducing the cost per passenger trip. The project will test the effectiveness of using incentive contracts to encourage private operators to improve service and productivity.

Prior analysis has indicated that shared-ride taxi service in suburban Long Island, New York, could be operated profitably at fares per passenger trip $1 less than is currently charged, provided productivity is increased. The project will take the following steps in order to accomplish the required productivity gains:

- Improve the quality and capacity of shared-taxi service through the acquisition of new vehicles.
- Reduce fares immediately to theoretically attainable levels, with deficits covered by project funds and measure ridership increase and actual productivity gain.
- Tie the profit margin of the private operator to productivity gains where profit per passenger will increase as overall productivity is raised.
- Provide improved dispatching facilities.
- Implement an intensive promotional campaign.

Four types of service will be provided during the project: Subscription commuter service to major employers, feeder service to commuter rail stations, shared taxi service during off-peak periods and off-peak subscription service for small groups such as senior citizens clubs. Arrangements have been made to subsidize the fares of the elderly, handicapped and welfare clients.

Reports from this project are not yet available.

Taxicab Feeder to Bus Service

Project: LA-06-0002
Funding: $325,350
Schedule: June 1976 - June 1978
Grantee: St. Bernard (La.) Parish Planning Commission
Evaluation: Urban Institute

The objective of this demonstration is to investigate the extent to which public transportation coverage in a suburban area can be increased efficiently by using shared-ride taxicabs to provide feeder service to line-haul bus transit and to commuter subscription bus service. To minimize passenger wait time the feeder service is coordinated with the bus schedules and convenient transfer mechanisms such as joint fares and sheltered bus stops are provided. The project is located in St. Bernard Parish (population about 60,000), a suburban area adjoining the City of New Orleans on the east.

A prototype taxi feeder service has been privately operated in a portion of the project area since 1974. The service will be expanded under the demonstration project to cover the remaining areas along the two parallel bus routes that extend from New Orleans. During the first year of the project, the existing bus service with two vehicles on one route and one bus on the other route will be improved by adding two new buses and four passenger shelters, and the existing 21-vehicle taxi fleet will be expanded by as many as nine seven-passenger vehicles. A joint fare structure will be based upon the distance-related bus fares (ranging from 25¢ to $1.50) with a 25¢ premium for the taxi transfer in the off-peak and a 35¢ charge during peak hours. During the second year, a subscription taxi-bus service for New Orleans commuters will be introduced. For a fare of $10 per week, taxis will pick up regular users at specified times and deliver them to a bus for a direct trip downtown.

The evaluation of this project will measure the level of service and the costs of the integrated services and compare them to other systems that could be implemented such as expanded fixed route service or dial-a-ride bus services. The economic impact on the bus and taxi operations will be determined, including whether the bus system is able to increase productivity or reduce costs because of the taxicab feeders, and whether regular taxicab revenue or operating costs are affected by the transfer service. The operational procedures that are developed for efficient coordination between the two systems will also be

investigated and documented.

Reports from this project are not yet available.

Feasibility Study of Multiple Trip Subscription Bus Service

Project: CA-06-0084
Funding: $75,675
Schedule: March 1976 - October 1976
Contractor: The Aerospace Corporation

The objective of this project is to determine the feasibility of implementing short-haul subscription bus service, coordinated with a program of staggered work hours in an employment center. Past uses of subscription bus service have necessitated a relatively long trip distance in order to economically utilize the driver and vehicle while charging a reasonable fare. For short trips, passengers pay a relatively high price for less perceived benefits. However, by establishing a coordinated staggered work hours program among several employers, a subscription-bus service could provide two or more trips per vehicle per peak period, thus greatly improving productivity.

This project encompasses the development of a service concept for a major employment center with staggered work hours and the application of this concept to the El Segundo, California Employment Center. The impact of subscription bus service coordinated with staggered work hours will be projected for employers, employees and competing modes of commuter travel. In addition, the possibility of expansion of the concept to a wider area is being studied.

Evidence from this study indicates that a multiple-trip subscription bus service is a feasible concept. As a consequence, the design of a full scale demonstration in the Los Angeles area is currently being developed.

The final report is available from UMTA's Office of Transportation Management and Demonstrations.

Vanpool Demonstration Program

Project: VA-06-0033
Funding: $490,000
Schedule: September 1976 - August 1978
Grantee: Tidewater Transportation Commission

Traditional fixed-route, fixed-schedule mass transportation provides the bulk of public transportation service in most urban areas. However, in areas where population densities are not sufficient to support fixed-route, fixed-schedule service, adequate alternative transportation is not often provided. A potential means of providing coverage to these areas is through subscription van service. This type of service has been successfully implemented in the past, particularly through employer-sponsored programs but these programs have been limited, lacking organization, regulation and financing.

This project is designed to overcome these problems by providing a publicly operated, self-financed (after initial start-up costs) subscription van program which complements and is integrated into existing transit services. The Tidewater Transportation Commission of Norfolk, Virginia, working in conjunction with the U.S. Navy, will administer a subscription van program which will transport commuters to the area's naval facilities.

At present, the only transit service to the naval base is provided by small private operators, generally using old school or intercity buses driven by an employee of the naval facility. Consequently, most travel is made by auto. The subscription service is not intended to compete with the existing services, but will complement them with the objective of shifting auto drivers into multiple occupant vehicles. Support to the private operators will be provided by the formation of an association which will endeavor to provide them with reduced cost equipment, parts, gasoline and insurance.

Reports from this project are not yet available.

Service for Special User Groups

Community-Based Transit System

Project: OH-06-0022
Funding: $655,000
Schedule: July 1974 - December 1977
Grantee: City of Xenia, Ohio
Evaluation: Transportation Systems Center, Multisystems, Inc.

A small city transit demonstration was established as an integral part of a community redevelopment program following the April 3, 1974 tornado disaster. The project provides an example of how a typical Midwestern city of the 20,000 to 50,000 population range can provide responsive transit service for the entire community.

Shortly after the tornado, UMTA Service and Methods Demonstration funding plus a capital grant allowed the city to establish a transit department, purchase vehicles and operate a fixed route service known as the X-line. In July 1975, the city of Xenia received an UMTA demonstration grant to supplement fixed route transit service with paratransit services; Sunday and holiday demand-responsive service has been operating since that time. However, other paratransit services did not begin until January 1976, when jitney service replaced the fixed route service.

The fixed route service proved to be very popular in carrying some 1,000 riders daily. The City Commissioners, however, believed that the already strained city budget could not cover the cost of the system.

On March 1, 1976, the Xenia Taxi Company began operating the jitney service under contract to the city; full demand responsive service was substituted for the jitney service two months later. New taxi vehicles were introduced in July 1976 and the complete package of paratransit services, including the new fare schedule, will be implemented by January 1977.

The prime objective of the paratransit phase of the demonstration is to develop a system which provides good transportation service to the community with a minimum subsidy level. The introduction of higher fares and the confusion stemming from a number of intermediate service changes caused a severe drop in ridership, but with the stabilization of operations, patronage has begun to increase again. The new services are a financial improvement as evidenced by the current monthly deficit which has fallen to one-half that of the former fixed route service.

Reports from this project are not yet available.

Coordinated Services for the Handicapped, New York City

Project: IT-06-0154
Funding: $109,340
Schedule: October 1976 - October 1977
Grantee: Tri-State Regional Planning Commission; City Planning Commission, New York City

This project is intended to develop a working model for meeting the transportation needs of the handicapped in a major metropolitan area, New York City, with a complex array of existing transit providers, funding mechanisms, and institutional considerations. The planning study will include the following tasks:

- Selection of the Target Service Area - There will be an identification and analysis of agencies serving the handicapped, an inventory of the handicapped population and an assessment of their transportation needs.
- Development of a Taxi and Livery Cooperative - In response to an evaluation of the taxi and livery services in the target area, a cooperative or consortium arrangement will be formed if it is found institutionally possible.
- Analysis of Dispatch Systems - Requirements of the system will be determined and related to the kinds of dispatching technology available within a reasonable cost framework.
- Evaluation of Taxis and Vans for the Handicapped - Existing equipment alternatives will be assessed and a specification for taxi and van procurement will be developed.
- Assessment of Agency Commitment - Legislation, policies, and operational precedents that serve as obstacles to pooling of funds and sharing of vehicles or staff will be examined.

Reports from this project are not yet available.

Large City Demonstration Planning for the Mobility Limited

Project: IL-06-0033
Funding: $60,765
Schedule: July 1975 - November 1976
Grantee: City of Chicago Department of Public Works

The purpose of this program is to determine an effective means of transporting mobility-limited persons in a large urban area. A detailed implementation plan has been developed, with cost projections, for a pilot demonstration of convenient barrier-free transportation for the elderly and handicapped. The planning includes an inventory analysis of data required to determine the travel needs of the mobility-limited and the most effective approach for meeting those needs in one geographic sector of Chicago.

This planning phase of the project defines the specific boundaries of the sector to be served in a demonstration phase and includes the plans, specifications, procedures and criteria for operating the special transportation service. The next phase involves a demonstration of the proposed service plan.

Reports from this project are not yet available.

A number of communities, including Cranston, Rhode Island, have implemented demonstration projects of demand-responsive transit service for elderly and handicapped persons.

Special Elderly and Handicapped Services for a Medium-sized City

Project: OR-06-0004
Funding: $916,768
Schedule: June 1975 - June 1978
Grantee: Tri-County Metropolitan Transportation District of Oregon
Evaluation: Transportation Systems Center, Crain and Associates (Contractor)

This project is a demonstration of a comprehensive transit company operated, demand-responsive, special transportation system in an urban area of 400,000 population. The project is designed to provide a basic level of service to the elderly and handicapped population of the city of Portland through the close coordination of the special demonstration transportation service with the regular transit system.

The project also will coordinate transit agency special services with social service agency special transportation as well as services offered by the taxi industry. A credit card fare collection and computerized billing system will be tested as a means of demonstrating low cost transportation where part of the cost per trip is billed to social service agencies. This demonstration will then test the cost effectiveness of the third party billing concept and the feasibility of a public transit operator providing special transportation services in coordination with the needs of social service agencies.

An extensive "before" survey of the general population has determined the incidence of transportation handicapped, their travel problems and mobility requirements. This has been used in designing the service and will be published for use by planners in other cities. The operational phase of the demonstration will begin in December 1976.

The special report on the nature and incidence of the transportation handicapped will be available from the Transportation Systems Center.

User Subsidy Demonstration for the Elderly and Handicapped

Project: AL-06-0003
Funding: $465,449
Schedule: July 1976 - June 1978
Grantee: City of Montgomery, Alabama
Evaluation: Transportation Systems Center

The primary objective of this demonstration is to test the effectiveness and viability of a user subsidy to improve the mobility of elderly and handicapped persons. In this project, the user subsidy mechanism is an identification card that will enable eligible persons to obtain public transportation (bus or taxi) services at half fare. The subobjectives are to examine the quality of service provided to the elderly and handicapped and to assess how

efficiently the various public transportation alternatives are used.

The project service area is within the City of Montgomery, Alabama, which is about 50 square miles and has a 1970 population of 133,471 persons. Approximately 21,000 of those persons are eligible for the user subsidy. The area is served by a municipally owned bus system with 22 buses operating on 16 routes. There are four large taxi companies (with 21 to 24 vehicles each) and several smaller operators.

In order to achieve the objectives, this project consists of a three phase program. In Phase I, data collection activities will be conducted to establish a reference point with regard to the existing travel patterns of the elderly and handicapped.

Phase II will start with an intensive advertising and promotional effort designed to encourage all citizens 65 years of age and older and all handicapped persons to register for an identification card that will allow them to obtain the discount fares. Marketing the available bus service will be an important part of registration. Phase III, coinciding with Phase II, will consist of the operational activities of the user subsidy scheme. When used for bus service, the identification card will allow the user to pay half-fare (current fare is 30¢) with no restrictions on how many bus trips can be made. If used for taxi service, the identification card will entitle the user to purchase up to $20 worth of shared-ride taxi trips each month by paying half of the total fare (currently about $1.65). It is anticipated that the project will stimulate increased ridership by the elderly and handicapped of both the bus and taxi systems.

Reports from this project are not yet available.

Expansion of a Transit System for the Elderly and Handicapped

Project: CT-06-0003
Funding: $1,187,250
Schedule: June 1971 - July 1977
Grantee: Valley Transit District (Connecticut)
Contractor: RRC International, Inc.

This project addresses the Service and Methods program objective of improving transit service for the handicapped and elderly; it also serves to increase the coverage of general transit service, in terms of geographical area, and types of service available, and the population groups using the system. An additional objective is to provide public transit service which can effectively meet the transportation needs of health and social service agencies.

The first phase of this project developed a specialized transportation system using six specially equipped vehicles to serve the transportation needs of health and social service agency clients in the lower Naugatuck Valley in Connecticut. This phase included development of barrier-free vehicles for the elderly and handicapped, flexible service modes, including demand-responsive and agency contact; and a deferred-payment credit card fare collection system.

Assisted by an UMTA capital grant for eight additional vehicles, Phase II has enabled the concepts developed for the limited system to be applied and tested in a full public system. Primary demonstration elements have included integration of a coin/credit card fare collection system, development and application of new combinations of three service modes to a wide clientele and a revised fare structure. In November, 1975, the fixed route service in and between four towns (Seymour, Derby, Ansonia, Shelton) was begun. Contract, demand and subscription services have continued without interruption and have been expanded as equipment was acquired. Weekly ridership is near 3,000 trips and productivity averages nearly six passengers per vehicle-hour over all services.

The Phase I report is available from UMTA's Office of Transportation Management and Demonstrations.

Albuquerque Integrated Elderly and Handicapped Service

Project: NM-06-0002
Funding: $584,884
Schedule: July 1976 - July 1979
Grantee: City of Albuquerque, New Mexico
Evaluation: Transportation Systems Center

The project is designed to demonstrate the coordination of public and private transportation operations in order to provide special transportation for the handicapped and elderly. Service will consist of a combination of specially equipped vans operated by the City and augmented with services provided by the local taxi operator.

The City will operate vans on a variable fixed route and route-deviation basis, concentrating on subscription and group rides. Taxi operators will be involved by a user side subsidy arrangement under which the City will partially subsidize the fares of elderly and handicapped persons using shared ride taxi service. Taxis would cover areas not reached or not convenient for the van service.

The project is currently in the implementation planning phase.

Reports from this project are not yet available.

Community Broker Transportation Service for the Elderly

Project: CA-06-0002
Funding: $152,675 (UMTA & HUD)
Schedule: July 1975 - December 1976
Grantee: Stanford University Department of Engineering - Economic Systems
Evaluation: Transportation Systems Center, Crain Associates (Contractor)

The Community Services Cooperative (CSC) in Mountain View, California is an agency established by the grantee to demonstrate a version of the "community broker" concept in which a broker aggregates elderly (and handicapped) travel demand on a pre-scheduled, shared-ride basis. Transportation is provided in either standard sedans or an 11-passenger van. Both sedan and van service is provided by the taxi operator.

It is expected that this concept can lower the cost of door-to-door taxi service and, at the same time, be economically self-sufficient from generated fares. Trips are organized to such destinations as churches, shopping centers and medical centers for residents of two apartment complexes for the elderly and the adjacent community. Many of the clients served have limited incomes and need to economize wherever possible. This service is intended to permit them to better use community human services and still be able to afford necessary trips to shopping

and medical appointments. The viability and cost of brokering small group taxi rides is being examined and compared with the cost of alternative transportation options.

Interim results indicate that clients are satisfied with the dependability and convenience of the service. About 55 percent of the total market have participated; the average number of passengers per trip is 5.5, and clients average 6.5 project trips per month.

Reports from this project are not yet available.

Research on the Transportation Problems of the Transportation Handicapped

Project: NY-06-0054
Funding: $997,310
Schedule: April 1976 - April 1977
Contractor: Grey Advertising Co.
Subcontractors: Chase, Rosen and Wallace; Smith and Locke Associates

The overall objective of this research is to determine the travel requirements of various classifications of handicapped people and to develop viable transportation service alternatives using all modes that can satisfy such requirements cost effectively. The central issue to be addressed is the cost/benefit tradeoff between developing the needed transportation service by modifying existing and new transportation systems to make them accessible to the handicapped, (including the mentally retarded) and instituting specialized transportation services for the handicapped (including the mentally retarded) market.

The project will develop classifications of the transportation handicapped and identify the number, location, demographic characteristics, travel patterns, and travel requirements of all classifications. A cost/benefit analysis will be conducted to evaluate alternative approaches for meeting the transportation needs identified. Demonstrations will be designed in typical urban environments to implement or test proposed solutions. Minimum standards and guidelines will be developed for the recommended alternative service and equipment improvements, and a manual for urban transportation planning for the transportation handicapped will be produced. A suggested national program, including its cost, for improving the mobility of the transportation handicapped will be described. Finally, a selected number of operating transit systems using Section 5 UMTA grants will be investigated to determine principal issues in the off-peak, half-fare program for the elderly and handicapped, and a study to assess the impact of this program will be designed.

The project covers the broadest range of transportation modes, including urban mass transportation, air travel, inter-urban bus and rail, private auto and taxi. The research will focus on travel within urban areas but also will extend to travel between urban areas; travel within rural areas will not be covered. Demonstrations of service or equipment improvements designed or recommended will not be implemented as part of this project.

Reports from this project are not yet available

Transit for the Physically Handicapped

Project: LA-06-0111
Funding: $171,050
Schedule: June 1971 - December 1975
Grantee: City of Baton Rouge, Parish of East Baton Rouge (Louisiana)
Evaluation: Transportation Systems Center, CACI, Inc. (Contractor)

The Special Transportation Service (STS) of Baton Rouge, Louisiana is a demonstration project that has provided free transportation to the elderly and handicapped. This project demonstrates a method of transporting the aged and disabled by means of a specially designed system, separate from conventional public transit. The service is demand-scheduled and is operated in conjunction with Baton Rouge's existing public transportation operation, the Capital Transportation Corporation.

Within the service area, 88.2 square miles within the Parish of East Baton Rouge, six radio-equipped 12-passenger vans (four with wheelchair lifts) provide door-to-door service for riders who make appointments one day in advance. Service was designed primarily to meet medical trip needs with some other social service trips provided. More than 3,000 riders per month have been served, including 12 to 15 wheelchair passengers per day. Although UMTA funding ended in December 1975, STS operations have been continuing under HEW funding.

It appears that the STS service has provided its elderly and disabled riders with a greater sense of independence, increased mobility, and a more accessible vehicle. A significant accomplishment of this project has been the large percentage of wheelchair clients carried (13 percent) compared with other similar services (typically 0-3 percent).

The final project report will be available from TSC and UMTA Office of Transportation Management and Demonstrations.

A Neighborhood Transportation System for the Elderly

Project: OH-06-0018
Funding: $450,000 UMTA; $250,000 Department of Health, Education and Welfare
Schedule: June 1973 - March 1976
Grantee: City of Cleveland, Ohio
Evaluation: Transportation Systems Center, Case Western Reserve University, DAVE Systems, Inc., and Crain & Associates

The concepts established in this project demonstrate another technique for achieving increased mobility and access to services for the aged population. A flexible routed transportation system serves the basic transportation needs of the elderly as part of a total neighborhood service for the aged. The project concept was developed to:

1) Ascertain the economic and institutional feasibility of a general public transit system (Cleveland Transit System) providing specialized vehicles and services for the elderly as part of its everyday operations.
2) Examine the benefits of a coordinated neighborhood transportation approach in achieving the objectives of existing and future health and social programs designed to serve the elderly.
3) Determine the economic and social impact of a system that increases the mobility potential of a major segment of the transit-dependent population in a large city.

The Neighborhood Elderly Transportation Project in Cleveland provides demand-responsive transit service in three areas with heavy concentrations of elderly persons.

The demonstration area is composed of three distinct high density, low income areas covering 7.6 square miles and containing a high percent of elderly persons. Door-to-door demand-responsive service has been provided within each of these areas to all persons 60 years of age and over. This project has been transporting about 11,000 elderly persons per month.

Surveys suggest that the mobility of users has been increased and that they have been able to make more trips to more desirable destinations at less cost to them. System operating costs are now being cut by reducing the hours of operation and requiring 24-hour advance reservations. Moreover, a new labor agreement allowing a new driver classification at a reduced rate for this special service will further cut costs. The transit service is being continued beyond the demonstration period by the Cleveland Regional Transit Authority with these modifications as well as contracting a portion of the service to local taxi operators.

A final report for this project is currently in production.

Demand-Responsive Public Transportation for Handicapped and Elderly

Project: NY-06-0041
Funding: $333,000
Schedule: May 1973 - October 1975
Grantee: Central New York Regional Transportation Authority (Syracuse)
Evaluation: Transportation Systems Center, SYSTAN, Inc. (Contractor)

This project designed and implemented a demand-activated transportation system using four specially equipped vehicles to serve the special transportation needs of the eldelry and disabled in Syracuse and Onondaga County. The project determined the latent travel demand of some 85,000 elderly and disabled residents, many of whom were completely transit-dependent, when they were provided a well publicized high level of service geared to their special needs. This service permitted the accommodation of regularly scheduled work trips as well as school, medical and social trips on a seven day per week basis throughout the urbanized area.

Sponsored by the local transit authority, the project involved close coordination of service among suppliers, customer and destination activity. Project activity included an analysis and evaluation of social and economic benefits to the user as well as the feasibility, cost effectiveness and latent demand for such a service if it were available to an entire medium size urban area. The project established a monthly ridership of 5,000 persons. Productivity gains achieved during the project resulted in a 25 percent reduction in cost per trip. This service is being continued by CYNRTA.

A final project report will be available from TSC and UMTA Office of Transportation Management and Demonstrations.

Pricing Policy

Transit Fare and Service Innovations

Project: DC-06-0120, DC-52-0002
Funding: $310,325
Schedule: July 1975 - May 1977
Grantee: The Urban Institute

This project is designed to identify the effects of various transit system characteristics on ridership, and investigate the importance of other transportation options and of demographic and socio-economic characteristics of the population to be served. Assessment of the relative sensitivity of ridership to enhanced vehicle speeds, shortened headways, expanded service hours, increased seating capacity, greater marketing and promotion, lowered fares, and investigation of incremental costs associated with making each of these changes, will permit an assessment of relative cost-effectiveness of various transit agency policy options for increasing patronage.

In response to Title II of the National Mass Transportation Assistance Act of 1974, this project is designing a research and demonstration program to investigate the impacts of fare-free transit service. This program will address the detailed methodological and management issues associated with mounting a coordinated set of experimental demonstrations. The project will also develop one or two transit fare prepayment demonstration projects to examine the effects of this type of fare policy.

This project has prepared two documents on the current understanding of general transit pricing and service policies and the relative cost-effectiveness of low fares as a ridership stimulant. A report presenting case studies of the recent experience of 35 transit agencies operating low-fare or free-fare services has also been developed.

Reports from this project are listed in Appendix I

Fare Prepayment Study

Project: DOT-TSC-1056
Funding: $94,340
Schedule: July 1975 - July 1976
Contractor: Huron River Group, Inc.

This project was designed to study the many forms of prepayment mechanisms that have been implemented within the transit industry over the last 30 years and identify the most important features and problems of their implementation. Three separate and complementary approaches were taken to accomplish these objectives: (1) a history and background of fare prepayment, based primarily on library research; (2) a survey of U.S. transit operators and a discussion of current operational issues; and (3) a discussion of transit user attitudes, based on several previously published studies as well as four user surveys performed specifically for this study.

It was found that about 93 percent of U.S. transit systems have some form of fare prepayment but there is a lack of hard data on various measures of their effectiveness. The judgment of transit operators apparently is that prepayment plans generally increase ridership and probably never decrease ridership, and usually have no observable effect on revenue. Administrative costs, impacts on staff level, and impacts on coin handling and counting seldom appear to be significant. Most plans are reportedly used by only small percentages (less than 10 percent) of boarding passengers.

The transit user surveys found that, among commuters, the choice of a transit payment method is based on a calculation of that user's expected cost per trip. However, economic considerations do not hold among groups having limited incomes. The front-end cost of a multiple-trip mechanism may be a deterrent to its use by people with limited income.

The study concludes that employer-sponsored programs for distributing prepayment mechanisms have been effective and deserve more attention from transit operators. Another conclusion is that day passes have significant but largely undiscovered advantages related to passenger convenience, encouraging off-peak travel and meeting the needs of low-income users. The study has been completed and the final report is being published. A demonstration of a prepayment program also is being planned to provide quantitative information on various measures of the effectiveness of prepayment mechanisms.

Reports from this project are available from UMTA's Office of Service and Methods Demonstrations.

Congestion Pricing

Project: DC-06-0120
Funding: $301,214
Schedule: July 1975 - May 1977
Grantee: The Urban Institute

This project is designed to demonstrate a transportation improvement package combining road pricing with expansion of high occupancy services such as carpools, vanpools and fixed route transit. The project includes development of descriptive reports on roadway pricing objectives and expected outcomes, selection of several metropolitan areas for preliminary analysis of transportation improvement packages incorporating road pricing, and the development of detailed demonstration designs and evaluation procedures for the most promising sites. Implementation of the demonstration concept is expected in at least one site.

Site selection criteria have been developed and a preliminary screening and selection of potential sites has been completed. The project has developed a monograph that reviews the most important elements of road pricing, motivation, desirability, feasibility, implementation costs, and questions of equity and efficiency. Two other informative papers have been developed, one comparing alternative strategies for reducing automobile use and making the case for road pricing, and the other summarizing the proposed demonstration concept and procedures. A detailed paper also has been prepared on implementation procedures for the road pricing element of the demonstration proposal.

Eleven potential demonstration sites have been contacted and preliminary sketch designs of the concept have been completed for three of the most promising cities. These designs use simplified analysis procedures to predict the traffic and other impacts of the demonstration package for different levels of road pricing and transit improvement.

Reports from this project are listed in Appendix I

User-side Subsidies

Project: DC-06-0120
Funding: $169,604
Schedule: July 1975 - May 1977
Grantee: The Urban Institute

Urban public transportation subsidies are usually paid directly to transit providers for offering specified services at low fares, below provider costs. An alternative approach, the user-side subsidy, allows certain users to purchase transportation vouchers or tokens from a public agency at a price below their face value. The providers accept the vouchers as payment for transportation services and then redeem them at face value from the public agency. Since the subsidy is passed along to the provider only when the target user is served, it acts as an incentive to the provider to offer attractive service rather than to take the subsidy for granted. Also, he must offer service that is attractive to the large number of users that pay the full charge directly because they don't qualify for the user subsidy. Where there are several alternative providers, users can choose the provider best able to meet their needs, thus encouraging competition between the providers. The objectives of this project are to examine the applicability of the user-side subsidy concept in public transportation and to develop demonstration projects to test its effectiveness under different institutional and operational conditions.

This project has reviewed existing examples of user-side subsidy techniques, with special attention to their applicability for improving the mobility of elderly and handicapped persons. Three user-side subsidy demonstration projects involving these client groups have been developed: in Danville, Illinois, with shared taxi services; in Montgomery, Alabama, with a publicly owned bus system and privately owned shared-taxis, and in Lawrence, Massachusetts, with privately owned buses and shared-ride taxis. Thus demonstration projects are testing different ticket and voucher

techniques for disbursing user-side subsidies and are illustrating alternative administrative and institutional arrangements.

In addition to examining the effectiveness of the techniques for assisting particular client groups, the project will also develop a demonstration project in which the user-side subsidy is available to all residents of an area, and is the primary source of subsidy for both fixed-route and door-to-door services. The administrative costs and service quality for this approach will be measured and used as a basis for comparison with provider-side subsidy schemes in other cities.

Reports from this project are listed in Appendix I

User-side Subsidy Demonstration

Project: IL-06-0034
Funding: $314,530
Schedule: June 1975 - August 1977
Grantee: City of Danville, Illinois
Evaluation: Transportation Systems Center, Crain and Associates (Contractor)

The Danville User-Side Subsidy, Taxi-Discount Demonstration Project is testing the effectiveness and viability of the user-side subsidy as a means for improving mobility of special user groups—elderly, handicapped, and young persons—and to develop better local public transportation services. (User-side subsidy is defined in the project as transportation assistance to specific eligible persons through the use of tickets that may be sold to the user at a discount and redeemed by the taxi operator at face value.)

The two-phase demonstration program included a three-month preparatory phase in which ticket design, distribution and redemption methods were established. During this phase, data was collected to establish a reference point regarding existing travel patterns and the status of taxi operations prior to introduction of the ticket system. The 21-month Phase II uses discounted taxi tickets (sold at 25 percent of face value) without changing other taxi operations. This is expected to show the effectiveness of the tickets in improving mobility for the special user group.

The project has been operating since December 1975, with service being offered to persons over 65 years and handicapped persons. To date, one-third of the eligible population have registered and one sixth have been using the service at least once a month.

An interim evaluation report will be available through TSC and UMTA's Office of Service and Methods Demonstrations.

A demonstration project in Danville, Illinois makes use of taxi vehicles and user-side subsidies to improve the mobility of elderly and handicapped persons.

Program Support Activities

Small Community Transit Study

Project: MA-06-0049
Funding: $180,000
Schedule: May 1975 - June 1976
Contractor: Transportation Systems Center

In the interest of sharing information about recent developments in public transportation for small cities (populations of 10,000-50,000), examples of effective approaches have been documented and disseminated through a variety of media. Thirteen cities were selected as examples of a variety of service approaches. Case studies were conducted and published, together with a technical comparison of cost and service characteristics and a summary of state programs for technical and financial assistance to small communities for implementing transit. A film was produced, illustrating four examples of innovative transit service which represent the spectrum of basic service models currently being applied in small cities. A session on small community transit was held at the 1976 Transportation Research Board Conference.

In the spring of 1976, UMTA held a series of six regional seminars on public transit for representatives of cities with populations between 10,000 and 50,000. Participants included local officials, private citizens, state and regional planners, and taxi and transit operators. Speakers discussed their experience in planning and operating small transit systems; topics included paratransit service options, management and marketing small transit systems, and state and Federal funding. Some 700 persons attended these seminars and copies of the publications and film have been widely distributed. The program has stimulated an interest in innovative approaches among city officials and transit operators who otherwise might not have access to information about service alternatives being applied in other communities.

Reports from this project are listed in Appendix I

Attitude Measurement Techniques for Transportation Planning and Evaluation

Project: DOT-TSC-1168
Funding: $177,456
Schedule: July 1976 - January 1978
Contractor: Transportation Systems Center, Abt Associates, Inc.

A study is being made of "Attitude Measurement Techniques for Transportation Planning and Evaluation" in order to develop better analytic techniques for measuring attitudinal responses to transportation improvements and demonstrations. This study is examining attitude measurement procedures relevant to understanding travel behavior and will establish the utility techniques relative to other transportation planning methodologies.

This study will produce a manual describing attitude measurement techniques for transportation planning and evaluation containing sufficient information that people unskilled in social science techniques could conduct attitudinal evaluations. Additionally, the study will produce a final report containing a technical discussion of the validity and utility of attitude measurement techniques based on integration of information from a literature search, field experience and analyses. This report will consider the utility of attitude measurement techniques relative to other transportation analysis procedures.

This study is expected to have a two-fold impact. It will make available to transportation planners and system operators a set of attitudinal measurement techniques which can be used to evaluate response to planned or implemented transportation innovations, and it also will validate the methodological bases of attitude measurement techniques, thereby designating the range of applications in which these procedures have utility.

Reports from this project are not available.

Transit Operations and Planning Status (TOPS) Information Retrieval System

Project: MA-06-0049
Funding: $25,000
Schedule: October 1975 - December 1976
Performed by: Transportation Systems Center (Cambridge, MA)

The Transit Operations and Planning Status (TOPS) file system is a comprehensive and convenient information retrieval system designed to aid DOT personnel, transit planners and others in keeping abreast of new and innovative transit operations. As a fast access information source, the TOPS file should prove to be a useful tool for demonstration site selection and for studies of the applications of innovative transit services. Bus priority treatments, innovative fare policies, and new service concepts currently in operation are examples of TOPS entries. Each entry is a concise summary of a particular project, and includes information on project location, a brief project description, the operating and funding agencies, project status, cost, and information source.

As an adjunct to this information, TOPS also contains a directory of transit modes and operators within each urban area. Accessing this sub-file by city provides output data which include information on population, population density, metropolitan and regional planning organizations, transit operating agencies, primary transit modes, route miles for each mode, number of vehicles in service, and UMTA Capital and Technical Studies Grants. The TOPS files are maintained and updated on a regular basis from sources which include transit industry publications, Departmental news releases, capital grant and technical study grant awards, and contacts with UMTA regional representatives.

TOPS is designed and implemented on the "Keyword" concept; keywords can be used either singly (for broad search) or can be combined together to narrow the search. Transit innovations can also be searched by Geographic Area (City and/or State). Consequently, it is possible to initiate a search for all transit innovations occuring in a particular locality by merely listing the city and/or State. It is also possible to combine a "Geographic" search with a "Keyword" search. At present, the TOPS file may be accessed from computer terminals located at the Transportation Systems Center. Outside requests for TOPS information are handled by the Technology Sharing Office.

Reports from this project are not yet available.

UMTA conducted a series of small community transit seminars around the country to stimulate interest in innovative approaches to public transit issues in small communities.

Double Deck Bus

Project: CA-06-0069, NY-06-0044
Funding: $334,375 (Los Angeles); $415,984 (New York)
Schedule: June 1974 - June 1977
Grantees: Southern California Rapid Transit District (SCRTD); New York Metropolitan Transit Authority (MTA)

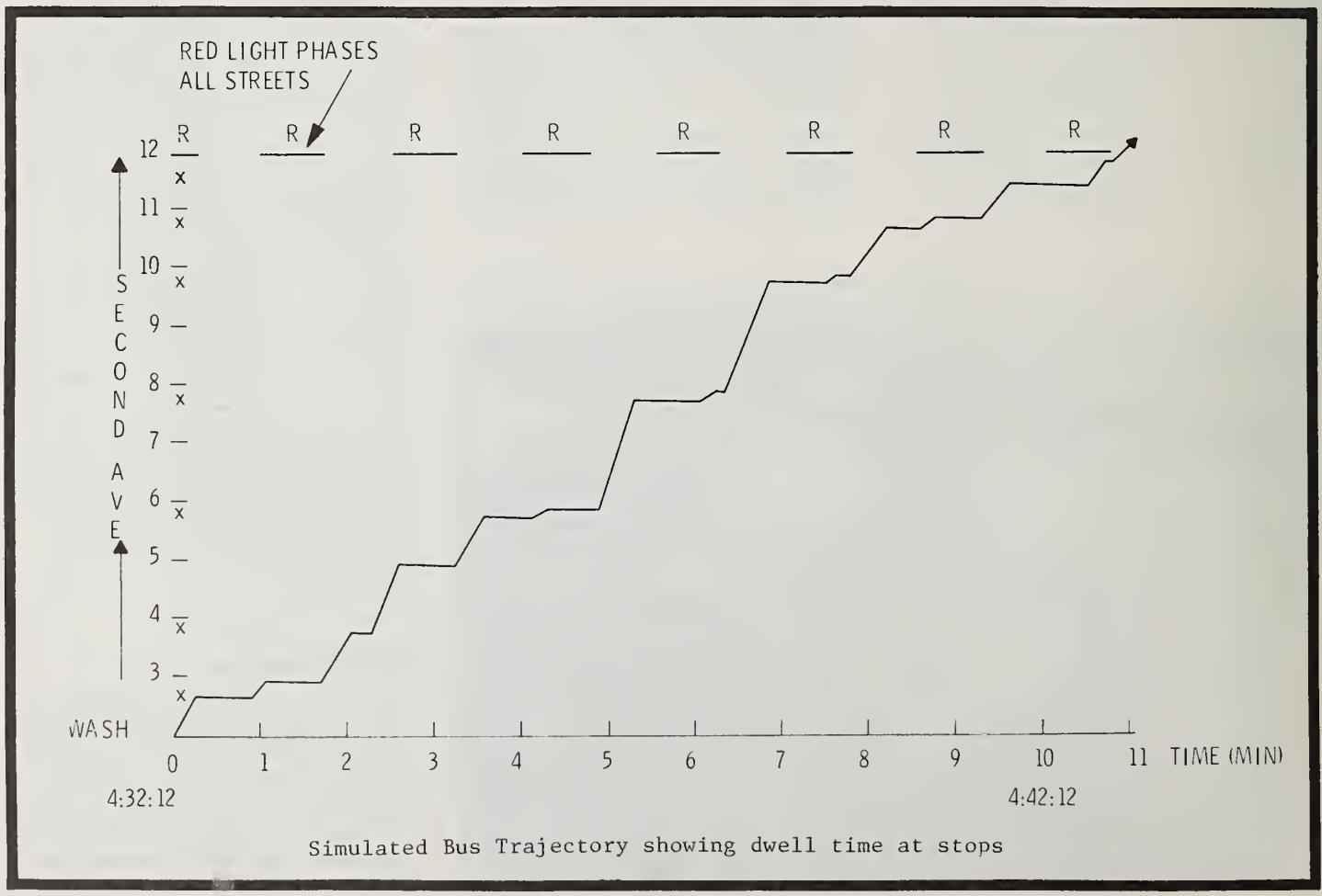
New York City again has double deck buses under an UMTA demonstration project.

Evaluation: Transportation Systems Center, Crain and Associates (Contractor)

The Double Deck Bus Demonstration Project addresses the Service and Methods Demonstration objective related to increased productivity of transit vehicles. This project is designed to demonstrate and evaluate double deck buses operating in daily revenue service in terms of public acceptance, rider safety, economic and service benefits. The project involves the purchase and operation of contemporary double deck buses, eight in New York City and two in Los Angeles. The buses will be operated in two types of service: arterial service with heavy ridership, frequent boarding and exiting, and relatively short spacing between stops will be operated in New York; express service with high average speeds, infrequent stops and a high level of passenger amenity will be operated in commuter and special service on the El Monte Busway and Los Angeles-area freeways.

SCRTD has been operating two German Neoplan buses on the El Monte Freeway since June 1975. These vehicles have encountered several mechanical problems which have continued to interrupt service. A recently completed rider survey indicates user satisfaction and a preference for the double deck over the standard bus. In New York, the eight British Leyland buses went into revenue service in September 1976 and appear to have become an immediate success with the New York riding public.

Reports from this project are not yet available.



Simulated Bus Trajectory showing dwell time at stops

Simulation for Traffic Management Analyses

Project: MA-06-0049
Funding: $450,000
Schedule: May 1974 - September 1978
Performed by: Transportation Systems Center

Increased traffic demand coupled with a moratorium on roadway construction has led to the development of sophisticated traffic management strategies. These include methods to maximize the movement of people, as opposed to vehicles, and range from bus-only streets to bus priority on metered freeway ramps. In order to predict the effect of the implementation of proposed bus priority strategies, computer models have been developed to simulate the flow of traffic for a wide range of control systems.

The movement of traffic on city streets and highways is an extremely complex system. A change in the operation of a single traffic signal can change the flow in the entire street network. A computer model, STRAP (*S*imulation of *TR*affic for *A*nalysis and *P*lanning) was developed as a laboratory test bed to evaluate candidate control strategies prior to field demonstration. Performance measures are computed for each street, as well as the entire network, from trajectories generated for each car, truck and bus moving through the simulated urban grid or freeway corridor.

Several bus operation improvement techniques have been modeled and field tested. Simulation results and field observations in Minneapolis show that simply reserving bus lanes in the CBD may not significantly decrease bus trip time because the dominant elements in CBD bus trip time are distance between scheduled bus stops, delays due to traffic signals and passenger service time. Simulation studies have also shown that the installation of mid-block pedestrian traffic signals, as an additional service to bus patrons, could increase significantly the delays incurred by general traffic and buses. Additional studies have shown that bus trip times can be reduced by designing fixed-time traffic signal settings for bus progression and by permitting preemption of traffic signals by buses.

In order to minimize the delays incurred by general traffic when buses are given priority in the street/signal control system, traffic routing strategies have been developed. Studies are underway to apply advanced control techniques to the optimization of general traffic performance subject to providing buses with priority commensurate to their people-moving capability.

Reports from this project are listed in Appendix I

Chapter 7:
POLICY AND PROGRAM DEVELOPMENT

UMTA's Office of Policy and Program Development is responsible for coordinating the development, planning and evaluation of the UMTA program. This office also performs short-term and long-range policy analysis and plays a major role in the development of legislative proposals, new policies, regulations and directives. The Office of Policy and Program Development also administers a program of policy-related research and analysis and the UMTA University Research Program. This office has three organizational components: the Office of Policy Development, the Office of Program Evaluation and the Office of Policy Research.

Office of Policy Development

The Office of Policy Development is responsible for policy analysis and development in relation to UMTA's strategic planning and program responsibilities, and for legislative and regulatory development. This office directs and coordinates UMTA's participation in the Departmental program review and planning process, and develops in consultation with other elements of UMTA new programs, regulations, practices and procedures designed to ensure more effective delivery of Federal urban transportation assistance.

Policy Analysis Support

Project: MA-06-0053-02
Funding: $160,000
Schedule: June 1976 - September 1977
Contractor: Transportation Systems Center

The purpose of this project is to provide analytical support to planning and policy issues associated with the status and development of urban transportation. The project will consist of two major tasks: Analysis of incremental development policy and general policy support. The incremental development task will provide an analysis of two policy issues related to fixed guideway transit: technological upgrading and system extension. The general policy support task will provide UMTA with analytical support in the development and implementation of urban mass transportation policy.

Reports from this project are not yet available.

Urban Transportation Policy Studies

Project: MA-11-0004
Funding: $40,658
Schedule: October 1976 - September 1977
Contractor: Massachusetts Institute of Technology (Dr. Ralph Gakenheimer)

This project, one of three in the grant, will study area responses to Transportation Systems Manage-

ment (TSM) requirements. It will examine which TSM options are chosen by urban areas and how the planning is done through examination of existing TSM plans, brief surveys of Metropolitan Planning Organizations (MPO's) and frequent communication with UMTA.

The project also will determine why these choices are being made in order to discover their basis in urban area planning, and will ascertain what new information is required and obtained for TSM planning. Typical issues examined will include: Is there a preference for traffic management approaches versus other TSM options suggested by Federal guidelines? Are some traffic management techniques favored over others, and if so, why? Is the substantial reduction of vehicle use in downtown areas viewed as feasible by MPO's? and Is private sector collaboration to arrange staggered or flexible work hours seen as feasible?

Reports from this project are not yet available.

Urban Transportation Policy Studies

Project: MA-11-0004
Funding: $52,588
Schedule: October 1976 - September 1977
Contractor: Massachusetts Institute of Technology (Dr. Allan Altshuler)

This project, one of three in the grant, will examine and evaluate selected funding issues in urban mass transportation. The study will focus on:

- The extent and nature of transit funding problems in urban areas of varying types;
- The decision-making process at the State, regional and local levels for meeting transit fiscal requirements, and for making fiscal-service tradeoff decisions;
- The impact of Federal and State aid policies on transit decision-making at the regional and local levels; and
- Potential means of targeting Federal and State aid to encourage transit innovation, efficiency and balanced decision-making with reference to capital versus operating expenditure tradeoffs.

A brief analysis will be conducted of the ways in which transit fiscal issues have evolved and been dealt with in eight to 10 representative urban areas over the past two decades. Attention will be focused on patterned differences and similarities among the varying types of areas with respect to the evolution of the current transit "fiscal crisis"; recent fiscal, service, patronage and planning trends; sources of revenue and their impact upon policy choices, the current intensity and nature of controversy over transit fiscal issues; and the policy outlook.

An exploratory review and analysis will be conducted of the varied funding sources available in one state to support special transportation services and subsidies for the elderly, handicapped and poor. Special attention will be placed on the transportation components of social service and medical programs assisted by the Department of Health, Education and Welfare, along with those programs assisted by the Department of Transportation.

Reports from this project are not yet available

Urban Transportation Policy Studies

Project: MA-11-0004
Funding: $21,149
Schedule: October 1976 - September 1977
Contractor: Massachusetts Institute of Technology (Dr. Daniel Roos)

This project, one of three in the grant, will study the potential of policies to capture land value increases resulting from urban transit systems—the principle of value capture. The study will explore the potential of policies which attempt to "capture" or tax away some of the changes in real estate values, either as a source of general revenues or to partially offset the operating costs of the transit system. As the first portion of the effort, the project will examine recent real estate transactions in the Washington, D.C. metropolitan area by drawing on existing files which describe land parcels. Properties near stations in operation, those near stations under construction and those largely unaffected by the new transit system will be examined to separate various sources of land value changes in the data.

Reports from this project are not yet available

A Study of the Feasibility and Impacts of All-Inclusive Transportation Trust Funds as a Mechanism for Transportation Finance

Project: NY-11-0014
Funding: $50,000
Schedule: September 1976 - August 1977
Contractor: Polytechnic Institute of New York (Roger P. Roess)

This project will study the feasibility of designing and implementing multi-modal transportation trust funds at three levels: Federal, state and regional (or local). The feasibility analysis will address, but not be limited to, the following factors:

- Existing and potential funding sources at the respective levels;
- Compatibility among the funds and their levies;
- Institutional changes required to implement these funds and fiscal tools;
- Effect on the political decision-making process; and
- Flexibility to meet differing transportation needs in the various states and localities.

A complete review of all current funding sources for capital and operating purposes will be made via a survey of selected state and local transportation agencies, as well as a review of pertinent legislation. Fiscal mechanisms for funding transportation capital and operating costs have historically been based upon general revenues or specific taxes or fees for specific modes. Highways have enjoyed a predictable base of national funding which no other mode has received; systematic forms for financing of all transportation modes must be developed that will provide stable funding in a form that will allow rational decision making.

Reports from this project are not yet available

Allocation of Transit Subsidies

Project: NJ-11-0004
Funding: $58,062
Schedule: July 1976 - July 1977
Contractor: Princeton University (Paul M. Lion)

Allocation of subsidies is one of the most acute problems now facing the New Jersey Department of Transportation and other similar agencies; this project is therefore designed to develop an analytical

methodology for the rational allocation of subsidies to different transit lines and modes. The research will make use of a simple analytic structure developed at Princeton for the management of transit systems.

Based on demand and cost models, explicit expressions can be derived for any measure of equity or efficiency such as subsidy per passenger, cost per passenger mile, etc. Contours of these variables can then be plotted on various planes using computer graphic facilities. This research will use the plots to examine the implication of possible subsidy allocation formulas in a systematic way. Although it is unlikely that subsidy decisions will be made solely on economic or technical considerations, it is believed that such decisions can be aided by mapping the trade-offs among explicit measure or formulas, rather than relying strictly on intuition. Graphic displays further aid in such decisions.

Reports from this project are not yet available

Non-urbanized Area Transit Assistance Requirements: Funding for Capital and Operations

Project: IT-06-0159
Funding: $50,000
Schedule: June 1976 - May 1977
Contractor: Ecosometrics, Inc.

This project will mathematically forecast the range of Federal capital and operating funds in the Nation's non-urbanized areas under varying assumptions of transit demand, service quality, fare revenues and costs. The study will determine transit ridership, costs and net revenues associated with assumed levels of transit service based on Ecosometric data for 400 systems and information from concurrent Department of Transportation research. The study also will estimate non-Federal financial resources for these services in conjunction with DOT research projects on transit funding and will estimate participation rates by non-Federal institutions in Federal transportation programs. It also will forecast the impacts of these Federal grant policies on non-Federal transit investments, including the mix of capital and operating funds; such information is to be estimated by small urban and rural areas. Assessment will include the inflationary impacts of Federal funding availability.

Reports from this project are not yet available.

The County Role in the Provision of Public Transportation in Non-urbanized Areas

Project: IT-06-0160
Funding: $75,000
Schedule: July 1976 - April 1977
Contractor: National Association of Counties

This project's objectives are:

- To develop a profile of county duties and responsibilities;
- To assess the current role of counties in the provision of public transportation and to outline potential future roles; and
- to evaluate the county, through case studies, as a coordinator or administrator in the preparation of transit development programs for non-urbanized communities.

Reports from this project are not yet available

Survey of Public Transportation Services in Small Urban Areas, 10,000 - 200,000 Population

Project: DC-06-0155
Funding: $15,000
Schedule: July 1976 - February 1977
Contractor: Urban Institute

This study will estimate the national availability of local bus transit, taxis, specialized paratransit and intercity bus services, in coordination with other state and trade association research. The contractor will conduct telephone interviews with transit providers in communities of 25,000 to 200,000 population and in a sample of several hundred non-urbanized areas of 10,000 to 25,000 population.

The proportion of communities with basic transit services shall be established. Basic data shall be collected about available local buses and taxi services, vehicles, and types of ownership and ridership; information about regulations and statistics on ridership, revenue and capital and operating costs also will be sought. This data shall be collected for other types of paratransit services in a subsample of 20 to 30 cities; existing Federal, state, county and trade association data will supplement interview data. Prepared interview guides and tabular summaries will be compatible with the UMTA research project on transit in areas under 10,000, to permit preparation of national estimates of transit availability and quality.

Reports from this project are not yet available

Survey of Public Transportation Services in Small Urban Areas under 10,000

Projects: NC-11-0004
Funding: $44,000
Schedule: July 1976 - February 1977
Contractor: North Carolina A&T University

This study will estimate the national availability of local bus transit, taxis, specialized paratransit and intercity bus services. Telephone interviews of operators in a sample of several hundred small urban areas will be conducted to establish the proportion of places with public transportation. Basic data shall be collected about available services, vehicles and types of ownership and ridership; information about regulations and statistics on ridership, revenue and capital and operating costs also will be sought. Existing Federal, state, county and trade association data will supplement interview data.

To permit preparation of national estimates of transit availability and quality, the study interviews, guides and data summaries will be compatible with those produced by the UMTA research project on transit in small cities (DC-06-0155).

Reports from this project are not yet available

Transit Problems in Small Cities and Non-Urbanized Areas

Project: NC-11-0004
Funding: $65,895
Schedule: July 1976 - July 1978
Contractor: North Carolina A&T State University (Douglas McKelvey, Arthur Jackson, George Amedee)

This project consists of two tasks: The first will develop techniques for information gathering on small city transit and then create a data base that could be used as policy input in

various areas; the second will investigate the impact of the UMTA Act's Section 16(b) (2) on programs for the elderly and handicapped and the attitudes of local taxi operators.

The first task will attempt to answer two questions: What is the proportion of places outside of urbanized areas and less than 10,000 population that have mass transportation? What is the number of transportation providers of each type (public transit, taxis, intercity carriers, specialized systems) and what is the level of service for those places? This complements the ongoing efforts of the Urban Institute to answer the same questions for areas of 10,000 to 200,000 population.

The research will use a statistically representative sample of about 750 places to answer these questions; all states will be contacted to determine if they have already undertaken a transportation inventory. The product of this research will be a set of summary tables that quantify the type of transportation providers and the levels of services; information on ridership, costs and revenues also will be included.

In addition, the project will investigate the impact of UMTA's 16(b) (2) programs on the travel patterns of elderly and handicapped persons [Section 16 (b) (2) provides funds for local non-profit organizations to purchase vehicles to serve the transportation needs of elderly and handicapped persons]. The research will address such questions as: How many special transportation programs for the elderly and handicapped (E&H) in small urban areas have purchased vehicles under the 16(b) (2) program? What are the socio-economic characteristics of the E&H riders of such services? What are the major travel patterns of E&H riders? What has been the impact of such programs on travel patterns of E&H riders? What has been the impact of 16(b) (2) in reducing the cost of transportation to the E&H rider?

Reports from this project are not yet available

Public Costs and User Charges Associated with Urban Auto Use

Project: IT-06-0115
Funding: $20,000 UMTA, $55,000 Department of Transportation
Schedule: June 1976 - August 1977
Contractor: Sam Harris Associates, Ltd.

The Department of Transportation and UMTA are interested in determining the spectrum of public and private costs associated with automobile use. This particular study will focus primarily on public costs and the extent to which users bear their share of public costs through user charges. This information is necessary to determine total costs of auto use, how costs are covered (via user charges, real estate taxes, etc.), and who they are being paid by, to assist in the evaluation of the impacts of changes such as increased gasoline tax and changes in parking fees.

The work will be accomplished in seven separate tasks: (1) categorization of costs and revenues associated with auto use; (2) quantification of public expenditures; (3) quantification of user charges; (4) quantification of special private cost by utilities, employers, etc.; (5) total cost analysis; (6) marginal cost analysis; and (7) recommendations.

Reports from this project are not yet available

Assessment of Conventional and Innovative Methods for Financing Public Transportation Systems

Project: IT-06-0127
Funding: $90,000
Schedule: September 1976 - September 1977
Contractor: Institute of Public Administration, Gladstone Associates

This study will assess the various ways in which public transit systems can be financed, such as through tax increment assessment, value capture, joint development, etc. The report will provide interested local officials with important guidelines for evaluating and implementing potentially attractive methods for funding transit programs.

Reports from this project are not yet available

Regional Financing Alternatives for Mass Transit

Project: NY-11-0003
Funding: $98,062
Schedule: October 1976 - September 1977
Contractor: Syracuse University (Dr. David Puryear)

This project will compare alternative regional financing mechanisms for mass transit in terms of their economic efficiency, equity, fiscal impact, locational and land use incentives, and administrative feasibility. Six alternatives revenue sources will be analyzed and evaluated according to the following criteria: 1) property (and land) taxes; 2) income taxes; 3) sales taxes; 4) user charges; 5) intergovernmental grants; and 6) general revenues. Each of these six general categories will be further divided into specific tax formulas identifying the extent of the tax base used, the geographic area bearing the nominal financing burden, and any other particular features of significance. Alternative formulations will be studied for each tax base. The impact of these financing alternatives will be examined in two ways. The first part of the project will consist of a conceptual economic analysis of the alternatives, focusing on the issues of efficiency, equity, fiscal impact, locational incentives, and feasibility.

Two case studies will be undertaken as the second major part of the project, which will allow a conceptual analysis of the financing alternatives to the actual metropolitan situations in the New York and Atlanta regions. These two regions represent, respectively, a central city-oriented and financed mass transit system and a regional transit system. The case studies will generate estimates of the impacts of alternative financing mechanisms on a variety of groups and jurisdictions in each metropolitan area.

Reports from this project are not yet available

Sources of Non-Federal Support for Non-Urbanized Area Transportation: State, Regional and County Assessments

Project: NC-11-0004
Funding: $35,000
Schedule: September 1976 - April 1977
Contractor: North Carolina A&T State University

This study seeks to identify current non-Federal funding for transit services and to anticipate likely resources to support non-urbanized area programs. Telephone interviews and site visits will be used to identify financial data and experts'

perceptions of funding trends. Emphasis will be on aspects unique to low density, non-urbanized areas.

Elements of the study will cover:

a) Inventory of amounts of current non-Federal fiscal and in-kind contributions to public transportation;
b) Inventory of current sources of non-Federal contributions to public transportation;
c) Relationships between transit expenditures and other social service budget outlays
d) New concepts of non-Federal finance,
e) Scenarios for increasing non-Federal funding for public transportation; and
f) Special problems of non-Federal funding.

Interview topics will include levels of funds necessary to match Federal programs or continue demonstration projects, needs for continuity and predictability of funding sources, the limited fiscal capacity of many low-income rural areas, and the appropriate classification of Federal funds transferred to non-Federal government treasuries.

Reports from this project are not yet available

Potential for Betterment District Financing of Surface Transit

Project: WA-11-0005
Funding: $30,000
Schedule: July 1976 - July 1977
Contractor: University of Washington (Dr. Edgar M. Horwood)

This project's objective is to determine whether there are incremental benefits accruing to land near bus, trolley and by inference, light rail facilities, and to examine equity issues in potential tax benefit districts. Seattle's ongoing geoprocessing system will be used, operating on a 10-year file of street address geocoded building permits for all construction, maintenance and repairs totaling more than $1,000. Use of this system will permit the assembly of investment information by city blocks emanating from transit lines, transit stops, transfer points and other transit improvements such as shelters and parking facilities near freeway flyer stops.

The total investment through the building permit file at these locations will be examined and contrasted with other locations which do not have transit facilities adjacent or nearby. Similar analyses will be studied by considering property sales and assessment records.

Expected products of the project include inferences of the potential for small area betterment tax districts relating to bus, trolley or light rail, and a methodology that could be replicated for the most part in other areas of the country where improved Census DIME files are operational.

Reports from this project are not yet available

Review of Highway Experience with Betterment Tax Financing Issues

Project: WA-11-0005
Funding: $20,000
Schedule: July 1976 - July 1977
Contractor: University of Washington (Dr. Edgar M. Horwood)

This project is designed to review and report on the outcome of the extensive studies undertaken almost 20 years ago (for the then Bureau of Public Roads) on the potential establishment of methods of recovering incremental land value benefits to non-users of the highway system and to study inferences for UMTA. The Interstate Highway and National Defense Act of 1956 required the Department of Commerce to report to the Congress on the feasibility of allocating a portion of the costs of the Interstate highways to non-user beneficiaries of the system; a national effort was mounted to determine the impact of transportation facilities on changing land uses and values and in legal and administrative studies regarding the potential for public bodies to tap the land value increase as a means of partially financing the facilities. The studies, however, did not produce any tangible Federal, State or local policy or actions.

In view of current UMTA interest in value capture, a study of this information is warranted to assist current thinking. The effort will include a limited conference of analysts in the subject area in cooperation with the Center for Transportation Studies at the University of California, Berkeley.

Reports from this project are not yet available

Office of Program Evaluation

The Office of Program Evaluation is responsible for evaluating the effectiveness of UMTA programs, and for monitoring urban transportation performance. The office is actively developing new approaches to transportation performance evaluation, applying them to selected systems and UMTA grant programs, and testing the utility of various indicators. Studies are also underway in such areas as transit costs, operating (expense/revenue) ratios, and transit efficiency and productivity. A major survey of work trip data is also underway, in cooperation with other federal agencies, to establish the basis for analysis of trends of national significance. Future activities will concentrate on grant import evaluations, grant delivery approaches, and grant criteria development, and a national conference on transit productivity in 1977.

Survey of Travel-to-Work, 1976-1977

Project: DC-06-0144
Funding: $1,025,000 UMTA, $25,000 FHWA
Schedule: July 1976 - April 1978
Contractor: U.S. Department of Commerce's Bureau of the Census

The travel-to-work survey is a supplement to the U.S. Department of Housing and Urban Development's 1976-77 Annual Housing Survey. The content of the survey is identical to the 1975-76 survey, except that data is being collected from 20 additional metropolitan areas. Special tabulations will be published and public use tapes will be made available.

Survey of Travel-to-Work, 1975 - 1976

Project: DC-06-0124
Funding: $1,195,000 UMTA, $300,000 Department of Transportation, $244,500 FHWA
Schedule: June 1975 - April 1977
Contractor: U.S. Department of Commerce's Bureau of the Census

The travel-to-work survey is a supplement to the U.S. Department of Housing and Urban Development's 1975-76 Annual Housing Survey. Data has been collected

from all workers in 170,000 households in the national sample and 200,000 households among 21 selected metropolitan areas. This information will include modal usage, travel time, travel distance, satisfaction with means of transportation, characteristics of commuters and other changes in commuting patterns since 1970. The data is expected to benefit local and national transportation planning and programming activities.

Special tabulations will be published and public use tapes will be made available

Paratransit Reporting System

Project: IL-06-0035
Funding: $100,000
Schedule: July 1976 - April 1977
Contractor: International Taxicab Association
Sub-Contractors: Wells Research Company

This project is designed to develop a paratransit reporting system that is compatible with the Fair Accounting and Reporting Elements (FARE) program and which meets reporting requirements as set out in Section 15 of the UMTA enabling legislation.

A final report, *A Paratransit Reporting System,* is scheduled for publication in April 1977.

Development of Performance Indicators for Transit Properties

Project: CA-11-0014
Funding: $79,528
Schedule: October 1976 - September 1977
Contractor: University of California—Irvine (Dr. G.J. Fielding)

This project undertakes research on the development of performance indicators for transit properties. This work will build upon previous research into this field as well as the experience of the transit industry with the use of indicators such as self support ratio, percent population served, revenue passengers per vehicle miles traveled, passengers per employee and operating cost per passenger. Measures of performance proposed for this study include passenger miles per vehicle mile traveled, passenger miles per employee, operating cost per passenger mile traveled.

Reports from this project are not yet available

Evaluation of Central Area Restraint Measures

Project: MA-11-0007
Funding: $125,000
Schedule: October 1976 - September 1977
Contractor: Harvard University (Dr. John F. Kain)

This project undertakes research for the evaluation of central area restraint measures site-specific to Boston. The study will build upon prior experience acquired in calibrating the Transport Air-Shed Simulation Model (TASSIM), an adaptation of the Urban Transportation Planning System (UTPS) approach, which projects urban travel as a consequence of trip generation, trip distribution, modal split and network assignment. The study also will investigate restraint schemes already implemented in London and Singapore.

Specific work to be conducted will include these tasks:

- Conduct a literature search evaluating central area restraint measures;
- Consult with Boston Redevelopment Authority planners to take account of their auto-restricted zone project and offer assistance;
- Assemble and prepare for analysis data describing patterns of transportation and land use in the Boston metropolitan area;
- Develop and calibrate travel forecasting model to Boston data;
- Devise alternative restraint policies for Boston;
- Interview elected officials, administrators and staff about factors affecting political and administrative feasibility of the alternative measures and analyze legal requirements;
- Calculate the transport effects of alternative restraint policies;
- Evaluate the political and administrative feasibility of alternative restraint policies; and
- Report on the findings.

Reports from this project are not yet available

Development of Indices of Transportation Effectiveness

Project: PA-11-0013
Funding: $19,110
Schedule: July 1976 - July 1977
Contractor: Carnegie-Mellon University (James P. Romualdi)

Recent concern for shorter range planning procedures and emphasis on evaluation of alternatives has renewed interest in the development of indices of transportation effectiveness. A full complement of such measures provides a basis for ranking the relative effectiveness of several alternatives. Prior work under this grant has concentrated on identifying the measures to be incorporated and weighting them. Criteria for the indices have been developed, and construction and testing of the indices is included. Example applications will be developed for test cities, with the results presented in a form suitable for use by communities, State or Federal governments as an evaluation tool.

Reports from this project are not yet available

A Methodology to Evaluate the Startup Yield for New System Commitments

Project: PA-11-0013
Funding: $26,808
Schedule: July 1976 - July 1977
Contractor: Carnegie-Mellon University (Richard A. Rice)

This project will seek to construct a methodology that will quantify the key elements of modal variants for urban transport for preliminary comparison and judgment in new system proposals. Energy, capital and timeframes have become most important in system planning and the ability to scientifically calibrate the implications of these parameters could greatly accelerate the process of system selection among candidate plans.

Prime planning variables include (1) specific system energy consumption rate per unit to be moved; (2) investment yield in annual mobility gained per dollar capital cost; (3) normal time to (startup) completion or recycle times for 60 percent changeover in existing systems; (4) public and/or private agencies now available for implementation, funding and management.

The methodology evolved will first be applied to recent historical cases, thus illustrating the considerable correlation between the proposed "startup yield" results and the initially perceived, or actually demonstrated, relative results. The project will include these tasks: preparation of general startup yield methodology, application of algorithms to generalized historical cases, application of algorithms to recent HSGT and urban proposals, presentation of algorithm methodology as a preliminary planning tool for urban decision makers, discussion of implications of findings and preparation of final reports.

Reports from this project are not yet available

Methodologies for Evaluating Public Transport Investments and Their Pricing and Financing Strategies

Project: PA-11-0013
Funding: $25,586
Schedule: July 1976 - July 1977
Contractor: Carnegie-Mellon University (Martin Wohl)

This project is designed to develop textual materials—suitable for use by engineering and planning analysts, and by policy making agency specialists—for evaluating different urban transportation proposals and their pricing and financing strategies. Topics to be discussed include:

- Functional development of short- and long-run cost functions, especially those used for investment planning analysis, cost effectiveness studies and pricing analysis;
- Functional development of demand functions for use in the determination of equilibrium flow and the travel benefits stemming from it;
- Basic pricing and economic efficiency principles for the short- and long-run, and their application;
- Benefit-cost analysis methods for mutually exclusive pricing and investment alternatives; and
- Pricing, investment planning and financing in practice.

Reports from this project are not yet available.

Regulatory and Marketing Aspects of Urban Transportation Systems

Project: PA-11-0013
Funding: $25,241
Schedule: July 1976 - July 1977
Contractor: Carnegie-Mellon University (Dwight Bauman)

The project will focus principally on the regulatory and marketing aspects of paratransit services. One phase of the project will include the development of a set of regulatory guidelines for use by the PUC with specific applicability to Pennsylvania. This phase will seek to analyze the effects of different regulatory environments on future paratransit operations. The second phase will be used to analyze the effects of the different regulatory environments on various marketing aspects of paratransit services. One aspect will be to determine the degree to which flexibility in contract negotiations for shared ride services is hindered by regulatory constraints concerning vehicle type, size or methods of fare calculation. A second aspect will be to consider the impact of subsidized social service programs on public and private carriers and to develop guidelines for contractual and marketing relationships. The project also will propose guidelines for developing joint marketing strategies between private operators and public mass transit operators.

Reports from this project are not yet available

Improving Center City Environment and Transportation

Project: DC-06-0163
Funding: $55,000
Schedule: September 1976 - May 1977
Contractor: Public Technology, Inc.

This study will focus on ways to improve the center city environment and transportation by working with local officials in general purpose government to assess the potential of such concepts as:

1. Auto-restricted zones, parking restrictions, selective closure of streets to traffic, bans of truck deliveries.
2. Pedestrian streets and malls, pedestrian skywalks, underground concourses and other kinds of pedestrian walkway systems.
3. Transitways, downtown minibus services, attractive displays of route and schedule information, and other improvements in center city transit service.
4. Moving walkways, people movers and other mechanized pedestrian assists for downtown circulation.

Pedestrian and transit malls, such as Nicollett Mall in Minneapolis, provide mechanisms for improving center city environments and transportation services at the same time.

5. Landscaping, use of outdoor art and street furniture (benches, shelters, lighting), creation of vest pocket parks and other downtown beautification projects.

Reports from this project are not yet available

Implementation of Joint Development/Value Capture Techniques

Project: TX-11-0006
Funding: $319,995
Schedule: June 1976 - June 1978
Contractor: Rice Center for Community Design and Research (Carl P. Sharpe)

This project undertakes research on the implementation of joint development/value capture (JD/VC) techniques in a series of selected cities. The project consists of four tasks:

Task I

Prepare a report cataloguing and describing alternative JD/VC techniques, based upon current literature and previous research. Investigate and analyze both conventional and innovative JD/VC techniques for funding mass transit that can be made available to local and state governments. Document each technique in terms of key characteristics against issues such as management, implementation, risk, return on investment, public acceptance, funding performance, land use impacts, community design opportunities, and social and natural environmental concerns.

Task II

Establish a research team of persons skilled in the legal, financial and planning aspects of JD/VC. As part of the research effort, this team will study the application of various JD/VC techniques to a group of from three to six cities. The cities will be selected from a list of candidate cities with the concurrence of UMTA. Investigate the selected cities and recommend a program of options according to the circumstances of each city. The research project will aid each city in the study of key problems, opportunities and constraints as participant observers to key local officials, agencies and institutions involved in transit/land use development. Prepare a report covering each city, setting forth a program of options for that city describing circumstances, needs, interaction of the team with city officials and recommended courses of action.

Task III

The grantee will establish and maintain a diary which documents the operational experience in evaluating different JD/VC techniques within different cities. The grantee will perform a reporting function on those cities selected for investigation as a component of the research performed for UMTA. The decision to proceed will be determined by UMTA should a need develop for a reporting function on other cities which may have JD/VC applications underway. The diary should include typical problems and opportunities experienced by different cities and will utilize the key issues to be addressed, as described earlier. Structure and time this reporting function to serve the primary purposes of supporting, rejecting or alternating the theoretical aspects of JD/VC as it confronts problems and constraints in application over the 24 month life of this project. Highlight accomplishments in progress within the selected cities as examples which may be of interest to other cities.

Task IV

The grantee will conduct three seminars and two conferences during the period of this project to enhance the state of JD/VC knowledge for the academic and professional community

Reports from this project are not yet available

Assessing the Role of Transit in the Implementation of Adopted Multi-Centered Land Use Plans

Project: WA-11-0005
Funding: $40,000
Schedule: July 1976 - July 1977
Contractor: University of Washington (Jerry B. Schneider)

Several large U.S. cities have recently adopted use plans that emphasize the development of a multi-centered structure during the next few decades. These plans call for the development of several relatively large "major diversified centers" (MDC's) in strategic locations within the metropolitan area. The expectation is that the creation of a multi-centered urban structure will reduce the convergence and congestion problems that most single-centered cities currently experience as well as providing a wide variety of other non-transportation benefits. Two basic concepts will be investigated initially: One states that the best way to encourage growth to take place in an outlying center is to connect it, in advance, with rapid transit service to one or more of the older established centers in the region; The other states that outlying centers will grow only if they are not provided with rapid transit service to the existing centers but are instead highly accessible by all transportation modes to their immediate hinterland. Other combinations of transit policy that fit between these two extremes will also be assessed.

One purpose of the project will be to define and analyze the risk factors that are associated with a policy of using transit investment to guide land use decision-making and to relate them to the benefits that are attributed to the multi-centered urban form. Much of the work in this project will be oriented to finding ways and means of testing the hypothesis that a multi-centered urban form can be attained only if transit investments are made in advance of developer decisions in the outlying centers designated for rapid growth. Multi-centered land use plans from several cities will be reviewed after which a sample will be visited to obtain the best available thinking from key persons. A research report will be produced that will contain an assessment of current actions and plans on this topic in the United States and several foreign countries. The material will provide useful guidelines to policy level people in Federal, state and local agencies.

Reports from this project are not yet available

Integrated Paratransit Transportation Planning for Low Density Suburban Areas

Project: IL-11-0008
Funding: $89,965
Schedule: July 1976 - July 1977
Contractor: University of Illinois, Chicago Circle (Ashish Sen, Siim Soot)

A typical question facing transportation planners is: What mode mix will be cost-effective while minimizing energy consumption and environmental impact in low density, presently auto-dependent areas? In this project, methodologies will be developed for application to the low density areas of the Chicago Standard Metropolitan Statistical Area (SMSA) to further refine and test the techniques. This effort will be limited to work trips and will produce:

- A low density planning package, national in scope, for use by local planning agencies across the nation; and
- An application, regional in scope, of the above package to the Chicago area.

Reports from this project are not yet available

Major Employer Attitudes Toward Promotion of Vanpools

Project: WA-11-0005
Funding: $20,000
Schedule: July 1976 - July 1977
Contractor: University of Washington (Dr. Edgar M. Horwood)

This project will seek the reasons for involvement/non-involvement of major employers with vanpool services and their attitudes toward promotion of vanpools for their employees. While there have been some important breakthroughs in the establishment of vanpool services to major employment sites, the urban planning community as a whole knows very little in a studied way about the receptivity to vanpool schemes by major employers.

One element of the research involves an investigation to determine under what circumstances vanpooling has developed or failed to develop and seeks answers to questions such as: How limited or widespread are the ingredients for success in employer-sponsored or assisted vanpool programs? What are the reasons for employer involvement or non-involvement? How critical is the initial reaction of top management? Do fears of getting involved in a new area of employee benefits discourage management?

The effort will include mail and telephone surveys with followup visits to selected sites for case study documentation. Also included will be an analysis of the impacts of local institutional barriers to responses to vanpooling.

Reports from this project are not yet available

A Prototype Paratransit Element for the Transportation Systems Management and Transportation Improvement Programs

Project: WA-11-0005
Funding: $40,000
Schedule: July 1976 - July 1977
Contractor: University of Washington (Dr. Edgar M. Horwood)

This project seeks to develop models of specific plans, programs, procedures, methodologies and experiments for making the paratransit elements of the Transportation Systems Management (TSM) element and Transportation Improvement Program (TIP) meaningful, particularly in relating to the integration of paratransit with general line-haul service. The project will include a case study of the Seattle urban area, evolution of guidelines and procedures arising out of the above experience and evolution of designs for experiments and technical studies arising out of the other work elements.

The case study would seek to identify all of the relevant entities, both internal and external, which may relate to potential paratransit financing, regulation, operations and management. It also would conduct an institutional, legal and organizational systems analysis of the specific goals, resources, constraints and opportunities of these entities in regard to the potential paratransit developments; monitor local adaptation to paratransit and its evolution in the local TSM and TIP; develop detailed substantive paratransit TSM and TIP prototype program elements for the Seattle urban area, including programmatic phasing; and evaluate local agency reaction to the program elements developed. Other actions would include analysis of the impact on the efforts of local MPO's (Metropolitan Planning Organizations) of Federal TSM and TIP regulations as they develop.

Expected products include prototype paratransit elements for the TSM and TIP; guidelines for the development of paratransit elements of the TSM and TIP; study and experimental designs for UMTA's potential use in the furtherance of local technical studies; and a report evaluating local MPO and other agency adaptation of paratransit elements in the TSM and TIP.

Reports from this project are not yet available

TSM Institutional and Planning Research

Project: IT-06-0138
Funding: $122,500
Schedule: June, 1976 - February 1978
Contractor: Not yet selected

UMTA's Transportation Systems Management (TSM) requirement establishes a new responsibility for planning agencies to coordinate and rationalize a set of short-term and low-capital improvements while attempting to achieve a balance between such diverse goals as improved mobility, energy conservation, efficiency of road space use, reduction of vehicle use in congested areas and pollution abatement. These often-conflicting goals demonstrate a real need for changing the planning process to become proficient at developing strategies with respect to the various objectives and to proceed in a much shorter time frame. Moreover, no standard technical study procedure exists for assessing current system performance and developing plans for implementation.

To help implement improved planning procedures, this project is designed to develop documentation on institutional arrangements and planning techniques for accomplishing TSM, and develop new approaches and methods for responding to the demands of TSM on the planning process. These tasks will be completed:

- Performance of case studies on institutional arrangements in 12 cities to identify the interagency agreements and delegations of responsibility needed to accomplish TSM and document the TSM planning activities in those cities;
- Description of technical planning activities necessary to support, develop, implement and maintain effective TSM programs;
- Description of the methods and techniques currently available to assist TSM activities;
- Summary of current knowledge of

interrelationships among TSM actions and suggested multi-action TSM strategies for dealing with the multiple TSM goals; and

- Development of work statements on high-priority or high-payoff research in TSM planning. Research will then be undertaken to advance the study of TSM institutional arrangements and planning methodology.

Two reports will be published at the project's conclusion; the initial report will summarize the findings from the case study cities, assess the impacts of institutional structure on TSM planning, discuss data requirements for multi-modal TSM planning, and summarize data on the impact of TSM actions and methods for the evaluation of actions. Portions of this material will be organized into a state-of-the-art manual for TSM planning.

The final report, estimated for February 1978, will document the results of research on a number of high-priority and high-payoff areas of TSM planning, and will probably include special emphasis on the problem of demonstrating and circulating technical methodology on the subject.

Reports from this project are not yet available

Transportation Systems Management Element Guideline Review

Project: NY-11-0014
Funding: $32,000
Schedule: July 1976 - July 1977
Contractor: Polytechnic Institute of New York (Professors Kenneth W. Crowley, Martin F. Huss)

This project will review a representative sample of Transportation System Management (TSM) plans to evaluate their format and organization. (The TSM element is now required in all comprehensive plans submitted to UMTA and FHWA by metropolitan planning organizations) This effort will identify areas of consistency as well as of diversity, areas of emphasis as well as areas of minimum response. Based on these evaluations, a determination will be made of the need for an expanded and, perhaps, more formally structured set of guidelines for future submissions of TSM plans. A formal final report will be prepared, describing the work undertaken and presenting conclusions and recommendations.

Transportation Systems Management Course Development

Project: NJ-11-0004
Funding: $23,314
Schedule: July 1976 - July 1977
Contractor: Princeton University (Alain Kornhauser)

This project was intended to develop a "short course" for professionals and an undergraduate course in Urban Transportation Systems Management (TSM), including the development of course lecture notes, documentation of references, collection of visual aid materials and teaching of the undergraduate course during the spring semester, 1977, and the short course during summer, 1976.

Current Federal directives require the formulation and implementation of Transportation Systems Management plans by urban areas, so there is a need for the graduating urban transportation student to be conversant with TSM and a need for the practicing professional to have the opportunity to quickly acquire a working knowledge of TSM.

Course materials will be available at the project completion.

Office of Policy Research

The Office of Policy Research plans and coordinates UMTA's research policies and programs and defines the R&D goals, objectives, needs and requirements. The policy oriented research conducted by this Office consists of studies and analysis designed to advance the understanding and resolution of critical transportation problems and to aid in policy formulation and resource allocation decisions at the Federal level.

This Office also administers the UMTA University Research and Training Program. Current policy research projects include the following:

Means for Reducing Light Rail Transit Cost Through Standardization of System Elements

Project: IT-06-0103-03
Funding: To be announced
Schedule: September 1976 - continuing
Contractor: To be selected

There is considerable evidence that standardization of LRT system components such as the power distribution subsystem, signals and controls, at-grade intersections, trackage switches, at-grade stations and other lesser elements could result in considerable savings. Manufacturers would be able to produce in larger quantities at lower unit costs, the larger market created by standardization would encourage competition, maintenance and replacement parts would be lower, inventory of spare parts would be lower, and the reliability of parts would be better since more experience can be accumulated on each part in a shorter time period. This study will focus on which parts should be standardized, how it should be achieved, and the impact it will have on operating flexibility and manufacturers capability.

Reports from this project are not yet available

Study of Methods of Improving LRT Service

Project: IT-06-0103-02
Funding: $53,000
Schedule: September 1976 - June 1977
Contractor: DeLeuw Cather and Company

This study will investigate the potential for improving light rail transit (LRT) service and reducing LRT cost through the following means:

- Implementation of self service fare systems. This could improve trip speed by reducing load/unload time, conserve manpower and permit the introduction of different fare structures. However this would have to be weighed against the cost of monitoring, the cost of automated ticket dispensing equipment and regulatory powers available in various cities.
- Improvement of surface LRT operation through various planning techniques such as pre-emptive signalling, low barriers or curbing, pedestrian malls, etc.
- Improve safety and flow through intersections.

Reports from this project are not yet available

Light Rail Transit Study

Project: IT-06-0103
Funding: $170,000
Schedule: June, 1975 - October 1976
Contractor: DeLeuw Cather and Company

This project consisted of a comprehensive assessment of light rail transit (LRT) throughout the world, tracing the development of the LRT mode during the last two decades, reviewing contemporary planning concepts of light rail and describing LRT guideways, vehicles, operating modes and economics. The resulting report, "Light Rail Transit: A State-of-the-Art Review," represents the most detailed and authoritative treatment of light rail technology available in the English language.

The report contains a detailed description of 12 representative light rail systems in Europe and North America and a comparison of LRT with other transit modes. Other chapters deal with rights-of-way and stations, light rail vehicles, track, power and vehicle control systems, light rail transit operations and cost considerations.

The report should be of particular interest to planners, engineers and analysts engaged in planning studies and alternatives analyses at the local level and to planning agencies and transit authorities which contemplate capital intensive improvements in their transportation systems.

Reports from this project are listed in Appendix I

The new Standard Light Rail Vehicle, developed in the United States with UMTA assistance, was one of many programs worldwide studied in a comprehensive light rail transit analysis.

Assessment of Present and Future Paratransit Potential

Project: DC-06-0150
Funding: To be announced
Schedule: June 1976 - continuing
Contractor: To be selected

Although the term "paratransit" was virtually unknown three years ago, today the concept is receiving increasing attention as a family of viable urban transportation options. In the last three years, several theoretical studies have examined specific aspects of paratransit and numerous paratransit concepts have been implemented as demonstration and production systems.

An important point in paratransit development has now been reached with respect to what extent the implemented systems have fulfilled the potential predicated in theoretical studies, what the future potential for paratransit should be, what goals should be set, what strategies can be followed to realize that potential and what initiatives the Federal Government can pursue.

This three-part project will assess the potential for paratransit through three tasks: Conduct of a background survey of previous research, current research and system implementation results; assessment of the existing state-of-the-art of paratransit development; and identification of future potentials for paratransit.

Reports from this project are not yet available

Assessment of Paratransit Service in Europe and North America

Project: FN-06-0002
Funding: $15,000
Schedule: March 1976 - January 1977
Contractor: Ecoplan International

Within the past few years there has been a growing interest in the potential of paratransit service in Europe and North America. Because of the rapid pace of this development, this study was jointly sponsored with Canada, Australia, France and Germany to provide a broad perspective of progress on both continents so that innovative ideas could be shared and comparisons could be made.

Reports from this project are not yet available

State-of-the-Art in Transportation Systems Management

Project: RI-06-0008
Funding: $90,000
Schedule: March 1975 - September 1976
Contractor: INTERPLAN Corporation

This is an updating and restructuring of INTERPLAN's earlier report on "Joint Strategies for Urban Transportation, Air Quality and Energy Conservation", January, 1975, to produce a current state-of-the-art handbook of information on Transportation Systems Management (TSM) actions.

A final report will be published by the end of 1976.

Case Study Development

Project: NC-11-0004
Funding: $8,839
Schedule: July 1976 - July 1977
Contractor: North Carolina A&T State University (Dr. Alice Kidder)

This project attempts to recognize two problem areas in the teaching of urban transportation: The need for faculty teaching in the field to spend more time with transit operators, and the lack of case studies on

public transportation that can be used in teaching students. In pursuit of this project, a North Carolina A&T faculty member will be assigned to a transit operator or planning agency for a summer to develop one or more case studies in urban transportation.

Case studies will be available at the project's completion.

Education Program

Project: NC-11-0004
Funding: $53,132
Schedule: July 1976 - July 1977
Contractor: North Carolina A&T State University (Dr. Alice Kidder)

This project will continue, for one additional year, support for the developing educational program in urban transportation. Efforts will include continuing developing of a Bachelor's Degree curriculum in transportation management and planning, of which urban transportation is a major component. It will provide continuing support for a number of minority students, field trips, seminar series, and recruiting, counseling and placement activities.

Reports from this project are not yet available

Other University Research Projects

There remain a number of university research projects which do not fit into the three previously mentioned categories. These are listed here.

Implementation and Monitoring of a Minority Accessibility Program (MAP)

Project: VA-11-0002
Funding: $34,079
Schedule: January 1976 - January 1977
Contractor: Virginia Polytechnic Institute and State University (Dr. Robert Jay Popper)

This project undertakes research in the implementation and monitoring of MAP applications into several agencies chosen to represent a range of city sizes, locations and extent of system coverage. All agencies will have prior experience using the Urban Transportation Planning System (UTPS) computer package for the comprehensive transit planning. MAP will be introduced to the selected set of agencies as an accessibility analysis planning tool in addition to specific civil rights applications.

Monitoring and evaluation of MAP will occur during the entire grant period to insure that all agencies have appropriately inserted MAP into their planning programs. An implementation manual will be produced which will describe the types of applications requiring MAP - UMODEL analysis and the exact role that both the local agencies and UMTA's Office of Civil Rights should play relative to the civil rights application of MAP. MAP will be modified as a result of feedback from the research program user agencies to make MAP a more effective tool.

Implementation of additional capability to MAP - UMODEL will consist of the possibility of adding a graphic output display capability. The final two months of the grant period will be used to prepare a comprehensive set of user's materials based on the accomplishments of the 10-month effort.

Reports from this project are not yet available

Study of Logit Analysis of Rapid Transit Access Choices

Project: VA-11-0005
Funding: $98,976
Schedule: January 1976 - September 1977
Contractor: University of Virginia (Dr. Lester Hoel, Dr. Michael Demetsky)

This project will provide an analysis of rapid transit access choices through the conduct of six tasks:

- Choice of test sites, considering origin/destination data, representation of rail and bus rapid transit and the availability of transit feeder service and paved parking;
- Organization and finalization of a data base by processing files for study sites, quantifying access mode supply and obtaining engineering data as needed;
- Use of the Task 2 data base in the Urban Transportation Planning System logistic model algorithm (ULOGIT) calibration program to aid in the derivation of disaggregate behavioral models of rapid transit access mode choice behavior;
- Analysis of the Task 3 models as an attempt to explain variations in model parameters among areas studied;
- Evaluation of the application of the logit models in rapid transit modeling and planning by considering issues other than transferability for applying the choice models calibrated on existing transit services in the modeling of and planning for transit feeder systems and terminal design; and
- Documentation of the study as a comprehensive analysis of the rapid transit access problem, develop case studies and state recommendations as to whether sufficient information has been generated to develop a rapid transit access planning manual as originally planned.

Reports from this project are not yet available

Corridor Planning Analysis

Project: IL-11-0008
Funding: $54,997
Schedule: June 1976 - June 1977
Contractor: University of Illinois - Chicago Circle (Ashish Sen, Siim Soot)

This project is, in part, an extension of work initiated under prior funding; its focus is on modeling trip distributions and modal split patterns within major urban corridors. The models will be designed for three types of applications: (1) as inputs in the early stages of planning for major capital improvements; (2) evaluation of low capital cost alternatives; and (3) providing marketing information. The models will be designed to facilitate quick, relatively low cost studies using easily obtainable data, and will rely mainly on the Census Bureau's Journey-to-Work Package.

The modeling will include both radial and circumferential corridors. The model effort will include selection of the model type, critical variables and the functional form. Project products will include a set of models, a discussion of their use and relevant computer programs with a section specifically delineating the marketing applications of the modal split models. Many of the methods are expected to be suitable for hand computations.

An important by-product of the work is expected to be the development of a procedure for the use,

interpretation and preliminary analysis of the Census UTTP data.
Reports from this project are not yet available

One-year Continuation of a Training Program

Project: IL-11-0008
Funding: $11,516
Schedule: June 1976 - July 1977
Contractor: University of Illinois - Chicago Circle (Richard M. Michaels)

This project is directed toward bringing the educational and training activities begun in 1975 to a point of reasonable maturity; the funds will be used to continue the seminar program started in that year, expand the student trainee program during the summer with participating local agencies and curriculum development. The development of an undergraduate program in transit operations/planning has progressed well in the first year and is expected to be finalized this year.
Reports from this project are not yet available

Additional Rail Rapid Transit Noise Studies Based on the New York City Transit Authority

Project: NY-11-0002
Funding: $62,304
Schedule: March 1976 - December 1977
Contractor: Polytechnic Institute of New York (Dr. William McShane, Dr. Simon Slutsky)

This project will continue relevant studies in keeping with the overall objectives of the Rail Technology Noise Abatement Program, undertaking tasks representing a logical refinement of the cost estimates and noise characterizations established in earlier work. The project specifically undertakes research in the areas of cost data and studies, degradation of improvements and use of car maintenance records.

Cost data and cost studies work will aim toward improved quantification of the cost of directly noise-related treatment items; more complete identification of cost items such as power consumed by extra weight and the excess equipment needs; systematic study of the cost, operation, cost effectiveness and operational implications of various treatments including traceability of manpower utilization, equipment out of service, financial and other available resources.

Degradation of improvements will be undertaken with the cooperation of the NYCTA to measure noise levels in or near selected cars or trackage on a periodic basis. A review of maintenance records of the selected cars will be accomplished during the study period.

Car maintenance records on selected cars will be used to analyze data for correlations of car status with noise characteristics. Included will be consideration of the time since last major overhaul and time since certain key repairs.
Reports from this project are not yet available

Fellowship for a Seminar on Underground Construction for University Staff

Project: IL-11-0011
Funding: $26,500
Schedule: July 1976 - September 1976
Contractor: University of Illinois (Dr. Ronald Heuer)

This seminar was designed to meet the needs identified by a questionnaire distributed in January 1975 by the Subcommittee on Education and Training of the U.S. National Committee on Tunneling Technology. The U.S. Department of Transportation sponsored the seminar, with planning, organization and seminar administration conducted by the National Committee. The course emphasized technology applicable to underground transportation facilities, with attention given to both braced cut and tunneling methods, but with a greater emphasis on the latter.

UMTA cooperated with the Department's sponsorship of this seminar because of the potential benefits of training additional university staff in geotechnics to broaden the knowledge and skills of civil engineering and engineering geology graduates in underground construction or urban underground transportation structures.

Fellowships were awarded to about 50 participants.
Reports from this project are not yet available

Multi-Disciplinary Study of the Use of Trains or Platoons of Vehicles in Combination with Individual Small Vehicles for Urban Automated Guideway Transportation (AGT)

Project: MA-11-0029
Funding: $22,000
Schedule: September 1976 - September 1977
Contractor: Massachusetts Institute of Technology (Steven Shladover)

This project undertakes research on the use of trains or platoons of vehicles in combination with individual small vehicles for urban automated transportation. The multidisciplinary study will undertake two tasks:

Task I, System Operations

- Relate the technological characteristics of the trained AGT systems to the potential economic and service advantages these systems offer.
- Survey the range of potential applications environments.
- Develop sample staged implementation strategies.
- Investigate system behavior.
- Investigate the tradeoff between capacity and service for a variety of assumed operation conditions.
- Investigate related operational issues which are affected by training policy.
- Consider station-size impacts.
- Consider methods for controlling the position velocity of vehicles in trains.

Task II, Vehicle Control

- Investigate vehicle control configurations.
- Determine vehicle state variables.
- Evaluate all vehicle control issues.
- Determine what kind of vehicle control system will permit operations at the highest capacity level.
- Derive and justify the safety assumptions and synthesize and simulate the controller configurations.
- Conduct a single-vehicle/train capacity analysis.

Reports from this project are not yet available

Investigation of Vehicle-Suspension Guideway Dynamic Interactions for Urban Transit

Project: MA-11-0003
Funding: $71,450
Schedule: August 1976 - August 1977
Contractor: Massachusetts Institute of Technology (Dr. Herbert Richardson, Dr. David Wormley)

The project on the investigation of vehicle-suspension guideway dynamic interactions for automated rail transit will be composed of two major tasks:

Task 1—Extend previously developed techniques to achieve design programs for multi-span, multi-vehicle guideway systems. This task will generate an operating design program for multiple single-span systems which have already been developed. The use of multiple spans is likely to reduce guideway cross-sectional requirements and minimize thermally induced deflections, thus reducing guideway costs when compared with multiple single-span systems. However, since the dynamic interactions between vehicle and the guideway are accentuated by the span-to-span coupling present in multiple-span guideways, it is essential that vehicle-guideway dynamics are included in any comparison between multiple single-span and multiple span guideway designs. This work will be an essential supplement to the design program developed to date for single-span systems.

Task 2—Conceptually design and evaluate practical limitations for lateral AGT vehicle steering. This task involves the continuation of current analytical studies of AGT vehicle modeling and optimal lateral control and will include the conceptual design of practical systems having improved performance over existing design. This work will provide a reference of optimum performance against which to measure the performance of any real steering system, and a series of practical steering systems which could be implemented in practice. It is intended that realistic vehicle parameters and measured performance data from existing systems will be used. The Morgantown Personal Rapid Transit System will be used as the example in this study.

Reports from this project are not yet available

Research on Longitudinal Control and Crashworthy Vehicle Design for Automated Guideway Transit (AGT) Systems

Project: MN-11-0002
Funding: $25,580
Schedule: April 1976 - April 1977
Contractor: University of Minnesota - Twin Cities (Dr. William L. Garrard)

The project on longitudinal control and crashworthy vehicle design for automated guideway transit systems will be comprised of seven tasks: (1) Undertake additional study of vehicle-follower control by examining the behavior of strings of vehicles during speed transitions, emergency stops, merging/diverging and degraded operations such as pushing a failed vehicle; (2) Study design and implementation of point follower control systems by determining the effects of non-linearities, sensor noise and sampling rates on the performance of point-follower control systems; (3) Examine various sensors in order to evaluate their suitability for use in AGT systems. Measure velocity, position spacing and acceleration to establish mathematical models which reflect the accuracy, dynamic behavior, noise characteristics, and non-linearities inherent in various types of sensing hardware which have potential use in AGT vehicles; (4) Determine trade-offs between vehicle-follower and point-follower control concepts by evaluating, on the basis of performance, cost of implementation and potential reliability; (5) Develop mathematical models and evaluate passenger protection systems for oblique collisions. Evaluate the effects of vehicle structure, shock absorbers, and restraint devices on passenger protection, since oblique collisions are more complex than simple fore-and-aft collisions; (6) Evaluate the potential for use of non-conventional braking systems to guarantee safe stopping at short headways. Such devices mechanically grip the guideway, thereby producing large braking forces on the vehicle; (7) Explore the safety and control problems associated with the use of AGT vehicles (large enough to permit standees) and with the process of transitioning from long to short headway operations. Determine the ultimate headway limitations of fixed block control systems since these systems are typical of large-vehicle AGT systems.

Reports from this project are not yet available

Small City Paratransit Innovations

Project: NC-11-0005
Funding: $74,753
Schedule: March 1976 - March 1977
Contractor: University of North Carolina (Dr. Gorman Gilbert)

This project consists of research activities which will implement and utilize available information on the composition of taxi ridership in small cities. The study will consist of five major tasks:

1. Compile data on existing small city taxi innovations, throughout the nation. This task will sharply focus to include only innovations in small cities (under 200,000 population) or innovations considered potentially viable in small cities.
2. Test hypothesis regarding end-of-month mobility decrease focused upon people's travel when they are *not* in taxis. The test will be critical to determine if taxi innovations are needed to improve mobility and as an indication of what innovations may be most feasible.
3. Evaluate alternative taxi innovations. This task will formalize discussions with taxi operators, who possess a wealth of information and experience which is essential in the evaluation of taxi service and policy proposals.
4. Test selected innovations based upon the willingness of taxi operators to experiment with those innovations judged to be the most necessary for small cities. Among those innovations likely to be tested are: end-of-month discounts; jitney services; and cooperative dispatching.
5. Report results and make recommendations for taxi innovations in smaller cities based upon review of research findings and consultation with taxi operators

Reports from this project are not yet available

Monitoring the Implementation of Innovative Public Transportation Services

Project: IL-11-0012
Funding: $89,994
Schedule: October 1976-September 1977
Contractor: Northwestern University

This project monitors the implementation of innovative public transportation services; two community based paratransit systems have been identified as candidate systems for applying and refining a monitoring approach. One system—to operate in the communities of Schaumburg and Hoffman Estates, Illinois—is a combination of subscription and dial-a-ride services and will serve a population of 69,000. The other system—in Deerfield, Illinois—is a combination of fixed route feeder, subscription and route deviation services to serve 19,000 people.

The products of this research will include a detailed monitoring and evaluation of the service innovation, including responses to service modification and marketing activities; a set of consumer measures which are applicable to many service innovations; and a fully documented decision-oriented method which can be used to monitor other service innovations.

Reports from this project are not yet available

Labor Relations Problems, Practices and Policies in the Urban Mass Transportation Industry

Project: WI-11-0004
Funding: $75,000
Schedule: June 1975 - January 1977
Contractor: University of Wisconsin (Dr. James Stern, Dr. Richard Miller)

This project is intended to provide meaningful insights for transit property managers and public administrators in the field of labor relations problems and practices in the urban mass transportation industry. The project will undertake a survey of the State legal frameworks within which industrial relations are conducted and the effect on labor relations in the transition from private to public ownership of transit properties. The project will determine the role of unions in the urban mass transportation industry by a study of union structure and administration, its membership and leadership, the evolution of policies regarding wages, hours, working conditions and union historical reliance on arbitration as a preferred method of resolving impasses rather than a strike.

The study will seek to identify and document the industry contract provisions that have cost implications and will include the current status of contract provisions and a study of recent patterns of development and future trends in contractual work rules. The effort also will construct and test multiple regression models to determine how much variation in wage rates and labor costs can be explained and which variables have significant impact on wage rates and labor costs.

Reports from this project are not yet available

APPENDICES

Appendix I: Project Reports

Chapter I: Bus and Paratransit

1. **Design of a Modern 40-Foot Transit Bus (TRANSBUS)**
FL-06-0012/IT-06-0025/MO-06-0009/NY-06-0045

Forecast of urban 40-foot coach demand, 1972-1990, December 1972, PB-222-684

Transit bus propulsion systems state-of-the-art, August 1972, PB-222-871/AS

Refined TRANSBUS specifications, September 1972.

TRANSBUS operation, passenger and cost impacts, July 1976

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Baseline bus ride and handling test methodology and data presentation, February 1976

Human factors evaluation of TRANSBUS by the elderly, May 1976

TRANSBUS public testing and evaluation program, January 1976, PB-251-882

2. **Small Bus Requirements, Concepts and Specifications**
IT-06-0074

Report on urban transit small bus operations in the United States

Report on bus characteristics needed for elderly and handicapped urban travel

3. **Low Pollution Paratransit Vehicles**
NY-06-0043/MA-06-0052/CA-06-0079/CA-06-0080/IL-06-0037

Monthly progress reports

The Taxi project: realistic solutions for today, Museum of Modern Art, New York, 1976, $7.95.

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4. **Automatic Vehicle Monitoring**
IT-06-0041/IT-06-0046/IT-06-0047/IT-06-0048

Automatic vehicle monitoring technology review, Aug. 1971, PB-207-849, 70 pages.

LORAN-C automatic vehicle monitoring systems, vol. I, Study results, July 1972, PB-216-332, 340 pages.

LORAN-C automatic vehicle monitoring system, vol. II, Appendices, July 1972.

Automatic vehicle monitoring systems, (describes narrow-band phase multilateration system) Feb. 1973, PB-216-165, 406 pages.

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Automatic vehicle monitoring systems, (describes medium band width phase multilateration system), Oct. 1972, PB-221-046, 415 pages.

Automatic vehicle monitoring, Feb. 1973, PB-216-165, 406 pages.

Urban field tests of four vehicle location techniques, April 1973, PB-221-732, 45 pages.

Overview of automatic vehicle monitoring systems, Aug. 1973, PB-223-509, 56 pages.

Monitor-CTA final report, May 1973, PB-223-878, 12 pages.

Evaluation of the monitor-CTA automatic vehicle monitoring system, March 1974, PB-231-533, 142 pages.

Channel measurements for automatic vehicle monitoring system, March 1974, PB-231-604.

5. **Dial-a-Ride and Areawide Demand-Responsive Transit**
DC-06-0141

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Haddonfield dial-a-ride demonstration, third household survey, March 1976, PB-257-033

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Dial-a-ride software installation guide, September 1976, PB-258-333

Demand responsive transportation system planning guidelines, October 1976

Dial-a-ride vehicle time analysis and vehicle productivity, June 1976, available from UMTA's Office of Technology Development and Deployment

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1. **Urban Rapid Rail Vehicles and Systems Program**
IT-06-0026

Urban rapid rail vehicles and systems program — annual report, July 1972, PB-212-848.

Applications of the BART program experience to UMTA urban rapid rail vehicle and systems program, April 1973, PB-221-955.

Investigations of voltage transients and spikes in direct current rapid transit systems, June 1973, PB-222-698.

Urban rapid rail vehicles and systems program — annual report, July 1973, PB-224-141.

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State-of-the-Art car engineering tests at DOT high speed ground test center vol. III, ride quality tests, 1975, PB-244-749, 240 pages.

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NY-06-0006

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3. **Railcar Standardization**
IT-06-0131

A determination of the optimum approach to railcar standardization, August 1976, PB-259-363

4. **Urban Rail Supporting Technology (URST)**
CO-06-0001/MA-06-0025

Light rail transit systems — a definition and evaluation, Oct. 1972, PB-213-447.

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5. Environmental Control in Underground Rapid Transit System DC-06-0010

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3. **Congestion Pricing**
DC-06-0120

Bhatt, K. (1976), "What Can We Do About Urban Traffic Congestion?: A Pricing Approach," Paper URI 14300, Washington, DC: The Urban Institute.

Higgins, T. (1976), "Comparing Strategies for Reducing Traffic Related Problems: The Case for Road Pricing," Working Paper 5050-3-5, Washington, DC: The Urban Institute.

Bhatt, K., Kirby, R., and Beesley, M. (1976), "Transportation Improvement and Road Pricing: A Demonstration Program," Working Paper 5050-3-4, Washington, DC: The Urban Institute.

Bhatt, K., Eigen, J., and Higgins, T. (1976), "Implementation Procedures for Pricing Urban Roads," Working Paper 5032-3-3, Washington, DC: The Urban Institute.

4. **User Side Subsidies**
DC-06-0120

Alternative Subsidy Techniques for Urban Public Transportation, Working Paper 5050-4-1, 1975, The Urban Institute, Washington, D.C.

Improving the Mobility of the Elderly and Handicapped Through User-Side Subsidies, Working Paper 5050-4-4, 1976, The Urban Institute, Washington, D.C.

5. **Small Community Transit Study**
MA-06-0049

Small City Transit series, PB-251-501 through 251-515

Film: Transit Options for Small Communities, available through UMTA's Office of Public Affairs

6. **Simulation for Traffic Management Analyses**
MA-06-0049

Bus Priority Strategies and Traffic Simulation. TRB Special Report 153, 1975, A. Myzyka.

Chapter VII: Policy and Program Development

1. **Light Rail Transit Study**
IT-06-0103

Light Rail Transit: A State-of-the-Art Review, spring, 1976, PB-256-821, $9.75. (an executive summary also is available)

Appendix 2:
Availability of Information on Federal Research and Development in Urban Mass Transportation

Annual Description of Research and Development Projects

The volume to which this is an appendix is UMTA's primary medium of dissemination of information about its R&D activity. The reports produced as important by products of these projects may be obtained by ordering them from the principal repository and disseminating agency for reports emanating from R&D performed by or for Federal agencies — the National Technical Information Service (NTIS). Reports are ordered directly from NTIS by the order numbers indicated in the report listings. The lack of an order number means that the report had not yet been entered into the NTIS depository system when this publication went to press. Inquiries about the availability or price of completed reports should be addressed to NTIS, not to the Urban Mass Transportation Administration. The NTIS Order Desk telephone number is: (703) 321-8543. Copies of the form used for ordering NTIS documents are reproduced on the last page; photo-copies may be used for orders. Payment must accompany orders. Prices vary in proportion to the size of the document for copies on paper with eye-legible text (hard copy) and at present can be ascertained only by inquiries directed to NTIS. Most reports in NTIS are also made available on microfiche. Microfiche copies have a uniform price: $2.25 per volume for orders sent within the United States or $3.75 if sent abroad.

Payment for either standard or microfiche copies is acceptable in cash, by check, postal money order, GPO coupons, or charge to an American Express Card. Postage stamps are not valid as payment. It is possible to establish a deposit account at NTIS, from which payments for ordered documents are withdrawn. The purchase price includes postage at the fourth class rate. Three to 5 weeks must be allowed for delivery. Much faster delivery is provided by NTIS's Rush Order Service (703-321-8948), with an additional charge of $10.00 per document.

UMTA publishes an annual guide to its research reports entitled *Urban Mass Transportation Abstracts.* These volumes contain descriptive abstracts of reports sponsored by UMTA which are available from the National Technical Information Service, along with complete indices by author, title, project number, and subject. These abstracts and indices cover reports of UMTA's research, development and demonstration plus technical studies projects, and reports produced under the university research and training program. The following volumes are available from NTIS: Volume 1, October 1972 (466 abstracts), PB-213-212; Volume 2, September 1973 (195 abstracts), PB-225-368/OAS.

The Transit Research Information Center (TRIC)

Another repository is the Transit Research Information Center (TRIC), which operates within UMTA's Office of Transportation Management and Demonstrations. TRIC maintains a full collection of all UMTA-sponsored reports and can provide information related to these reports and their findings. Although TRIC does not stock copies of reports for distribution, it will provide a one-page technical abstract of any report upon request. One can also request, preferably in writing, abstracts of reports on specific subjects that have been sponsored by the Urban Mass Transportation Administration. TRIC also publishes and distributes monthly abstracts of new UMTA reports. Anyone wishing to receive these abstracts on a regular basis should address a request to: Urban Mass Transportation Administration, Office of Transportation Management and Demonstration, Transit Research Information Center, 2100 Second Street, SW., Room 6412, Washington, D.C. 20590.

UMTA's Public Information Services

UMTA also conducts an active and continuous information program. All significant projects are announced when contracts are awarded, when important milestones have been reached and when completed, usually through press releases issued by the Office of Public Affairs. This Office also has available, and will send on request, brochures on various UMTA programs and policies.

UMTA's activities also are reported regularly in a magazine published by the Department of Transportation (DOT) and available from the Superintendent of Documents, entitled *Transportation USA.*

Those who wish to receive press releases may request this service by writing to UMTA's Office of Public Affairs.

Congressional Hearings

Each year UMTA, like all other agencies of the Federal Government, appears before appropriation committees of both the House and the Senate to request funds for the following fiscal year, justifying the request with an abundance of factual and statistical data concerning its present program and its plans for the future. Committee members elicit additional information and explanation by questions. The entire transcript, constituting a rather comprehensive record of UMTA's activities, is published and made available on request addressed to the committees: Subcommittee on Transportation, Committee on Appropriations, United States Senate, Washington, D.C. 20510 and Subcommittee on Transportation, Committee on Appropriations, House of Representatives, Washington, D.C. 20515.

The Department of Transportation (DOT) Library

DOT's library contains approximately 500,000 volumes and pamphlets, 170 drawers of vertical file material, and receives more than 1,500 periodical titles. The library began operation in 1969 when the Washington libraries of the Bureau of Public Roads, Coast Guard, and Federal Aviation Administration were consolidated.

The Bureau of Public Roads' library had extensive materials on urban mass transportation and the collection has been substantially enriched since it was taken over by DOT. The library contains all reports produced by UMTA's R&D program. Most library materials are available for interlibrary loan to other libraries.

Information About Contracts

Most requests for information on R&D activities relate to contracts. Numerous firms are interested in providing goods or services for various R&D projects and wish to bid or negotiate for contracts or subcontracts. Some information may be obtained through relatively informal channels by correspondence or oral communication with DOT officials and staff but the prescribed procedures for negotiating a contract require the Federal Government to disclose a considerable amount of detailed information about projects.

Most procurements for the Federal Government are accomplished either by formal advertisements or by negotiation. The former are initiated by issuance of "invitation for bids" (IFB) which contain specifications describing the actual minimum needs of the Government. The negotiation process, the method most frequently employed by UMTA, involves Requests for Proposals (RFP) which are designed to generate competition that will obtain industry's best efforts toward achieving UMTA's objectives. Each UMTA RFP also is designed to enable potential suppliers to compete on an equal basis; each includes such items as scope of work, delivery schedules, type of contract, closing date, technical evaluation factors, and expected terms and conditions.

IFB's or RFP's estimated at $5,000 or more are synopsized in the *Commerce Business Daily.* In addition to this dissemination, UMTA's Procurement Division will notify by mail a large number of businesses on its Bidders' Mailing List when an IFB or an RFP involving the specialties of those firms has been issued. (See Section: *RFP's and Bidders' Mailing List,* page 80.) The Commerce Business Daily is also a source of information about contract awards involving $25,000 or more. These are published, in large part, for the benefit of potential subcontractors.

UMTA Files

In conformance with the Freedom of Information Act (80 Stat. 250), UMTA has established a "Document Inspection Facility" within the Office of Administration. This facility is open to the public only during regular working hours (8:30 a.m. to 5 p.m.).

The Administrator also maintains, at the same place and under the supervision of the same official, a document inspection facility where the general files of the Administration are kept, and where the following records are located and available:

- Any final opinions and orders made in the adjudication of cases and issued within the Administration;
- Any policy or interpretation issued within the Administration, if that policy or interpretation can reasonably be expected to have precedential value in any case involving a member of the public;

- Any administration staff manual or instruction to the staff which affects any member of the public; and

- An index to the material described above.

Any person desiring to inspect such a record or to obtain a copy thereof must submit his request in writing, specifying the record, to the Associate Administrator for Administration, Department of Transportation Building, 400 Seventh Street, SW., Washington, D.C. 20590. Each request for a copy must be accompanied by the appropriate fee prescribed in 49 C.F.R., Part 7, Section 7.85. The fees prescribed may be paid by check, draft or postal money order, payable to the Treasurer of the United States.

Any person to whom a record is not made available within a reasonable time after his request, and any person who has been notified that a record he has requested cannot be disclosed, may apply, in writing, to the Administrator, Urban Mass Transportation Administration, for reconsideration of his request. The decision of the Administrator is final.

Correspondence with UMTA

UMTA also is responsive to letters of inquiry. Letters addressed to the Administrator will be routed to the appropriate offices for reply.

UMTA's addresses

The headquarters and most offices of UMTA are located at 400 Seventh Street, SW, Washington, DC 20590. The Office of Civil Rights, the Office of Transportation Management and Demonstrations, two divisions of the Office of Administration and the Office of Technology Development and Deployment are located at 2100 Second Street, SW, Washington, DC 20590.

The Office of the Secretary of Transportation and the Department library are located at 400 Seventh Street, SW, Washington, DC 20590.

MAIL ORDER TO:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road
Springfield, Va. 22161

TELEX 89-9405
Telephone (703) 321-8543

Date _____

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Organization _____

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Attention: _____

City, State, ZIP _____

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- ☐ Check enclosed for $ _____
- ☐ Bill me. See reverse for costs (not applicable to foreign customers).
- ☐ Charge to my American Express Card account number:

☐☐☐ ☐☐☐ ☐☐☐ ☐ ☐☐☐

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DOCUMENT NUMBER [If ordering by title or if item ordered is a magnetic tape, please see reverse side.]	USER ROUTING CODE (see reverse)	Quantity			Unit Price	Total Price
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USCOMM-DC 6367-P75

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ORDERING MAGNETIC TAPE: (check mode) ☐ 9 track (odd parity) ☐ 1600 BPI ☐ 800 BPI ☐ 7 track ☐ 200 BPI ☐ 556 BPI ☐ 800 BPI ☐ odd parity ☐ even parity

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TITLE #2

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
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TITLE #3

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Originator (Give specific laboratory, or division and location.)		Personal Author
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Sponsor's Series #	Contract or Grant Number of Report	Date Published
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TITLE #5

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
Turn to other side. Write "5" in the Document Number block and complete the rest of the line.		

MAIL ORDER TO:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road
Springfield, Va. 22161

TELEX 89-9405
Telephone (703) 321-8543

Date _____

PURCHASER:

SHIP TO: (Enter if different from address at left)

Name _____

Organization _____

Address _____

Attention: _____ City, State, ZIP _____

- ☐ Charge my NTIS deposit account no. _____
- ☐ Send me an application for an NTIS deposit account.
- ☐ Purchase order no. _____
- ☐ Check enclosed for $ _____
- ☐ Bill me. See reverse for costs (not applicable to foreign customers).
- ☐ Charge to my American Express Card account number:

☐☐☐ ☐☐☐ ☐☐☐ ☐ ☐☐☐

Signature _____

Wherever a foreign sales price is NOT specified in the listings, all foreign buyers must add the following charges to each order:

$2.50 for each document
$1.50 for each microfiche

FOR DDC USERS ONLY

DDC User Code _____

Contract Number _____
(Last 6 characters only)

Allow 3-5 weeks for delivery on your order. If ordering without a document number, by title only, allow an additional 2 weeks.

DOCUMENT NUMBER [If ordering by title or if item ordered is a magnetic tape, please see reverse side.]	USER ROUTING CODE (see reverse)	Quantity			Unit Price	Total Price
		Paper Copy	Micro-fiche	Other (specify)		
					Enter Grand Total	$

USCOMM-DC 6367-P75

USER ROUTING CODE: NTIS can label each document for routing within your organization. If you want this service put your routing code in the box marked USER ROUTING CODE. (Limit eight characters)

SHIP & BILL SERVICE: NTIS appreciates prepayment for documents through the use of an NTIS Deposit Account, check, or money order. Should this not be convenient, NTIS will mail your order and bill you about 15 days after shipment. The handling charge for ordering documents is $5.00 per order (not line item); $5.00 per NTISearch ordered; $2.50 per subscription ordered. NTIS does not bill customers for magnetic tapes or shipments destined for outside the United States.

ORDERING MAGNETIC TAPE: (check mode) ☐ 9 track (odd parity) ☐ 1600 BPI ☐ 800 BPI ☐ 7 track ☐ 200 BPI ☐ 556 BPI ☐ 800 BPI ☐ odd parity ☐ even parity

ORDERING BY TITLE: If ordering without document number, by title only, allow an additional 2 weeks.

TITLE #1

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
Turn to other side. Write "1" in the Document Number block and complete the rest of the line.		

TITLE #2

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TITLE #3

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
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TITLE #4

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
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TITLE #5

Sponsor's Series #	Contract or Grant Number of Report	Date Published
Originator (Give specific laboratory, or division and location.)		Personal Author
Turn to other side. Write "5" in the Document Number block and complete the rest of the line.		

FORM NTIS-173 (REV. 2-75) GPO 888-993 USCOMM-DC 6387-P75

Appendix 3:
Federal Grant and Procurement Contracts for Research and Development in Urban Mass Transportation

Introduction

The Department of Transportation issues a publication entitled *Contracting with the Department of Transportation* (DOT P 4200.1)* which provides information intended for organizations desiring to do business with the Government. While neither that pamphlet nor this one is a substitute for the legislation and the official rules and regulations governing procurement, they should provide useful background information and serve as initial guides in a somewhat complex field.

Methods of Funding

Most of UMTA's research and development is performed by organizations equipped with expert staff and appropriate instruments and tools. If the organization is another Federal agency, its services are paid for by the interagency transfer of funds. If it is a public body (e.g., a city, a public or private university, or a nonprofit institution), the funding is usually made under a grant contract. To engage the services of private industry or commercial establishments, UMTA enters into procurement contracts in accordance with Federal procurement regulations.

Grant Contracts

The award of grant contracts is, essentially, a two-step process involving the Administrator's approval of the project and the amount of the grant deemed necessary to accomplish it, followed by the execution of a grant contract which becomes the basic document describing the mutual obligations of the Government and the grantee with respect to the project. Interagency transfer of funds involves only the Administrator's approval and the execution of an interagency working agreement. These methods of funding are relatively uncomplicated; the project work can begin, with assurance of funding, as soon as the grantee or other agency is notified of the approval.

Contract Procurement

The contract procurement process is more complex, since it is circumscribed by an extensive body of Federal contract law, the Federal and DOT's Procurement Regulations, decisions of the Comptroller General, and numerous court decisions. The purpose of these is to assure that the basic principle of fair and open competition for Government contract work is maintained. As UMTA's R&D program has moved more and more to emphasize new and improved technology and systems, it has tended to look more to private industry sources for its project work and to greater use of the contract funding method.

Procurements for the Federal Government are accomplished either by formal advertising or by negotiation. Most UMTA procurements for R&D programs use the latter. The negotiation process involves Request for Proposals (RFP), designed to generate competition that will obtain industry's best efforts toward achieving UMTA's objectives. Each UMTA RFP is also designed to enable potential suppliers to compete on an equal basis; each includes such items as scope of work, delivery schedules, type of contracts, closing date, technical evaluation factors and expected terms and conditions.

RFP's and Bidders' Mailing List

RFP's estimated at $5,000 or more are synopsized in the *Commerce Business Daily*. In addition to this dissemination, the Procurement Division, UMTA, will notify by mail a large number of businesses on its Bidders' Mailing List when an RFP involving the specialties of those firms has been issued. Any company (or individual) may have its address placed on the "Bidders' List" upon request. Copies are available at all Government procurement offices and a copy is attached to the DOT pamphlet *Contracting with the Department of Transportation*. The completed form should be mailed to: Procurement Division (UAD-70), Urban Mass Transportation Administration, Department of Transportation, 400 Seventh Street, SW, Washington, D.C. 20590.

No one whose address is on the "Bidders' List", however, should feel assured that he will receive notification of all RFP's that may be of interest to him. Notifications are made selectively to firms which have claimed special skills or resources closely related to the topic(s) covered by the RFP, and there is much latitude in interpretation and even nomenclature of the thousands of specializations that may be involved in various R&D projects directed toward the problems of urban mass transportation.

Unsolicited Proposals

UMTA's R&D program has been formulated after several years of study and experience. It is the product of a thorough planning process which continually updates and refines the programs. Each project is part of a unified program which is translated into a budget months in advance of execution of any project.

For these reasons, the lead time between the birth of a concept and the initiation of a project implementation is lengthy. It is, therefore, improbable that even a highly competent and very promising unsolicited proposal would fit immediately into UMTA's R&D program or that there would be uncommitted funds to finance it.

The above recital of impediments in the proposal-to-project path are not intended to discourage serious and well qualified applicants. On the contrary, every proposal will be reviewed and responded to as promptly as possible. It must be recognized, however, that budgetary and program constraints make it necessary to select for further consideration only the most promising projects which appear to be soundly conceived and most relevant to the needs of the budgeted program. Proposals selected for further consideration will usually require substantial documentation as the basis for detailed review including, as appropriate, a comprehensive analysis of engineering and economical implications.

UMTA's Evaluation of Proposals

The primary criteria employed in evaluating proposed R&D projects (both solicited and unsolicited) are:

- Potential contribution to R&D program plan and objectives;
- Potential for wide national application;
- Extent of the potential information to be developed;
- Degree of innovation incorporated; and,
- Potential for eventual funding support by UMTA's Capital Assistance Program (capital facilities and equipment only).

UMTA has drawn up a set of guidelines for the content and format of applications. These will be mailed, on request, to potential applicants.

Subcontracting

Another possible means of participating in UMTA's procurements is by subcontracting. In many instances, an UMTA prime contractor wishes to use another firm for professional services, construction or equipment. Thus, if a firm considered itself well qualified to perform one aspect or part of a project for which another firm has been chosen, the first mentioned firm could approach the prime contractor and offer its goods or services on a subcontract basis.

The *Commerce Business Daily* is a source of information about contract awards. These are published, in large part, for the benefit of potential subcontractors.

Cost Sharing

In some cases when a grant or procurement contract is awarded, financial participation by the performing organization may be required. This is intended to serve the mutual interests of the Federal Government and the performing organization by helping to assure efficient utilization of the resources available for the conduct of research projects and by promoting sound planning and prudent fiscal policies by the performing organizations. The requirement for cost sharing is determined on an individual project basis. The proportion of Federal funding support to be supplied to an authorized R&D project is determined by the Administrator of the Urban Mass Transportation Administration.

Available, free of charge, from the Procurement Operations Division (TAD-432), Office of the Secretary, Department of Transportation, 400 Seventh Street, SW, Wash. D.C. 20590.

University Research and Training Grants

University Research and Training (URT) Grants may be made to public and private non-profit institutions of higher learning performing research and offering training in fields such as economics, the social sciences, engineering, the physical sciences, law, architecture, public administration, urban or metropolitan planning.

Preference will be given to applicants with interdisciplinary research and training programs — those in which the knowledge and expertise in the various social sciences and technical disciplines are brought to bear, in unison, on the problems of urban mass transportation.

Several institutions in a common geographic area may jointly sponsor an institute or program and make a joint application for Federal funds.

Grants will not be made to applicant institutions which do not have, or do not propose to undertake, continuing programs of comprehensive research in problems of transportation in urban areas.

Colleges offering 2-year programs of training leading to subprofessional employment in urban transportation fields are eligible only if they are associated with universities undertaking comprehensive programs of research in urban transportation.

URT Proposals

In the early fall, the Administrator of UMTA will normally issue a call for submittal of grant proposals for the next academic year. This letter will provide any specific or yearly policy guidance necessary. It will also provide a deadline submittal date.

A formal proposal must be submitted outlining in detail the proposed research and training program, as well as a sufficiently detailed delineation of organization, staff, faculty and budget. When necessary, UMTA personnel will provide informal assistance in interpreting the guidelines and preparing the formal application. UMTA has prepared a brochure entitled *Program Information for University Research and Training Grants* which will be mailed, if requested, to potential applicants. It provides a suggested format and detailed instructions for preparing an application.

Technical discussions or correspondence pertaining to the proposal, if relevant, should be referenced in the letter transmitting the proposal in order to be considered in the proposal evaluation. UMTA requires institutions to be well enough established that further Federal support will become unnecessary. Hence, other possible future sources of support should be discussed in the proposal.

Five copies of the proposal, signed by the proposed director of the institute or program and an authorized business representative of the university, should be sent to:

Office of Technology Development and Deployment
Urban Mass Transportation Administration, Department of Transportation
2100 Second Street, SW • Washington, D.C. 20590

A university's proposal should cover plans for the operation of its institute or program over a period of 2 years, in accordance with the procedure described in the above-mentioned brochure. Continuing support may be provided upon review of the program, subject to the availability of funds under section 11 of the Urban Mass Transportation Act of 1964, as amended.

Evaluation of URT Proposals

Proposals submitted to UMTA will be reviewed and evaluated by a panel selected by the Department of Transportation. It is essential that proposals be complete and organized according to the specified format as set forth in the above-mentioned brochure to permit equitable evaluation. Each proposal will be reviewed as an entity, but elements of the budget may be negotiated with the applicant. Thus, amounts less than those requested may be approved, including the funding of a training component only. If appropriate, the review process will involve site visits to evaluate the value of the proposed program and to assess the benefits both to the institutions and to the program.

Evaluation of the following points will assist, but not necessarily govern, UMTA's decision in awarding grants:

- Relevance of the program to urban transportation;
- Extent to which the program will improve the academic quality of the institution in regard to research, curriculum, seminars, and other educational programs relating to the study of urban mass transportation and the extent to which the training program will maximize contribution to and from training fellows;
- Merit of the scientific and technological aspects of the research program, if involved, based upon the quality of the staff and research methodology;
- Compatibility of the program with the institution's long-range goals and DOT needs to meet future manpower requirements in urban mass transportation;
- Manner in which the disciplines involved are to be organized and integrated;
- Consistency of budgetary estimates with the type and level of the proposed work;
- Geographical location of the applicant institution (an effort will be made to encourage the establishment of research and training programs of excellence in several regions of the country to insure broad relevance to metropolitan problems);
- Extent to which opportunities are provided for participation of minority groups and colleges and universities serving minority groups;
- Degree of involvement with local urban transportation problems;
- Relationship of faculty-directed team research to attendant training program; and,
- Extent to which the institution is willing to share the costs of the project.

Within the limits of available funding, support in order of merit is the rule, except that in cases of substantially equal merit, consideration will be given to other factors such as disciplinary and geographical balances.

A proposal that does not result in a grant may be retained by UMTA. However, it will not be made available outside UMTA without the consent of those who signed the proposal or their successors in office, except to the extent that disclosure thereof may be required by a court of competent jurisdiction. Proposals may be withdrawn by the applicant at any time prior to final action by UMTA.

INDICES

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Guide to Projects by Project Number

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