





A DIRECTORY of RESEARCH, DEVELOPMENT and DEMONSTRATION PROJECTS

INNOVATION IN PUBLIC TRANSPORTATION

Fiscal Year 1975

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

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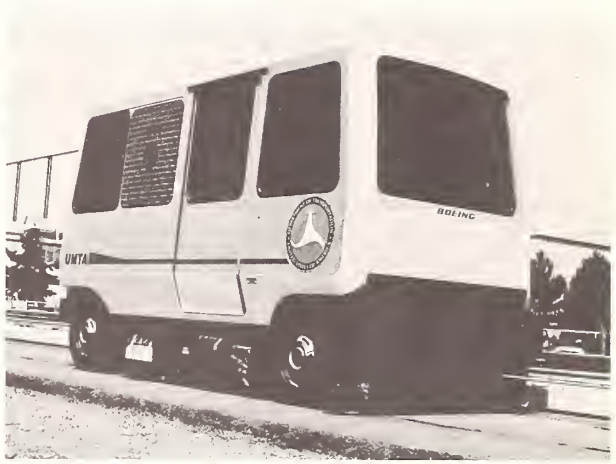

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Introduction

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 and 1974 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 appear in Appendix 2.

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, 1974–June 30, 1975. Funding recipients are listed as 'contractor' although some may in fact be grantees.

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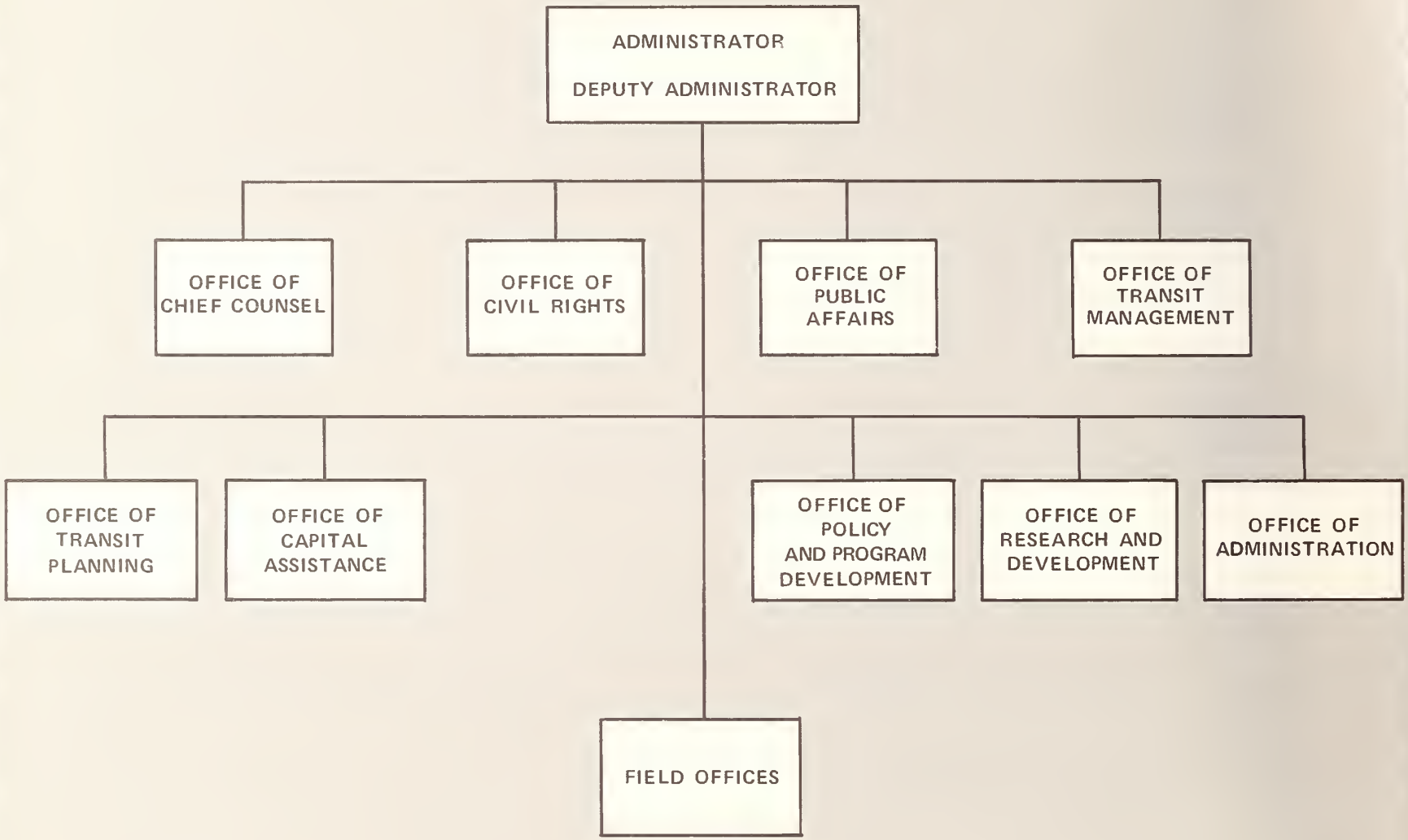
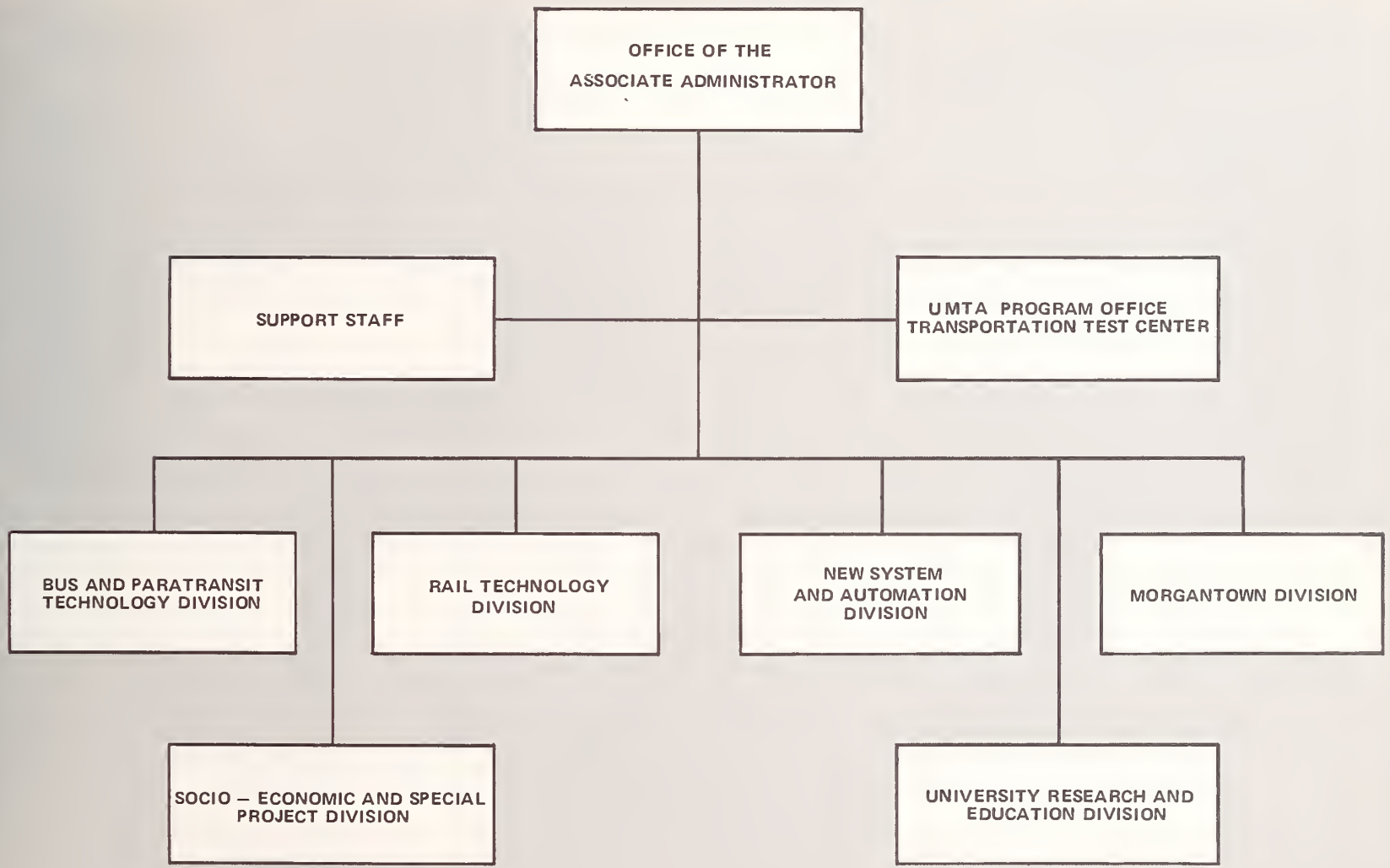


Office of Research and Development



CHAPTER I

office of research and development

With the exception of policy-related research efforts, UMTA's research, development and demonstration projects were originally conducted by the agency's Office of Research, Development, and Demonstration. During Fiscal Year 1974, however, a reorganization took place and projects were divided among three new offices: The Office of Research and Development (URD), the Office of Transit Planning (UTP), and the Office of Transit Management (UTM). URD projects can be found in chapters 2 through 5, UTP projects in chapter 6, and UTM projects appear in chapter 7.

UMTA's Research and Development (R&D) program is designed to provide information on a wide spectrum of potential improvements to urban mass transportation systems that may be useful to localities in selecting the best way to deal with particular transportation problems and needs. Such information is intended to provide guidance to localities in tailoring capital grants to suit local needs and should enable local authorities to achieve improvements in transit service through direct local action. It also assists UMTA in formulating policy on issues involving technology and its implementation.

This information is derived, whenever possible, from empirical observation of prototype or operational vehicles and systems. When a given technology has not yet been put into practice, however, the information usually is based on engineering calculations, simulations, and other forms of analysis.

UMTA's R&D program is guided by some basic objectives established by the U.S. Department of Transportation (DOT) for all its component R&D operations:

Improvement of capacity and service
Reduction of costs
Protection of the environment and energy conservation
Provision of future options
Improvement of safety
Improvement of R&D payoff

Through Research and Development, UMTA seeks to improve capacity and service by such developments as minimizing congestion and reducing trip time. It also attempts to achieve increasing use of mass transit by providing riders with greater comfort and safety, better vehicle availability and more reliable service.

Demonstrations show how special techniques and operating methods can be adapted to serve transit rider needs.

UMTA's research, development and demonstration program is designed to make mass transit use as comfortable, convenient and safe as possible.

The Office of Research and Development attempts to reduce costs by systems analysis and standardizations. For example, UMTA's light rail program is designed to provide guidelines and standards for low cost urban light rail vehicles and systems.

UMTA has made environmental protection and energy conservation fundamental criteria for acceptance or rejection of any new or modified system or vehicle, and the principal objectives of some of UMTA's R&D projects have been to protect the environment, conserve energy or both.

The objective of providing future options embraces all investigations of new approaches to transportation. Noteworthy examples in UMTA's R&D program are Automated Guideway Transit (AGT) systems and the development of computerized Dial-A-Ride techniques.

Vigilance in protecting people from injury is a built-in feature of all UMTA projects. In addition, UMTA's Systems Analysis and Evaluation Division is conducting a special study of the safety factor. One of its principal projects will be a manual on safety for use in all mass transit modes and systems.

Improving R&D payoff is largely a management and coordination activity. It is exemplified in UMTA's R&D program by such projects as the UMTA test facilities at DOT's Transportation Test Center, Pueblo, Colorado, where a systematic program to improve and develop urban rail technology is continually conducted.

UMTA's program primarily affects the daily living and livelihood of four groups: The transit passenger, the transit operator, the urban community, and the transit manufacturing industry and related commercial enterprises. UMTA consciously plans and monitors its program in terms of the manner in which each group is affected by activity for which UMTA is responsible.

UMTA R&D projects are intended to show how one or more of the following types of benefits can be attained:

1. Improving accessibility of public transportation by:
*Extending route coverage to all potential users;
*Making it easier to reach most urban destinations by public transportation; and
*Increasing choice among modes for a wider range of available service.

2. Providing higher quality transportation service to passengers by:
*Reducing total (door-to-door) trip time;
*Providing more comfortable rides;
*Maintaining safe, dependable service;
*Providing protection from bad weather, criminal actions and hazards at transit stops and transfer points;
*Easing the processes of boarding, alighting and transferring;
*Providing for easier use by the elderly and handicapped; and

Joint UMTA-industry R&D projects develop technologies and methods to serve specific needs within the industry.

*Providing more aesthetically pleasing interiors in vehicles and reducing the incidence and effects of vandalism.

3. Improving economic performance of public transportation systems by:
*Reducing costs of equipment, facilities, and rights of way; and
*Modernizing equipment and facilities to reduce operating and maintenance costs.

4. Minimizing adverse impacts of public transportation on the urban environment by:
*Reducing air pollution;
*Reducing congestion in major corridors and activity centers;
*Reducing noise levels;
*Improving aesthetic quality of public transportation equipment and facilities; and
*Avoiding or reducing spatial disruption and barriers within urban areas.

The nation's cities depend on UMTA to produce solutions to a variety of complex problems of implementation in communities whose characteristics are so diverse as to preclude their adopting any standard remedy.

UMTA's R&D effort, therefore, addresses key problems common to many cities so general solutions can be adapted to unique local circumstances. UMTA supports R&D in conventional modes of urban mass transportation (bus and rail) as well as in unconventional new systems.

UMTA is firm in its intention to promote the spirit and practice of competitiveness among producers and suppliers of mass transit equipment. UMTA's typical procedure is to discover requirements and then invite industry to compete in producing the best designs and prototypes.

UMTA's policy in the matter of competition in private industry involves several measures:

Innovative technology is employed to provide the best possible transit service.

Awarding separate contracts for competing preliminary designs, prior to fabrication of engineering prototypes;

Contracting for as many distinct competing prototype vehicles, systems or subsystems for test, evaluation, and demonstration as needed to avoid passing up strong candidates;

Testing, demonstration, and evaluation of competitive vehicles, equipment and subsystems (even those developed entirely or partially at private expense) to determine which are qualified for capital grant support or further development for demonstration;

Solicitation and evaluation of competitive proposals for large scale systems where project funding limitations preclude procurement of more than one design; and

Competitive evaluation and selection of a standard vehicle design as a basic specification that can be used as the basis for capital grant procurements from multiple sources, including special provisions to encourage the establishment of more than one production capability.

UMTA supports the principle that the Federal Government should continue supporting the development of advanced, high-risk transportation technology. It nevertheless encourages the growth and strengthening of R&D within the private sector. As new systems and subsystems are launched, the R&D process will be carefully staged with a well-articulated rationale, explicit objectives, and a clear plan for Federal disengagement once the results of R&D efforts are put into practice.

CHAPTER II

bus transit and paratransit

Bus and paratransit vehicles carry more passengers in urban areas than do all other mass transit modes combined. 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.

Bus and Paratransit Technology

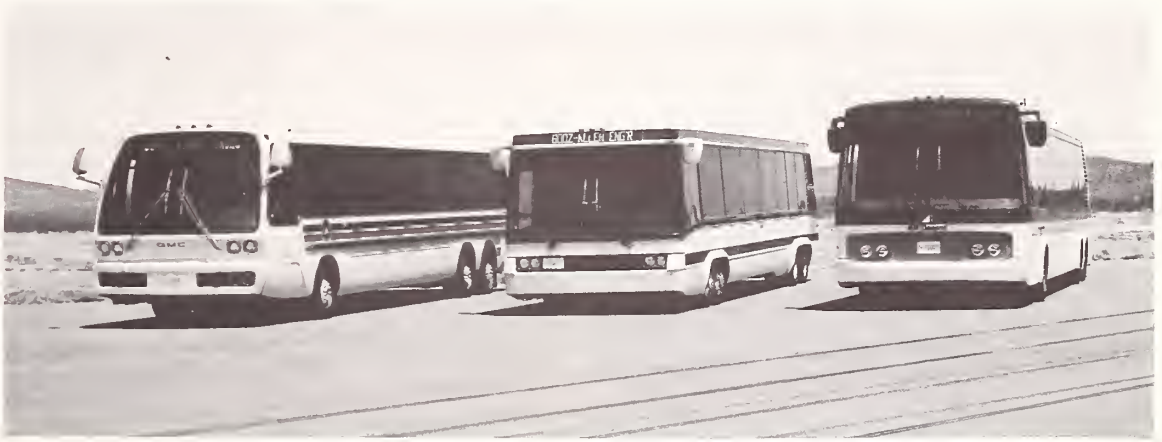
Bus and paratransit technology involves three program areas: Bus vehicle development; paratransit development and energy conservation; and operational technology development.

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.

Rohr prototype of UMTA's TRANSBUS



Three bus manufacturers developed prototypes under UMTA's TRANSBUS project.

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 — December 1975
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. Modern technology now has made it possible to design and manufacture an improved bus — TRANSBUS — that is more comfortable than existing buses.

Although major manufacturers of 40-foot transit buses have been developing design concepts for new equipment, a poor economic climate within the industry and a consent decree issued against General Motors have effectively discouraged the development and marketing of a truly new 40-foot bus. The present bus design was introduced in 1959, with few significant improvements since then. Better and more costly equipment has not been introduced because of the relatively small market and the industry's deficit status during recent years.

UMTA's TRANSBUS program is designed to make available more modern buses by developing 40-foot vehicle designs using the best available existing technology. Improvements sought in this project include: 1) Improved comfort and ride quality to make buses more competitive with the private auto;

Accessibility for elderly and handicapped persons is a major element of TRANSBUS. This Rohr prototype includes a sliding ramp and wide doors to accommodate wheelchair-bound riders.

2) Improved safety for passengers, pedestrians and occupants of other vehicles; 3) Reduced maintenance costs and easier maintainability; and 4) Specific improvements — such as lower floor, lower and fewer steps, more secure interior arrangement, improved lighting and information display — to facilitate use by the elderly and handicapped.

The current phase of this project involves prototype development wherein non-production models of TRANSBUS are developed, tested and evaluated. Each prototype manufacturer — AM General, Rohr and General Motors — has furnished three buses.

A thorough test program is nearing completion. Following manufacturer tests, independent proving ground tests were conducted to establish performance and endurance characteristics. Actual service testing in Miami, New York, Kansas City and Seattle was conducted in late 1974 and early 1975 to obtain operating and public attitudinal information. Test data now is being evaluated to develop recommendations on production design configuration(s).

Reports from this project are listed in Appendix I

High Capacity Bus

Project: PA-06-0007
Funding: $226,000
Schedule: August 1972 — December 1974
Contractor: National Transportation Center
Subcontractor: Booz Allen Applied Research; Daniel, Mann, Johnson and Mendenhall; A. Alan Townsin (Birmingham, England); Gessellschaft fur Verkehrsberatung und Verfahrenstechniken mbH (GVV) (Hamburg, Germany)

Bus mass transit is a labor intensive industry and a given system's over-all driver requirements are largely determined by peak hour demand. If high capacity buses — double decker and articulated vehicles — can be used to increase productivity, the public can obtain better service without corresponding increases in driver costs. This project determined the requirements of the U.S. transit industry for a high capacity bus (nominally 75 or more passengers) and defined the operating limitations, both physical and legal, that are applicable. It also developed a performance specification and conceptual design to meet the requirements of the U.S. transit industry.

Eight U.S. operating properties formed a consortium to review and comment on the project as it progressed and provided a local cash contribution of $15,000 each.

Reports from this project are listed in Appendix I

This German-made M.A.N. articulated bus is one form of high capacity vehicle studied for potential U.S. use.

There is a growing need for a suitable small bus for urban mass transit use.

Small Bus Requirements, Concepts and Specifications

Project: IT-06-0074
Funding: $300,000
Schedule: December 1974 — April 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 built up from existing components or 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 desired operations in the U.S.; 2) Establish 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 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 final report is due about April 1976

Low Pollution Paratransit Vehicle

Project: NY-06-0043, MA-06-0052, CA-06-0079 and CA-06-0080
Funding: Transportation Systems Center: $660,000; Museum of Modern Art: $60,000; AMF: $1 million; Steam Power Systems: $1 million
Schedule: March 1975 — December 1976
Contractor: 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.

Paratransit provides an alternative to individual car ownership and is of vital importance to people without ready access to regular mass transit or private cars. It also acts as feeder service to fixed-route mass transit and, in effect, extends the area served by the latter. UMTA, therefore, wishes to encourage wider public use of paratransit; through research and development activities, it intends to make available vehicles that will be more convenient, effective, productive and attractive than ones now in use.

An AMF model (top) and Steam Power Systems' mockup (below) were two of several designs for a low-pollution paratransit vehicle.

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 ingress and egress — 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 1974 Appropriation Bill," the House Committee provided a separate budget item "for the development 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 results are encouraging and useful, but much more work is required.

The objective of this project is to develop a vehicle well-suited for use in the small vehicle sector of paratransit, particularly in taxi service. Performance requirements call for compliance with 1977 emission standards, now postponed until 1978; capacity of one passenger in wheelchair plus two regular passengers, or five regular passengers without wheelchairs; high maneuverability in urban environment; and acceleration from 0-45 mph in 11 seconds.

The vehicles fabricated under this project will be exhibited to the public during the City Taxi Exhibition which the Museum of Modern Art (MOMA) is planning for June — August 1976. After completion of the exhibition these vehicles will be tested by an independent laboratory.

Two contracts were let in March 1975 for the design and fabrication of one of each prototype in accordance with the proposed approaches with UMTA's requirements; both vehicles will have steam engines to meet stringent emission requirements. UMTA has made a grant to MOMA to prepare and conduct the City Taxi Exhibition; the Department of Transportation's Transportation Systems Center has been funded to provide technical support and to conduct the vehicle tests through an independent laboratory.

Monthly progress reports are produced

Flywheel Energy Storage

Project: CA-06-0014, CA-06-0068, MA-06-0044, IT-06-0017
Funding: $675,000
Schedule: December 1975 — September 1976 (Phase I)
Contractor: to be selected

UMTA's initial Trolley Coach Kinetic Energy (Flywheel) Program was terminated while still in the design phase because it was calculated that a production version of the flywheel package could not meet an established production cost limit.

The cancelled project was intended to relieve total dependence of trolley buses on the overhead electrification system and to provide greater route flexibility. During the project period, it became apparent that it might be feasible to eliminate all dependence on an overhead wire system for trolley coaches and other multi-stop fixed-route urban vehicles by using energy collection stops installed at transfer and turn-around points.

The program has since been redirected toward a determination of transit vehicle energy requirements for various types of fixed-route, multi-stop services. The program also will study the economic effect of introducing the flywheel and its fast recharging technology into existing propulsion systems.

This project 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

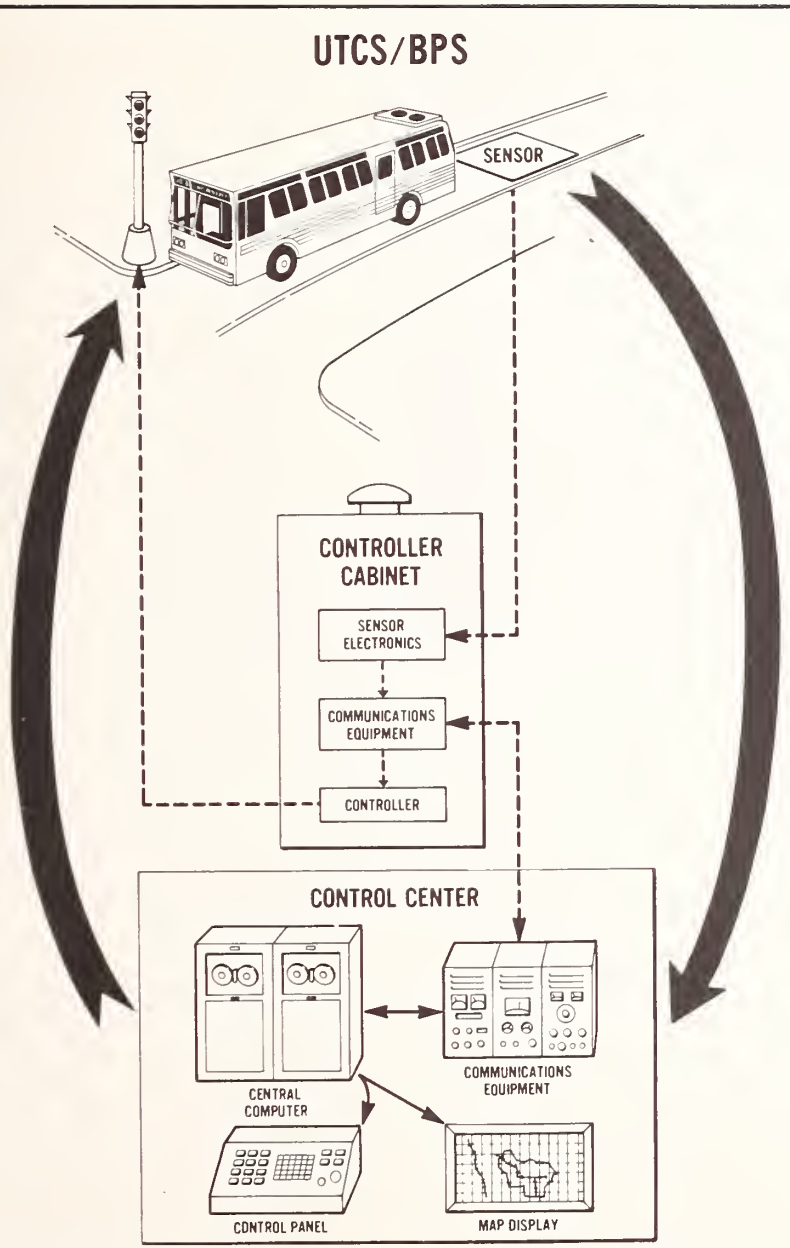
Phase I will determine and categorize the user's requirements and challenge the creativity of the successful contractor(s) to identify a design concept that can: 1) Be applied to a spectrum of urban transit vehicles; 2) Meet varying requirements using a modular assembly approach; 3) Use proven materials 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.

Competitive procurement procedures will be used to select two contractors to compete throughout Phase I. 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

Bus Priority System (BPS)

UMTA is sponsoring demonstrations of Bus Priority Systems (BPS) which are intended to improve the travel speed of urban buses without removing them from the general traffic flow. By modifying established traffic control procedures, developing and demonstrating innovative traffic signal systems, preferential treatment for buses may be provided at signalized intersections. Under some circumstances, delay times at traffic signals may be reduced by as much as 30 percent.

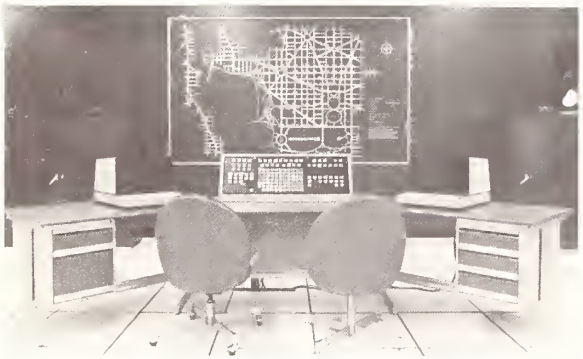


This diagram shows how the Bus Priority System operates to improve travel speed for urban buses on streets.

A demonstration of an integrated urban traffic control and bus priority system in Washington, D.C., undertaken in cooperation with the Federal Highway Administration, uses a central computer to optimize the flow of traffic throughout a network of controlled signals. Under certain conditions, the system grants buses a longer green phase in the traffic signal cycle or provides a truncated red phase so traffic signal-caused delay for buses is minimized.

In order to provide BPS benefits in communities where installation of complex control computer systems is not feasible or justified, methods of providing preferential treatment for buses at signalized intersections not linked to a central computer will be demonstrated by using devices (either optically or electronically actuated) that "recognize" buses requesting priority passage at given intersections, provide preferential treatment and then revert to normal operation, including proper coordination with respect to other signals.

Localized control equipment may be able to provide BPS benefits at considerably lower cost than central control systems under some operating circumstances. Such systems also may be competitive for use in environments where a central control system, lacking BPS features, already exists.



The control center set up to direct bus movement in Washington, D.C. includes a map mechanism that pinpoints participating buses' locations.

Urban Traffic Control and Bus Priority System

(In conjunction with the Federal Highway Administration)

Project: DC-06-0057
Funding: UMTA, $1,707,000; FHWA, $3,273,000
Schedule: April 1970 — December 1974
Contractors: Sperry Rand Corporation; TRW, Inc.; KLD Associates

The Bus Priority System (BPS) is designed to give preferential treatment to transit vehicles in normal street traffic. The BPS operates as part of the Urban Traffic Control System (UTCS), a computerized system developed to optimize vehicle flow through center city intersections. The BPS "recognizes" buses on their approach to an intersection and, if possible, gives them priority to move through the intersection by holding the 'green' phase for a longer period of time than usual or by shortening the red signal. If the impact on cross street traffic is too great, no priority is given. This option prevents the city traffic net from becoming snarled.

Under this project traffic signals at 200 major intersections in the downtown Washington, D.C. area were controlled by the UTCS; of these, 34 included the BPS feature. Four hundred fifty transit buses were equipped to activate the priority override feature and obtain preferential treatment. This project has contributed to urban mobility by increasing the operational efficiency of transit vehicles on city streets and by reducing transit vehicle dwell time at traffic signals.

Reports from this project are listed in Appendix I

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 increase police effectiveness up to one-third 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 then 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, 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 AVM system that will satisfy the requirements of multiple users, many of them governmental services. By accommodating the requirements of diverse governmental users with a single system, cities will be able to install a single system and save money rather than having to install a system for each user. These initial savings will be continuously augmented by reduced maintenance costs resulting from standardization.

The Chicago Transit Authority implemented an AVM demonstration project using a relatively simple location technology capable of providing estimates of the deviation between actual and scheduled vehicle location over pre-determined fixed routes. This demonstration was intended to measure improvements in service and managerial efficiency resulting from the ability to monitor schedule adherence and communicate corrective action to the vehicle fleet.

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 I.

Advanced Multi-User Automatic Vehicle Monitoring

Project: MA-06-0041
Funding: to be determined
Schedule: June, 1975 — July, 1979
Contractor: to be selected

UMTA's multi-user AVM program consists of two phases: In Phase I, requests for proposals were issued, with up to three contractors to be selected to demonstrate the technical feasibility of their location subsystem approach. Philadelphia, the site of previous tests, has been selected as the site for Phase I tests because it represents a typical urban city with harsh electromagnetic interference. The two series of tests will be compared.

The highly successful Haddonfield Dial-A-Ride project has prompted the implementation of at least 20 other demand-responsive systems.

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 the entire multi-user 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-routed vehicles, probably police and transit supervisor vehicles.

Reports from this project are listed in Appendix I

Dial-A-Ride Systems

Dial-a-ride provides effective, dynamic scheduling of small vehicles to suit 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

Haddonfield Dial-A-Ride buses were ramp-equipped to accommodate wheelchair-confined riders.

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.

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 the 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.

Future Research and Development

The future research and development on dial-a-ride will focus on the integration of dial-a-ride services with conventional fixed-route services in area-wide 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.

Area-wide transit systems with mixed fleets of 100 to more than 1,000 vehicles in integrated dial-a-ride and conventional service already are being included in communities' comprehensive transportation plans. Demonstration studies will provide data needed to determine the public response to the service combination and to estimate the cost and performance of transit systems with integrated services. Simulation studies will define the size and configuration of the computers, computer software and communications facilities needed to effectively operate these area-wide systems. New computer software identified in these studies will be developed for use in demonstrations.

Dynamic simulation facilities for evaluating alternative methods of operating regional transit systems also are planned. Alternatives to be evaluated include expanded use of dial-a-ride services in off-peak periods and overall coordination of the various transit modes in a region. The simulation facilities will reduce the cost and public impact of evaluating alternative transit operating methods via the use of computer simulation prior to equipment purchase and in-service tests.

The Haddonfield command and control operations clearly demonstrated the feasibility of computerized dial-a-ride scheduling.

Dial-A-Ride Market and Technology Tests

Projects: VA-06-0012; MD-06-0001; NJ-06-0002; PA-06-0030; TN-06-0004; MA-06-0009
Funding: $6,563,000
Schedule: April 1971 — March 1975
Contractors: The Mitre Corp.; Westinghouse Electric Corp.; University of Pittsburgh; New Jersey Department of Transportation; University of Tennessee; Lex Systems, Inc.; Dave Systems, Inc.; Wilbur Smith & Associates; Transport of New Jersey

This project provided information on public demand and economic factors of on-call, door-to-door public transportation service. In conjunction with the New Jersey Department of Transportation, a dial-a-ride system was tested in Haddonfield, New Jersey.

The Haddonfield Dial-A-Ride Demonstration began in May 1972 with 12 vehicles under manual control, serving 25,000 people with various socio-economic characteristics, living in a 5-square mile area. Feeder and distribution service for a rapid transit station, as well as local point-to-point service, was provided on a seven day week, around-the-clock basis.

Service was expanded until 19 vehicles were serving 40,000 people in an 11-square mile area. More than 700,000 passengers were carried during the three years of operation. Fares of 25¢, 50¢ and 80¢ were used to provide data needed to estimate the relationship between fare and public response. A study of shared-ride taxi systems in Davenport, Iowa and Hicksville, New York has provided additional information on privately operated dial-a-ride services.

The ability of dial-a-ride to attract riders under low densities was demonstrated in Haddonfield and by the many locally supported systems. Additionally, the Haddonfield project clearly showed the feasibility of using computers in dial-a-ride systems too large to be scheduled manually.

The project was completed in March 1975 and a final report has been published by the New Jersey Department of Transportation. More than 30 reports document the results of the demonstration. A comparative analysis of computer and manually scheduled service showed the computer providing at least as good service as the well-honed manual system; the computer system provided shorter waiting times for pickup while maintaining the same riding time. This points toward better service as well as higher capacity with larger computer based dial-a-ride systems.

Reports from this project are listed in Appendix I

Evaluation of Diesel Propulsion in Fleet Taxicabs

Project: NY-06-0049, MA-06-0066
Funding: $480,000 UMTA; $300,000 Department of Transportation
Schedule: June 1975 — August 1978
Contractors: New York Metropolitan Taxicab Board of Trade; U.S. Department of Transportation's Transportation Systems Center

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. Expectations are based on experience gained from manufacturer testing of two prototypes — a Checker Marathon with a 6-cyclinder 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. Despite the proven advantages of diesel engines, few such engines have been used in lighter weight vehicles of the type used for paratransit service.

Invitations for bids were announced in November, 1975 and a contract is expected to be awarded early in 1976.

Reports from this project are not yet available

CHAPTER III

rail transit

UMTA's activities in urban rail transportation research and development involve development, testing and evaluation of new vehicle systems as well as continuing efforts 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 the next generation transit car, the Advanced Concept Train (ACT-1) is underway. ACT-1 will be thoroughly tested and demonstrated on operating rail systems just as SOAC has been.

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 safety problems in existing rail systems and is evaluating the extent to which new urban rail cars meet specifications. In addition to Pueblo activities, directed research is underway in tunneling, crashworthiness, noise abatement, track geometry and safety 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 one/third 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.

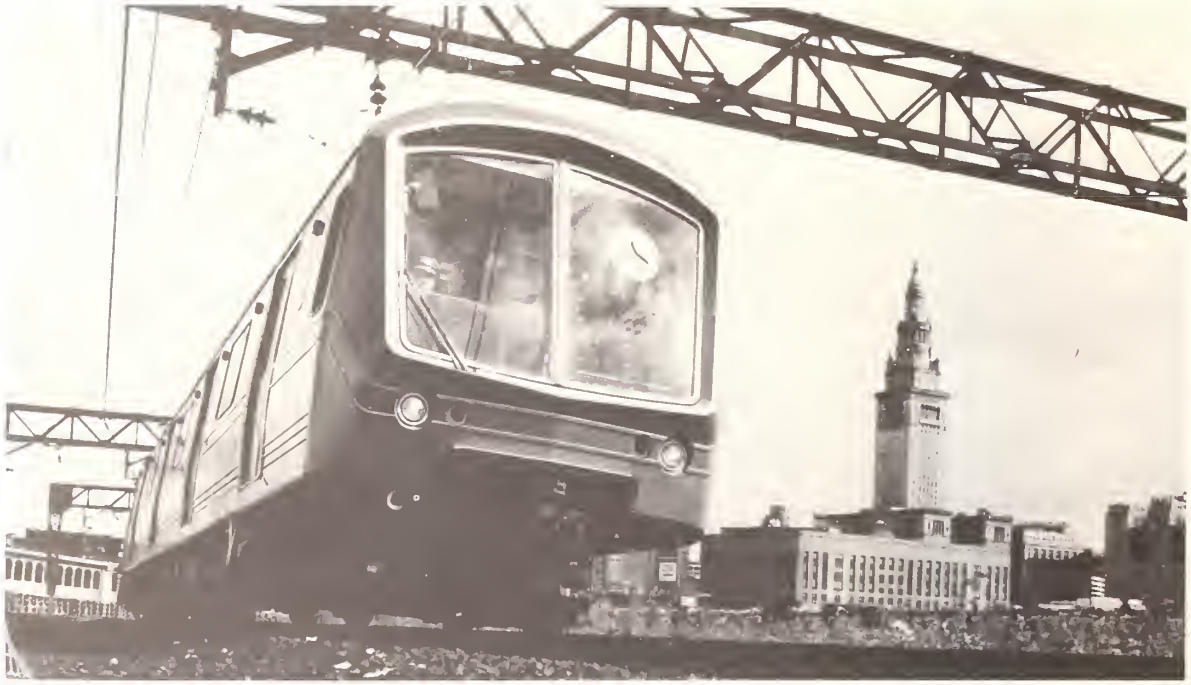
Bay Area Rapid Transit (BART) rapid rail cars provided practical experience for UMTA's SOAC and ACT cars as well as for other transit operators.

new Standard Light Rail Vehicle (SLRV)

By providing rail car 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 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, incorporated the best existing technology (with BART as the baseline) and 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 was scheduled to begin an extensive revenue service test late in 1975 on PATCO's Lindenwold High Speed Line from Philadelphia to Southern New Jersey points.



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

Other advanced propulsion systems also are being developed and tested as part of the rapid rail research and development program. Three Cleveland Transit System "Airporter" cars were equipped with a new AC propulsion and control system and were tested in revenue service under an UMTA research and development project. The cars also were restyled by Peter Muller-Munk Associates to reflect the latest in passenger amenities and featured bucket seats, carpeting, indirect lighting and clean graphics.

The AC system was developed by the Westinghouse Air Brake Company (WABCO) and featured a solid state control system, inverters and AC traction motors. The stepless control provided jerk-free acceleration/deceleration and the solid state control system regenerated power during the braking cycle.

In another 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 on-board 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 event of a power failure and passengers can be unloaded safely in emergencies.

As a long-range goal, an 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: $22,000,000
Schedule: June 1971 — June 1977
Contractor: Boeing-Vertol Company
Subcontractor: St. Louis Car Division of General Steel, Garrett AiResearch (SOAC, ACT-1)

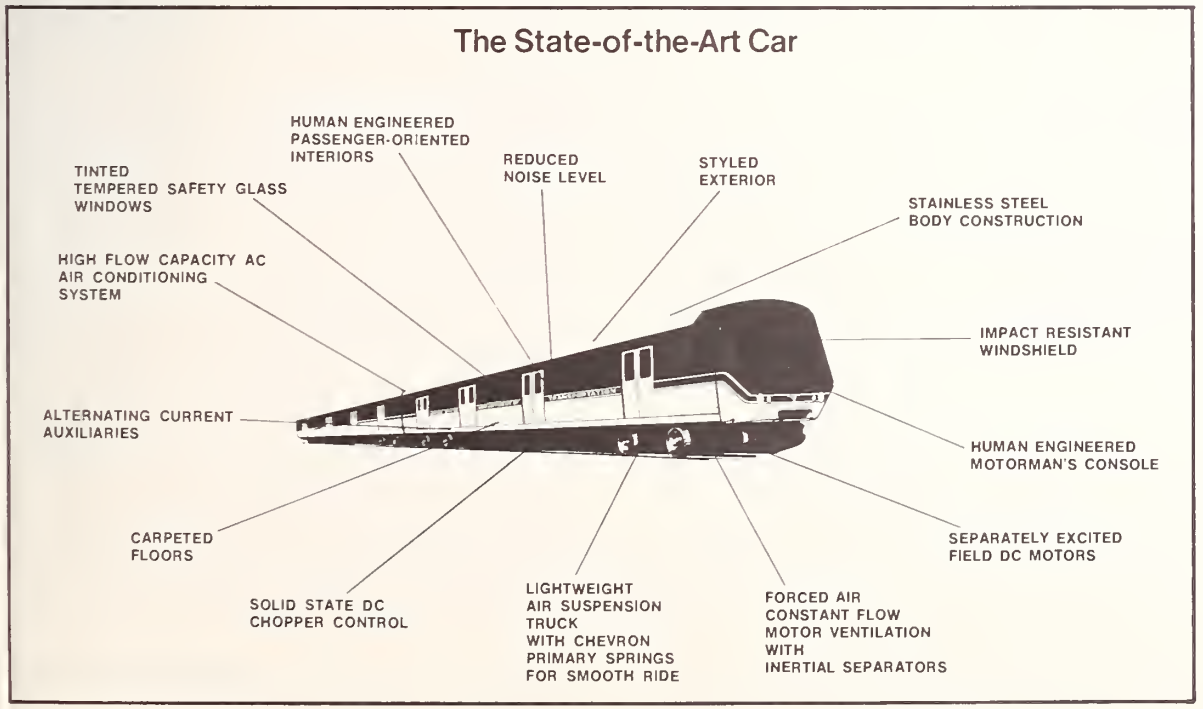
Ten prototype cars for San Francisco's Bay Area Rapid Transit (BART) were engineered, produced, tested and evaluated; these were the basis for subsequent production of BART cars. Boeing-Vertol Company, the systems manager, reviewed the demonstration and monitored the progress of the BART prototype cars in early revenue service and recommended methods for incorporating improvements appropriate to the development of State-of-the-Art and Advanced Concept Train Cars.

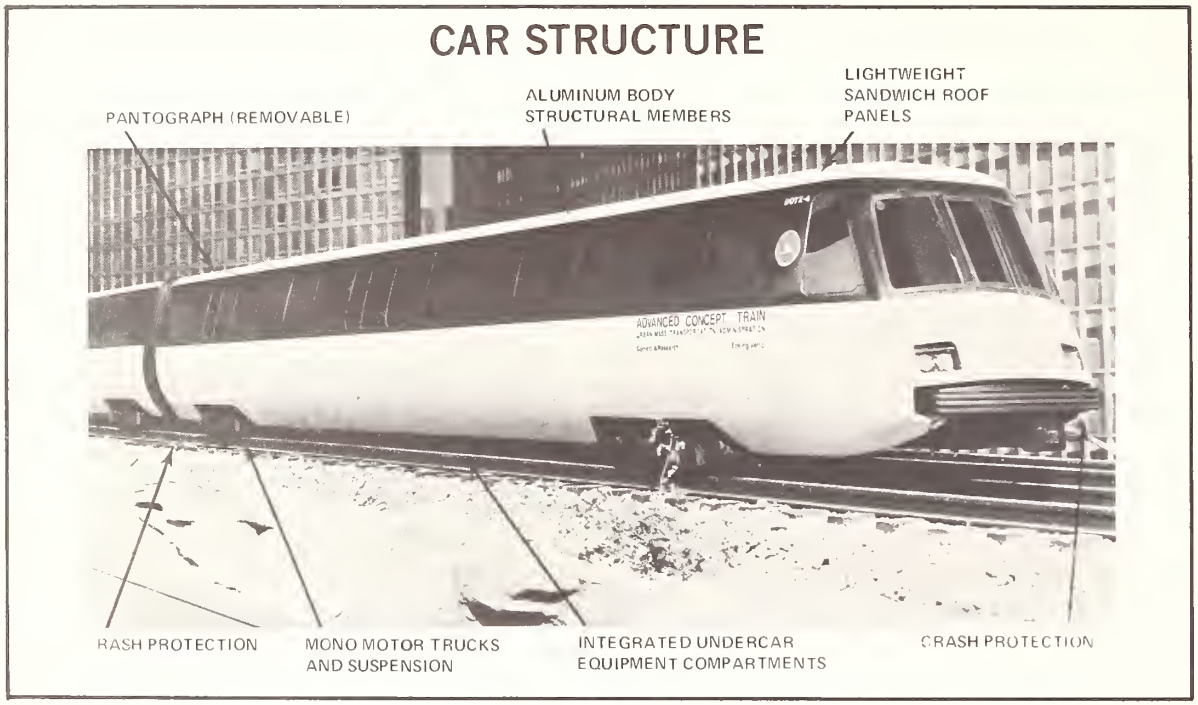
Two new State-of-the-Art Cars (SOAC) were built, incorporating the best in existing technology, and tested in New York, Boston, Cleveland, Chicago and Philadelphia. Passenger convenience and operating efficiency were the primary goals set for these cars. Boeing-Vertol conducted technical tests and directed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

As a long-range goal, an Advanced Concept Train (ACT) is being produced as the next generation of rapid rail cars. The demonstration and evaluation of the ACT vehicles on operating transit systems will lead to the upgrading and replacement of existing obsolete rail vehicles. 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; 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

The State-of-the-Art Car (SOAC) incorporated numerous technological innovations to improve passenger convenience and operating efficiency.





The Advanced Concept Train, the next generation in rapid rail car design, is undergoing final design work.

applications; and reduced life cycle cost of ownership and operation. Assembly of ACT-1 is underway at Garrett.

Concurrent with the development of the Advanced Concept Train are a number of promising subsystems designed for near-term applicability either to existing or planned rapid transit vehicles. The effort, designated the Advanced Subsystem Development Program or ASDP, has initiated work on an AC propulsion system and monomotor truck to be fitted onto the SOAC cars for testing.

The AC propulsion system is being developed by the Delco Division of General Motors Corporation. It features simple 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 design with 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 for rail transit cars.

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

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: Two conventional R-32 New York subway transit cars have been equipped with two energy packs each. 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

The Energy Storage System now being evaluated for rapid rail car use.

THE ENERGY STORAGE SYSTEM
HOW THE SYSTEM WORKS

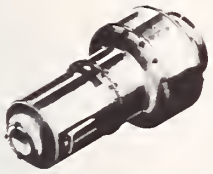
How the System Works

1 BASIC FLYWHEEL

Spin a flywheel supported by two bearings and the flywheel inertia will keep it spinning until the atmosphere and bearing resistance stop it.

2 ADD VACUUM CHAMBER

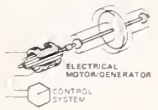
Enclose the flywheel in a low pressure chamber and it will spin almost indefinitely



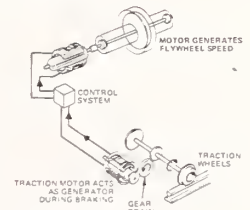
ENERGY STORAGE MACHINE

3 CONNECT ELECTRICAL DRIVE

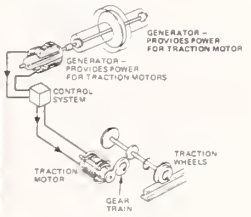
Energy is introduced to the flywheel extracted from the flywheel by the use of an electrical device which acts as an electrical motor or generator



WHAT HAPPENS DURING BRAKING



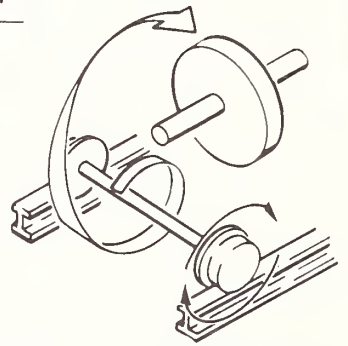
WHAT HAPPENS DURING ACCELERATION



THE ENERGY STORAGE SYSTEM
WHAT THE SYSTEM DOES

1. IT RECOVERS ENERGY GENERATED BY SUBWAY CAR BRAKING

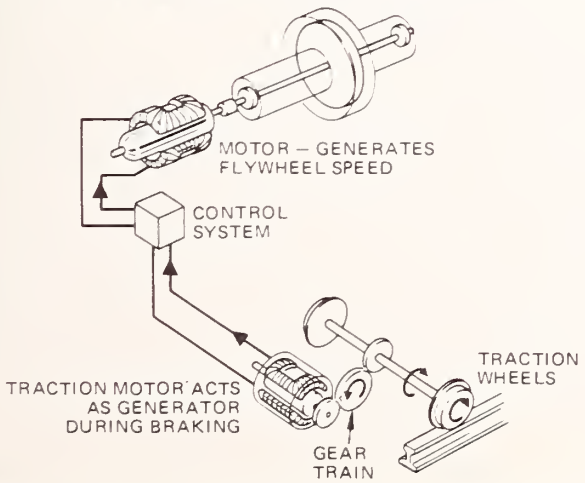
ENERGY STORAGE FLYWHEEL



- **SYSTEM EFFECTS 50% SAVING IN TOTAL POWER CONSUMPTION**
- **80% SAVING IN PEAK POWER (PEAK POWER REQUIRED FOR ACCELERATION FROM STATION)**
- **SYSTEM HELPS TO REDUCE TUNNEL HEAT BY TRANSFORMING BRAKING HEAT TO ENERGY**

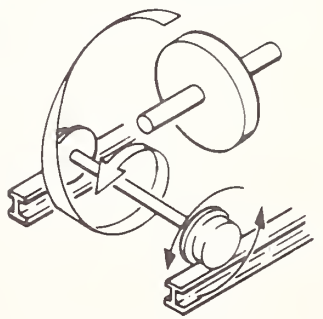
THE ENERGY STORAGE SYSTEM
WHAT THE SYSTEM DOES

2. IT RETURNS THIS ENERGY TO THE ONBOARD STORAGE SYSTEM



THE ENERGY STORAGE SYSTEM
WHAT THE SYSTEM DOES

ENERGY STORAGE FLYWHEEL



3. USING THIS ENERGY, AUGMENTED BY THIRD RAIL ELECTRICAL POWER, THE SUBWAY CAR MOVES TO THE NEXT STATION

power demand from the third rail during acceleration and less wasted heat during braking. A DC chopper system, first developed for SOAC, 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.

The cars underwent performance and other tests at the Pueblo (Colorado) Transportation Test Center in 1974 and currently are being tested and evaluated on the New York City rapid transit system.

A second generation energy storage system is incorporated into the ACT-1 vehicles now under construction.

Reports from this project are listed in Appendix I

Three Cleveland Transit System "Airporter" cars were equipped with AC propulsion and control systems to test smoother acceleration/deceleration and power regeneration during the braking cycle.

AC Propulsion System for Rapid Rail Cars

Project: OH-06-0006
Funding: $1,728,456
Schedule: June 1971 — September 1974
Contractor: Cleveland Transit System

All existing rapid transit systems in the U.S. and Canada employ propulsion equipment with DC motors and controls, a system that is reliable but costly to maintain. An AC propulsion system offers the alternative of significantly lower maintenance costs, improved ride quality through smoother acceleration and deceleration, and reduced power demand and cost through regeneration. The Cleveland Transit System and WABCO developed and tested an AC motor and a pulse-width-modulated solid state control system on one car in non-revenue service. Subsequently, a demonstration grant provided funds for a three-car train to test and evaluate the AC propulsion system in revenue service. In addition, the interiors of two of the three retrofitted cars were modernized and passenger surveys tested hypotheses related to perception of various improvements.

An UMTA-prepared experimental design provided a statistical framework for measuring power consumption, maintenance costs, passenger reaction and other elements. It was found that the AC equipped cars generally consumed less power than DC cars but were more costly to maintain.

Following the 12-month revenue service demonstration in 1973, equipment was removed from the AC cars because the AC equipment did not meet the availability levels of DC cars.

Reports from this project are listed in Appendix I

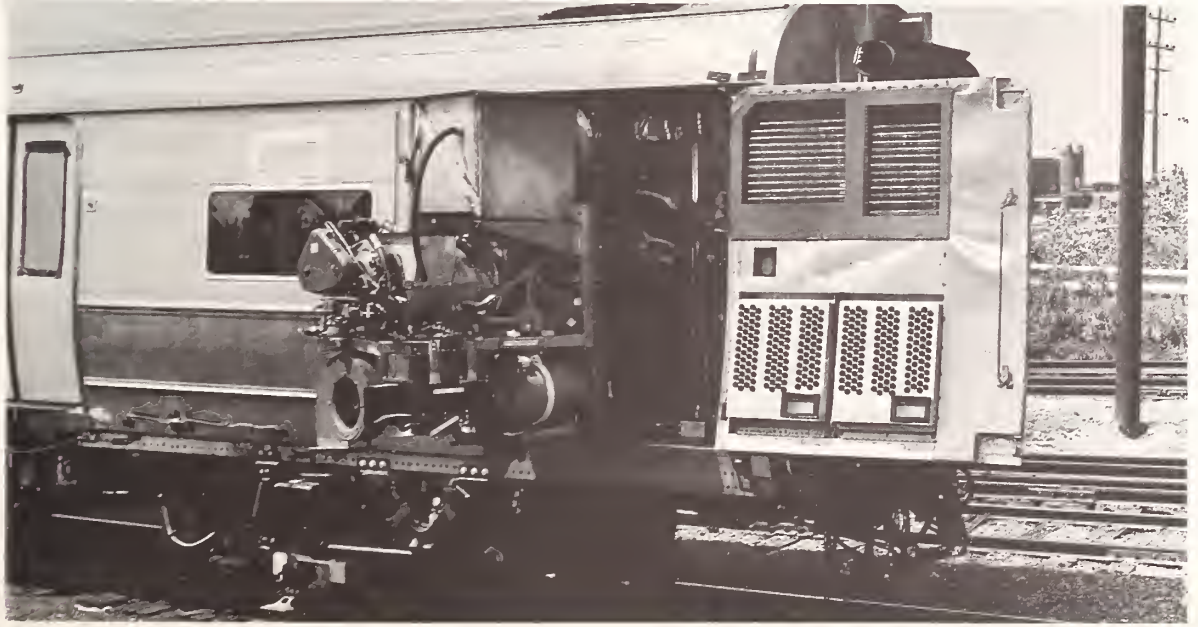
Commuter Rail Vehicles and Systems

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. This study,

General Electric's Gas Turbine/Electric commuter rail cars are fitted with engine units that swing out for maintenance.



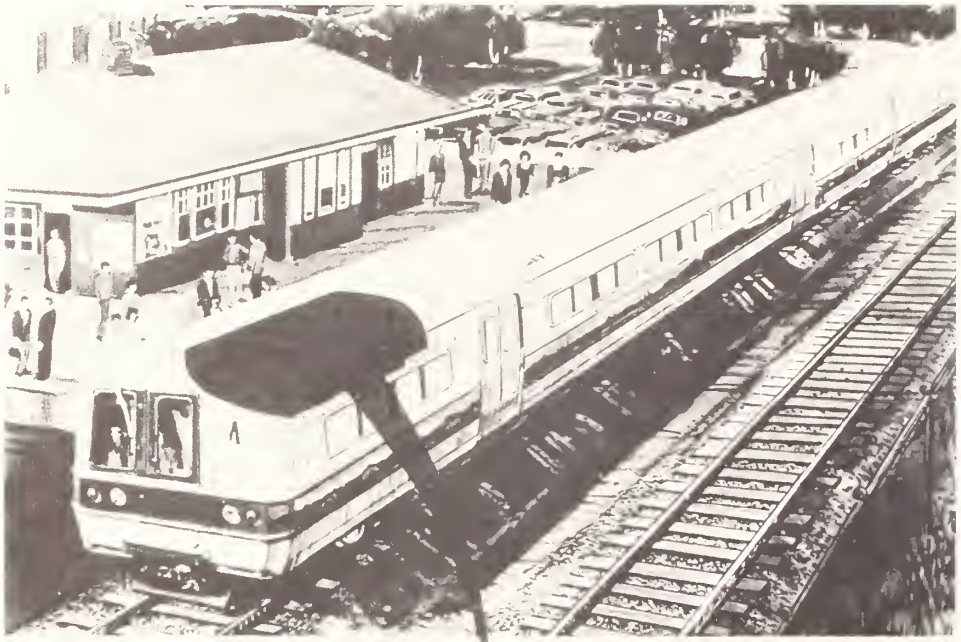
entitled *Washington Metropolitan Area Rail Commuter Feasibility Study*, is available from NTIS, order number PB-200-103. The Maryland Department of Transportation has since acted on the report's recommendations and has implemented improvements in the service.

Dual-Power Gas Turbine/Electric Commuter Rail Cars

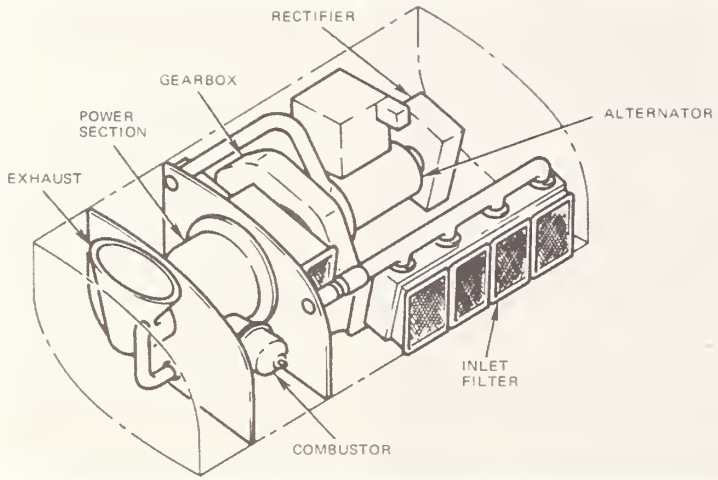
Project: NY-06-0005
Funding: $7,400,000 UMTA; $7,400,000 local
Schedule: June 1971 — December 1976
Contractor: New York Metropolitan Transportation Authority
Subcontractor: Garrett AiResearch; General Electric

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 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. Other transit authorities, railroad companies and the public will be given



Pod Layout



The Garrett Gas Turbine/Electric rail car carries roof-mounted engine pods.

an opportunity to observe and evaluate the cars on a later national tour.

Reports from this project are not yet available

Light Rail Vehicles and Systems

Light rail transit is defined as modern rail vehicles operating on predominantly private right-of-way at surface level, on elevated structures or in tunnels. 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 new Standard Light Rail Vehicle (SLRV) is the first new light rail car design since 1935.

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

Now underway is an assessment of construction, operating and maintenance costs and service characteristics of light rail transit.

Urban Rail Supporting Technology (URST)

The 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 systems manager for the URST program; other agencies involved are the Federal Railroad Administration and the Federal Highway Administration.

Activities are carried out under two projects, CO-06-0001 and MA-06-0025. This program, initiated in December, 1970, now includes facilities development, technical support and applications engineering, test and evaluation, and technology development.

1. *Facilities Development.* In order to systematically study and advance supporting technology for all kinds of transit systems, the Department of Transportation has established the Transportation Test Center (TTC) near Pueblo, Colorado. The Center provides a site for the testing of all types of track-guided vehicles under precise, controlled conditions. UMTA has constructed the Rail Transit Test Track and related facilities for the testing of transit track, structure and vehicles.

TSC is improving the UMTA facilities at TTC by designing and constructing special purpose track sections, permanent traction power systems maintenance and laboratory structures, and instrumentation systems.

2. *Rail Transit Test Track.* The 9.12 mile Rail Transit Test Track has been in use since September 1972; two additional segments are planned to provide a 150-foot radius tight-turn loop for investigating wheel squeal, and a 2-mile long train dynamics track. When complete, these additions will permit vehicle testing under additional dynamic conditions.

Power for energizing the test track third rail is now supplied by a diesel-electric locomotive and by auxiliary diesel generators but completion of a permanent power system is proceeding. Procurement has begun to obtain the long-lead major electrical equipment; construction and installation work will follow with the completed power system operational by the end of 1976. An overhead power distribution system for testing pantograph-equipped urban rail vehicles has been completed over a 2-mile portion of the test track.

3. *Buildings and Facilities.* A 40x192-foot Transit Maintenance Building, complete with 100-foot service pit and necessary supporting equipment, is available, and includes a wheel truing machine and a track scale.

There also is a Technical Service Facility that provides all necessary maintenance capabilities (excluding major repair and overhaul) for both existing and research vehicles, plus office space, emergency vehicle garages and storage space.

A Rail Dynamics Laboratory, a joint UMTA/ Federal Railroad Administration project, is being equipped and will permit testing of full-size vehicles under safe, controlled conditions that simulate actual rail and trackbed.

4. *Instrumentation.* Three data collection systems were developed to support vehicle and wayside test requirements. Eight imbedded instrumentation stations were included in the construction of the 9.12 mile UMTA track and will be used to measure roadbed response.

The final report of the study, *Development of Design Tools and Criteria for Urban Rail Track Structures,* Volumes I and II, delineates problem areas in urban track structures and contains design recommendations and suggestions for further study (PB-233-061/AS and PB-233-017/AS).

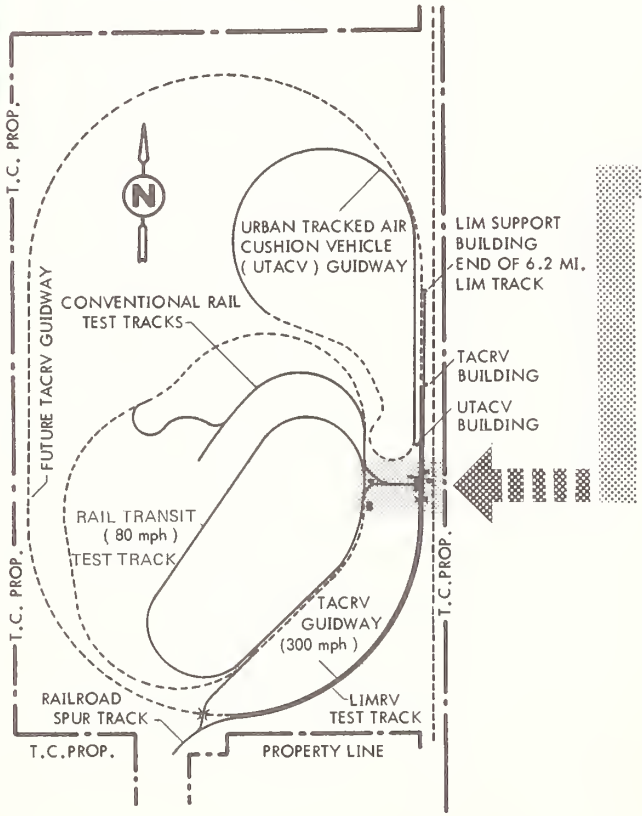
Technical Support and Application Engineering

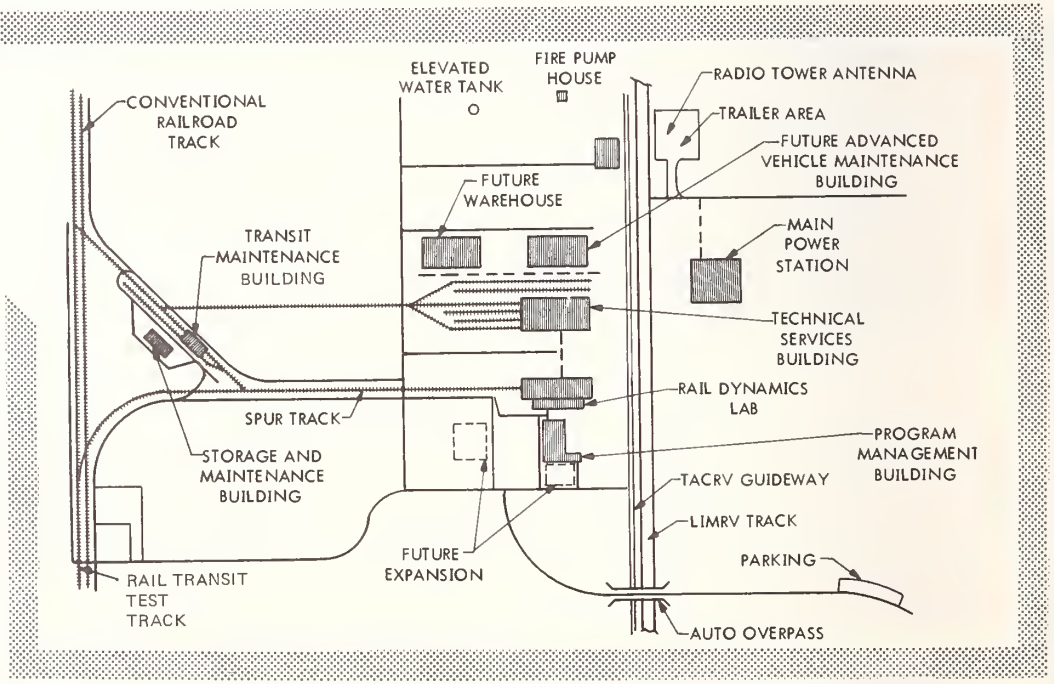
Current projects are concerned with the measurement of ride roughness, track geometry, vehicle performance and noise, and with studies to improve vehicle crashworthiness and the economics of rail system construction and operation.

DEPARTMENT OF TRANSPORTATION

TRANSPORTATION TEST CENTER

PUEBLO, COLORADO





LEGEND

PRESENT (FY 1974) ————————

FUTURE - - - - - - - - - - - -

In the AC propulsion test in Cleveland, the difference in ride roughness between the conventional CTS Airporter vehicle equipped with a DC propulsion system and an Airporter equipped with a developmental AC system were measured in September 1973 using a triaxial, linear accelerometer placed at two locations in each car. While both propulsion systems provided comfortable rides according to the International Organization for Standards specifications, the stepless AC system produced much smoother vehicle acceleration and provided lower ride roughness levels along the longitudinal axis.

1. *Track Geometry Measurement System.* Boston's MBTA Green Line track geometry was measured in December 1972, using capacitance probe sensors and analog recording methods. The data then was used in the trackbed rehabilitation program to locate areas of greatest deterioration. A post-rehabilitation measurement was taken early in 1975 for before-and-after comparison and to determine the effectiveness of the rehabilitation work.

Work is progressing on improved equipment, including the triaxial and variable-gain accelerometer and illuminated-optics sensors for track geometry measurement, low-vibration mounting methods and automatic car location techniques. Digital data handling methods are being used and the improved Mark II Track Geometry System is currently being tested.

2. *Energy Storage Cars.* Two New York Metropolitan Transportation Authority R-32 transit cars equipped with an Energy Storage Propulsion System were tested at the UMTA Rail Transit Test Track in a program supported by TSC. These cars are undergoing further testing on New York City Transit Authority lines, including revenue-service testing.

3. *Transit Vehicle Crashworthiness.* This project was designed to provide the industry with a set of recommended engineering standards intended to reduce rider injury incurred during vehicle crashes. Five representative vehicles have been analyzed by Calspan, Inc.; tests already completed include bodily injury criteria, occupant model, injury relationships model and collision model. The integration and simulations of train-occupant models are in progress and will be followed by preparation of engineering standards.

4. *Noise Assessment.* Site specific noise and vibration assessments are being made on a number of transit properties; the Polytechnic Institute of New York is proceeding with work in New York City and the University of Illinois in Chicago. Similar assessments are underway for San Francisco, Cleveland and Philadelphia. Transportation Systems Center (TSC) completed an earlier assessment for the Massachusetts Bay Transportation Authority and the results have been used to study the effectiveness of the TSC methodology for various abatement methods used.

5. *Transit System Construction Costs.* TSC is developing representative cost estimates of constructing and operating various types of urban rail transit systems (rapid rail, commuter rail and light rail) and is identifying areas where improved technology would reduce costs. The results will be a data package that can be used to compare construction and operating costs as well as technology features of the three types of rail transit systems.

Test and Evaluation

Current projects involve vehicle testing and associated documentation, and the processing of test data for final use.

1. *SOAC Engineering Tests.* Engineering tests at the Transportation Test Center were completed for the SOAC and final test reports were issued.

2. *Test Plans and Requirements.* The document *General Vehicle Test Plans for Urban Transit Cars* provided standard procedures and objectives for testing rail transit vehicles, thereby permitting easy comparison of data. (This is now being revised to incorporate experience gained in the SOAC tests.) Categories include performance, power consumption, adhesion, community noise, passenger noise, ride roughness, power system interaction and structural dynamics. In addition, Section 17 of the *Guideline Specification for Urban Rail Cars* is being revised to ensure consistency with the revised *General Vehicle Test Plan.*

3. *Vehicle Tests at TTC.* In addition to the SOAC tests, the Energy Storage Cars, Garrett Gas Turbine/Electric (GT/E) Cars, and the new Standard Light Rail Vehicle also have undergone testing there. The new rapid rail cars for the Washington, D.C. system and ACT-1 also are expected to undergo extensive testing there.

Technology Development

1. *Noise abatement.* The objective is to reduce noise and vibration levels in urban rail systems by reducing the noise generated and by attenuating the remaining noise. In-service tests began in 1974 on the effects of acoustic barriers, station acoustic conditions, resilient wheels and the damping of elevated structures.

In the area of wheel/rail noise and vibration, an evaluation of existing models of wheel squeal, impact and roar, and of the effectiveness of existing devices to limit wheel/rail noise has been completed.

A method also has been developed for objectively rating control measures and an analytical model is well underway.

The generation and transmission of noise by elevated track structures also is being investigated. Literature compilation and evaluation has been completed and prediction models have been developed. The next step is to devise and evaluate control suppression methods. In-service testing of various abatement techniques is underway on the SEPTA system in Philadelphia.

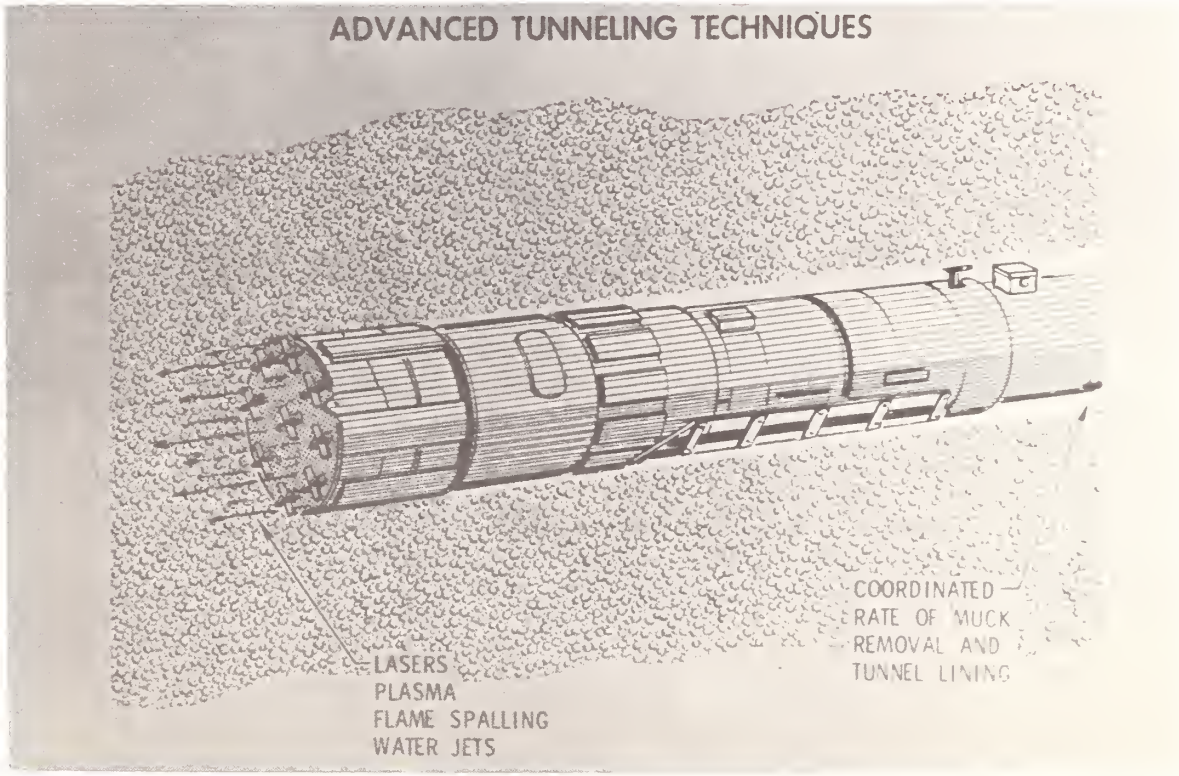
2. *Tunneling.* The objective of the UMTA program is to improve the social, economic and environmental impacts of tunneling processes, reduce costs and time required for tunnel construction compatible with minimal environmental impact and health/safety risks, improve rapid transit tunnel design and technology, improve maintenance and upgrade procedures for existing and future transportation tunnels, and increase advance rates through improved materials handling systems.

New concepts in tunneling technology are now being introduced to the industry. UMTA's program has developed requirements, specifications and preliminary designs for subsurface instrumentation for detecting obstacles prior to excavation and ahead of the tunnel face. It also developed requirements, specifications, and preliminary designs of instrumentation to monitor stress, strain, movement, bore pressure and other relevant parameters during tunneling operations. Preliminary cost models of urban tunnel systems have been prepared and sensitivity factors identified, using specific case histories from BART and the Washington Metropolitan Area Transit Authority; procedures for improved construction control techniques for deep braced excavations in urban areas also have been developed.

New tunneling technology currently being developed includes guidelines for improving the environmental impact and safety of urban tunnel construction, guidelines for planning muck disposal alternatives, more economical subway station design and construction procedures, improved tunnel maintenance procedures, methodologies to determine, predict and assess the disruption effects of urban tunneling; urban tunnel construction cost, data base and cost estimating guidelines; and a pneumatic materials transport system for muck hauling.

Reports from this project are listed in Appendix I

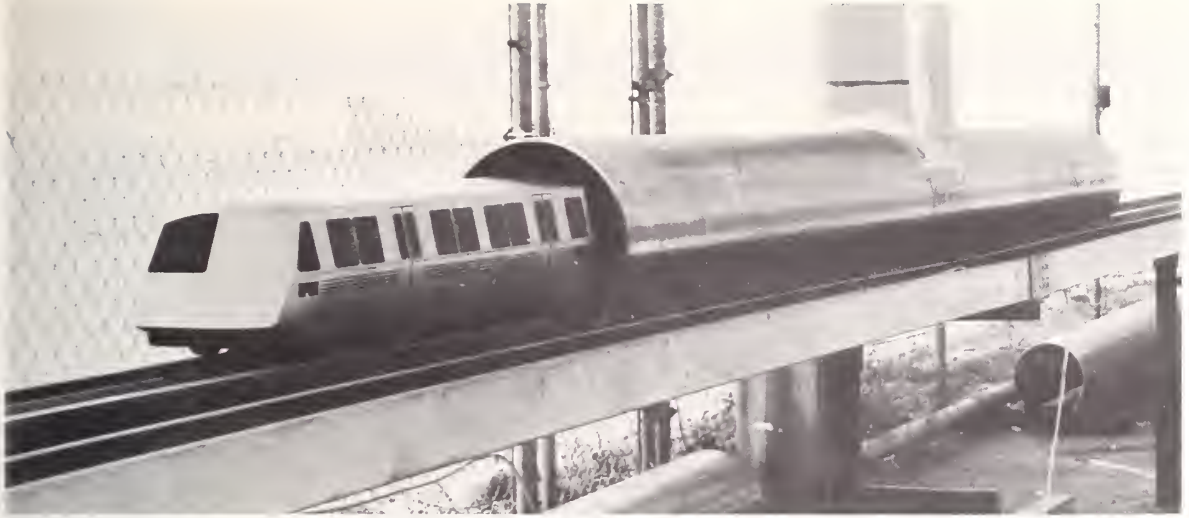
UMTA's R&D efforts in tunneling are designed to develop and test new technologies, develop specifications and preliminary designs for tunneling equipment and procedures.



Environmental Control in Underground Rapid Transit Systems

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

This project was developed to fill a gap in subway environmental design. Since the first subway sys-



The Subway Aerodynamic and Thermodynamic Test Facility (SAT) at Developmental Sciences, Inc., was used to determine the interaction between vent shafts and other elements of the total underground environment of subway tunnels.

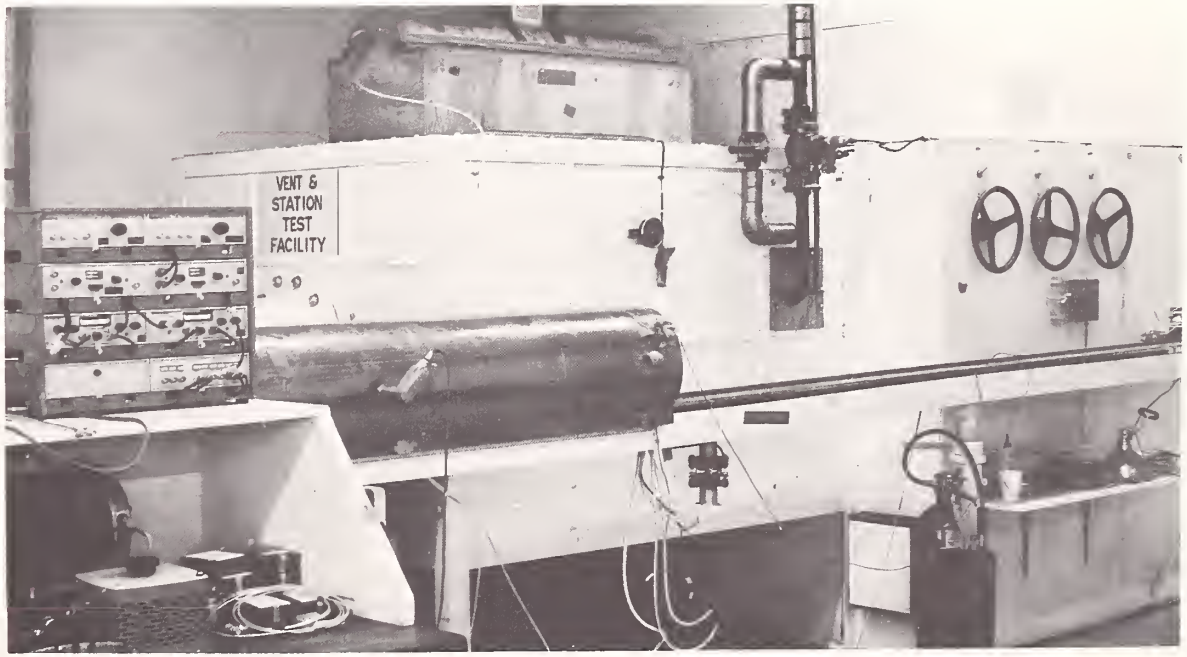
tems were built at the turn of the century, "guesstimation" has been the principal ingredient of subway environmental criteria, analysis and control. Although ventilation shafts, including surface property, and station air conditioning represent 8-10 percent of the total cost of underground subway construction, there is 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 will produce an engineering handbook and a computer program to provide subway system planners, designers and operators with methods for determining answers to these complex and interrelated problems that are made even more serious by the rapid escalation of subway costs in recent years. Twelve rapid transit properties in the U.S. and Canada, through the Transit Development Corporation, formulated a detailed 3-1/2 year research program to produce the environmental design handbook.

This handbook is being published in two volumes; Volume I, *Subway Environmental Design Handbook: Principles and Applications,* has been completed and is available through the Superintendent of Decuments, Government Printing Office (Stock No. 050-014-00005-3). Volume II will include a users' and programmers' manual for the Subway Environmental Simulation (SES) computer program (to be available from NTIS). Another phase of the project, approved in June 1974, will include complete validation of the SES computer program, testing of a new concept of removing heat from stations, revision and updating of Volume I of the handbook.

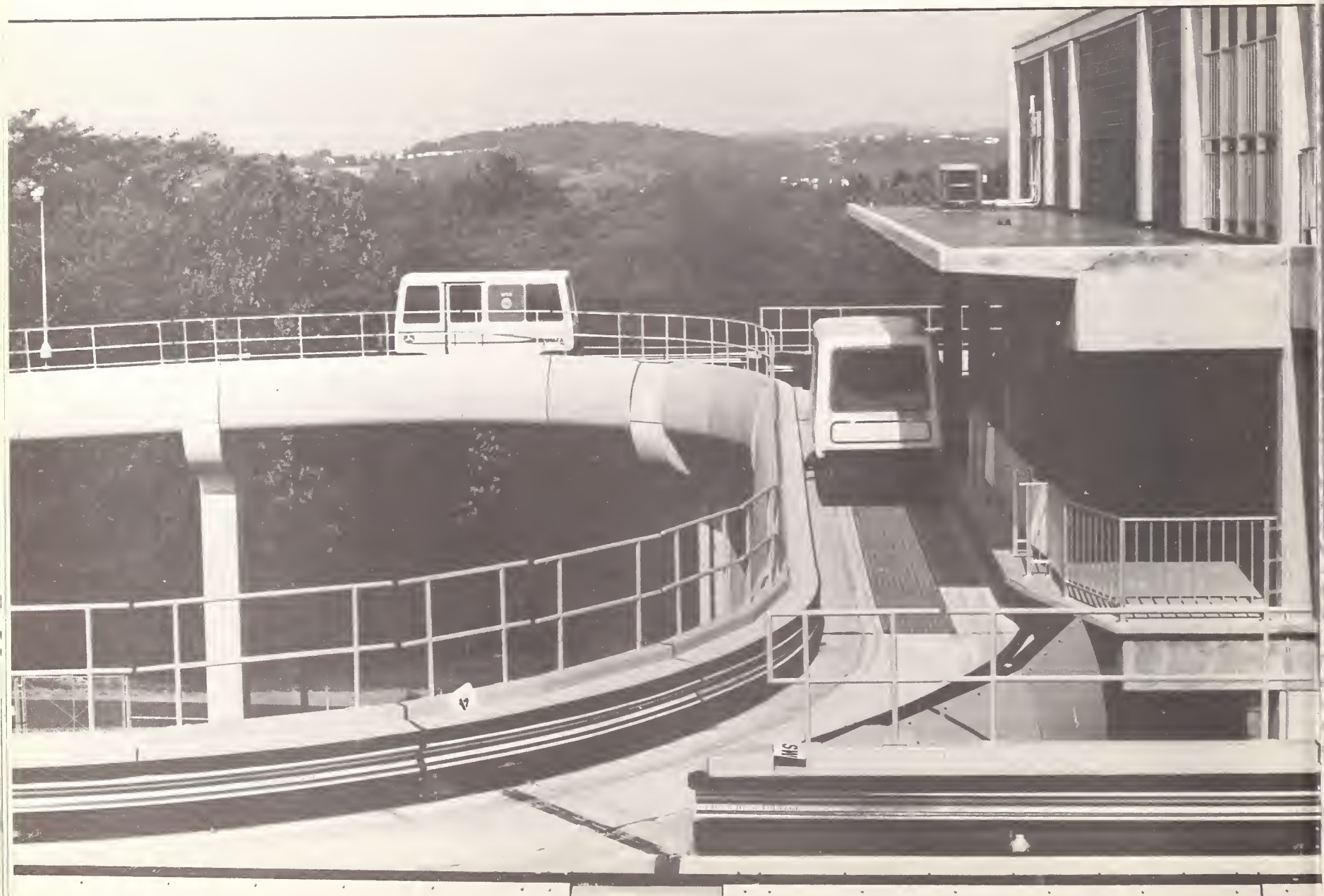
Reports from this project are listed in Appendix I

The Vent and Station Test Facility (VST) at Developmental Sciences, Inc., was used in the research leading to development of the Environmental Design Handbook.



CHAPTER IV

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 — 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 types of transit systems, all characterized by heavy emphasis on modern computer and control technology. These new systems are designed to operate quietly under electric power with attractive vehicles and structures that will facilitate their assimilation into the urban environment.

The current dominant means of public transportation are transit buses and rapid rail systems. The development of computer and automation technology, particularly 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 have the promise of offering significantly better service than existing urban public transportation modes. All of these concepts include the use of vehicles capable of automatic operation on separate roads or guideways and may be classified as automated guideway transit (AGT) systems.

Characteristics of these three classes follow :

Shuttle-Loop Transit

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

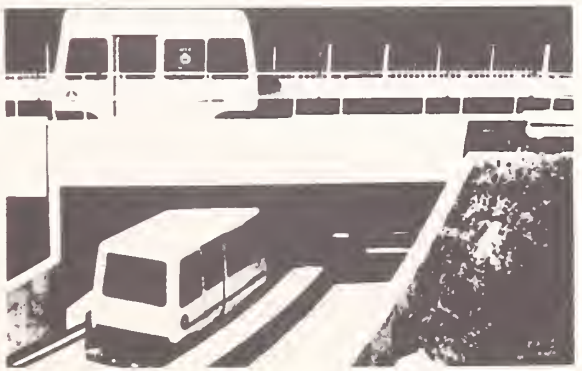
Passenger Shuttle System
Tampa International Airport, Florida

Group Rapid Transit

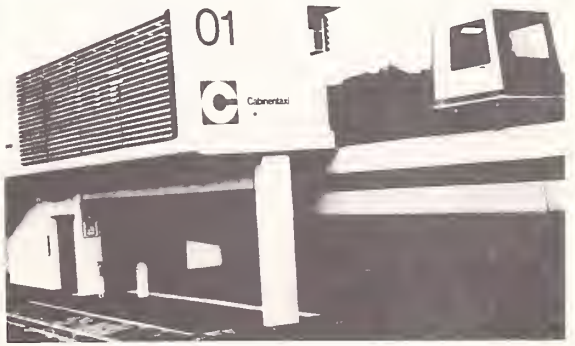
- Medium sized vehicles
  — 12 to 70 passengers
- Switching to shorten
  en route delays
- Scheduled or limited nonstop
  origin-to-destination trip
- On-line or off-line stations
- Intermediate headways
  — 3 to 60 seconds

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



GRT System, Morgantown, West Virginia



Cabinentaxi — Hagen, West Germany

The Morgantown, W. Va., Personal Rapid Transit (PRT) system

AIRTRANS, an automated guideway system at the Dallas/Ft. Worth Airport, carries both passengers and cargo between distant terminals.

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

UMTA has constructed the world's first operational GRT system at Morgantown, West Virginia, which began revenue service in October 1975.

A more advanced GRT technology is now under development to serve the needs of more heavily traveled corridors. Three preliminary design studies for the Advanced GRT system were recently completed.

Automated Guideway Transit (AGT)

The attractiveness of public transportation can be improved by the application of two approaches: Reduce travel time on and improve access to public transportation systems.

Automated Guideway Transit (AGT) can improve service because it operates on exclusive guideways to avoid traffic congestion and uses off-line stations, small vehicles and sophisticated automation techniques to reduce or eliminate intermediate stops and transfers and to decrease trip times. 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.

A number of important automated guideway transit system developments 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 found application at the Tampa and Seattle-Tacoma airports, and was followed by the Dallas-Fort Worth Airport, Morgantown, TRANSPO 72 and Advanced GRT system developments.

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. 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. Higher capacities permit more revenue passengers to use the expensive guideways and stations, thus increasing return on investment.

Figure 1

AUTOMATED VEHICLE SYSTEM DEVELOPMENTS

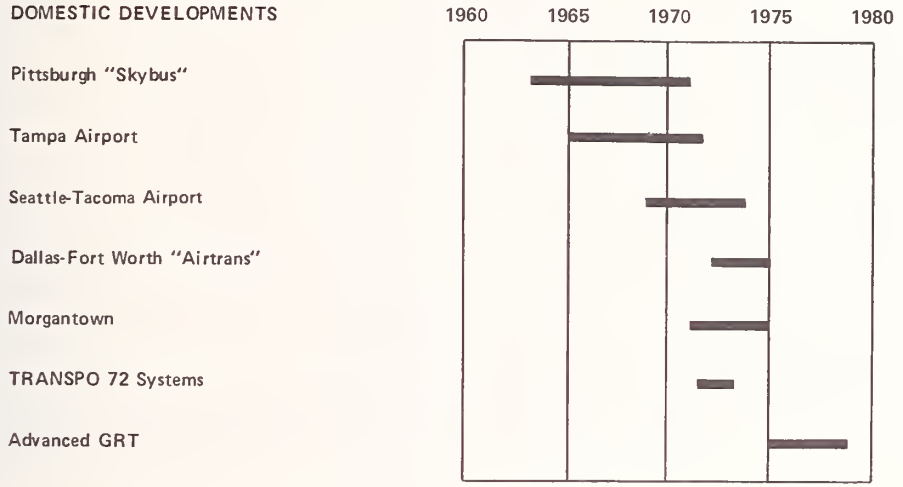
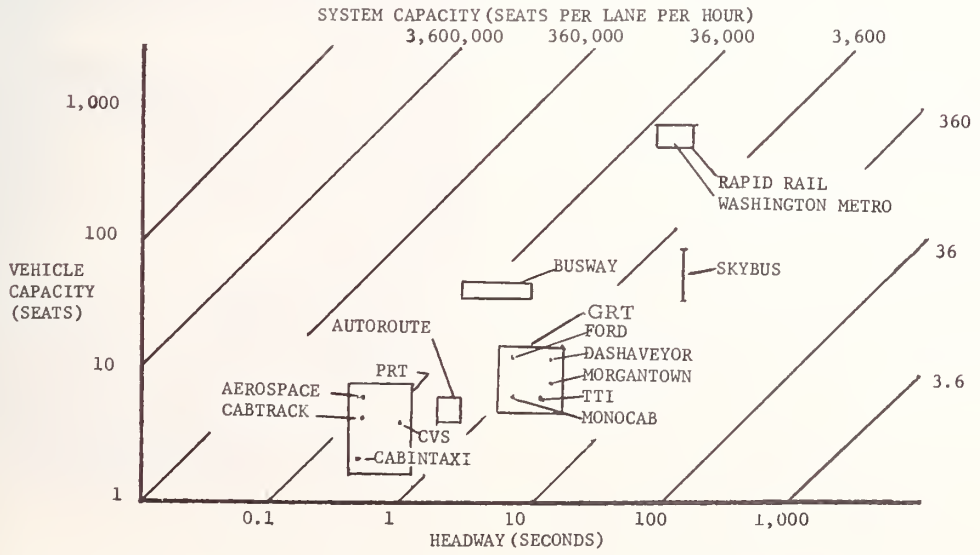


Figure 2

Vehicle capacity versus operating headway



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 system cost. By using small vehicles on light guideway structures, PRT 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.

Morgantown Personal Rapid Transit Demonstration Project*

Projects: MA-06-0026, WV-06-0003, WV-06-0005, WV-06-0006, WV-06-0007

Funding: $64,200,000

Schedule: June 1969 — September, 1975

Contractors: 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

*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.

The Morgantown PRT system links distant reaches of the West Virginia University campus by elevated automated guideways.

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 revenue service operation in accordance with rigorous system specifications. Acceptance tests, culminating in a five-day demonstration, were completed early in September, 1975. Since September, the system has been met with enthusiam by West Virginia University students who use the system.

Reports from this project are listed in Appendix I

capable of transporting 1,100 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 offline 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 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.

The Morgantown PRT vehicle carries up to 21 passengers, both seated and standing.

The Transportation Technology Air Cushion Vehicle was first demonstrated at Transpo 72 and then was evaluated in extended use at Dulles Airport outside Washington, D.C.

Advanced Group Rapid Transit System

Projects: CA-06-0078, CO-06,0007, PA-06-0032
Funding: $1,900,000
Schedule: 1975 – 1979
Contractors: Boeing-Vertol Company, Otis Elevator, Rohr Industries

This project will develop a second generation GRT system capable of line-haul capacities of 14,000 passengers per lane per hour, using vehicles with 12 or fewer seated passengers. Light vehicles will allow construction of small guideways and, thus, greatly lower capital costs than prior GRT systems.

The project consists of three phases – a preliminary design phase; a design, engineering analysis and experimental verification phase; and a fabrication, installation and test phase. Three competing contractors are involved in Phases I and IIA. The best system will be selected for implementation in Phase IIB.

Three system concepts were selected for the design phase. The Boeing-Vertol system utilizes rubber-tired vehicles riding on a U-shaped concrete guideway. The Otis design utilizes air-cushion supported vehicles which operate on an open U-shaped guideway. The Rohr Industries design utilizes a suspended monorail in which propulsion and suspension are provided electromagnetically by a Rohr ROMAG motor. The guideway is of precast concrete construction and has a four foot by four foot cross section.

Urban Deployability Studies will support the development of the Advanced GRT System. These studies will develop and evaluate techniques for routing full and empty vehicles in response to demand for service. The Urban Deployability Studies encompass the definition of service policies, development of routing and scheduling algorithms, and failure management.

System reliability is a prime requirement of any new transportation system and is also an important determinant of cost. To assure the success of AGT systems, it is necessary to develop highly reliable, low maintenance, long life components and a well trained, expert working force.

The reliability and availability of the Advanced GRT System will be carefully evaluated through a study program. Failure mode effects analyses will be performed on components and the response of the system to on-line failures carefully investigated.

Guideway and station structural components are important cost determinants for current automated guideway transit. Guideway costs range from $1.5 to $3 million per lane-mile. Guideway and station structures, in addition, may require an inordinate amount of time for installation. Improved guideway and station engineering and fabrication techniques, coupled with new concepts such as modularization and prefabrication, should permit substantial reductions in guideway and station cost and in installation time.

The Advanced GRT Program will provide engineering designs for medium-capacity GRT systems, a complete design with specifications, standard simulation tools for vehicle management and vehicle system studies, comparisons of the different management approaches, improved vehicle management algorithms, and economic analyses of operating costs.

The Advanced GRT Program will lead to an operational prototype that will be installed and exhaustively tested at the Transportation Test Center in Pueblo, Colorado. The system will be

The Rohr Monocab system uses a suspended monorail and electromagnetic propulsion.

designed for application to urban areas in expanded configurations.

Reports from this project are not yet available

Automated Guideway Transit Technology

Projects: CA-06-0071, CA-06-0089, CA-06-0091, MD-06-0022, MA-06-0048, others to be assigned

Funding: $4,425,000

Schedule: 1974 – 1979

Contractors: Aerospace Corporation, California Institude of Technology Jet Propulsion Laboratory, Johns Hopkins University Applied Physics Laboratory, 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 development 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 Technology Program will expand the scope of these earlier programs.

The automated guideway technology program 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 Level 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 to the above, 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 such systems; "fail-operational" design concept will receive particular attention. Redundant implementation will provide the key to operations that permit 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 program will include analyses and experimental investigation at the contractor's facility.

The vehicle lateral control and switching program 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.

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

The Wayside Technology program will investigate implementation technologies for guideways, stations, and power distribution systems. Studies in these areas will emphasize identification (through analyses, modeling, and tests) of innovative approaches in construction techniques and material selection to reduce the costs of these system elements. 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, PRT and DMT.

The program also will develop data required for the development of PRT systems and will assess the potential cost and performance of such systems.

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.

Program plans for this project have been developed and approved and procurement packages now are being prepared.

Reports from this project are not yet available

Ford prototype of an Advanced Group Rapid Transit (GRT) vehicle.

CHAPTER V

socio-economic and special projects

UMTA's Office of Research and Development also is responsible for R&D projects representing broad concerns that cover more than one urban transportation mode. This program includes technology studies to support policy, automated guideway transit (AGT) socio-economic research, systems development and experimental design.

Technology studies to support policy include studies addressing aspects of urban mass transportation technology that contribute to resolution or establishment of policy affecting the UMTA research and development program or that support programmatic decisions concerning planned R&D projects.

Projects in this program area include technological qualifications/operational certification, life cycle costing, research and development delivery systems, and the effects of alternative metropolitan development.

Objectives of the AGT socio-economic research program are the accurate match of characteristics of automated guideway transit technology with specific needs for improved forms of urban transportation; determination of the social, economic, environmental and performance factors that may affect the acceptance of AGT systems; ascertainment of the nature and size of markets for this form of transit technology; establishment of an organized central repository of technical, performance and socio-economic information on AGT systems through assessment of existing domestic and foreign AGT installations; and the establishment, through experimentation and urban simulation, of service levels and system configurations that will ensure local acceptance of this new form of urban transportation.

This program area includes these activities: AGT requirements analyses, including social, economic, environmental and performance requirements as well as requirements for additional research and development; AGT technology status, including an AGT assessment program and AGT inventory; AGT market and policy analyses, AGT urban simulations and AGT user documents.

The systems development program includes research and development projects that involve development of total system operations from systems analysis of concept through prototype implementation. Projects included in this area are automated-assistance transit information systems, elderly and handicapped technology, urban goods movement and a self-cancelling ticket.

The experimental design program area results in the formulation, for each research and development project, of a plan that establishes project objectives, formalizes test and evaluation activities to be conducted, and structures the form of the final report in a way that fosters maximum dissemination of information for national application from individual R&D projects.

Washington, D.C.'s Metro rapid rail system will be controlled and monitored by this operations control center. (Photo courtesy of WMATA)

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 the need for technological qualifications guidelines of new transit systems or equipment prior to eligibility for capital assistance, and operational certification guidelines for an entire metropolitan or area-wide 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 that incorporate 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

Life Cycle Costing

Project: RI-06-0007
Schedule: May 1975 — June 1976
Contractor: Naval Underwater Systems Center

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

Effects of Alternative Metropolitan Development

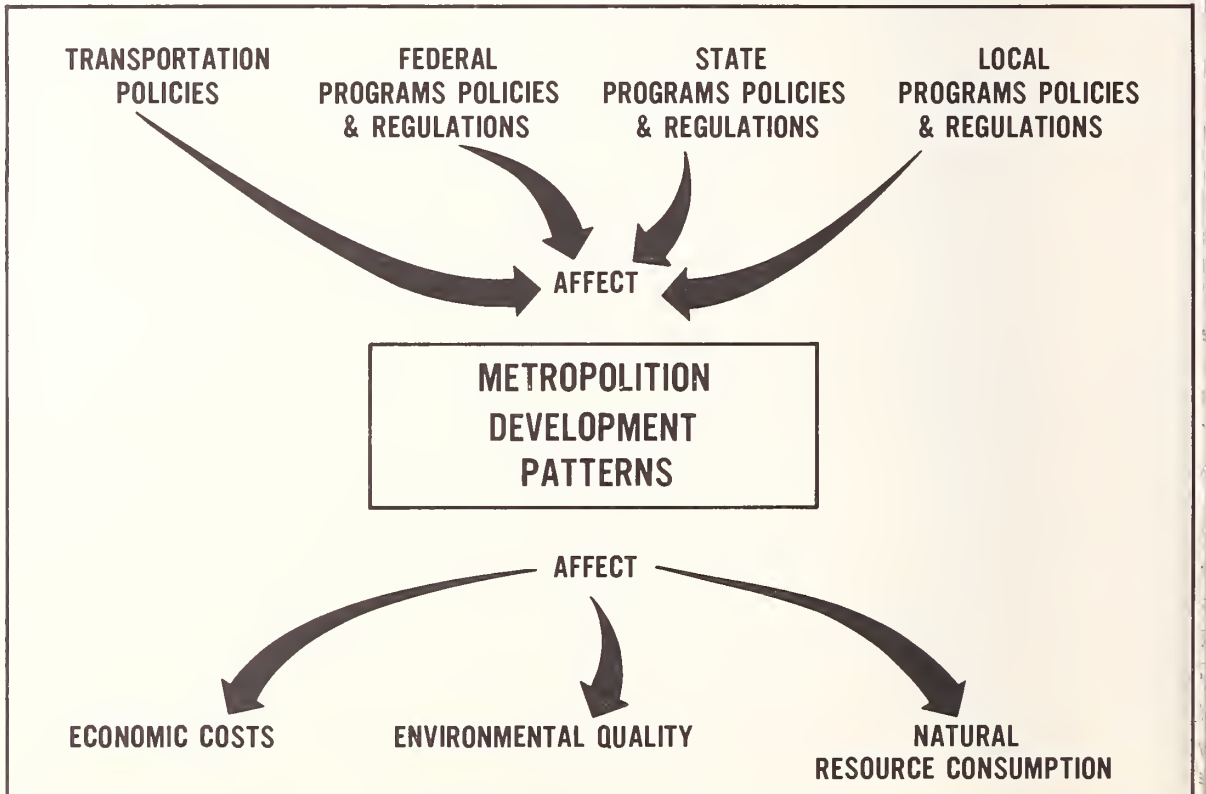
Project: IT-06-0129
Funding: $10,000 UMTA; $10,000 Federal Highway Administration; $75,000 U.S. Department of Transportation's Office of Environmental Affairs; $255,000 from Housing and Urban Development Department, Federal Energy Administration and Council on Environmental Quality
Schedule: June 1975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

The study will be conducted in five stages: 1) research, review, analyze and document past and current studies relating to the subject area; 2) design detailed analyses to be undertaken during the study; 3) conduct the required analyses; 4) interpret results of the analyses and undertake sensitivity analyses; and 5) prepare final report.

Reports from this project are not yet available



Metropolitan development patterns are influenced by numerous policies and programs and in turn affect economic and environmental concerns.

Safety Program Development

Project: RI-06-0005
Funding: $178,000
Schedule: July 1973 – October 1975
Contractors: Naval Underwater Systems Center; Battelle Memorial Institute

This project is designed to determine: 1) The need for safety efforts in various mass transportation systems and the significance and magnitude of identified safety problems; 2) the best approach and procedures for devising a safety program and a means of incorporating such a program into mass transportation systems; 3) the benefits and costs of various safety practices; and 4) the techniques and procedures for analyzing, designing and planning an effective safety and reliability program.

A significant product from this project will be a guidelines manual for system safety in urban transportation containing these topics: Foundations of safety considerations in urban mass transportation, safety program management, techniques for safety analysis, tradeoff considerations, system safety data base, safety standards and specification, and intermodal interface safety considerations.

Reports from this project are listed in Appendix I

AGT Systems Evaluations in Alternatives Analyses

Project: IT-06-9033
Funding: Not yet determined
Schedule: June 1975 – June 1976
Contractor: To be selected

Many urban areas had, by 1975, examined AGT systems in various forms as potential transportation modes for solution of all or a portion of the requirements of transportation planning studies.

This project will examine the results of these analyses to filter out the perceived strengths and weaknesses of AGT systems at the local level and to identify needed technological improvements to the current generation of AGT systems.

Reports from this project are not yet available

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 is designed to identify evolving urban transportation submarkets and to determine requirements for urban transportation research and development activity. The approach is 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 not yet available

AIRTRANS Assessment

Project: MA-06-0067
Funding: $75,000
Schedule: April 1975 – July 1976
Contractors: Transportation Systems Center; the MITRE Corporation

This project will perform a technical, operational and socio-economic assessment of the Dallas/Fort

The AIRTRANS system at the Dallas/Ft. Worth Airport is being assessed to provide data that will aid planning and implementation of future automated guideway systems.

Worth Airport's AIRTRANS system in order to: Review design, development and implementation experiences with the AIRTRANS system to determine what has been learned and how future similar programs might be more effectively implemented; obtain factual engineering, operating and socio-economic data about AIRTRANS that can be used in planning and producing other automated guideway systems; and determine the feasibility of joint-use transit facilities such as for mail, trash and passengers.

Reports from this project are not yet available

Automated-Assistance Transit Information System

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

This project, a modification of Project MD-06-0013, will develop a methodology for use by transit properties in the evaluation of the applicability of various forms of an Automated-Assistance Transit Information System (AATIS) for improvement of their telephone information center and to evalute various software/hardware requirements for an AATIS. 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 PTPTM, Point to Point Trip Management

Reports from this project are not yet available

The Automated-Assistance Transit Information System will help transit operators upgrade their telephone information operations.

Physical Barrier-Free Transit for the Elderly and Handicapped

Project: PA-06-0031
Funding: $14,985
Schedule: July 1974 – June 1975
Contractor: Franklin Institute Research Laboratories

This study was designed to examine and categorize all the physical barriers to handicapped and elderly persons in the nation's many urban transit systems, identify and classify the varying degrees of elderly and handicapped persons' abilities in terms of specific dysfunctions; propose and analyze the cost of alternate solutions to each physical barrier; and structure a family of specifications identifying generic requirements for public facilities.

Reports from this project are listed in Appendix I

A Directory of Vehicles and Related System Components for the Elderly and Handicapped

Project: PA-06-0031
Funding: $30,000
Schedule: December 1974 – June 1975
Contractor: Franklin Institute Research Laboratories

The Washington Metropolitan Area Transit Authority's new rapid rail system will include elevators to assist elderly and handicapped riders. (Photo courtesy of WMATA)

This study was conducted to identify and assess all available on-shelf hardware that would facilitate the use of urban public transit systems by elderly and handicapped persons, including the wheelchair-confined.

The study also categorized all equipment suppliers having products that would improve the use of public transit by the elderly and handicapped.

Reports from this project are listed in Appendix I

Handicapped and Elderly Access to Rapid Transit Systems

Project: MA-06-0047
Funding: $50,000
Schedule: April 1974 – September 1975
Contractor: Transportation Systems Center

This study was conducted to define the problem of providing access to rapid transit systems for

the elderly and handicapped and identify technological improvements that, if developed, would remove major barriers now existing within transit systems. The scope of effort will concentrate on methods and approaches to remove the stair barrier in rapid transit systems in an economical fashion.

Reports from this project are not yet available

Time-Calibrated Self-Cancelling Ticket

Project: IT-06-0125; RI-06-0009
Funding: Not yet determined
Schedule: October 1975 – January 1977
Contractor: Not yet selected

This procurement 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 ticket's face 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 Transit Planning.

Reports from this project are not yet available

Integrated Services Delivery

Project: CA-06-0002
Funding: $120,000 joint UMTA and Housing and Urban Development Department funding
Schedule: September 1973 – January 1975
Contractor: Stanford University

This project was conducted to assess present methods and develop improved methods of integrating delivery of public services, employing effective public transportation as the primary means of providing urban areawide mobility to users of public services.

A new concept advanced in this project was the notion of a "community broker" who would match the needs for individual public service to the available supply of public services. Scheduling of these services was packaged to reduce the transportation costs and increase service delivery efficiency.

Following completion of the research phase of the project in January, 1975, the project was transferred to UMTA's Office of Transit Planning to begin its demonstration phase. The techniques used during the project appeared to be potentially useful in any sub-area of an urbanized area where there is a significant proportion of elderly, handicapped and disadvantaged persons and in small towns and rural areas.

Reports from this project are not yet available

Point-to-Point Trip Management Program: Program Analysis and Planning and Minimum Path Algorithms

Project: MD-06-0013
Funding: $60,000
Schedule: July 1974 – February 1975
Contractor: National Bureau of Standards

A major deficiency of existing public transportation in the U.S. is the lack of detailed information regarding transit system use for particular trips. Point-to-point trip management (PTPTM), if successful, may provide the apparently missing interface between available public transportation system capacity and service and the desire of urban residents to use public transportation.

This project's objectives are to assess the requirements for system development necessary for establishing a PTPTM system and assess the requirements for minimum path algorithm and software development necessary for establishing a PTPTM system.

PTPTM program has been renamed AATIS, Automated-Assistance Transit Information System.

Reports from this project are listed in Appendix I

CHAPTER VI

office of transit planning

UMTA's Office of Transit Planning provides planning assistance through grants and staff studies to States, local and public agencies, and transit operators to improve mass transportation services. This Office also conducts demonstration projects which are operational experiments involving the public and designed to introduce and obtain user reaction to new facilities, equipment or methods that have been proved technically feasible through the research and development process.

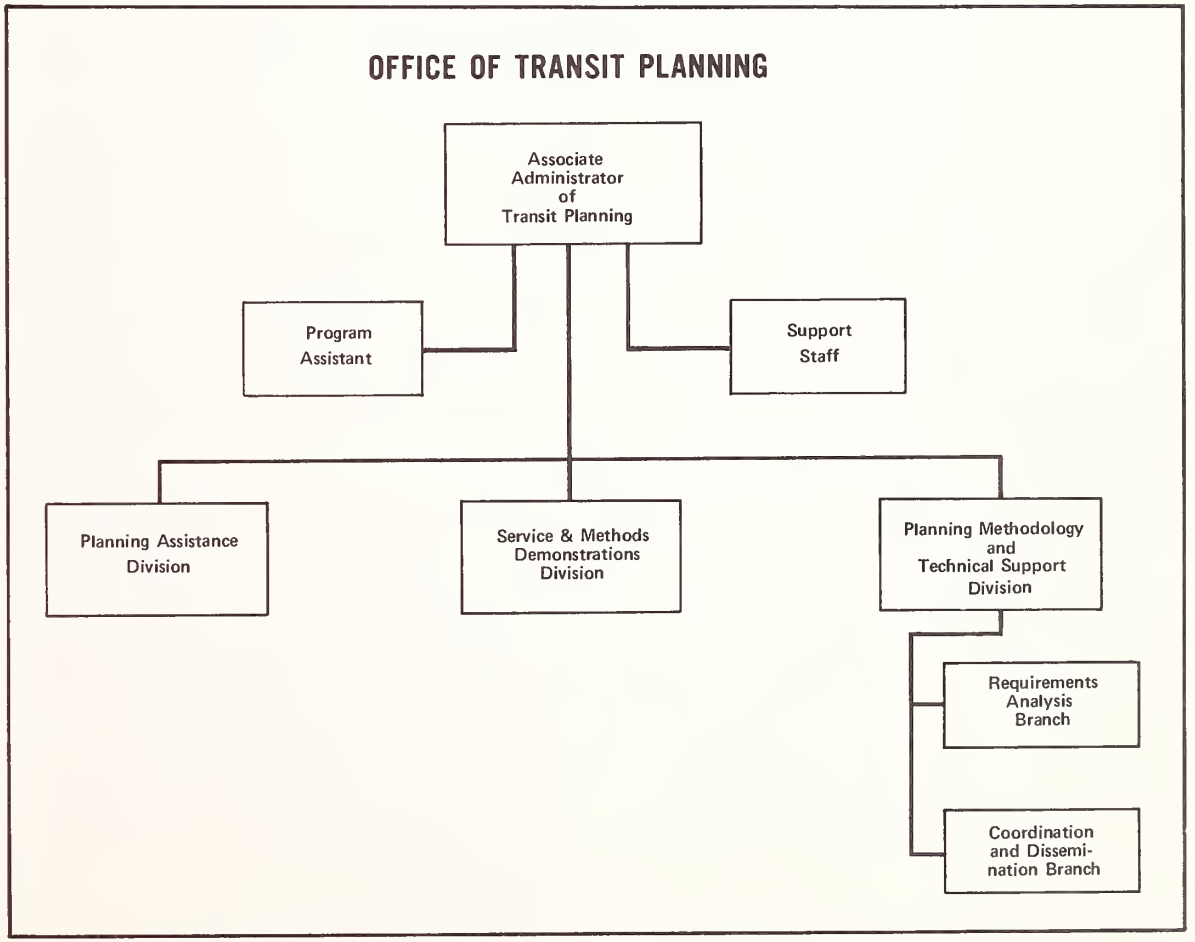
Planning Methodology and Technical Support Division

The Planning Methodology and Technical Support Division researches, develops and disseminates manual and/or computerized techniques to assist Federal, state and local agencies in their planning and operation of urban transportation systems. These techniques support both national and local transportation planning, including the optimization of existing transportation resources.

Prior to 1972 UMTA had no urban transportation planning system. In November of that year the first version of the Urban Transportation Planning System (UTPS) was made available to all state and local planning agencies. UTPS has been widely accepted by the transportation planning community, with the number of users increasing from about 50 in July 1973 to more than 275 in July 1975.

The most significant advantage of UTPS is UMTA's commitment of support to its use. More than 800 people have attended the various training sessions that have been offered and more than 3000 persons receive periodic information concerning UTPS and Technical assistance that is available to assist users of the programs.

UTPS most generally supports what may be called "Long Range System Planning," wherein the alternatives to be analyzed are few in number but in



Shirley Highway exclusive bus and carpool lanes near Washington, D.C.

sufficient detail to estimate land development impacts, system costs, major facility and corridor volumes, levels of service and some impacts such as energy use, major air quality effects, accidents and others. The existing UTPS has also been used with satisfactory results for shorter term transit operational studies and with some simplifying approximations, for the very long range screening of numerous system alternatives. For these applications, which may be termed "short range" and "sketch" level analysis respectively, more appropriate programs and methods are under development by UMTA and the Federal Highway Administration (FHWA) which will become components of UTPS in the future. Also in the near future, a unified UMTA/FHWA planning system will be distributed and supported by UMTA and FHWA jointly. This package will be built upon the evolving UTPS system with capabilities of the FHWA "PLANPAC" package and a multimodal network representation incorporated.

The combined Urban Transportation Planning System will be a multimodal transportation planning system capable of performing concurrent highway and transit planning. The analysis of the interaction between transit and highway plans will provide a comprehensive transportation plan which could significantly contribute to the solution of the national transportation problem.

UMTA and FHWA have been cooperatively developing this joint Urban Transportation Planning System. These models will be made a part of UTPS when completed. Both agencies use the same software standards and frequently confer with each other to insure that all computer programs developed will be compatible and useful to urban transportation planners. UMTA and FHWA each year jointly sponsor about 30 urban transportation planning courses for state and local agencies; both UMTA and FHWA staff prepare and teach these courses.

During the planning stage, transportation systems are represented mathematically in terms of route alignments, speeds, capacities, headways, delays, station capacities, etc. Effectiveness of a planned system is measured by predicted patronage, cost, benefits, effect on land use, air and noise pollution, energy consumption, etc. At the present time, the Urban Transportation Planning System (UTPS) encompasses the techniques for dealing with many of these complex factors. UTPS uses both computerized and manual approaches to planning. The Urban Transportation Planning system has been and is currently improving transportation planning methodology by incorporating the best available means of quantitative analysis.

Present and future products will result from the perceived need:

- To continue development of long-range planning tools which allow quick and inexpensive comprehensive evaluation of alternate multimodal transportation strategies;
- To significantly improve local capabilities to discover and assess low-cost methods of optimizing the person-movement, convenience and capability of their existing transportation system;
- To integrate the above into a unified UMTA-FHWA urban transportation planning procedure which exploits the capabilities of advanced computing machinery; and
- To disseminate these procedures to local planners in the most expeditious manner.

Improved Transit Planning Methods, Including Sketch Planning, Extension to Existing Capabilities and Microsimulation

Project: IT-06-0044
Schedule: March 1972 — November 1975
Funding: $1,394,680
Contractor: Planning Research Corporation
Subcontractors: Alan M. Voorhees and Associates, Inc.; Richard Pratt Associates; Creighton, Hamburg Inc.; DTM, Inc.

This is one of three major projects comprising a program to create and enhance the Urban Transportation Planning System. The program's goals are to build computer-based tools for multimodal transportation planning, demonstrate and validate use of tools with real data, disseminate tools to local planning agencies, and continually re-evaluate and improve the tools as the result of feedback from local communities and research and development results.

This project has the specific objectives of developing a microsimulation tool for the detailed analysis of public transportation networks, improving traditional traffic assignment methodology to relate to transit systems, and developing a "sketch planning" tool that will permit quick, inexpensive preliminary evaluation of the feasibility of proposed multimodal urban transportation systems.

All of these techniques will be documented, tested and distributed for use by local transportation planning agencies.

This project has three elements: The development of an expandable software package of analytical techniques and computerized transportation planning tool — the Urban Transportation Planning System (UTPS); design and development of a multimodal transportation sketch planning technique for inclusion in the UTPS; and design and development

of a computer microsimulation model for inclusion in the UTPS to assist the detailed design of public transportation systems.

When these elements are completed, methodologies and related software systems will be disseminated to local transportation planning agencies.

Several revised programs have been delivered for use in UTPS, including:

UPATH, the transit path finder program, that reads the network description output by UNET and describes the "shortest" paths between all or selected nodes in the system;

UPSUM, the path summarizer program that traces across each path output by UPATH, and calculates the components of disutility associated with interzonal transit trips;

ULOAD, the transit passenger loading program that reads a trip matrix and assigns its elements to the corresponding interzonal shortest paths described in UPATH's output;

USTOS, the station-to-station volume analyzer that reports out passenger flows between selected nodes in the system;

UROAD, the highway analyzer that performs many traditional functions associated with highway system planning, including pathfinding, path tracing and traffic assignment;

UMODEL, the demand model program that is a framework to accommodate virtually any direct demand or modal choice model;

UMATRIX, the matrix manipulation program that is powerful utility program useful in demand estimation, assignment trip table preparation and system evaluation; and

UMCON, the matrix conversion program that creates, copies, modifies and/or merges matrices.

UMTA's Software Standards, volumes I and II, have been revised and specification language has been defined. In addition, the file design for the integrated Data Base has been completed.

Reports from this project are listed in Appendix I

Advanced Transit Planning Methods, Including Transportation System Evaluation Indicators, Interactive Sketch Planning and Station Simulation

Project: IT-06-0050
Funding: $1,345,089
Schedule: March 1972 — March 1976
Contractor: Peat, Marwick, Mitchell & Company
Subcontractor: Barton-Aschman, Cambridge Systematics

This is one of three major projects comprising a program to create and enhance the Urban Transportation Planning System. The program's goals are to build computer-based tools for multimodal transportation planning, demonstrate and validate use of tools with real data, disseminate tools to local planning agencies, and continually re-evaluate and improve the tools as the result of feedback from local communities and research and development results.

The project's specific objectives are to build computer based tools for multimodal transportation planning, using time-share computer and cathode ray tube technology; facilitate evaluation of multimodal transportation alternatives in an immediate-response analytical environment; and facilitate transit terminal design.

The project has four elements: The development of a set of indicators to evaluate existing and proposed transportation systems; design and development of an interactive transportation sketch planning technique that exploits to the greatest practical extent the present state-of-the-art in time-shared computer use; design and development of a computer simulation model to assist the design of public transportation terminal facilities; and the performance of special analyses required, i.e., drafting of a transportation demand estimation manual.

Upon completion, these methodologies and related software systems will be disseminated to local transportation planning agencies.

Several reports were completed during FY 75, including the User's Guide for Station Simulation (April, 1975), Functional Specifications for Interactive Planning (June, 1975), Development of Program UGMFIT (June, 1975), and Revised Specifications for Interactive Planning System (June, 1975).

Reports from this project are listed in Appendix I

Software Pilot Testing

Project: IT-06-0049
Funding: $1,100,000
Schedule: March 1972 — December 1975
Contractor: De Leuw, Cather and Company
Subcontractor: Wilbur Smith and Company, Consad Research Corporation

This is one of three major projects comprising a program to create and enhance the UMTA Transportation Planning System. The program's goals are to build computer-based tools for multimodal transportation planning, demonstrate and validate use of tools with real data, disseminate tools to local planning agencies, and continually re-evaluate and improve the tools as the result of feedback from local communities and research and development results.

The project's specific objectives are to demonstrate use of UTPS planning tools with real data, disseminate transportation planning tools to local planning agencies, and analyze the results of the demonstration and feed these inputs back to the designers.

The project has three elements:

1) The certification, as user-ready software, of the urban transportation planning packages being developed by the two previous projects. This will be accomplished through a systematic process of checking and evaluation that will involve applications with real data.

2) The definition of the interaction between new systems technology and its use in the above mentioned software planning packages. This will be accomplished in several steps, including the development of a systematic urban transportation new systems data structure keyed to the needs of the planning process and the related software suitable for updating in order to reflect progress in technology and planning methodology; and analysis of required performance and other related characteristics of transportation systems in light of results and sensitivity analyses carried out in pilot applications of planning software.

3) Conduct of a number of special studies that will contribute to the further development of the planning methodology for new urban transportation systems, i.e., the documentation of needs for short-range transit planning.

A number of UTPS programs were tested, modified and validated during the year and a revised Characteristics of Urban Transportation System (CUTS) manual was produced in June, 1975.

Reports from this project are listed in Appendix I

Short Range Transportation Planning

Project: IT-06-9020
Funding: $972,000
Schedule: November 1974 — November 1977
Contractor: Peat, Marwick, Mitchell & Company

The package of computer software developed by UMTA's software program has been focusing on improvements that will become fully effective 5 to 30 years from now. Many of the most pressing problems of urban transportation, however, demand solutions within one to five years. Problems such as fuel use, air quality, service for the poor, elderly and handicapped; parking policies, pricing, and efficiency in use of existing systems involve questions requiring immediate answers.

Analytical methods to improve conventional modes of urban transit have, therefore, been added to UTPS. These methods will take a multimode approach, emphasizing near term and low-capital solutions. The major products will be manual methods, computer software and documentation, and users' guides to the effective integration of such software into local planning activities.

One manual will offer quantitative methods that transit planners and operators can apply to day-to-day problems in routing and scheduling. Another will provide analytical methods for studying the effect of low capital and operational policies on travel cutting across modes. Both manuals will provide non-computer methods.

Software will be developed to extend the capabilities of UTPS into short range multimodal planning. Users' guides that will go well beyond normal documentation for planners and operators will be prepared.

Reports from this project are not yet available

The Service and Methods Demonstrations Division

The 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.

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 Transit Dependents, 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.

Urban Goods Movement, which addresses the issue of potential conflict of person and goods movement and how opportunities for simultaneous solution may be used most efficiently. This functional area includes such topics as how to take advantage of priority facilities or how to avoid interfering with their use, how vehicles or systems may be designed to have dual person/goods movement use.

The Service and Methods Demonstration Division 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.

A. Priority Treatment for Transit and Other High-Occupancy Vehicles

Santa Monica Freeway Concurrent Flow Research 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
Contractor: Southern California Rapid Transit District
Subcontractors: California Department of Transportation, California Highway Patrol, Santa Monica Municipal Bus Lines

This project will investigate the feasibility of reserving a concurrent flow freeway lane for the exclusive use of buses and other high occupancy vehicles such as carpools. This technique has not yet been tested and has some potential safety hazards associated with the operation; nevertheless, it is hoped that this demonstration will prove the workability of this concept because it holds high promise of wide applicability elsewhere.

Under this project, the left hand lanes in both directions of a 12.6 mile length of the Santa Monica Freeway (I-10) will be reserved for buses and high occupancy vehicles (3 or more persons) 24 hours per day. In addition to the median lane reservation, a number of entrance ramps in both directions will be metered in order to limit freeway congestion.

"Diamond Lanes" provide non-separated bus and carpool lanes on the Santa Monica Freeway near Los Angeles, California.

This demonstration will mark the first time that freeway lanes are reserved without barriers between adjacent lanes for use by concurrent flow bus and carpool vehicles. Access and egress to/from the reserved lanes will be accomplished by weaving across the unreserved lanes to the normal entry and exit ramps. The ramp metering will reduce the degree of congestion on the unreserved lanes, thus assisting the weaving maneuver.

In addition, the Southern California Rapid Transit District (SCRTD) and the Santa Monica Municipal Bus Lines (SMMBL) will operate 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 will be from newly established park-and-ride lots on the west side of Los Angeles and Santa Monica to accommodate 600-1,300 automobiles; the other eight routes will operate as suburban local buses picking up passengers along the major arterial streets in the west side area and then operate as express runs on the freeway. These lines will be supplemented by existing local lines in the area that will act as feeders, plus four new feeder and cross-town services. About 75 bus trips will operate during each peak period.

The project will be evaluated carefully to record impacts that may occur due to the reserved lane, new transit service and new park-and-ride lots. Data will be collected to record the effect on passenger volumes for freeway lanes, parallel arterials, vehicle occupancy including transit, travel times by mode, accidents, etc. An in-depth home interview attitudinal survey will be conducted to determine the basis factors that encourage a modal shift from single occupant autos to transit and carpools.

Reports from this project are not yet available

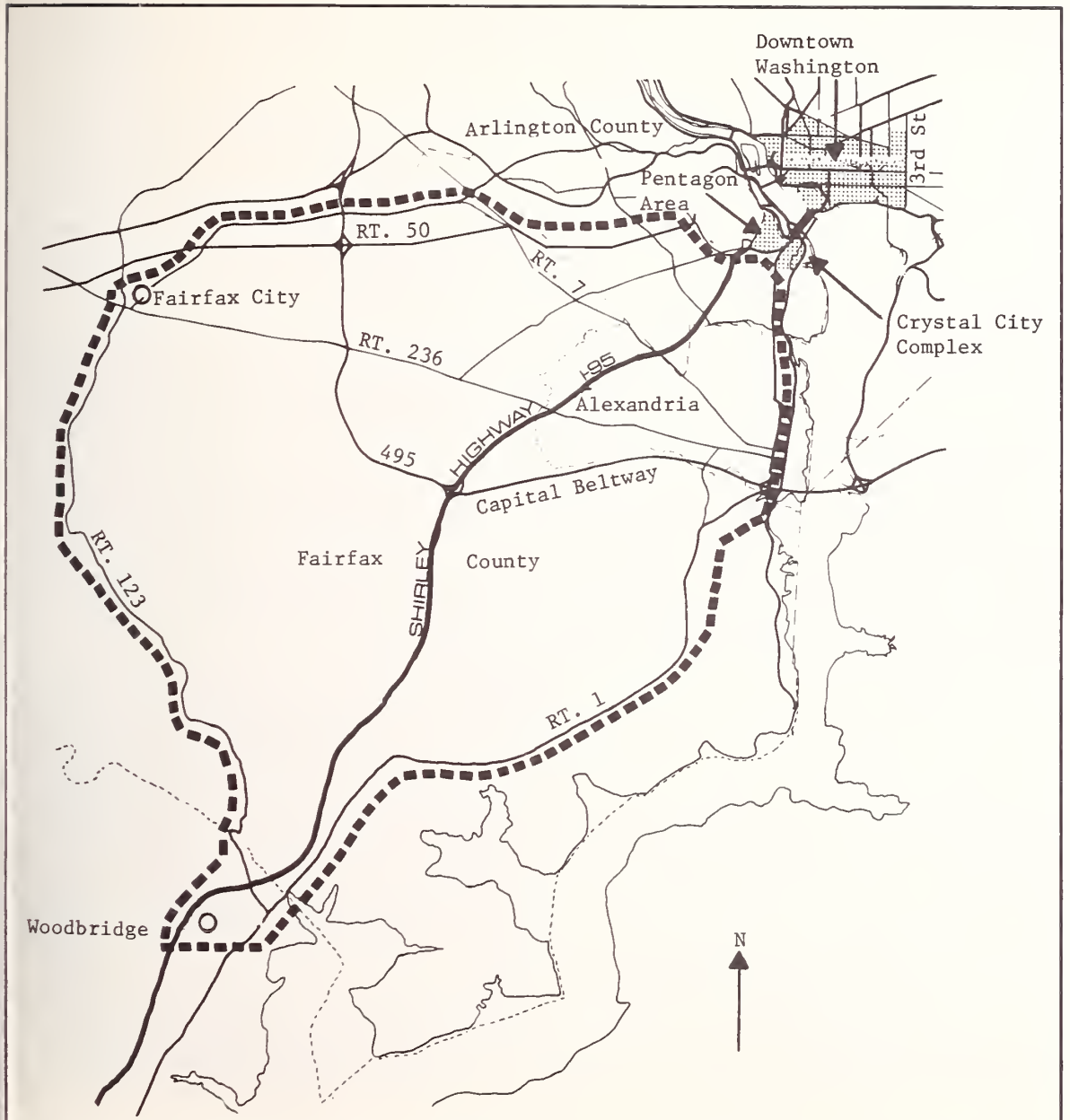
Shirley Highway Express Bus-on-Freeway
(conducted jointly with the Federal Highway Administration)

Project: IT-06-0024
Funding: $5,868,419 from UMTA and FHWA
Schedule: June 1971 — December 1974
Contractor: Northern Virginia Transportation Commission

This project involves the operation of express buses between Northern Virginia and downtown Washington, D.C., using bus service innovations such as reserved and exclusive bus lanes, frequent service and fringe parking. Built into the project is a system of monitoring and evaluation from which analytical reports are being produced on riders' attitudes, project costs and benefit demand relationships, and other matters that should be valuable as guidance for other communities contemplating similar service.

Since the first portion of the bus lane opened in September 1969, the number of riders using it has increased more than 500 percent. The origi-

Shirley Highway's (I-95) separated, exclusive bus and carpool lanes cut substantial time from commuting trips between Washington, D.C. and its northern Virginia suburbs.



The I-95 corridor area in northern Virginia serves the majority of Virginia commuters who work in Washington, D.C.

nal goal was to attract more than 5,000 new riders by 1975; by mid-1974, however, there were more than 10,000 new riders. The Northern Virginia Transportation Commission, the project sponsor, has recognized the value of the Shirley Highway express service and is continuing the project through the Washington Metropolitan Area Transit Authority. Ridership continues to increase.

Reports from this project are listed in Appendix I

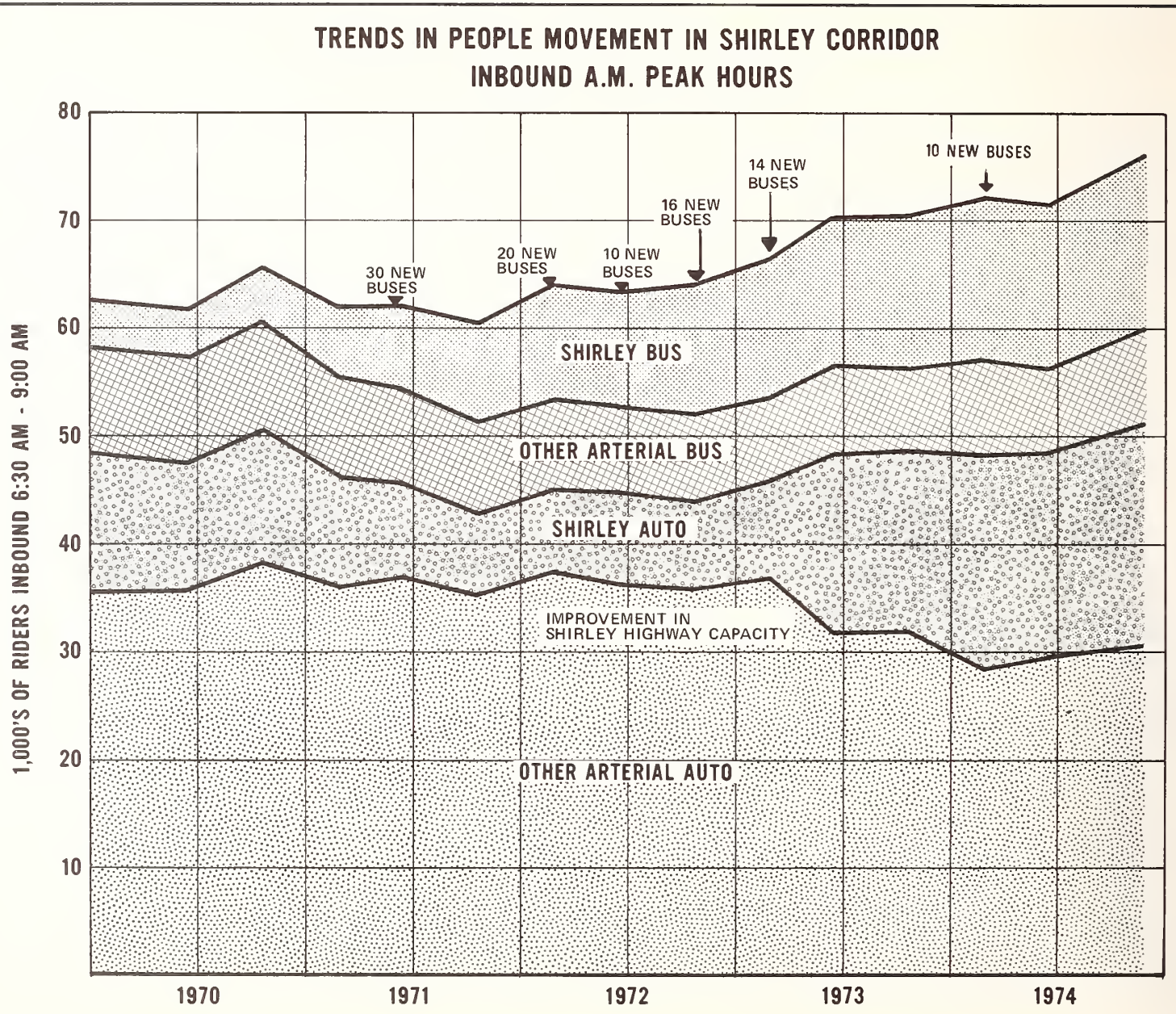
Evaluation of Shirley Highway Express Bus-on-Freeway Project

Project: DC-06-0066
Funding: $925,550
Schedule: December 1970 – July 1975
Contractor: U.S. Department of Commerce's National Bureau of Standards

This project includes an evaluation and experimental design plan development for the Shirley Highway Express Bus-on-Freeway Project that will provide a quantitative assessment of the project's operational success. The Shirley Highway project operates express buses between Northern Virginia and downtown Washington, D.C., using bus priority techniques. There are three main elements to the experiment – the roadway, bus service and fringe parking.

This project designed a process for evaluating the Shirley Highway Demonstration Project to obtain maximum value from the information developed during its operations. Benefits of various improvement features of the project as well as the overall project will be analyzed and related to costs.

See reports listed for Project IT-06-0024, Shirley Highway Express-Bus-on-Freeway



Shirley Highway bus patronage has grown more rapidly in recent years than other methods of transportation for commuting.

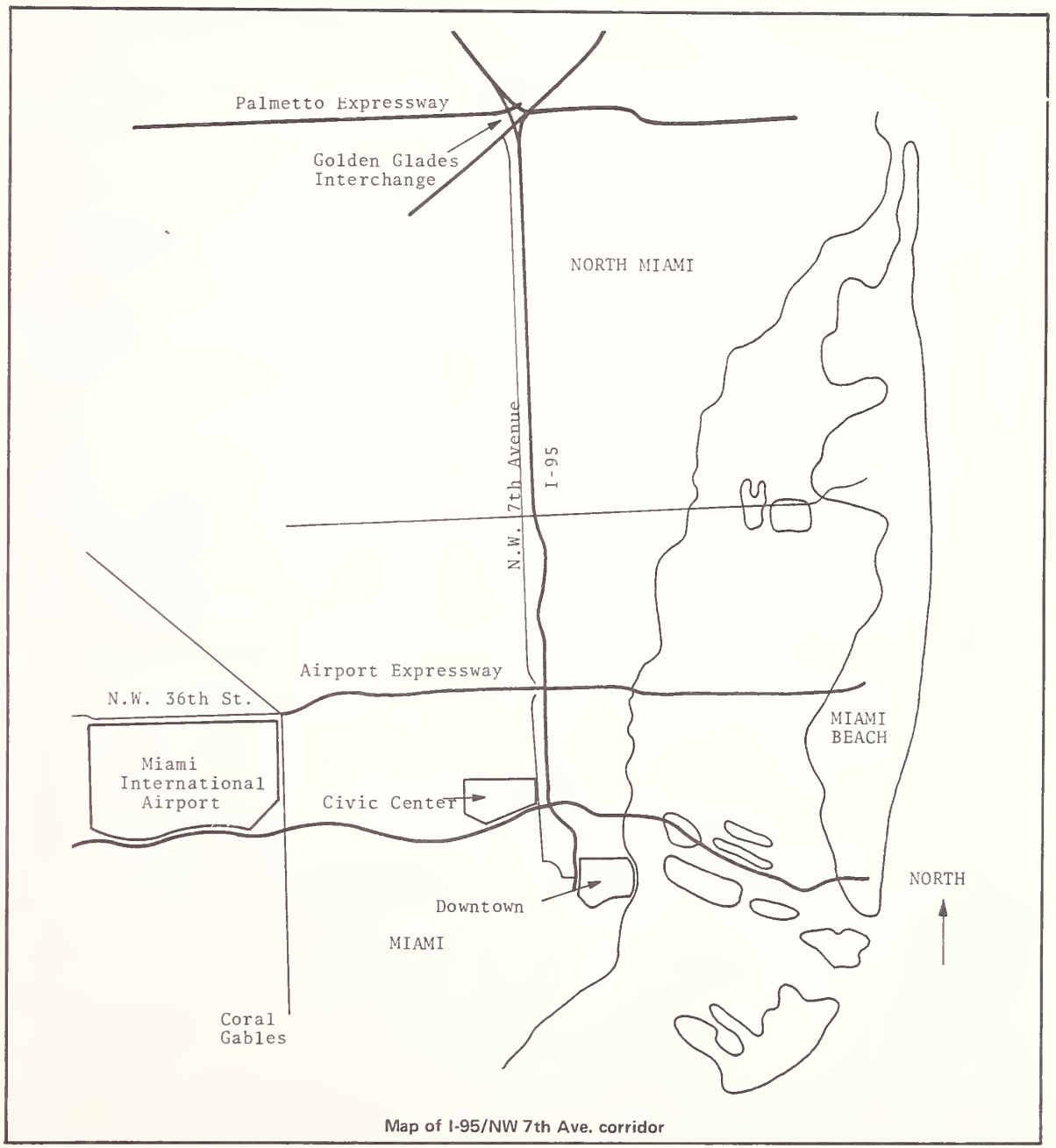
Miami I-95/Northwest 7th Avenue Bus-Carpool Priority System

Project: FL-06-0006
Funding: UMTA RD&D — $1,407,000; UMTA other — $1,400,000; Federal Highway Administration — $13,176,000; local — $2,030,000
Schedule: January 1972 — October 1976
Contractor: Florida Department of Transportation
Subcontractor: Metropolitan Dade County Transit Authority; University of Florida

This two-phase project will demonstrate a bus and carpool priority system for the Miami area. In Phase I, express commuter bus service is being operated under five different combinations of mixed mode or reserved lane and signal preemption.

Under Phase II, two lanes will be added to the adjacent I-95 freeway and will be reserved for buses and carpools for about 10 miles to and from downtown Miami. Additional bus service will be added in the corridor to test the extent

A bus with a signal preemption device (above destination sign) provides express service along the I-95/Northwest 7th Avenue corridor in Miami.



Map of I-95/NW 7th Ave. corridor

to which this type of bus preference will encourage both carpool formation and a modal shift to buses.

Express bus service currently is running from the Golden Glades Interchange park-ride lots to the Miami central business district, airport and Civic Center. By the end of FY 75, three different bus operating techniques had been tested on NW 7th Avenue: Mixed mode with no preferential treatment, mixed mode with signal preemption, and reserved lane with signal preemption. Average peak period speeds over the 10-mile route for each operating technique have been 25 mph, 29.6 mph and 33.8 mph, respectively. Express buses operating in the reserved lane with signal preemption approach the speed limit of 35 mph.

The park-and-ride lot express bus services began in April, 1974. Ridership had grown 35 percent during the first year of operation.

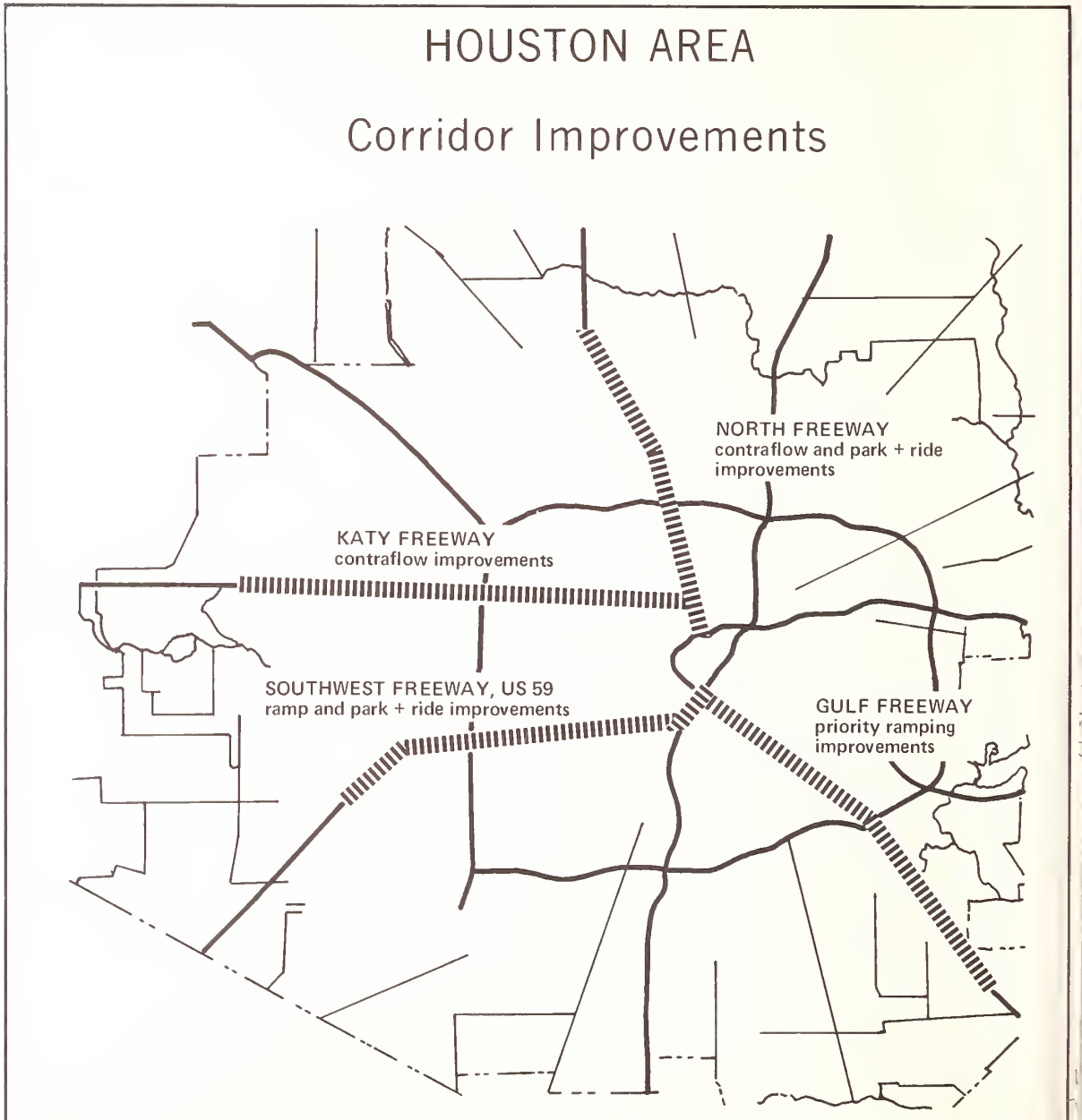
Reports from this project are not yet available

Corridor Improvements in Houston, Texas

Project: TX-06-0018
Funding: $689,396
Schedule: July 1975 – June 1977
Contractor: City of Houston, Texas

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



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

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 four major corridors for improvements ranging from metered freeway ramps to contra-flow lanes all supplemented with park-and-ride facilities. The objective of the 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 four corridors will be evaluated to determine the impact on trip time, transit ridership and vehicle occupancy. Detailed designs are currently being developed for changes in the four corridors.

Reports from this project are not yet available

Urban Corridor Demonstration

(jointly with the U.S. Department of Transportation and the Federal Highway Administration)

Project: DC-06-0062
Funding: $3,500,000 UMTA; $9,443,000 FHWA
Schedule: June 1970 — June 1976
Contractors: Metropolitan Washington Council of Governments; Tri-State Transportation Commission, New York; Delaware Valley Regional Planning Commission, Philadelphia; Ohio-Kentucky-Indiana Regional Planning Authority, Cincinnati; Montgomery County Planning Commission, Dayton; Falls of the Ohio Metropolitan Council of Governments, Louisville; City of Dallas; and Metropolitan Council of the Twin Cities Area, Minneapolis/St. Paul; Alan M. Voorhees and Associates (evaluation)

Most traffic corridors in each of the 60 major urban areas of 500,000 to 3 million population become highly congested in peak hours. By coordinating existing FHWA and UMTA programs, eight cities — Cincinnati, Dayton, Dallas, Louisville, Minneapolis/St. Paul, New York, Philadelphia and Washington, DC — have undertaken to improve the efficiency of existing transportation facilities by coordinating highway and transit planning. Elements of the project include fringe parking and associated bus service with reserved lanes and express routes, adding freeway ramp controls and remote signal activation devices on buses, staggering work hours and increasing transit services. Successful demonstrations are expected to provide examples for other cities to follow. To date, the Minneapolis and Cincinnati projects have been completed.

Reports from this project are listed in Appendix I

Metered freeway ramps combined with bus signal preemption controls are expected to speed traffic flow in Minneapolis (I-35W).

Automobile Restricted Zone/Multi-User Vehicle System Feasibility Study

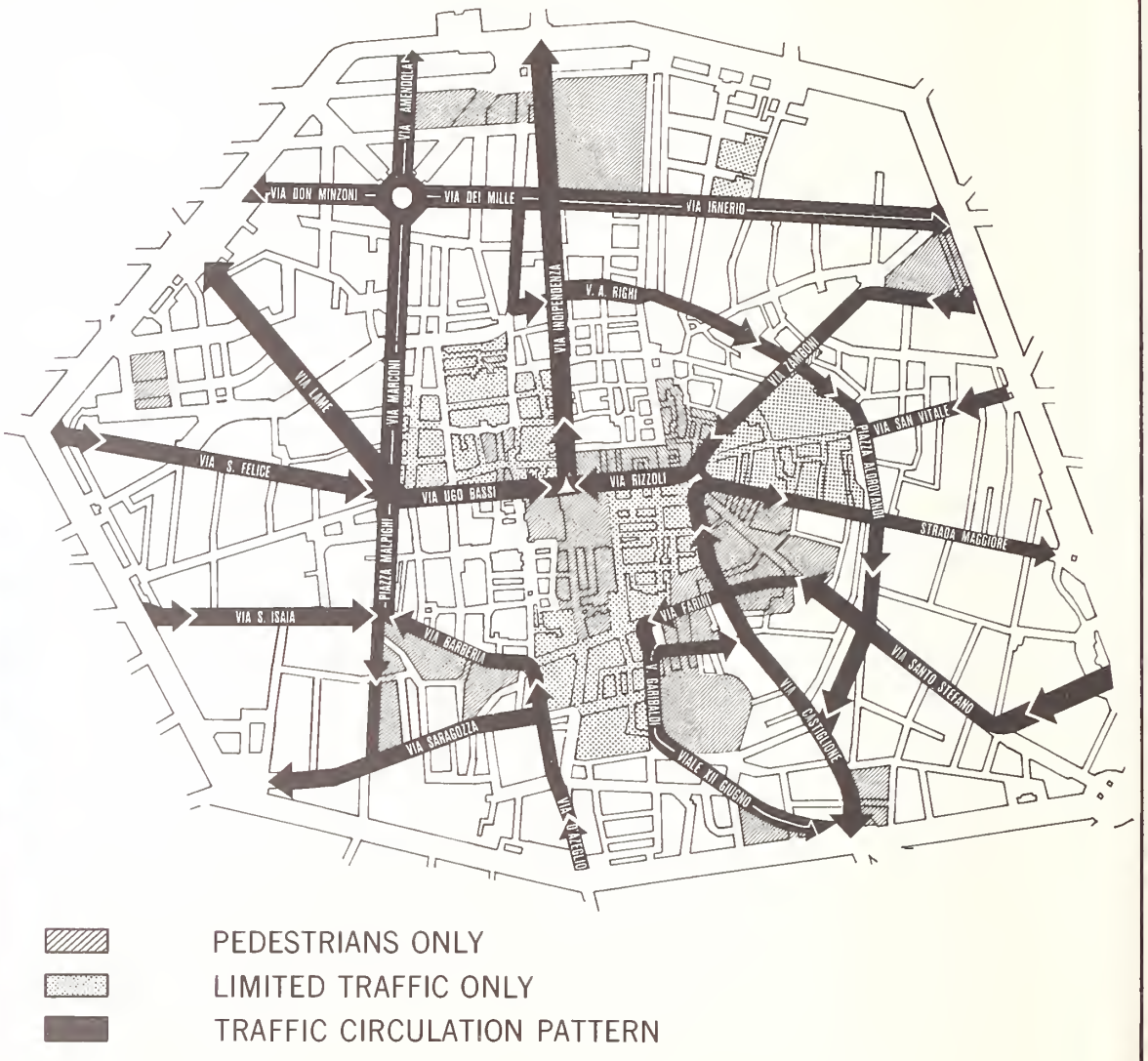
Project: DOT-TSC-1057
Funding: $373,457
Schedule: July 1975 — July 1976
Contractor: Alan M. Voorhees and Associates

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 created through the use of severe 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 (ubiquitous access). This project will include analyses of auto restricted zones and multi-user vehicles plus an analysis of the system operating within an auto restricted zone.

This project is designed to analyze factors that help or hinder implementation and operation of these innovations, determine site selection

Nicollett Mall in Minneapolis utilizes an auto-restricted zone plan for downtown shopping.



This diagram of Bologna, Italy, shows an existing auto-restricted zone project that cuts congestion yet permits adequate traffic flow in the area.

criteria for each innovation, select possible demonstration sites, design demonstration plans for the innovations and for a combined demonstration of the two, and analyze costs and benefits, quantitative and qualitative, of each singly and together.

Reports from this project are not yet available

Double Deck Bus

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

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.

Each of the two transit authorities will acquire and operate double deck buses, four 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.

To date, SCRTD has begun operating one German Neoplan bus on the El Monte Freeway; New York MTA has placed a bus order with British Leyland U.K. Limited. An evaluation plan has been prepared for both sites.

Reports from this project are not yet available

Exterior and interior views of the British Leyland double deck bus that will be used by the New York Metropolitan Transportation Authority in a demonstration and evaluation of this type of service. (Below) The German Neoplan bus that is being used by the Southern California Regional Transit District.

Microsimulation of CBD Traffic Movement

Project: MA-06-0038
Funding: $450,000
Schedule: May 1974 – September 1976
Contractor: Transportation Systems Center (Cambridge, Mass.)

Scarce street rights-of-way in American cities' central business districts (CBD) make it important to understand the consequences of certain actions giving priority to surface transit such as designating some streets for exclusive bus use or establishing reserved bus lanes.

This project has validated a computer model developed to simulate traffic flow in the CBD, with car, bus and truck movement simulated on a microscopic (individual path) basis. The course of each vehicle was monitored and the effectiveness of various traffic engineering changes analyzed.

As a result, several different bus operation improvement techniques have been modeled and field tested. Preliminary findings indicate that 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. Therefore, more thought should be given to shifting and/or separating bus stops and traffic signal systems that give preference to bus movement.

Additional tests are being conducted to determine the benefits of special fixed time traffic signal settings for bus progression, bus preemption of traffic signals, and the effect of various operating strategies on bus fuel consumption and engine emissions.

Reports from this project are listed in Appendix I

Development of a Program of Technology Exchange in the Field of Priority for Surface Transit

Project: DC-06-0122
Funding: $200,497
Schedule: November 1975 – November 1976
Contractor: Public Technology, Inc.

Despite the apparent success of surface transit priority schemes such as reserved and/or exclusive bus and carpool lanes, preferential entry at metered freeway ramps and traffic signal preemption, many urban areas have been slow to implement these proven techniques for improving surface transit flow. It is believed that a more active role by the Department of Transportation in information dissemination and involvement of local jurisdictions in identifying needs and solutions will both increase knowledge of these proven priority techniques and reduce institutional inertia regarding this implementation.

Public Technology, Inc., (PTI) carries out technology transfer programs supported by State and local governments, public interest groups, the U.S. National Aeronautics and Space Administration and U.S. Department of Housing and Urban Development, and several foundations. In addition, PTI acts as Secretariat to the Urban Consortium for Technology Initiatives, a multi-jurisdictional effort involving the nation's 27 largest cities and six large urban counties, dedicated to improving the service of urban governments by technology transfer and problem resolution. The Consortium's Needs Committee has listed urban transportation problems among the highest priority for action.

A five-task technology transfer program has been developed to identify surface transit priority techniques that show potential for transfer to other urban areas, develop a User Design Committee, establish priorities for implementation of priority techniques, prepare a Technology Exchange Package, a written guide for implementing the techniques; identify and select urban areas with high potential and distribution of Technology Exchange Packages to them, and assist the Service and Methods Demonstration Division in the dissemination of information about other projects and the collection of feedback.

In this project, the Office of The Secretary of Transportation (Assistant Secretary for Systems Development and Technology) will provide technology sharing support for the demonstration activities of UMTA's Office of Transit Planning. It is proposed that the Secretary's office will contract with Public Technology, Incorporated to develop a program of technology exchange in the field of priority for surface transit, using methods that PTI has developed, refined and successfully used in other technology transfer programs.

Reports from this project are not yet available

B. Paratransit

Coordinated Paratransit Service Demonstration Project

Project: TN-06-0006
Funding: $997,959
Schedule: June 1975 – June 1977
Contractor: City of Knoxville, Tennessee

This 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, i.e., 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. The city of Knoxville, Tennessee will establish itself as a public agent to match transportation needs with transportation providers. The city also will work with employers to establish subscription bus and van operations.

Reports from this project are not yet available

Study of Integrated Taxi/Fixed-Route Transit

Project: CT-06-0007
Funding: $25,000
Schedule: July 1975 — December 1975
Contractor: Westport (Connecticut) Transit District

This project, conducted in Westport and Weston, Connecticut is a study to determine the feasibility of an integrated taxi/fixed-route system. The project will focus on the integration of bus, taxi and commuter rail services in order to provide the optimum mix of services for transit users. The available options may include premium ride taxi, shared-ride taxi, dial-a-ride bus and fixed-route bus service as well as the commuter rail service.

This study also will address such factors as the appropriate mix of service and type of vehicle in various geographic areas and at various times; and integrated fare systems, including the use of a prepaid pass. The transit operator currently provides fixed-route service with eight 16-passenger buses serving seven routes. The buses, using an annual prepaid pass format, provide service coordinated with the morning and evening commuter rail operations as well as regular service on the seven bus routes. The seven existing routes do not provide complete coverage to Westport and do not serve the neighboring town of Weston, however, so this project explores means of improving transit service to those areas.

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

Reports from this project are not yet available

Integrated Demand-Responsive, Fixed-Route Transit Systems

Project: NY-06-0048
Funding: $2,598,200
Schedule: February 1975 — June 1977
Contractor: Regional Transit Service (Rochester, New York)

This comprehensive project is designed to determine the optimum use of demand-responsive and fixed-route transit modes in the Rochester area by

This photo shows the integration of fixed-route and demand-responsive transit in Rochester through use of nearby or mutual transit stops.

operating a computer-dispatched demand-responsive service using three demand-responsive service area modules connected to the central business district by line-haul service.

Many-to-many demand-responsive service will be offered within each module and persons traveling outside the demand-responsive service area will be able to transfer to fixed-route buses. Existing fixed-route service within the demand-responsive modules will be eliminated to improve operating efficiency.

The project will determine the extent to which demand-responsive service can substitute for existing fixed-route service, coordinate the transfer between demand-responsive and fixed-route service, and monitor user acceptance. Long-term plans call for many demand-responsive service modules that will encompass the Rochester area. The system's computer system has been installed.

Reports from this project are not yet available

Guidelines for the Establishment of Subscription Bus Service and Study of Shared-Ride Taxi Service

Project: DC-06-0093
Funding: $24,438
Schedule: February 1974 — September 1974
Contractor: The Urban Institute

This project analyzed the experiences of several charter and subscription commuter bus operations and established guidelines for the formation and operation of such services. Guidelines included service development; attracting ridership; operating methods, i.e., operator's versus subscribers' control; routing, scheduling, and legal and regulatory problems.

The project also documented and analyzed the experience of a private taxi operator seeking to implement a shared-ride taxi service in the suburbs of a major metropolitan area.

Reports from this project are listed in Appendix I

Transit Service and Fare Innovations

Project: DC-06-0111, DC-06-0120
Funding: $316,069
Schedule: June 1974 — January 1977
Contractor: 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, 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 and 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.

This project will:

- Assemble information on current understanding of general transit pricing and the relative cost-effectiveness of low fares as a ridership stimulant;
- Analyze ridership responsive to fare and service changes, using data supplied principally by the San Diego public transportation system;
- Collect and analyze additional data to supplement that provided by the San Diego system to analyze ridership response;
- Design an experimental demonstration of fare-free transit including delineation of objectives and performance measures; and;
- Monitor a new transit industry activity in service innovations and perform selective small scale data analysis.

Data from San Diego have been used to empirically investigate fare and service changes implemented since 1972; this has led to the development of specifications for a mixed time series cross sectional demand model.

The project also has completed an analysis, using data from the 1960-61 Survey of Consumer Expenditures, that for the first time separates expenditures so spending on transit by income type, for example, can be identified. Work is in progress to design program guidelines and an experimental framework for a fare-free demonstration.

The annual "Report to Congress Concerning the Demonstration of Fare-Free Mass Transportation," published per Title II requirements of the National Mass Transportation Assistance Act of 1974, has been published and is useful for identifying what is known about the ridership response to fares compared to improved service. It briefly surveys the current state of knowledge regarding the benefits and costs of fare-free transit and describes essential elements of a demonstration program.

Reports from this project are listed in Appendix I

C. Service for Transit Dependents

Combined Fixed Routes and Demand-Responsive Transit

Project: AK-06-0001
Funding: $295,130
Schedule: June 1972 — July 1974
Contractor: City of Anchorage, Alaska

This project is designed to develop a fixed route transportation system in an area with limited mass transportation services. Groups that will be served by this demonstration include the elderly, handi-

These street scenes in Anchorage, Alaska show service vehicles and bus shelters adapted for the Alaskan climate in a demonstration of combined fixed-route and demand-responsive transit.

capped, native American Indians and Eskimos, the poor, unemployed and youth.

The demonstration will include inner-city circulation to enable transit users to travel between different areas of the city, and home-to-work and work-to-home services within the area served by the project.

Reports from this project are listed in Appendix I

Community Based Transit System

Project: OH-06-0022
Funding: $655,000
Schedule: July 1974 – January 1977
Contractor: City of Xenia, Ohio

This project will develop a small city transit system as an integral part of a community redevelopment program necessitated by the April 3, 1974 tornado disaster. The demonstration will provide a model of how a typical Midwestern city of the 20,000-50,000 population range can provide

Xenia, Ohio's X-line transit service was developed and implemented after that city suffered a major tornado that destroyed most of the town's private automobiles.

responsive transit service for the entire community. This demonstration includes implementation of a comprehensive prepayment fare program, development of a model marketing program to assure maximum ridership retention and growth, acquisition of major industrial and retail support for the transit service through employee subsidy and customer fare reimbursement, and provision of an orderly progression of the demonstration service to assure permanent, locally sponsored, revenue producing responsive transit.

This project was amended in June 1975 to supplement the fixed route service with demand-responsive transit to be provided by the local taxi operator.

Reports from this project are not yet available

Development and Evaluation of a Transit System in a Developing Urban/Rural Region

Project: ND-06-0001
Funding: $236,713
Schedule: June 1971 — September 1974
Contractor: Three affiliated tribes in Fort Berthold, North Dakota

This project developed and evaluated a transit system in a developing, urban/rural Indian region in central North Dakota. The primary objective was support of the economic and social development of the entire region by inter-connecting the various and sometimes isolated residential communities with employment, commercial, medical, educational and other centers of activity.

The project also was designed to seek ways of incorporating all transit services in the region into a package that would sustain the system at a point where it would be economically self-sufficient. This demonstration provided data concerning ways in which an environment characterized by low socio-economic conditions and limited transit expertise can support badly needed transportation.

Reports from this project are listed in Appendix I

Research on the Transportation Problems of the Transportation Handicapped

Project: DC-06-0084
Funding: To be determined
Schedule: June 1975 — January 1977
Contractors: Abt Associates; Grey Advertising; Peat, Marwick, Mitchell and Company

This project will determine the travel requirements of various classifications of handicapped people and develop viable transportation service alternatives using all modes to satisfy such requirements cost-effectively.

Despite apparent strides to date, a review of current literature in the field reveals there is little detailed, factual information either about the nature of the problems of the handicapped or the design of facilities, vehicles and equipment affecting their daily living and travel. A complete classification of physical disabilities and a comprehensive catalog of equipment specially designed for the disabled seem to be nonexistent. Meager coverage is given by most current architectural guides to design for the handicapped.

No single source is known to exist that delineates the precise nature of the problem.

A complete understanding of the problem is needed, including detailed information on what persons with various degrees of disablement can and cannot do. This should be accompanied by additional information as to what they can or cannot do with the use of various types of mobility aids.

This project will consist of two phases; Phase I includes a competition to develop the work program to be undertaken in Phase II. Detailed descriptions will be developed for transportation handicaps, a proposed scheme for determining numbers and types of transportation handicapped, a methodology for planning and designing to meet special needs of the transportation handicapped, and hypothetical solutions to the mobility problems of the handicapped. The solutions sought should be those that best provide the mobility needed by the transportation handicapped to permit them to carry on as normal a life as their disabilities permit.

The project will cover 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. Phase II will center on a market research effort to hypothesize the approaches to serving the transportation needs of the handicapped and test them against the market research information. Operating demonstrations will be designed to test the most promising approaches in representative urban environments. The implementation and evaluation of these demonstrations will not be included.

The universe will be identified in order to subsequently identify an appropriate sample of handicapped persons living in urban areas to be personally interviewed in a follow-on survey. Concurrently, a survey will be conducted of associations serving the handicapped, such as the Easter Seal Society for Crippled Children and Adults, the Cerebral Palsy Foundation, the Paralyzed Veterans of America, Association of Retired Teachers, Senior Citizens Council and others. These associations can supply valuable information about the needs of their members.

Toward the end of 1975, three contractors were competing for Phase II contracts.

Reports from this project are not yet available

Merced, California is one of many areas that have provided dial-a-ride transit service for elderly and disabled people through UMTA demonstration projects.

These photos illustrate special bus modifications used to assist handicapped riders, including a hydraulic ramp to raise wheelchairs to floor height and a special low-step design with extra step extension to aid ambulatory users.

Special Elderly and Handicapped Services for a Medium-Sized City

Project: OR-06-0004
Funding: $916,768
Schedule: June 1975 — June 1978
Contractor: Tri-County Metropolitan Transportation District of Oregon

This project is designed to conduct an exemplary demonstration of a comprehensive, transit company operated, demand-responsive, special transportation system in an urban area of 40,000 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 and integration of the special demonstration transportation service with the regular transit system.

The project also will coordinate transit agency special service with social service agency special transportation and services offered by the taxi industry. A credit card fare collection and computerized billing system will allow monthly payment as well as provide detailed data on the travel patterns and desires of the elderly and handicapped.

Reports from this project are not yet available

Large City Demonstration Planning for the Mobility Limited

Project: IL-06-0033
Funding: $75,000
Schedule: July 1975 — March 1976
Contractor: City of Chicago Department of Public Works

This project will develop a detailed implementation plan, with cost projections, for a pilot demonstration of convenient, barrier-free transportation for elderly and disabled persons in a large urban area. The planning phase will include an inventory and 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.

The project will define the specific boundaries of the sector to be served in the demonstration phase and will also develop the plans, specifications, procedures and criteria for operating the special transportation service.

Reports from this project are not yet available

Transit System for Disaster Stricken Area

Project: PA-06-0028
Funding: $300,000
Schedule: October 1972 — July 1974
Contractor: Luzerne County Transportation Authority (Wilkes-Barre, Pennsylvania)

This demonstration was conducted to design and implement a transit system with maximum retention of emergency-generated riders after a natural disaster. The demonstration included incremental increases in the fare structure, restrictions imposed on automobiles, reserved bus lanes, park-and-ride lots, bus-actuated traffic signals and a substantial increase in parking rates for downtown parking lots. A secondary purpose of the project was to prepare a transit operations manual for communities experiencing a civil emergency.

Reports from this project are listed in Appendix I

Combined Subscription and Demand-Responsive Transit

Project: CA-06-0017
Funding: $300,469
Schedule: August 1971 — September 1974
Contractor: City of Los Angeles Model Cities Program

This project developed a combination subscription, demand-responsive transit system to provide flexible

intra-community services to people in a low-density, poverty neighborhood where existing public transportation was inadequate or non-existent. The new service was intended to be integrated into the regional transit operation as a supplement to the existing fixed schedule services. The project provided neighborhood residents with access to health and social services, shopping centers and cultural and recreational facilities. The effectiveness and benefits of such services were measured.

Reports from this project are listed in Appendix I

Demand-Responsive Public Transportation for Poor and Elderly Persons

Project: MI-06-0004
Funding: $193,600
Schedule: June 1971 — August 1974
Contractor: City of Grand Rapids, Michigan

This project developed a demand-responsive public transportation system to supplement the existing fixed-route, fixed-schedule transit operations. The system is primarily oriented to inner-city poor and elderly residents and their needs for transportation to get to jobs, health and social service facilities, and cultural and recreational activities.

Reports from this project are not yet available

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 — December 1975
Contractor: City of Cleveland, Ohio

This project, jointly sponsored by UMTA and the Department of Health, Education and Welfare's Social and Rehabilitation Service, has designed and implemented a flexibly routed neighborhood transportation system to serve the basic transportation needs of the elderly as part of a total neighborhood system 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 demonstration area is composed of three distinct high density, low income areas covering 7.6 square miles and containing a high percentage of elderly persons. This project currently transports about 11,000 elderly persons per month.

Reports from this project are not yet available

Demand-Responsive Transportation for the Handicapped

Project: NE-06-0002
Funding: $136,384
Schedule: June 1972 — January 1975
Contractor: City of Lincoln, Nebraska

This project tested the feasibility, effectiveness and economics of providing public transportation for physically handicapped persons who have no access to regular public transit. Vehicles operated on a dynamically flexible routing system in which riders telephoned to a radio-dispatcher to schedule pickup

Cleveland, Ohio's Neighborhood Elderly Transportation dial-a-ride project, an UMTA demonstration, provides door-to-door service for elderly riders in three city areas with large elderly populations.

and delivery from homes to specific destinations. The operating system was integrated into a similar system designed for the elderly and operated by the city of Lincoln through the publicly owned and operated municipal bus transit service. This demonstration project represented an additional specialized transportation service to be incorporated into the Lincoln Transportation System.

A final report is being prepared

Demand-Responsive Public Transportation for Poor and Elderly Persons

Project: NY-06-0041
Funding: $333,000
Schedule: May 1973 — October 1975
Contractor: Central New York Regional Transportation Authority (Syracuse)

This project designed and implemented a demand-activated transportation system using four specially equipped vehicles to serve the special transportatior needs of the elderly 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.

Reports from this project are not yet available

Personalized Transit Service for Elderly and Handicapped Persons

Project: FL-06-0007
Funding: $300,000
Schedule: December 1972 — March 1975
Contractor: City of St. Petersburg, Florida

This project implemented a demand-responsive transit system to increase mobility for the elderly in a medium size urban area with a large concentration of elderly people. Several types of service were provided, allowing for extreme schedule flexibility, high use of vehicles and maximum personal safety.

Primary service was a personalized reservation system within a 10-square-mile area, providing door-to-door service from origin to destination. Prearranged group transportation to major medical facilities and same-day demand-responsive service were available on a limited basis.

Two of the fleet of small buses and van-sized vehicles were equipped with hydraulic lifts to accommodate wheelchairs; senior citizens over age 60 and the handicapped were eligible to use the system by registering with the city.

This demonstration was the follow-up to a planning phase that analyzed the population characteristics and transportation needs of the elderly in St. Petersburg and assessed the cost/benefit of possible alternative services.

Reports from this project are listed in Appendix I

Demand-Responsive and Subscription Transit for the Elderly and Handicapped

Project: RI-06-0006
Funding: $230,312
Schedule: May 1972 — December 1974
Contractor: City of Cranston, Rhode Island

This project, designed to provide special transportation services for elderly and handicapped residents

Cranston, Rhode Island's Transvans help elderly and handicapped riders get to medical facilities, community and commercial services, and other activity centers.

of Cranston, Rhode Island, had two components:

1) A demand-responsive service to meet basic travel needs between residential locations and medical facilities, community services, commercial services and other activity centers;

2) A series of subscription services for travel to regional shopping centers, selected major medical facilities and to the daily programs of the Cranston Chapter for the Retarded.

The project met the transportation needs of persons who could not use existing public transit services. Although the demonstration has been concluded, the service is continuing under local sponsorship.

An operations manual and final report are available from UMTA's Office of Transit Planning.

Development and Demonstration of a Transit System for the Elderly and Handicapped

Project: CT-06-0003
Funding: $625,050
Schedule: June 1971 – July 1977
Contractor: Valley Transit District (Connecticut)
Subcontract: RRC International, Inc.

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 additional vehicles, Phase II will permit the concepts developed for the limited system to be applied and tested in a full public system. Primary demonstration elements include integration of a coin/credit card fare collection system, development and application of new combinations of three service modes to a wide clientele, centralizing of the fare/billing system to meet demands of a larger system, and revised fare structure and system evaluation.

Phase II planning has been completed and equipment designs are being developed. Delivery on additional vehicles was expected for October, 1975.

The Phase I report is available from UMTA's Office of Transit Planning.

Transit for the Physically Handicapped

Project: LA-06-0001
Funding: $171,050
Schedule: June 1971 – October 1975
Contractors: City of Baton Rouge, Parish of East Baton Rouge (Louisiana)

The Special Transportation Service (STS) of Baton Rouge, Louisiana is a 15-month demonstration project that provides free transportation to the elderly and handicapped. 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 demand-responsive service for riders who make appointments one day in advance. Service is designed primarily to meet medical trip needs with some other social service trips provided. More than 2,000 riders per month were being served, including 12-15 wheelchair passengers per day.

Reports from this project are not yet available

D. Pricing Policy

Prepaid Pass Potential

Project: DOT-TSC-1056
Funding: $92,340
Schedule: July 1975 – March 1976
Contractor: Huron River Group, Inc. (Ann Arbor, Michigan)

This project is 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 implementation of such mechanisms. A cost/benefit analysis will be made to determine net cost of prepaid pass programs when compared to costs from conventional fare systems; this will permit the development of detailed plans for demonstrations of prepaid pass concepts.

The project will include a detailed examination of literature and existing prepaid pass programs, identification of key features and problems, cost/benefit analysis, identification of market types for prepaid passes, determination of the best implementation and marketing methods, recommendations of at least 10 potential sites for implementing prepaid pass programs, and development of detailed demonstration plans.

To date, the literature search has been completed and suppliers of sophisticated fare collection hardware have been queried on their products. A classification system using 30 variables to describe prepaid fare plans has been developed; in addition, transit operators in cities with more than 10,000 population have received questionnaires to help the contractor identify operators with programs worthy of detailed study.

Reports from this project are not yet available

User-Side Subsidy

Project: IL-06-0034
Funding: $314,530
Schedule: June 1975 – June 1977
Contractor: City of Danville, Illinois

A taxi-ticket demonstration project will test 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.)

A two-phase demonstration program plan has been developed, including a three-month preparatory phase in which ticket design, distribution and redemption methods will be established. During this phase, surveys will be conducted and data 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 will use discounted taxi tickets (sold at 25 percent of face value) without changing other taxi operations. This is expected to indicate the effectiveness of the tickets in improving mobility for the special user group.

Reports from this project are not yet available

Congestion Pricing Demonstration

Project: DC-06-0111, DC-06-0120
Funding: $346,214
Schedule: July 1974 — January 1977
Contractor: The Urban Institute

This project is designed to implement a congestion pricing demonstration that will study the elements of a congestion pricing scheme and inform policy makers of the advantages/disadvantages of such a concept for reducing urban congestion. Detailed designs of the pricing mechanism will be performed and analysis and evaluation procedures will be developed. The project includes development of a descriptive paper on roadway pricing objectives and expected outcomes, selection of several metropolitan areas for preliminary analysis of congestion pricing policies, sketch designs of efficient pricing mechanisms for each selected city, development of detailed demonstration designs, analysis and evaluation procedures. This project should provide necessary information required to facilitate the actual implementation of an area-wide congestion pricing demonstration.

The project also has developed a monograph that describes the most important elements of congestion pricing; motivations, desirability, feasibility and costs of implementing congestion pricing; and questions of equity and efficiency.

Site selection criteria have been developed and a preliminary screening and selection of demonstration sites made. In addition, work has been completed on the congestion pricing implementation procedures.

Reports from this project are listed in Appendix I

E. Urban Goods Movement

Urban Goods Movement Demonstration Project Design

Project: IL-06-0030
Funding: $121,000
Schedule: October 1974 — October 1975
Contractor: A. T. Kearny, Inc.

This project defined qualitatively and quantitatively the impact of traffic congestion, air and noise pollution, energy consumption, land use and excessive costs on urban goods movement; identified fundamental problems and their causes; formulated new and evaluated previously proposed solutions to these problems; developed systematic methodology and criteria for proposing solutions to be demonstrated or to be eliminated from further consideration; and proposed and designed demonstration projects to implement and/or test proposed solutions.

The study, including the problems of moving goods by truck, will develop solutions that are non-capital intensive and capable of being implemented in a short time period.

The project included these steps:

1) A literature search was conducted and, supplemented by contacts with 24 identified urban goods movement researchers, more than 200 materials were assembled.

2) An impact matrix analysis was conducted 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). Qualitative conditions, under which specific problems affect specific groups, were identified, resulting in a reduced matrix of problems/affected groups/conditions of about 3,000 cells. This approach did not appear to offer sufficient focus on the true problems of urban goods movement, however, and it was determined that some level of quantitative data must be developed to assist in problem definition and solution identification.

3) A distribution analysis was conducted in which 42 "segments" of goods or service movement were identified. Using Bureau of the Census and other sources, estimates were then developed of the quantities of goods and/or services distributed to urbanized areas. These descriptions included the operations of pickup, intercity freight transportation, delivery, warehousing, delivery to retail, and final delivery.

4) Problem/opportunity analyses were then made for congestion that might be attributed to urban goods movement, energy consumed by urban goods movement, air and noise pollution generated by these vehicles, the impact of urban goods movement on land use, and cost reduction opportunities.

5) With the development of preliminary findings for the distribution analysis and problem/opportunity analysis, the study team reviewed all information developed to identify actual problems of urban goods movement and their causes.

6) The study team, with assistance from U.S. Department of Transportation professionals, used knowledge gained from the study to identify potential solutions to the problems of urban goods movement. More than 150 potential solutions were produced.

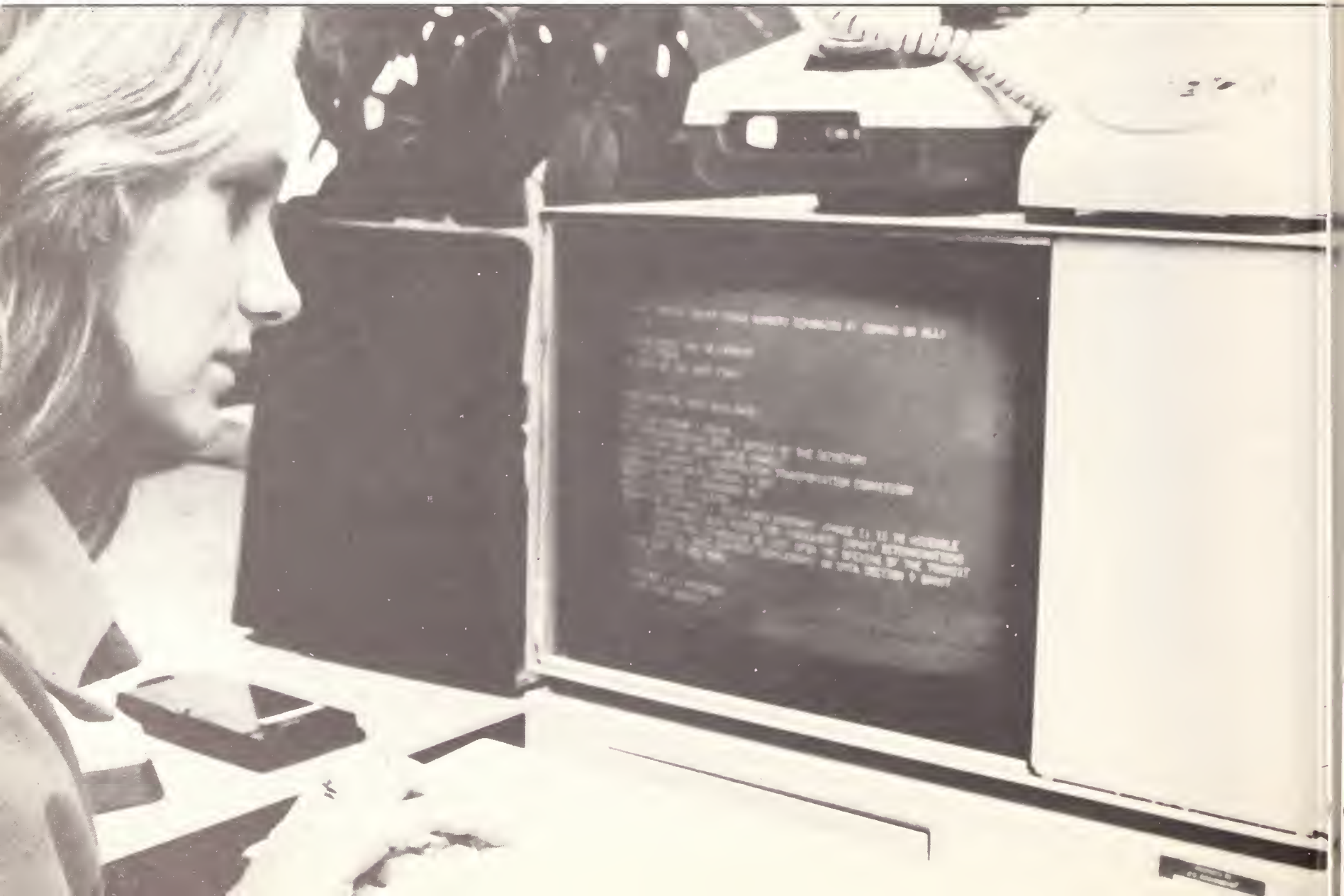
7) Each potential solution was then rated or screened, according to its potential impact on each of the six urban goods movement problems, to determine if the solution decreases, increases or does not change the impact of the problem.

8) Using these findings, the study team singled out all short-term and low capital intensive potential solutions that did not significantly increase the impact of any one urban goods movement problem. These solutions were then ranked according to preliminary quantitative estimates of the probable impact of each solution on each problem for each of five urban groups, and a step-by-step methodology to evaluate the solution in greater detail was then applied.

Reports from this project are not yet available

CHAPTER VII

office of transit management



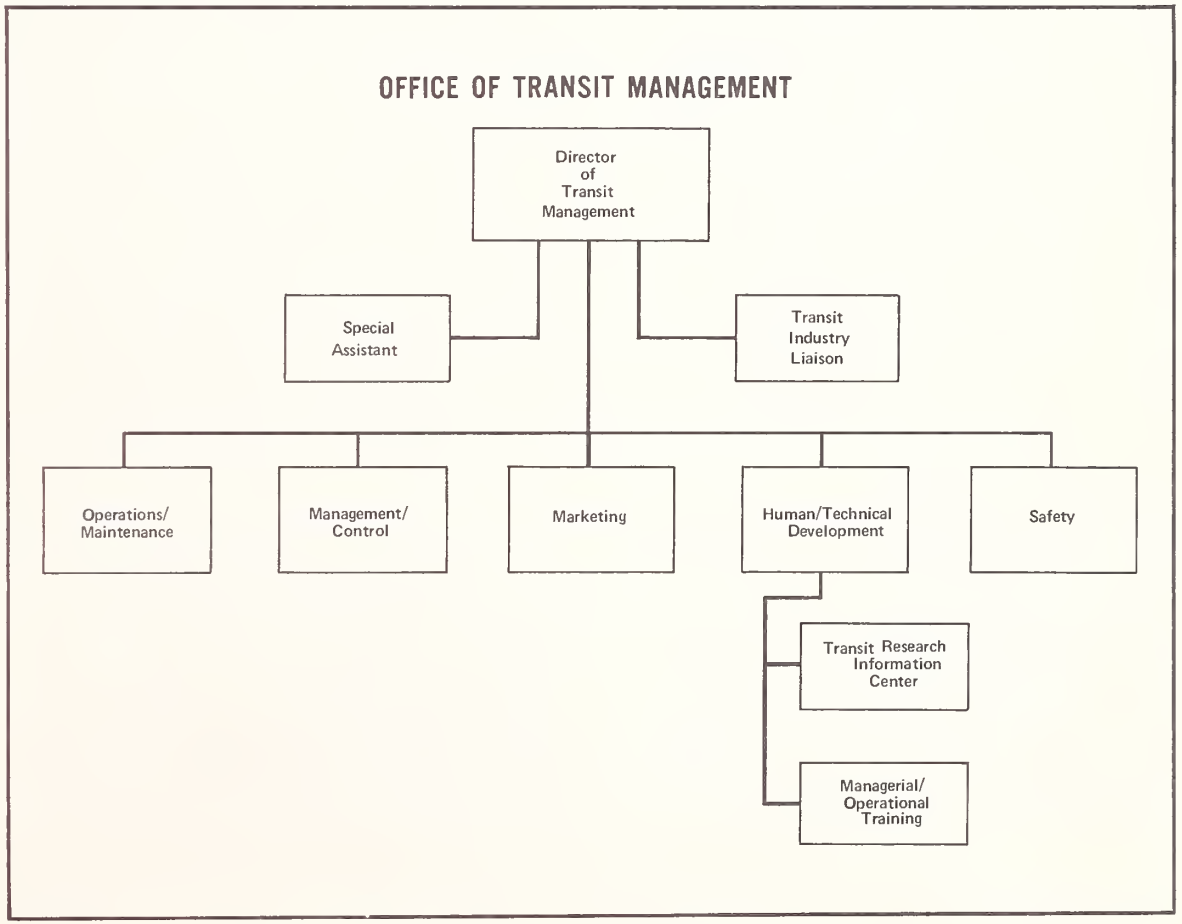
UMTA's Office of Transit Management (UTM) was created in 1973 to improve transit management through the optimum allocation of resources, increased productivity of labor and capital, and the provision of improved tools for developing and marketing transit service. The Office consolidated projects on management previously administered by the Office of Research and Development (then known as the Office of Research, Development and Demonstration), expanding and strengthening the program to resolve the increasingly complex problems of transit management.

The continuing trend toward public ownership of transit systems has altered the balance between public service and financial objectives and new and varied demands for transit service have been initiated because of environmental and energy concerns. In addition, technological advancements coupled with severe shortages in trained managerial and operational personnel have created additional analytical and operational burdens on the management of mass transportation. At the same time, the long-term trend toward declining transit ridership requires better understanding of and attention to the marketplace.

In response to these relatively new problems, the Office of Transit Management manages RD&D projects in five functional areas:

Operations and Maintenance, relating to the efficient allocation and control of operating resources in a transit system, including the scheduling and maintenance of vehicles, allocation of manpower resources, and operational data collection.

Management and Control, concerning the internal administration of financial and information resources, including the development of management information systems, management organization structures, and related managerial improvements.



Transit management activities use computerized tools to develop and market transit services.

Marketing, involving the development, operation and communication of transit services consistent with market needs, including market research, user information dissemination, service improvement and promotional activities.

Human and Technical Development, including the recruitment, development, training, assignment and evaluation of managerial and operating personnel, and the dissemination of technical information.

Safety, relating to the development and evaluation of procedures, operating requirements, controls and special equipment needed to assure the safety and security of transit operations, including the analysis and resolution of performance trade-offs with cost, quality, reliability and maintainability factors.

Projects of the Office of Transit Management include the development of improved management software for manpower and vehicle resource allocation; improvements in transit information handling capabilities; development and dissemination of improved marketing techniques; and demonstration and evaluation of training impacts on job performance and research on safety factors.

Operations and Maintenance

Operations and Maintenance Programs deal with the efficient allocation and control of operating resources in a transit system.

The principal objective of O&M programs is to develop and assist in the implementation of mechanical and procedural improvements to insure that operating equipment and personnel are used productively and efficiently; particular attention has been focused on improved systems for scheduling and maintenance information control.

The Run Cutting and Vehicle Scheduling (RUCUS) computer package provides a basic tool for vehicle scheduling and driver run cutting to operate at a given level of service. On-site testing of the package has demonstrated savings of up to 5 percent of total requirements for buses and drivers.

The Service Inventory Maintenance System (SIMS) provides a basic information handling computer program for the management of bus maintenance operations. It will furnish source information on the cost of operating transit vehicles, as well as daily use of consumables, cost of repairs for each vehicle and statistical and control information concerning repairs and the use of materials.

General areas UTM addresses include the need for updated vehicle scheduling and maintenance policies; methods to determine fleet size requirements in conjunction with improved operations and maintenance techniques; personnel requirements and job performance measures in the maintenance activity; the application of automated diagnostic equipment and vehicle maintenance schedules; improved maintenance facility arrangements, and more efficient linkages between the operations and marketing functions to ensure that transit services are responsive to market needs.

During FY 1975 particular attention was focused on the development of prototype operating guidelines, procedures and standards; the development, documentation, and testing of software packages; the development and testing of supporting mechanical devices such as automatic fare collection and bus diagnostic equipment; support for local improvements through the conduct of special training, the dissemination of information, and the demonstration of operations; and maintenance improvements for implementation throughout the transit industry.

Transit Operations and Management Systems (TOMS)

Project: VA-06-0004
Funding: $3,460,000
Schedule: June 1971 – June 1975
Contractor: Mitre Corporation

TOMS is a comprehensive program to develop, test and demonstrate modernized operating procedures and management methods that can be widely adopted by the transit industry. Transit operating costs can be substantially reduced through improved allocation of resources, increased productivity of labor and capital, and better planning and management of services.

This project, under the original three-year contract, focused attention on bus maintenance program software, a computer software package for bus and driver scheduling (RUCUS), automatic passenger counters, and automatic fare collection. Elements of the fourth-year extension included documentation for the Service Inventory Maintenance System (SIMS), automatic fare collection equipment, an operational data collection system for buses (DATABUS), and the rail Maintenance Planning System (MPS). The development/demonstration of hardware and software systems to improve transit management operations were emphasized.

All programs were completed by June, 1975 and RUCUS has been installed at several transit operating properties.

Reports from this project are listed in Appendix I

Service Inventory Maintenance System (SIMS)

Project: CA-06-0033
Funding: $225,242
Schedule: June 1969 — December 1974
Contractor: Alameda-Contra Costa (California) Transit District

This project was designed to improve bus operations by supporting operational tests of a computerized management information system specifically for urban bus transit systems. The project tested and evaluated a semi-automatic data collection device for maintenance, inventory and service operations. The collected data will be used for budget projection, fleet modernization analysis and maintenance, and service operations analysis.

Both maintenance and service personnel were trained to operate the system, which will streamline current operations and reduce fleet service and maintenance costs.

All SIMS modules have been tested and final enhancements to the inventory control module have been implemented. This was a companion project to TX-06-0005.

Reports from this project are not yet available

Service Inventory Maintenance System (SIMS)

Project: TX-06-0005
Funding: $171,861
Schedule: June 1969 — December 1974
Contractor: Dallas Public Transit Board

This project financed operational tests of an automated information system for bus transit maintenance operations. Specifically, it demonstrated the benefits that can be achieved from using a computer-based system to collect and report service data, inventory control, maintenance costs and coach unit history data for management.

This project was a companion to CA-06-0033.

Reports from this project are not yet available

MANAGEMENT AND CONTROL

Management and control programs pertain to the internal administration of financial and information resources — the organization of functions, the development and maintenance of effective management processes and procedures, and the efficient allocation and control of financing and operating resources.

The overall objective is to provide the software and procedural tools necessary for more efficient financial information control by transit management. Problem areas addressed by management and control programs include the need for better planning, budgeting and administrative operations; assessment of alternative operating economies; management information control systems; and performance measures. To a large extent, these problems reflect the increasing complexity of transit operations and the trend toward public transit system ownership, both of which have fostered significant and rapid changes within the transit industry and increased management requirements.

The development of standardized accounting and reporting procedures has been emphasized under the FARE (Financial Accounting and Reporting Elements) project, whose objective is to establish an industry-wide program to manage and report operating data in a uniform system that enhances the potential for comparative analysis and furnishes the basis for new management information software.

Implementation of FARE; the development of management information systems to use the FARE data base, operating standards and performance measures; management organization improvements and related studies received particular attention during FY 1975.

Operational Data Collection System (ODCS)

Project: VA-06-0004
Funding: $595,000
Schedule: June 1971 — June 1977
Contractor: Mitre Corporation

This project is designed to develop an integrated set of equipment that will automatically measure and record bus passenger activity, revenues collected and miles driven, and relate this activity to time points on a line or route; in short, the operational information concerning a day's activity on a bus that is essential for management decisions.

Reports from this project are not yet available

Intermodal Automatic Fare Collection System

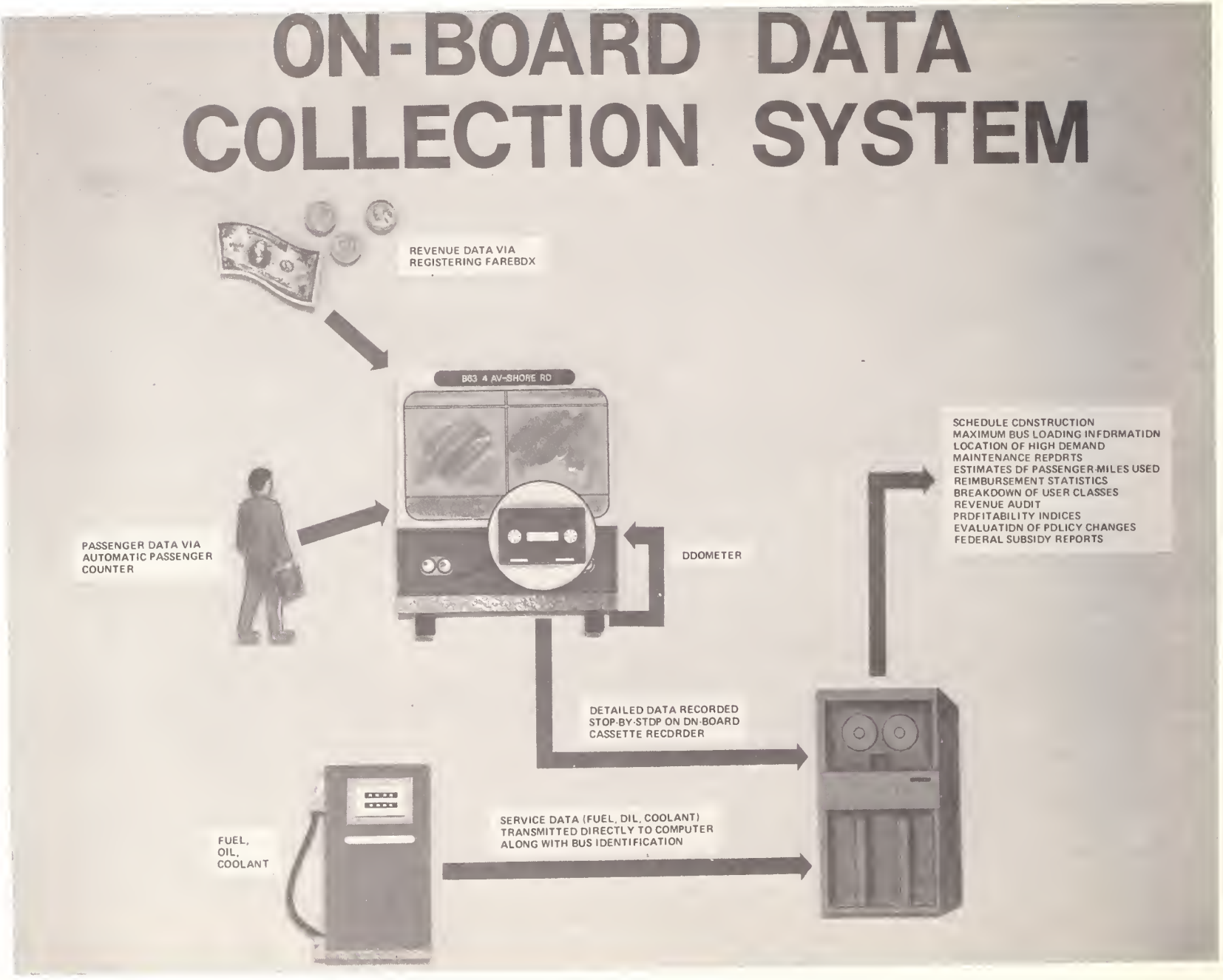
Project: VA-06-0004
Funding: $783,000
Schedule: June 1971 — December 1975
Contractor: Mitre Corporation

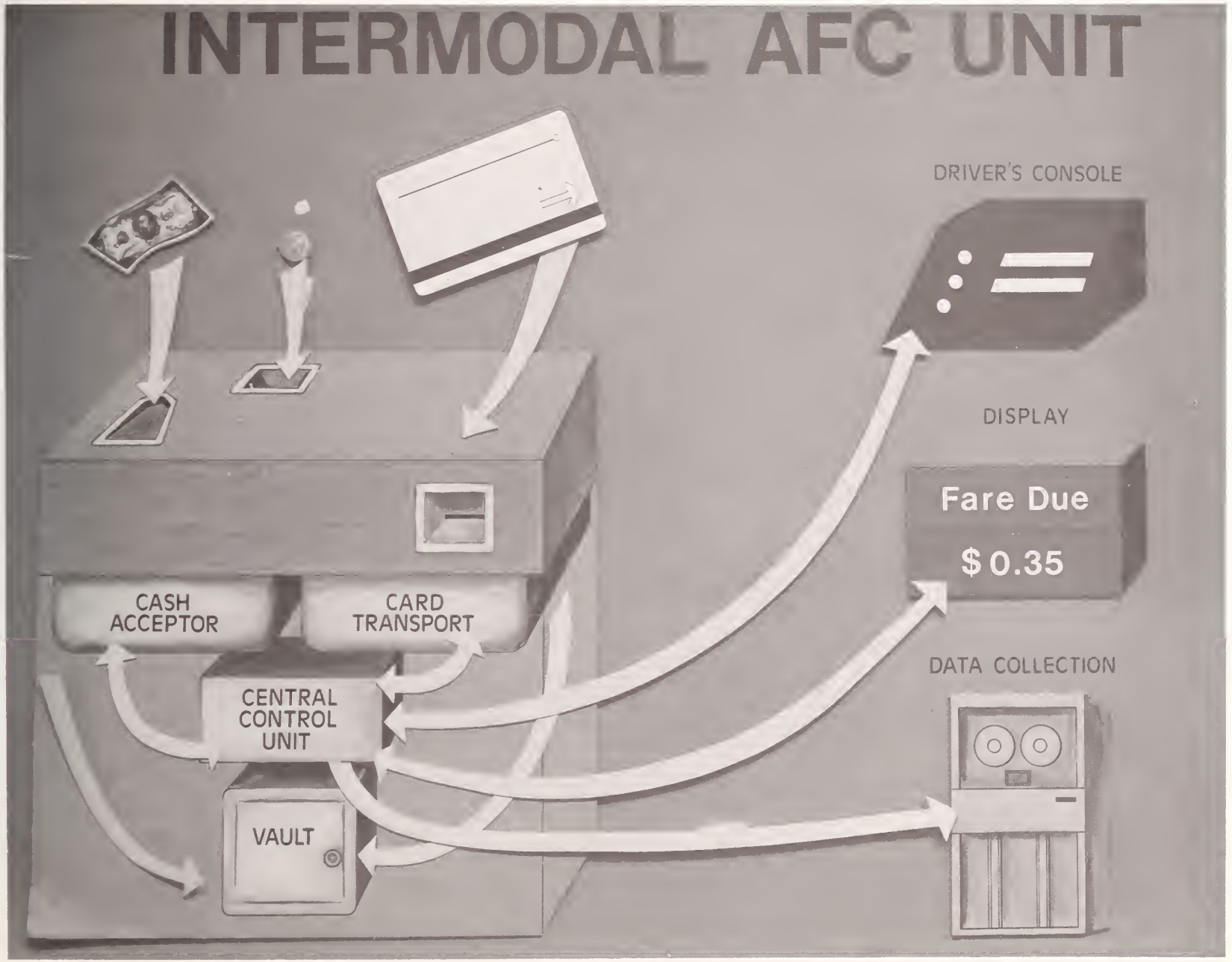
This project is designed to develop a fare collection device for buses that can accept magnetic cards used by rapid rail transit systems. By the end of FY 75, critical subsystems — magnetic card transport, reader/printer, cash acceptor system — had been tested.

Specifications now are being written and action has been initiated to procure two engineering prototypes of the integrated system Successful prototype testing will be followed by production and demonstration in FY 77.

Reports from this project are not yet available

ON-BOARD DATA COLLECTION SYSTEM




INTERMODAL AFC UNIT
DRIVER'S CONSOLE
DISPLAY
Fare Due
$ 0.35
CASH ACCEPTOR
CARD TRANSPORT
CENTRAL CONTROL UNIT
VAULT
DATA COLLECTION

Marketing

This program's objective is to provide transit operators and management with the basic tools necessary for more effective transit marketing.

Projects in this division are concerned with the development, product planning, and promotion of transit services consistent with market needs. They conduct systematic research on market characteristics, translate the results into service plans responsive to market needs, disseminate product information to consumers, and engage in promotional activities that emphasize the attractiveness of transit service and increase public acceptance of mass transit.

There is increasing recognition of marketing as a basic management responsibility and a growing sensitivity to the public service role of mass transit. Accordingly, the Office of Transit Management develops and demonstrates improved marketing techniques such as new approaches to information dissemination, service development, promotional communication and market segmentation analysis.

In order to provide the basic tools necessary for more effective transit marketing, programs have focused on the demonstration of marketing techniques in a comprehensive, integrated project which combines service-related, informational and promotional elements. Research also has been conducted in transit user information systems, transit pricing policies and marketing's place in management organization structure. Efforts also have been made to monitor, evaluate and report the results of local marketing innovations.

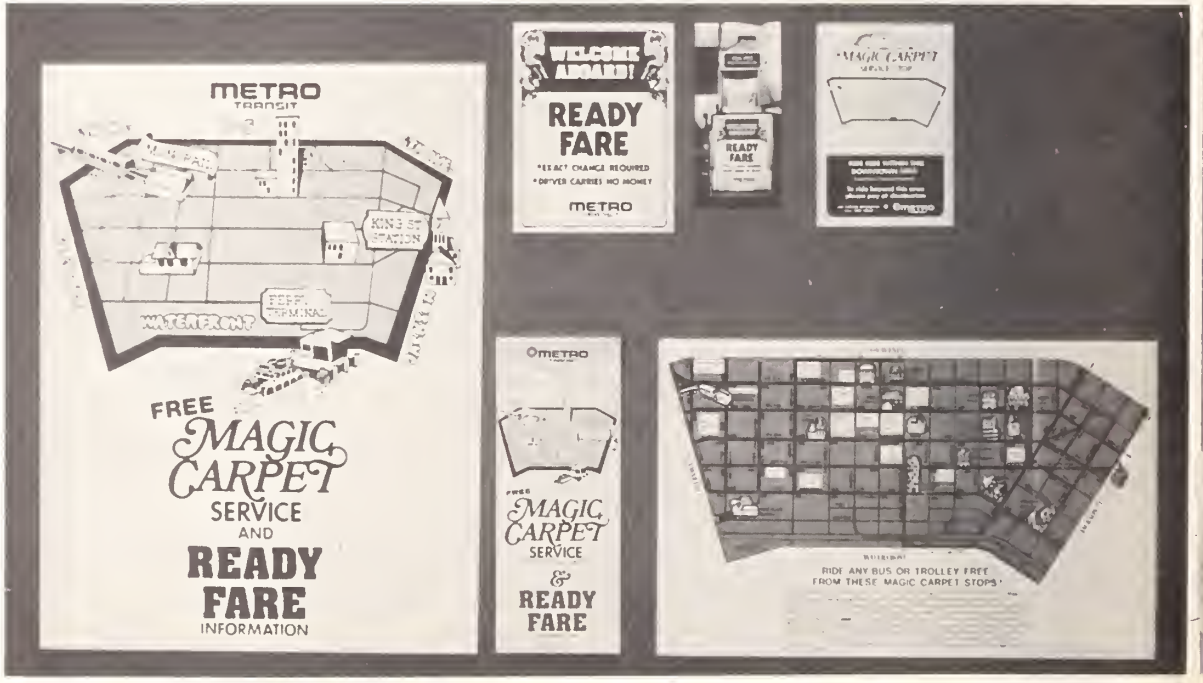
Transit Marketing Project

Projects: IT-06-0078, MD-06-0021
Funding: IT-06-0078 – $728,790; MD-06-0021 – $1,300,000
Schedule: February 1974 – January 1977
Contractor: Grey Advertising, Inc.
Subcontractors: Chase, Rosen, and Wallace, Inc.; Smith & Locke Associates

Two concurrent demonstrations of transit marketing will be conducted at sites of large (over 600,000 population) and medium (between 300,000 and 600,000 population) size with the objective of increasing ridership and improving the attitudinal disposition of potential riders to use transit. Four integral elements of the project are market research, transit service planning, fare and schedule modification and promotional techniques.

The contractor is conducting extensive market research at the two sites – Baltimore and Nashville – and will develop demonstration plans that integrate informational, service-related and promotional elements. In addition, the contractor will monitor the effectiveness of transit marketing during the demonstrations and report the results in a comprehensive Transit Marketing Manual. Two marketing training sessions, a transit marketing conference and regional seminars are being conducted to familiarize transit industry personnel with marketing techniques. A marketing handbook for transit managers also is being prepared. Market research and demonstration plans at both sites have been completed.

Reports from this project are listed in Appendix I



Seattle METRO uses a wide variety of user dissemination aids to tell riders about available services and how to use them.

Marketing activities include coordination of transit services, such as this use of mutual transfer points by Chicago Transit Authority rapid rail cars and charter bus operations.

A Study of Transit Fare Policies and Their Implications

Project: IT-06-0095
Funding: UMTA — $60,000; Department of Transportation — $60,000
Schedule: May 1975 — January 1976
Contractor: Peat, Marwick, Mitchell, and Company

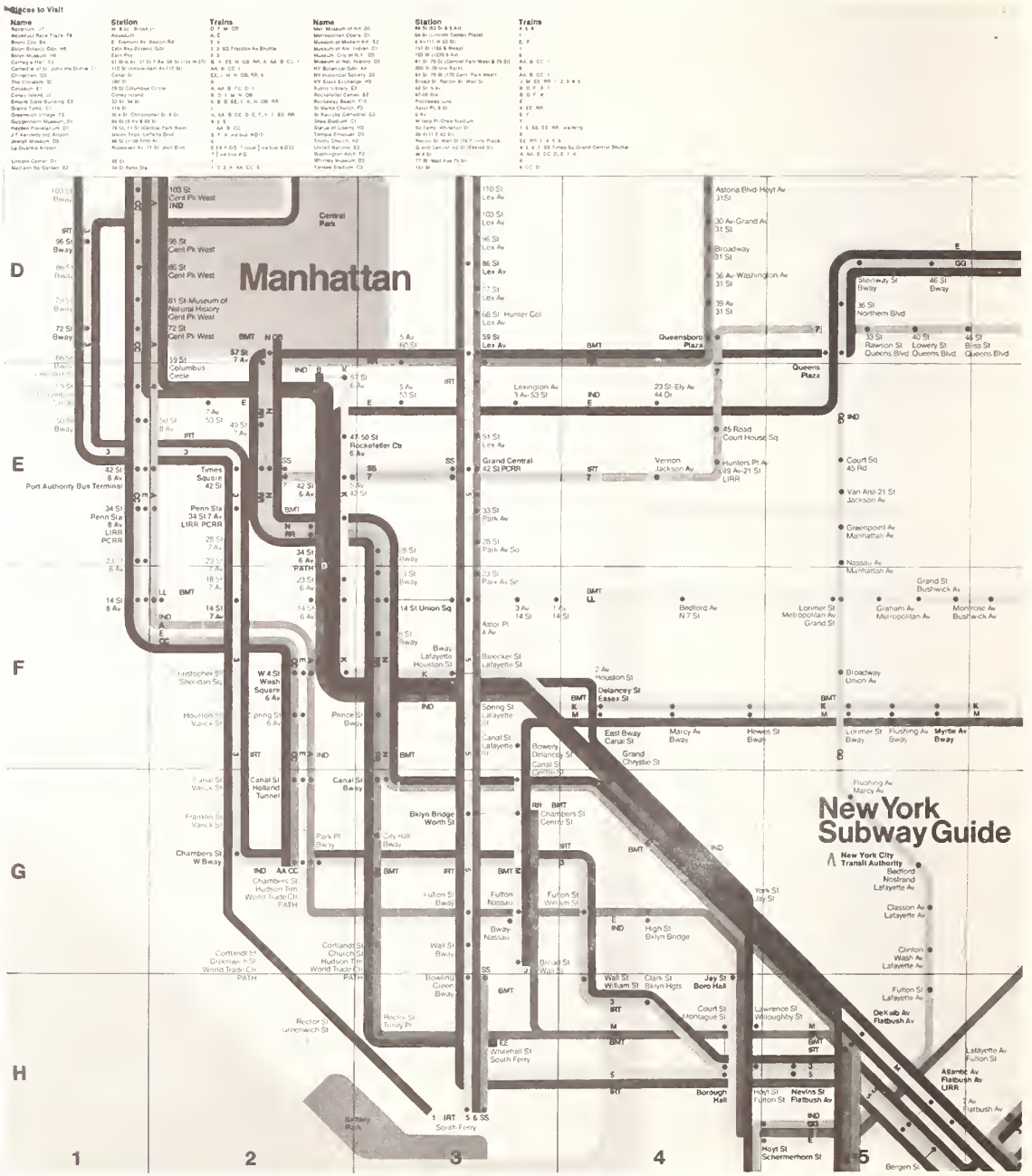
This project will develop information on transit fares and fare structures that can identify promising techniques to increase ridership, assess effects of fare policies on operations, instruct public policy regarding transit pricing, and guide management decision-making regarding fare policies by transit properties.

Attention will be given to existing pricing policies in the urban transit industry, alternative fare structures and packaging techniques (including the extent of no-fare transit operations), the potential for fare modification as a marketing tool, the effects of alternative fare and service packages on transit ridership and revenue (i.e., the price elasticities of transit demand), the institutional constraints affecting fare and service change, the implications for public policy and the need for additional research.

In addition to a final report covering all data, analysis methodology, findings and recommendations, a Transit Pricing Manual will be prepared for transit operators and other interested public agencies responsible for transit operations.

The contractor has completed the inventory of fare techniques and policies and the analysis of transit fare elasticities.

Reports from this project are not yet available



New York Metropolitan Transportation Authority provides full-color subway maps to assist riders in getting around the greater New York area.

Transit User Information Aids and Dissemination Techniques

Project: IT-06-0098
Funding: $84,404
Schedule: February 1975 — July 1975
Contractor: Ilium/Octopus, Inc.

In this project, alternative mechanisms for the dissemination of transit user information were identified and evaluated. (User information embraces communication of transit routes, schedules, fare structures, transfer policies, vehicle destinations, stop locations, and other requisite information for transit accessibility.) Various existing user information aids were inventoried and evaluated, including maps and schedules, on-vehicle destination markings, stop location signs, telephone information and other innovative techniques. Dissemination techniques were synthesized, and a detailed transit information handbook for transit operators is being prepared.

Reports from this project are listed in Appendix I

Marketing Functions in Transit Management Organization Structures

Project: IT-06-0099
Funding: $75,000
Schedule: March 1975 — September 1975
Contractor: Lesko Associates, Inc.

This study inventoried and evaluated alternative management organization structures and decision processes regarding transit management and marketing. In addition, alternative organization structures were evaluated with regard to the effective integration and conduct of generic marketing functions in the overall transit organization.

Reports from this project are listed in Appendix I

Analysis of Boston Prepaid Payroll Deduction Transit Fare Pass

Project: MA-06-0059
Funding: $80,000
Schedule: March 1975 — December 1975
Contractor: Decision Research Associates, Inc.

This study evaluates the behaviors and attitudes of the consumer and business community to the MBTA's Prepaid Payroll Deduction Transit Pass Program. The evaluation includes an operational effectiveness assessment and will be reported as a manual for implementing the program in other urban areas.

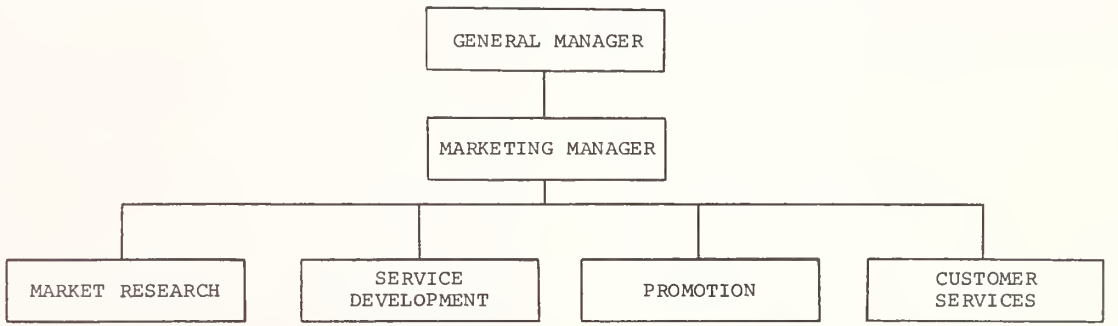
Reports from this project are not yet available

Improvement of Offpeak Ridership and Revenue Project

Project: IT-06-0116
Funding: $100,000
Schedule: September 1975 — March 1976
Contractor: To be selected

This study will inventory, formulate and assess approaches transit operators can take to improve use of existing personnel and equipment during nonpeak periods. Approaches will be integrated into modules or programs keyed to the resources and needs of systems of all sizes. Each module will be sufficiently detailed to facilitate its successful application by line transit managers.

Reports from this project are not yet available



This organization chart shows the components of a representative marketing operation within transit management.

Marketing Techniques for Smaller Transit Systems

Project: GA-09-8001
Funding: $160,000
Schedule: July 1975 – December 1975
Contractor: Alan M. Voorhees & Associates

This project will develop a comprehensive package containing everything a transit system manager in a smaller city needs to conduct an effective marketing program. The package will encompass the entire marketing mix including market research, service development, pricing, user information, sales communication and evaluation. Also included will be an assessment of the needs and resources of small city transit systems and small city transit marketing.

Reports from this project are not yet available

Human and Technical Development

This area combines the dual functions of human resources development and technical information transfer and technology sharing. The human resources development programs encompass the recruitment, development, training, assignment and evaluation of managerial and operating personnel. Particular emphasis is given to programs aimed at human development, increased labor productivity, selection and related aspects.

The overall objective of these programs will be to provide the basic methods and tools for more effective human resources development in the transit industry. However, the significant labor-intensiveness of the transit industry also warrants increased attention to methods that improve productivity and measure job performance.

Research projects complement and supplement UMTA programs for managerial training and technical information exchange. Problem areas to be addressed include the need for improved recruitment and selection techniques, expanded development and testing of training methods, and increased technical information dissemination. There also is a need to upgrade overall management programs to promote human resources development as an extension of selection and training activities.

In future programs, attention will be focused on the development of substantive short courses and seminars; the assessment of blue-collar training needs; the development of appropriate training aids and procedures; the assessment of prototype human resources planning programs and support of applied local improvements in human resources development.

The Technical Development Program supports information exchange and technology sharing through a variety of forums, including workshops, conferences and seminars. These programs are aimed at disseminating a broad range of information in various aspects of urban transportation technology and management. A large portion of these functions is performed through continuing support for activities of the Transportation Research Board.

Training seminars are increasingly being used to train and develop skills of managerial and operating personnel.

Validation of Employment Testing and Selection Procedure

Project: MA-06-0011
Funding: $450,000
Schedule: August 1970 — continuing
Contractor: Massachusetts Bay Transportation Authority
Subcontractor: University of Chicago Industrial Relations Center

A validated test battery has been developed to aid in the selection of applicants with the highest potential for successful on-the-job performance as bus operators. The validated test battery also was developed to be ethnically and racially non-discriminatory, applicable to different geographical areas, and in compliance with requirements established by the Equal Employment Opportunity Commission and the Office of Federal Contract Compliance for employment testing.

During the Concurrent Validation phase of this project, a sample of 1,113 white, black and Spanish-surnamed bus drivers at five participating transit properties (Atlanta, Boston, Chicago, Cleveland and Oakland) were tested to identify characteristics associated with successful performance. Results of this phase were analyzed to validate a three-test battery that determines the probability of an applicant's having the characteristics associated with success as a bus operator. During the predictive validation phase, newly hired bus drivers at the participating properties took the test; after one year, their performance was correlated with respective test scores to validate the battery's predictive capability. This test battery is now available for implementation.

Reports from this project are listed in Appendix I

Training programs for transit maintenance employees are being evaluated to determine the impact of training on performance and cost reduction.

Blue Collar Training

Project: CA-06-0065
Funding: $64,150
Schedule: April 1974 — October 1975
Contractor: Southern California Rapid Transit District

The effectiveness of training programs on improving the performance of transit maintenance employees is being assessed in this project. Blue collar employees in three skill groups — welders, electricians and air conditioning repairmen — will receive specialized classroom and on-the-job training. Specific performance measures are being developed and applied to assess the impact of training on employee performance and cost reduction in maintenance operations.

Reports from this project are not yet available

Transportation Research Board

Project: DC-06-0015
Funding: $627,200
Schedule: Funded annually 1971 — 1975
Contractors: National Academy of Sciences' Transportation Research Board

Activities of the National Academy of Sciences' Transportation Research Board are supported under this program to provide the services and resources for improved transportation research, information dissemination and technology transfer. This project generally supports the Transportation Research Board's information service, Field Visit Program, committee and task force activities. The project also supported several forums, including seminars, conferences and workshops on various research topics.

Information services and a variety of regular publications relating to transportation research are available from the Transportation Research Board.

Developing the Urban Transportation Training Role of a State DOT

Project: CA-06-0082
Funding: $99,276
Schedule: June 1975 — December 1976
Contractor: California Department of Transportation

This project will document the development of training at the State DOT level relating to urban transportation. As states develop various levels of technical assistance capability in dealing with urban areas, training becomes an important element. The results of this project will be a documented final report, case studies, training materials, workshop and seminar presentations.

Reports from this project are not yet available

Joint UMTA/FHWA Training Agreement

Project: DC-06-0114
Schedule: October 1974 — continuing
Funding: UMTA — $25,000; FHWA — $25,000
Contractor: Transportation Research Board

This agreement was initiated to identify, develop and present training programs on subjects having application to both UMTA and the Federal Highway Administration (FHWA). The effort is designed to make available to the transportation professions programs that are tailored to changing and expanding roles in the transportation field. It will result in a number of programs leading to added staff expertise at the Federal, State and local levels. The Transportation Research Board is establishing an Industry Advisory Board; requests for proposals (RFP's) have been advertised to conduct courses on Public Transportation and Management of Low Cost Capital Improvements.

Reports from this project are not yet available

Safety

Programs in safety are intended to insure the safety and security of transit passengers through the development and evaluation of transit procedures, operating requirements, controls and special equipment. Both existing and developmental transit technology are addressed, including the resolution of performance trade-offs among cost, quality, reliability and maintainability.

The objective of this program is to provide the basic information and techniques necessary for fatality-free transit operations with minimized potential for accidents and injuries. Safety addresses such problems as the need for adequate safety standards for rail systems; assessment of reliability and maintainability aspects of new transit technology; performance trade-offs with other developmental and operational factors; information on the safety characteristics of basic system components; and development of methods to prevent crime and vandalism on transit systems.

Additional research is being conducted on safety aspects of rapid rail transit, the trade-offs between manually operated and fully automatic transit technologies, and the compilation of information on the safety characteristics of materials used in transit systems. The increasing complexity of transit operations and the availability of novel technologies demand that further attention be given to safety factors throughout the life cycle of transit systems.

During FY 1975, attention was focused on UMTA safety policy programs, the development and testing of safety procedures and programs, documentation of security techniques and the analysis of other safety-related issues.

Command and control centers such as this monitor rapid rail systems, pinpointing potential problems and their exact location.

Rail Rapid Transit System Safety

Project: IT-06-0091
Funding: $120,000
Schedule: January 1974 — March 1975
Contractor: Transit Development Corporation

The Transit Development Corporation prioritized the safety concerns of rail rapid transit authorities and recommended actions to alleviate these concerns in this project. The identifications and recommendations are contained in a final two-volume report entitled "Safety Priorities in Rail Rapid Transit." Volume I carries the report and Volume II is Exhibits.

Reduction of Crime on Transit Properties (Transit Security)

Project: IL-06-0023
Funding: $148,000
Schedule: June 1973 — continuing
Contractor: Chicago Department of Public Works

Phase I of this project focused on four primary ingredients considered crucial to the decision of what should be anti-crime techniques for transit properties. These tasks, completed and reported in December 1973, were collections of data on ridership, operations, facilities, crime and the development of scenarios of crime; investigation of the kinds of existing mass transit security techniques and devices; investigation of the kinds of security devices and techniques available to provide security on mass transportation systems; and the conduct of a general population survey on crime perception.

Transit security now includes closed-circuit television monitoring of station areas in many cities.

Phase II will implement a plan formulated in Phase I for the demonstration of a transit security system by the City of Chicago and the Chicago Transit Authority. Two demonstrations selected from Phase I were:

Demonstration #1 (Televiewe-Alert), which included a closed circuit television system, public address system, a push-pull emergency and emergency telephone.

Demonstration #2, a less intensive security system that will be placed in a similar high-crime area to compare the two systems.

The Phase II applications are expected to be approved in January 1976.

Reports from this project are not yet available

Manned/Unmanned Transit Systems Study

Project: MA-06-0050
Funding: $70,000
Schedule: April 1974 — continuing
Contractor: Transportation Systems Center

This project compares and evaluates the technical capabilities and safety aspects of two types of transit systems — one with on-board human control, the other automated with no on-board human control. The principal factors to be studied will be public acceptance, safety and security for the passengers; and the reliability, maintainability and life cycle costs and benefits of the system. The findings are intended for use by authorities faced with advising or deciding on selection and development of new systems.

Working draft documents have been prepared on "Selected Spectrum of Manned and Unmanned Transit System," "Selection Criteria" and "System Description."

This project was started under the Office of the Secretary of Transportation where it was known as Automatic Train Control Study. It was transferred to UMTA in April 1974 for expansion and completion.

Reports from this project are not yet available

Transit Systems Materials Information Bank

Project: MA-06-0051
Funding: $210,000
Schedule: November 1973 — continuing
Contractor: Transportation Systems Center

This project will develop and maintain 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, serviceability and other characteristics related to safety, utility and cost. 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, durability, maintainability and weight characteristics; the costs of competing materials, and development of guideline specifications for materials selection. This project also will establish a materials consulting service for UMTA and the transit industry.

These tasks have been completed to date: A literature search to determine the combustible materials now being used in transit vehicles; assembly of test procedures for flammability and smoke density; issuance of a request for proposal (RFP) to acquire a contractor to develop the software for a computerized materials information bank; participation as a voting member on the ASTM Committee E39 on Fire Hazard Standards, Transportation Subcommittee; development of preliminary guidelines for flammability and smoke and emission specifications for materials used in transit vehicle interiors; and consulting services to transit authorities and UMTA in preparing vehicle specifications and in evaluating existing vehicle materials.

Reports from this project are not yet available

Mass Transit Safety and System Assurance

Project: MA-06-0060
Funding: $400,000
Schedule: April 1974 — continuing
Contractor: Transportation Systems Center

This project is developing and implementing a technological technical management and evaluation capability in the area of system assurance to support UMTA — conducted and UMTA-funded programs and projects related to the research, development, demonstration, planning design, capital acquisition, and operation of new transit systems or improvements of existing transit systems. The systems assurance elements incorporated in this capability are system safety (including security), system reliability, maintainability, availability, quality assurance and system life cycle costing.

Major tasks include: 1) The acquisition of resources; 2) Development of U.S. Department of Transportation guideline manuals for use by UMTA, project sponsors, consultants and contractors, and the transit industry in general to promote optimum safety and system assurance during the development and operational phases of transit system acquisition; 3) Development of similar executive and technical management guidelines for the regular review and evaluation of safety and system assurance processes; 4) Implementation of technical assistance support to UMTA; and 5) Completion of work initiated under Project MA-06-0050 (Manned/Unmanned Transit Systems Study) within the overall framework of the transit safety and systems assurance program.

Guideline manuals have been drafted for safety, security, reliability, maintainability, quality assurance, availability, human factors and life cycle costing.

Work continues on the identification and definition of information transmission requirements as a method for developing guidelines for the distribution of men, machines and manned/unmanned vehicle designs in the composition, organization and use of modern mass transit systems.

An important technical assistance review has been conducted at the Metropolitan Atlanta Rapid Transit Authority (MARTA). This project supported a comprehensive report, "Safety and System Assurance Review of the Metropolitan Atlanta Rapid Transit Authority Rail Rapid Transit System Development Program" from UMTA's Office of Transit Management. Subsequent reviews of transit vehicle and train control contract specifications also have been conducted.

Reports from this project are not yet available

appendices

Appendix 1:
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5. **Automatic Vehicle Monitoring**
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Shirley highway express-bus-on-freeway demonstration project — Project description, Aug. 1971, PB-218-983.
Bus user reactions to innovative bus features, June 1973, COM-73-1453 (NTIS).
Shirley highway express bus on freeway demonstration project, Second yr. results, Nov. 1973, COM-74-10785.

5. **Evaluation of Shirley Highway Express-Bus-On-Freeway Project**
DC-06-0066
(See reports for IT-06-0024)

6. **Urban Corridor Demonstration**
DC-06-0062
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Urban Corridor Demonstration Program Transit Improvement Program Evaluation, Louisville, Kentucky, U.S. Department of Transportation, June 1973.
Washington, D.C.
Final Planning Report:
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New York, New York
Final Planning Report:
Urban Corridor Demonstration Program, Manhattan CBD — North Jersey Corridor Summary of Findings Program for Action, U.S. Department of Transportation, November 1971.
Implementation Reports:
Urban Corridor Demonstration Program Interstate — 495 Exclusive Bus Lane, U.S. Department of Transportation, July 1972, PB-229-015. Available from NTIS.
Cincinnati, Ohio
Final Planning Report:
Cincinnati East Side Demonstration Corridor Program, U.S. Department of Transportation, September 1971.
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Cincinnati East Side Corridor Demonstration Program Final Report, April 1975.
Atlanta, Georgia
Atlanta Urban Corridor Demonstration Program, Phase I (Planning) Recommendations, March 1972, Report No. UCDP-73-1.
Atlanta Urban Corridor Demonstration Program Staggered Work Hours Plan, Technical Report, 1973. (Final documentation of uncompleted study.)
Dallas, Texas
Urban Corridor Demonstration Program for Dallas, Texas, March 1972, Report No. UCDP-73-2.
Spring Creek Demonstration Project, May 1973, Report No. FH-11-7790.
Dayton, Ohio
Urban Corridor Demonstration Program System Planning Report, October 1971, Report No. UCDP-73-7.
Los Angeles, California
Santa Ana Freeway Corridor Study, December 1971, Report No. FH-11-7561.
Santa Ana Freeway Widening — An Evaluation of Freeway Widening and Ramp Control, March 1973, Report No. DOT-FH-11-7786.
Santa Ana Freeway Widening — Safety Evaluation of Widening and Ramp Control, February 1974, Report No. DOT-FH-11-7786 (Supplement).
New Haven, Connecticut
Route 10 Canal Line Corridor, Urban Corridor Demonstration Program, New Haven, Connecticut — Part 1: Narrative and Part 2: Figures, February 1972, Report No. UCDP-73-3.
Minneapolis, Minnesota
Final Planning Report:
I-35 Urban Corridor Demonstration Project: Bus Metered Freeway System, Minneapolis, Minnesota, U.S. Department of Transportation, September 1971.
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Final Report — I-35W Urban Corridor Demonstration Project — August 1975.
Reports, unless otherwise stated, are available from the Department of Transportation, Office of Environmental Affairs, 400 — 7th Street, S.W., Washington, D.C. 20590.

7. **Microsimulation of CBD Traffic Movement**
MA-06-0038
Bus priority alternatives in the central business district, Transportation Systems Center, Kendall Square, Cambridge, MA. Available from TSC.

8. **Guidelines for the Establishment of Subscription Bus Service and Study of Shared Ride Taxi Service**
DC-06-0093
Guidelines on the operation of subscription bus services, Aug. 1974, PB-237-076/AS.
Implementing shared taxicab services: A case study in Arlington, VA, Feb. 1975, Urban Institute.

9. **Transit Service And Fare Innovations**
DC-06-0111, DC-06-0120
"What are we learning from experiments with reduced transit fares?" Working paper 5032-1-1, The Urban Institute, Washington, DC, July 1974.
Report to Congress concerning the demonstration of fare-free mass transportation, July 1975.
Spending transit operating subsidies, Working paper 5032-1-3, Urban Institute, Oct. 1975.
An econometric model of bus transit demand and supply, Working paper 5032-1-4, Urban Institute, Oct. 1975.
Expenditures on transportation by urban households, 1960-61, Working paper 5032-1-2 Urban Institute, Nov. 1974.

10. **Combined Fixed Routes and Demand-Responsive Transit**
AK-06-0001
City of Anchorage demonstration transportation grant, May 1975, PB-245-160.

11. **Development and Evaluation of a Transit System in Developing Urban-Rural Region**
ND-06-0001
Fort Berthold Indian Reservation Bus Demonstration project, Jan. 1974.

12. **Transit System for Disaster Stricken Areas**
PA-06-0028
Manual of Transit Operations in Civil Emergencies, April 1974, PB-234-668.

13. **Personalized Transit Service for Elderly and Handicapped**
FL-06-0007
Transportation of the elderly (TOTE), Apr. 1974, PB-233-593/AS.

14. **Demand-Responsive and Subscription Transit for the Elderly and Handicapped**
RI-06-0006
Operations Manual, final report available from the Office of Transit Planning.

15. **Congestion Pricing Demonstration**
DC-06-0111, DC-06-0120
What can we do about urban traffic congestion? — a pricing approach, working paper 5032-03-1, Urban Institute, Feb. 1975.
Site selection criteria, working paper 5032-3-2, Aug. 1975.
Implementation procedures for pricing congested roads, working paper 5032-3-3, Sept. 1975, KY.

Chapter 7: Office of Transit Management

1. **Transit Operations and Management Systems (TOMS)**
VA-06-0004
Application of Computers to Transit Information Services, vol. I, Nov. 1972, PB-221-748 (Set, vol, I & II, PB-221-747).
Application of Computers to Transit Information Services, Vol. II, Jan. 1973, PB-221-749.
Transit Telephone Information Systems, March 1973, PB-221-459.
Automatic Fare Collection, Oct. 1972, PB-221-448.
Vehicle Scheduling and Driver Run Cutting, RUCUS Package Overview, May 1973, PB-222-675.
SIMS Overview; Service, Inventory and Maintenance System.

2. **Transit Marketing Project**
IT-06-0078/MD-06-0021
Available from Office of Transit Management, Transit Marketing Division: Introduction to Transit Marketing, Transit Marketing Proceedings, Transit Marketing Handbook — Vol. I, User Information Aids, Vol. II, Marketing Functions.

3. **Transit User Information Aids and Dissemination Techniques**
IT-06-0098
Final report is User Information Aids, vol. I, of the Transit Marketing Handbook (see Transit Marketing Project, IT-06-0078/MD-06-0021).

4. **Marketing Functions in Transit Management Organization Structures**
IT-06-0099
Final report is Marketing Functions, vol. II, of the Transit Marketing Handbook (see Transit Marketing Project, IT-06-0078/MD-06-0021).

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 microfich 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 and Development, Transit Planning*, and Transit Management 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 Transit Management. 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 Transit Management, Transit Research Information Center, 2100 Second Street, SW., Room 6412, Washington, D.C. 20590.

*The Office of Transit Planning sponsors research and demonstration projects and also makes grants to municipalities for detailed planning studies, or "Technical Studies". The final reports of both the projects and the technical studies are abstracted and indexed in this publication.

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 two magazines published by the Department of Transportation (DOT) and available from the Superintendent of Documents. One is entitled *Transportation USA* and the other is *Highway and Urban Mass Transportation* which is jointly published by UMTA and the Federal Highway Administration.

Those who wish to receive press releases and the FHWA/UMTA magazine 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 business 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 95.) 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, D.C. 20590. The Office of Civil Rights, the Office of Transit Management, two Divisions of the Office of Administration and the Office of Research and Development are located at 2100 Second Street, SW, Washington, D.C. 20590.

The Office of the Secretary of Transportation and the Department library are located at 400 7th Street SW, Washington, D.C. 20590.

MAIL ORDER TO:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road
Springfield, Va. 22161

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Telephone (703) 321-8543

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Organization _____

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☐ Send me an application for an NTIS deposit account.

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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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		Paper Copy	Micro-fiche	Other (specify)		
					Enter Grand Total	$

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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 ☐ 1600 BPI (odd parity) ☐ 800 BPI ☐ 7 track ☐ 200 BPI ☐ 556 BPI ☐ 800 BPI ☐ odd parity ☐ even parity

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Originator (Give specific laboratory, or division and location.)		Personal Author
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FORM NTIS-173 (REV. 2-75) GPO 886-993 USCOMM-DC 6367-P75

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)

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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 _____
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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	$

FORM NTIS-173 (REV. 2-75)

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

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TITLE #2

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TITLE #3

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TITLE #5

Sponsor's Series #	Contract or Grant Number of Report	Date Published
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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 886-993 USCOMM-DC 6367-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 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 contraints 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

*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.

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.

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 relevent, 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 Research and Development
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.

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