IMPROVING URBAN MOBILITY

A DIRECTORY OF RESEARCH, DEVELOPMENT AND DEMONSTRATION PROJECTS IN PUBLIC TRANSPORTATION

JUNE 30, 1973

DEPARTMENT OF TRANSPORTATION

URBAN MASS TRANSPORTATION ADMINISTRATION

Washington, D.C. 20590

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INTRODUCTION

This publication contains descriptions of current research, development and demonstration projects sponsored and funded by the Urban Mass Transportation Administration (UMTA) of the Department of Transportation.

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." The activity includes "the development, testing and demonstration of new facilities, equipment, techniques and methods." The projects may be conducted in-house, by grant, or by contract (including working agreements with other Federal departments and agencies).

These RD&D projects are generally initiated and planned by UMTA and implemented by means of contracts with private firms, grants to public bodies and working agreements with other Federal agencies. Analytical and planning tasks are usually performed by the UMTA staff.

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 activities conducted under the Act cited above. The principle means of reporting is to publish annually a compilation of reports on the status of projects.

The volume dated June 30, 1972, constituted a historical record of all projects funded under the Act cited above as well as projects funded earlier under authorization of the Housing Act of 1961. It is available from NTIS (see second paragraph on page ii), PB-213-228, $6.00.

The compilation at hand is a supplement to last year's comprehensive volume, containing updated descriptions of those projects which were active in the fiscal year 1973 (including, of course, all that were initiated or completed in that period). Copies of this volume are available from the U.S. Superintendent of Documents.

Most of the completed projects included in this volume have reports already published, or in process of publication. The Urban Mass Transportation Administration does not distribute these reports. They are available from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22151. Reports are ordered directly from the NTIS by the order number indicated in the summary. 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 should be addressed to NTIS, not to the Urban Mass Transportation Administration. Payment must accompany orders. For the convenience of those wishing to order, prices are indicated in this compilation. These prices, which vary in proportion to the size of the document, are for copies on paper with eye-legible text ("hard copy"). All reports in NTIS are also made available on microfiche with a uniform price of $1.45 each. Payment is acceptable in cash, by check, postal money order, 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.

In October 1972, UMTA released the first compilation of "Urban Mass Transportation Abstracts". This volume contains 466 descriptive abstracts of reports sponsored by UMTA which are available from the National Technical Information Service, along with complete indexes by author, title, project number and subject. These reports are the product of not only UMTA's RD&D program, but its Technical Studies and University Research and Training programs as well. "Urban Mass Transportation Abstracts" is available from NTIS (PB-213-212; $6), and will be updated with semi-annual supplements as new reports become available.

The dates under "Schedule" in the project descriptions below usually indicate the period from approval by the Administrator to receipt of a draft of the final report. The "Funding" represents, except when otherwise indicated, Federal money made available by UMTA; the sums are cumulative to June 30, 1973. "Recent Progress", except in few cases, refers to activity up to June 30, 1973, the cut-off date for the entire compilation. The project numbering scheme was changed in FY 72; conversion tables from "old" to "new" project numbers are provided in the June 30, 1972, compilation, but are not repeated in this supplement.

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UMTA'S RD&D PROGRAM

The purpose of UMTA's RD&D program is to provide information about a wide spectrum of possible improvements to urban mass transportation systems which communities can use in selecting the best way to deal with their particular transportation requirements. The information is intended to provide guidance to communities in tailoring capital grants to suite local needs and should enable local authorities to achieve improvements in transit service through direct local action.

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.

The objectives of the UMTA RD&D projects are improvements that will benefit these impact groups in one or more of the following ways:

1. Improving accessibility of public transportation, by such measures as:

    a. Extending route coverage to all potential users;
    b. Making it easier to reach most urban destinations by public transportation;
    c. Improving routes and schedules to provide more frequent service, reduced waiting and fewer transfers;
    d. Providing better information on routes and schedules for users;
    e. Increasing flexibility in adjusting routes and schedules to changes in passenger demand, and
    f. Increasing choice among modes for a wider range of available service.

2. Providing higher quality transportation service to passengers, by:

    a. Reducing total (door-to-door) trip time;
    b. Providing more comfortable rides;
    c. Maintaining safe, dependable service;
    d. Providing protection from bad weather, criminal actions and hazards at transit stops and transfer points;
    e. Easing the processes of boarding, alighting and transfer;
    f. Simplifying fare computation and collection;
    g. Providing for easier use by the elderly and handicapped, and
    h. Providing more aesthetically pleasing interiors in vehicles and reducing the incidence and effects of vandalism.

3. Improving economic performance of public transportation systems by:

    a. Maintaining lower fares;
    b. Reducing costs of equipment, facilities and rights of way;
    c. Modernizing equipment and facilities to reduce operating and maintenance costs;
    d. Improving management and effective utilization of public transit equipment, manpower and facilities, and
    e. Improving control of costs and revenues.

4. Minimizing adverse impacts of public transportation on the urban environment by:

    a. Reducing air pollution;
    b. Reducing congestion in major corridors and activity centers;
    c. Reducing noise levels;
    d. Improving aesthetic quality of public transportation equipment and facilities;
    e. Avoiding or reducing spatial disruption and barriers within urban areas, and
    f. Improving coordination of transportation system planning and development to foster more equitable distribution of transportation services and desired patterns of urban development and land use.

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 RD&D effort, therefore, addresses key problems common to many cities in such a way that the solutions found can be adapted to unique local circumstances. UMTA supports RD&D in both hardware and software; in conventional modes of urban mass transportation (bus and rail) as well as in unconventional new systems; in intermodal integration projects that will tie together transportation facilities and related institutional arrangements into one coordinated system; in systems analysis and planning to guide the RD&D effort to meet the special needs of transportation-dependent groups.

UMTA manages its RD&D projects according to the mode of urban mass transportation involved, and, for convenience, arranges them in the following categories:

Bus Transit

Bus Vehicle Technology
Bus Propulsion

Rail Transit

Urban Rapid Rail Vehicles and Systems
Commuter Rail Vehicles and Systems
Urban Light Rail Vehicles and Systems
Rail Supporting Technology

New Systems

Advanced Transit Planning Methods
PRT Technology Development
PRT System Development and Demonstration
Morgantown PRT Demonstration
Demand-Responsive Transit Systems
Dual-Mode Transit Systems

Systems Analysis

RD&D Rational Analytical Studies
Experimental Design

Planning Research

Service Development

Transit Operations and Management

Transit Research Information
Transit Operations
Transit Management
Intermodal Integration
Transit Safety

The projects in this compilation are grouped in accordance with these categories, each group preceded by a brief introduction intended to provide a context within which individual projects can be seen in proper relationship to others.

BUS TRANSIT

Bus Technology

UMTA's RD&D in bus transit involves "bus technology" (i.e., vehicles and their propulsion) and methods of operating them. Projects concerned with the latter are described in the section entitled "Transit Operations and Management" (pp. 129 to 178).

The objectives of UMTA's bus technology program are: to produce improvements for incorporation in existing buses; to consolidate available technology in modern 50-passenger transit buses, and to define major advances for buses of the future.

Specific improvements sought include: reduction of smoke, odor, noise and vibration; improved passenger comfort, safety and convenience; accommodations to permit wider use by the elderly and handicapped, and lower maintenance costs.

The design of currently available transit buses has not changed fundamentally since 1959. With UMTA capital grant assistance, many cities are buying new buses to replace aging fleets and to extend public transportation service. In addition, many cities are planning to deal with air pollution problems by curtailing automobile operation in congested areas and relying more heavily on bus transportation. UMTA's RD&D in bus technology is intended to permit meeting the demand for new buses with up-to-date technology rather than limiting communities to continued reliance on vehicles of obsolete design.

UMTA will continue to test and evaluate modifications of existing buses to make them quieter and less polluting. Prototypes of three different designs of modern transit buses will be demonstrated and the best of these (or a combination of their best features) will be incorporated into a new transit bus for the intermediate future. United States requirements for high capacity buses will be established in early 1974.

Project: Prototype of a Modern 50-Passenger Transit Bus (TRANSBUS)

I. Description

A fundamental objective of UMTA is to lure motorists from their private autos, in commuter and urban travel, and induce them to use mass transit vehicles instead. Persuasion depends heavily upon the attractiveness and improved characteristics of the vehicle. Modern technology makes it possible to design and manufacture large buses which are more comfortable for riders than presently available buses.

Although the two major manufacturers of 50-passenger transit buses have been developing design concepts for new equipment, the economics of the transit industry and the existence of the consent decree against General Motors have mitigated against the development and marketing of a modern 50-passenger transit bus. The market has been extremely small and the deficit position of the industry overall during recent years has not encouraged the introduction of better, more costly, equipment. The present bus design was introduced in 1959 and few significant improvements have been introduced since.

The Transbus program will make more modern buses available to the transit industry by developing prototype 50-passenger vehicles exploiting the best available technology. The improvements sought include: 1) improved comfort and ride quality to make buses more competitive with the private automobile; 2) improved safety for passengers, pedestrians and occupants of other vehicles; 3) reduced maintenance costs and easier maintainability, and 4) specific improvements to facilitate use by the elderly, such as lower floor, lower and fewer steps, more secure interior arrangement, and improved lighting and information display.

II. Schedule

November 1971-February 1975

III. Funding

$26,133

IV. Recent Progress

Prototypes are in final stages of fabrication.

Arrangements are being made to conduct evaluation at independent proving grounds and in four transit properties (see project immediately following).

V. Project Number

IT-06-0025

VI. Contractor

Booz Allen Applied Research

Subcontractors

Rohr, AM General, General Motors

VII. Report(s)

Forecast of Urban 40-Foot Coach Demand, 1972-1990, December 1972, PB-222-684, $3.00.

Project: Tour of Transbus Models

I. Description

Under the Transbus program (IT-06-0025) UMTA is developing the design of an improved city transit bus. It is designed to a performance specification which is intended to exploit the present state-of-the-art. Three major vehicle manufacturers are participating by building prototype vehicles of their own designs:

American Motors General Corporation
General Motors Corporation
Rohr Industries

The first prototype buses are to be delivered in late fall, 1973, and, after an extensive test program, a selection of the best vehicle design will be made. It is planned that a production version of this basic design will become the much-needed new transit bus for the transit industry.

If it is to be successfully received and accepted by the transit industry so that they will buy it under the UMTA Capital Grant program, the industry must be informed on the objectives of the program and its progress.

Because of the time constraints and limited availability of prototype vehicles in the Transbus program, it is not possible for each transit company to test or evaluate the prototype buses on its system and, thus, most will not have first-hand information on the vehicles nor have participated directly in the Transbus development program.

The use of detailed scale models of the prototype buses in a display touring the cities of the United States has been selected as the most satisfactory and effective alternative.

Two information displays have been constructed employing detailed, high quality models of each of the competing Transbus prototypes. They have been on tour since May 1973 under ATA auspices and coordinations and under the sponsorship locally of interested transit companies. The transit company at each site assists in making local arrangements for the display setup, publicity and security.

II. Schedule

March-November 1973

III. Funding

$96,800

IV. Recent Progress

East and West tours began in Providence, Rhode Island, and Baltimore, Maryland, respectively, during May and had visited 23 cities by July.

V. Project Number

DC-06-0086

VI. Contractor

American Transit Association, Washington, D. C.

VII. Report(s)

Summary report to UMTA due January 1974.

Project: High Capacity Bus

I. Description

Bus mass transit is a labor intensive industry and a system's overall driver requirements are largely determined by peak hour demands. If high capacity buses can be used to increase productivity, the public can be provided better service without corresponding increase in driver costs. This project will determine the requirements of the United States transit industry for a high capacity bus (nominally 75 or more passengers) and define the operating limitations, both physical and legal, which are applicable. A performance specification and conceptual design will be developed to meet the requirements of the United States industry.

It is known that such equipment is extensively used in other countries, but the United States transit industry has almost no modern day experience. The project is oriented to lean heavily on the European experience.

Seven properties have formed a consortium to review and comment on the project as it progresses and have provided a local cash contribution of $15,000 each.

II. Schedule

August 1972-January 1974

III. Funding

Federal	$226,000
Non-Federal	105,000

IV. Recent Progress

The consortium group visited Europe during May 14-26 to familiarize themselves with available high-capacity equipment and the way it is being used in transit service.

V. Project Number

PA-06-0007

VI. Contractor

National Transportation Center, Pittsburgh, Pennsylvania

VI. Contractor (cont.)

Third Party Contractors

Booz Allen Applied Research, Bethesda, Maryland
Daniel, Mann, Johnson and Mendenhall, Los Angeles, Calif.
A. Alan Townsin, Birmingham, England
Gesellschaft fur Verkehrsberatung und Verfahrenstechniken mbH (GVV), Hamburg, Germany

VII. Report(s)

Due in the spring of 1974.

Project: Urban Vehicle Design Competition

I. Description

UMTA contributed $5,000 to a $41,000 grant made by DOT to a competition of engineering students in producing a prototype urban vehicle with low pollution output, high safety characteristics, low consumption of fuel and good handling performance. The competition, managed and conducted by Student Competitions on Relevant Engineering, Inc. (SCORE), was a safety-oriented successor to the Clean Air Car Race of 1970. Eighty-four colleges and universities participated.

The vehicles were tested in August 1972 and a final report on the best performing vehicles and the most innovative features has been submitted.

II. Schedule

February 1972-January 1973

III. Funding 1972

UMTA	$ 5,000
Other DOT	36,000

IV. Recent Progress

Report completed. See VII below.

V. Project Number

DC-06-0025

VI. Contractor

Student Competitions on Relevant Engineering (SCORE)

VII. Report(s)

The 1972 Urban Vehicle Design Competition; Final Report. Available from SCORE, Inc., 105 Anderson Hall, Tufts University, Medford, Massachusetts 02155. $5.00.

Project: External Combustion Engines (ECE) in Transit Operations

I. Description

The objective of this completed project was to evaluate the technical feasibility and public acceptance of the ECE as a low-emission, quiet propulsion system using urban buses as demonstration vehicles. Emphasis was placed on an immediate demonstration of inherent potential rather than early realization or technical perfection. All three contractors of the project chose Rankine cycle engines to exemplify the ECE because technology of this cycle was more readily available than that of others.

Three different steam engines using water as working fluid, two reciprocating versions and one turbine version, were installed in 40-foot urban transit buses by three different contractors. The three steam buses were tested and demonstrated in Oakland, San Francisco and Los Angeles covering a total of over 8,300 road miles, including 800 miles in passenger service. All three buses produced emission levels below 1975 California emission standards. Exterior noise levels were below those of the quietest diesels.

Riders interviewed on the steam buses indicated a high degree of user acceptance. Fuel consumption, however, was unacceptably high: in the order of 2-3 times that of corresponding diesels.

II. Schedule

February 1969-March 1973 (Completed)

III. Funding

UMTA	$2,294,525
Local	5,667,949
Total	$7,962,474

IV. Recent Progress

Testing completed on September 30, 1972.

V. Project Number

CA-06-0031

VI. Contractors and Subcontractors

California Legislature -- Office of Research
Scientific Analysis Corp. -- San Francisco, Calif.
International Research and Technology Corp. -- Washington, D. C.

VI. Contractors and Subcontractors (cont.)

Engine Subcontractors:

1. William M. Brobeck & Associates -- Berkeley, California
2. Lear Motors Corp. -- Reno, Nevada
3. Steam Power Systems -- San Diego, California

VII. Report(s)

California Steam Bus Project Final Report, January 1973, PB-217-508, $3.00.

The California Steam Bus Project--Technical Evaluation, January 1973, PB-218-139, $3.00.

Goals and Guidelines: Rankine Cycle Propulsion Systems for Application to Urban Buses and Other Heavy-Duty Vehicles, December 1, 1972, PB-218-143, $3.00.

California Steam Bus Project, 1973, PB-217-509, $3.00.

California Steam Bus Project--Project Report on Community Attitude Surveys, Phase I, 1973, PB-217-510, $4.50.

California Steam Bus Project Final Report--Surveys, 1973, PB-217-511, $3.75.

Steam Bus Symposium Proceedings, November 17, 1971, PB-212-535, $3.00.

Project: Dallas Rankine Cycle (Toluol) Bus Power Plant

I. Description

Of the many candidate systems for low pollution external combustion power plants, one of the simplest and best understood is the Rankine cycle. This project was designed to determine the feasibility of applying Rankine cycle to transit bus propulsion.

The Dallas project together with the related California Steam Bus Project provided a comparison of four different engine configurations, two of which had reciprocating expanders (engines) using water and two had turbine expanders; the Dallas project was based on a turbine using an organic working fluid, while the three California engines were based on water as the working fluid.

A Rankine cycle engine propulsion system using toluol as the working fluid was installed in a city bus. The modification resulted in reduced air pollution, greater passenger comfort and reduced noise. The bus was operated experimentally and EPA tested its emissions.

II. Schedule

February 1969-September 1973

III. Funding

$914,000

IV. Recent Progress

All project test work completed on April 13, 1973. EPA-Ann Arbor tests confirmability to meet 1975 emission requirements. Fuel economy significantly inferior when compared with Otto cycle. Preliminary final report received in June 1973.

V. Project Number

TX-06-0004

VI. Contractor

Dallas Public Transit Board of the City of Dallas, Texas

VI. Contractor (cont.)

Third Party Contractors

LTV Aerospace Corporation
Dallas, Texas

Sundstrand Corporation — Subcontractor to LTV
Rockford, Illinois

VII. Report(s)

Due in Autumn 1973.

Project: Bus Engine Conversion to Liquid Natural Gas Fuel

I. Description

This project represents one of three approaches toward solving the problem of pollution from bus engines (the other two being: 1) absorption of emission by additional hardware, and 2) different engine configurations such as Rankine cycle or gas turbine).

This project will determine the technical feasibility of converting the General Motors two-stroke cycle diesel engine to operation on liquid natural gas (LNG); it will then measure the emission characteristics of the converted engine.

If the LNG conversion is successful and achieves significant emission reductions, it can be applied on a backfit basis to a majority of the engines in the nation's existing bus fleets because this engine is almost universally used in the newer equipment which has been purchased by the transit industry.

II. Schedule

March 1972-April 1974

III. Funding

$486,000

IV. Recent Progress

Phase I program objectives have not been met, resulting in major program revisions. The program objective of actual bus installation has given way to continued research on engine conversion to LNG, and performance objectives. Two ignition configurations are being evaluated on cylinder RIG test equipment.

V. Project Number

PA-06-0005

VI. Contractor

National Transportation Center

Third Party Contractors

Southwest Research Institute, San Antonio, Texas
Apt, Bramer, Conrad and Associates, Pittsburgh, Pennsylvania

VII. Report(s)

Project: Sodium-Sulfur Battery Development

I. Description

The sodium-sulfur couple was selected from among several other "exotic" couples as the one most amenable to development as a low cost, high power and high energy density cell in the near term.

Dow is seeking to improve cell performance through research on the major reactants, physical configuration of the cell, and investigation of optimal current collection methods.

II. Schedule

December 1970-December 1973

III. Funding

Jointly funded by UMTA, U.S. Navy, U.S. Army and EPA; total cost of $170,000.

IV. Recent Progress

Fiber-cutting and fiber-sealing operations have been successfully combined.

Tubesheet fabrication is now done on a machine and acceptance is running near 80 percent.

Fiber breakage near tubesheet major unsolved problem. Small size laboratory cell performance and life meet contract requirements, but contract is being extended on a no-additional-cost basis until solution to fiber breakage problem near tubesheet allows successful fabrication of larger cells.

Cells with a capacity of 8 watt-hours to be delivered during 4th Quarter 1973.

V. Project Number

RI-06-0004

VI. Contractors

Naval Underwater Systems Center, Newport, R.I.
Dow Chemical Company, Walnut Creek, California

VII. Report(s)

Project: Bus Engine Anti-Pollution Kits

I. Description

Two projects are involved, both with the same objective: to test the General Motors' Environmental Project (EIP) Kit installed on buses and operated in transit service. The factors measured by the tests were emissions, noise, vibration and suitability of the installation for normal transit operations and maintenance. For one demonstration, GMC installed the kits at the factory on four new buses and delivered the buses to San Francisco for transit service. In the other project, GMC retrofitted the kits to five transit buses already in use. Tests were conducted during 1 year of transit operations, after which the results were analyzed and reported. The EIP kit was also tested (requested by UMTA, funded by HEW) at the Southwest Research Institute in San Antonio, Texas.

II. Schedule

February 1970 to December 1972 (completed project)

III. Funding

	CA-06-0034	IT-06-0022
Federal:	$60,000	$164,936
Non-Federal:	30,000	18,500
Total:	$90,000	$183,436

IV. Recent Progress

Completed projects.

V. Project Number(s)

CA-06-0034
IT-06-0022

VI. Contractors or Grantees

Public Utilities Commission
City and County of San Francisco
287 City Hall
San Francisco, California 94102

Executive Director
Washington Metropolitan Area
Transit Authority
950 L'Enfant Plaza, SW.
Washington, D. C. 20024

VII. Report(s)

Evaluation of City Transit Bus EIP Kits to Reduce Engine Smoke, Odor, Noxious Emission and Noise, August 1971, PB-204-813, $3.00.

Transit Bus Noise Control Feasibility Study, December 1972, PB-220-809, $4.85.

Project: Catalytic Anti-Pollution Device for Bus Diesel Engines

I. Description

As stated elsewhere, there are three possible approaches to meeting future emission standards for transit buses: change to different engine concepts such as a Rankine cycle, modifications of diesel engines, or absorption of emissions by additional hardware. Other projects address the first two, the catalytic muffler uses the latter approach.

Until a satisfactory solution is reached, it is prudent to pursue alternatives which show promise. An additional advantage of the catalytic muffler is its application to backfit installation in present equipment.

The purpose of this project is to develop and demonstrate a diesel exhaust emission control system which will eliminate smoke and odor, and substantially reduce NOx and noise. Under the grant, the Southern California Rapid Transit District (SCRTD) funded a private research laboratory (Atomics International Labs of North American Rockwell at Canoga Park, California) to conduct development and evaluation tests of an emission control system. Specifically, the system entails application of a molten alkali carbonate exhaust gas scrubber to a bus engine. After the development and installation of such a system, on a typical SCRTD transit bus, dynamometer tests will be run. Then, to determine the effectiveness and practicality of such an installation the bus will be operated over normal SCRTD bus routes. Information will then be obtained relating the use of such an emission control system to the installation and operating costs, and on the overall effectiveness of such a system.

II. Schedule

January 1971-August 1973

III. Funding

$477,000

IV. Recent Progress

Dynamometer and installed tests have been completed. The results did not meet program objective for NOx removal. UMTA is now assessing the value of catalytic mufflers for reducing diesel emissions.

V. Project Number

CA-06-0035

VI. Contractor

Southern California Rapid Transit District (SCRTD)

Third Party Contractor:

Atomics International, a Division of North American Rockwell, Canoga Park, California

VII. Report(s)

RAIL TRANSIT

UMTA's activities in urban rail transportation RD&D involve development, testing and evaluation of new vehicle systems as well as continuing efforts to develop supporting technology and test facilities.

The first vehicles produced under the Urban Rapid Rail Vehicles and Systems Program were delivered in FY 1973. These "State-of-the-Art Cars" (SOAC) are now being tested and demonstrated to evaluate their suitability for cities planning new or extended rail rapid transit systems. They represent a baseline of what is possible to accomplish with currently available technology. Meanwhile, design and development of even more innovative Advanced Concept Train (ACT) rapid rail cars has been undertaken, to be followed by fabrication and testing of this new generation of urban rail technology. Demonstrations of improved commuter rail and light rail vehicles and service also have been undertaken during FY 1973.

In rail supporting technology, UMTA has completed a Rail Transit Test Track at the Pueblo (Colorado) High Speed Ground Test Center. A Rail Dynamics Laboratory, supported jointly by UMTA and the Federal Railroad Administration (FRA), is also under construction at the Center. With the availability of these important new facilities, a comprehensive program of research and testing has begun to address key problems in existing rail systems and to evaluate thoroughly the extent to which new urban rail systems meet performance specifications.

UMTA's rail transit RD&D efforts are categorized as follows:

Urban rapid rail vehicles and systems;
Commuter rail vehicles and systems;
Urban light rail vehicles and systems, and
Rail supporting technology.

Urban Rapid Rail Vehicles and Systems

Currently, there are seven United States cities which have rail rapid transit systems in operation or under construction. These systems carry the bulk of mass transit passengers in those cities. Together with commuter railroads, urban rail systems carry over two 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 or acquiring new rolling stock offers opportunities to apply advanced technology in producing them. 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 concept trains involving innovative concepts. Design and hardware specifications for these new cars will be made available to the cities for use in replacing old or acquiring new rolling stock.

By providing rail car builders and transit operators with tested and proved prototypes, UMTA will make available to our ultimate customers, the riders, more comfortable and more esthetically pleasing cars to complement new routes and services 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. The community at large 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, partially financed by an UMTA grant. Demonstration and monitoring of these cars have suggested improvements for the BART revenue service fleet and have generated data for development of UMTA's State-of-the-Art Cars (SOAC) and Advanced Concept Trains (ACT).

UMTA is utilizing the services of a systems manager contractor, Boeing-Vertol, to develop advanced cars. Two new State-of-the-Art Cars (SOAC) have been completed by the St. Louis Car Division of General Steel Industries. These cars incorporate the best existing technology (with BART as the baseline) and will be demonstrated in New York, Boston, Cleveland, Chicago and Philadelphia. SOAC features a DC chopper control propulsion system by Garrett AiResearch, new air ride trucks by General Steel, and styling by Sundberg-Ferar.

Other advanced propulsion systems are also being developed and tested as a part of the rapid rail RD&D program. UMTA has been instrumental in the demonstration and evaluation of AC motor propulsion. Three Cleveland Transit System "Airporter" cars equipped with a new AC propulsion and control system are in revenue service. The new cars also have been restyled to reflect the latest in passenger amenities.

The AC system was developed by the Westinghouse Air Brake Company (WABCO). It features a solid state control system, inverters, and AC traction motors. The stepless control provides jerk-free acceleration and deceleration. The AC motors promise to save money on maintenance when compared to DC systems requiring commutators and brushers. The solid state control system is also capable of power regeneration to reduce overall system power costs.

The interior redesign is by Peter Muller-Munk and features bucket seats, carpeting, indirect lighting and clean graphics.

Passengers will be surveyed for their reaction to the better ride and new interiors. A technical evaluation will determine the performance and economic characteristics of the AC drive. The demonstration will continue through 1973.

In another UMTA project, the Garrett Energy Storage Propulsion System will be tested on two New York City Transit Authority rapid transit cars. Under this concept, braking energy usually dissipated as heat will be stored in a flywheel. During acceleration, the flywheel energy can be used to reduce peak power requirements. This project is expected to reduce propulsion energy requirements by perhaps 20%-50% while reducing the waste heat now dissipated in subway tunnels. Thus, additional power requirements imposed by air conditioning and 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 line power failure. Thus, passengers could be unloaded safely in case of emergency.

As a long-range goal, an Advanced Concept Train (ACT) will be produced. The ACT vehicles will 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 will be capable of operating over the same transit lines as the SOAC cars. The ACT cars will be derived from a design and specification development competition for four alternative concepts representative of the next generation of rapid rail cars.

Project: Urban Rapid Rail Vehicles and Systems Program

I. Description

Ten prototype cars for San Francisco's Bay Area Rapid Transit (BART) have been engineered, produced, tested and evaluated. These cars have formed the basis for subsequent production of BART cars. The systems manager has reviewed the demonstration and monitored the progress of the BART prototype cars and early revenue service. He has recommended methods for incorporation of improvements appropriate to the development of State-of-the-Art and Advanced Concept Train Cars.

Two new State-of-the-Art Cars (SOAC) have been built. These cars incorporate the best in existing technology and will be demonstrated in New York, Boston, Cleveland, Chicago and Philadelphia. The cars' primary goals are passenger convenience and operating efficiency. UMTA's systems manager is conducting technical tests of these cars and will direct the operational demonstration of these cars in the five cities.

As a long-range goal, an Advanced Concept Train (ACT) will be produced. 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 new vehicles will be designed to permit efficient and economic dynamic substitutions of improved subsystems in complete modules. The cars, capable of operating over the same transit lines as the SOAC cars, will be built under the direction of the systems manager. After evaluation of operational test results, a complete train of ACT cars will be built and demonstrated in revenue service. UMTA's systems manager has conducted a design and specification development competition for alternate concepts representative of the next generation of rapid rail cars. The best design proposal will be selected for conversion to prototype hardware. Advanced subsystems will be installed and the cars demonstrated in five cities.

II. Schedule

June 1971-June 1975

III. Funding

FY 71	FY 72	FY 73	
$ 3,000,000	$ 2,487,000	$ 2,610,000	(continuing project; incremental funding)

IV. Recent Progress

Design work on ACT-1 competition completed by GE, Rohr, LTV and Garrett. Proposals evaluated. Recommendations made to UMTA. UMTA will proceed with two prototype contracts.

SOAC cars delivered to HSGTC. Rollout ceremonies successfully accomplished on October 12. Cars are undergoing extensive testing at HSGTC prior to five-city test and evaluation.

V. Project Number

IT-06-0026

VI. Contractor

Boeing-Vertol, Philadelphia, Pennsylvania

Subcontractors

SOAC: St. Louis Car Division of General Steel Industries, St. Louis, Missouri
Garrett AiResearch, Torrance, California

ACT-1: GE, Erie, Pennsylvania
Rohr, Chula Vista, California
LTV, Dallas, Texas
Garrett AiResearch, Torrance, California

VII. Report(s)

Urban Rapid Rail Vehicle and System Program, July 1973, PB-224-141, $3.50.

Project: Automated Fare Collection Equipment

I. Description

Automatic Fare Collection systems vary from the simplest coin-operated turnstile to complex electronic assemblies capable of computing fares and handling magnetically coded tickets. Rapid transit fares are categorized in three basic groups: (1) flat fare, (2) zoned fare and (3) graduated fare. On most rapid systems, however, the fare is a flat rate. The flat rate fare is usually independent of the distance traveled. Some transit systems have zones to approximate an equitable charge. For multi-route transit systems covering large distances, neither the flat fare nor the zoned fare has been consistently satisfactory. These collection methods often fail to fully recover operating costs, do not hold fare collection expense to a small percentage of total operating expense, and are inconvenient to the passengers and the operators. Both flat fare and zoned fare collection systems are expensive to operate, depend on slow and inefficient manual methods, and are notably susceptible to abuse by some passengers.

Prior to the initiation of this project, BART conducted studies to determine foreseeable problems if a graduated fare system were to be established. Out of these studies certain basic criteria were defined which established the characteristics of a satisfactory graduated fare type system. These criteria were used as the basis for this project, which consisted of two basic phases: (1) BART solicited proposals and awarded engineering design contracts to three manufacturing firms to produce prototype equipment; (2) contracts were awarded to manufacture, test and demonstrate three different systems. The three systems produced about the same end result, although concepts and hardware differed significantly.

Based on the results of laboratory and other equipment testing under simulated operating conditions, BART's consultant prepared a performance specification and BART called for competitive bids for the production of fare collection equipment. Ultimately, a contract was awarded for production and installation at all BART stations.

II. Schedule

March 1965-September 1973

III. Funding

Federal:	$1,133,333
Local:	566,667
Total:	$1,700,000

IV. Recent Progress

The project is completed. IBM was selected to build and install an automatic fare collection system for BART. Revenue service began on September 11, 1972. The performance of the fare collection system has been monitored and will be evaluated.

V. Project Number

CA-06-0023

VI. Contractor

BART; San Francisco

Third Party Contractors:

IBM
Data Systems Division of Litton Industries
GE
Joint Venture of Control Data Corporation and FMC Corporation

VII. Report(s)

Automatic Fare Collection; Final Report, 1970, PB-189-148, $3.00.

Automatic Fare Collection; Supplementary Report, 1973.

Project: Test of 10 Prototype Transit Cars, San Francisco, California

I. Description

Since the Bay Area Rapid Transit (BART) System was the first large-scale completely new rapid transit system to be built in the United States in 30 years, the BART management decided that a thorough prototype vehicle test and debugging program was necessary to assure that production run cars would meet specifications. Accordingly, under this project the first 10 prototype cars of the System were produced, debugged and tested. By systematic test and evaluation, optimization and integration of the many new and sophisticated systems included in the vehicle design were realized, thus enabling the car builder to maximize economies in production and ensure reliability of operation. This program is also a prototype that other transit operators will be able to use to test new cars before they go into revenue service. As a result of this prototype program, modifications and improvements have been incorporated into the BART production cars. Problems which have been corrected are: motor flashover, motor coupling, and hydraulic brake problems; additional noise control measures have been taken.

II. Schedule

March 1969-August 1972

III. Funding

Federal:	$5,000,000
Local:	2,500,000
Total:	$7,500,000

IV. Recent Progress

Project completed.

V. Project Number

CA-06-0032

VI. Contractor

BART, San Francisco, California

VII. Report(s)

BART Prototype Car Development Program, Vol. 1, Program Synopsis -- Final Report, March 1973, PB-223-131, $3.75.

BART Prototype Car Development Program, Vol. 2, Program Details -- Final Report, March 1973, PB-223-132, $6.75.

Project: Guideline Specifications for Urban Rail Cars

I. Description

The objective of this project is to provide a useful document in the preparation of the actual procurement specifications, drawings and documentation. In the long range, these guideline specifications are expected to reduce the cost of rail and commuter rail cars while improving the reliability, maintainability and safety of cars manufactured from specifications based on guidelines.

The Urban Mass Transportation Administration provides funds to assist public agencies in purchasing various types of capital equipment used to maintain, improve and expand urban transportation service. To assist these eligible agencies in obtaining equipment best suited for their operations, UMTA has developed a guideline specification format for urban rail transit cars, including both rail rapid transit and commuter rail cars. This format will be used in the preparation of the actual procurement specifications, related drawings and documentation.

The specifications are applicable to these types of equipment as a class and not unique to one design. They cover all significant aspects of the cars, including: the drive system; truck (including suspension and wheels); electrical system; cooling, ventilating and heating; control system; interfaces with external power sources; interface with other cars; interface with track and roadbed; safety requirements; maintenance and operational considerations; car structure; brakes; emergency systems; communication systems; lighting; seating; exits; sound isolating; coupler and draft gear; testing; quality assurance and design, and support and management.

This project combines the original INT-RDC-4 (IT-06-0027), Guideline Specifications for Urban Rapid Transit Cars, and TRD-111 (PA-06-0023), Guideline Specifications for Urban Self-Propelled Commuter Rail Cars.

II. Schedule

December 1970-continuing

III. Funding

Up to June 1973: $43,000

IV. Recent Progress

V. Project Number

IT-06-0027

VI. Contractor

Boeing-Vertol, Philadelphia, Pennsylvania

VII. Report(s)

Guideline Specifications for Urban Rail Cars, March 1973, PB-220-678, $6.

Project: Stored-Energy (Flywheel) Propulsion for Rapid Rail Cars

I. Description

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

The energy storage system works as follows: two conventional R-32 NYCTA transit cars will be equipped with two energy packs each. During the braking process, energy normally dissipated as heat (through 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 will be to reduce peak power demand from the third rail (during acceleration) and waste heat (during braking). A DC chopper system will be 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 on the tracks to the next 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 a walk over railroad tracks and ties in a darkened tunnel.

II. Schedule

June 1971-June 1974

III. Funding

Federal:	$1,264,000
Local:	632,000
Total:	$1,896,000

IV. Recent Progress

Two R-32 cars are now at the Garrett plant in Torrance, California, for retrofit with flywheel stored energy propulsion system. Systems test with first energy storage unit conducted April-May. Installation of energy storage units and minor redesign of certain components June-August.

V. Project Number

NY-06-0006

VI. Contractor

Grantee: Metropolitan Transportation Authority (New York)

Third Party Contractor

Garrett AiResearch Corp., Torrance, California

VII. Report(s)

Project: AC Propulsion System for Rapid Rail Cars

I. Description

All existing rapid transit systems in the United States and Canada utilize propulsion equipment with DC motors and controls. The DC propulsion system is reliable, but costly to maintain. An AC propulsion system offers the alternative of significantly lowering maintenance costs, improving rider quality by smoother acceleration and deceleration, and reducing 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 non-revenue service transit car. This demonstration grant provides funds for a three-car revenue service train to test and evaluate the AC propulsion system. In addition, the interiors of two of the three retrofitted cars have been modernized and passenger surveys will test hypotheses relating to perception of the various improvements.

The test is measuring maintenance cost savings, measuring regeneration of power to assess power saving and studying the compatibility of an AC propulsion system operating in a multiple unit with conventional DC motors.

This AC propulsion system is adaptable for use in any present DC operation. Rapid rail systems are found in the following United States cities: New York, Philadelphia, Chicago, Boston, Cleveland and San Francisco. Construction is underway in Washington.

II. Schedule

June 1971-April 1974

III. Funding

Federal:	$1,274,000
Local:	526,000
Total:	$1,800,000

IV. Recent Progress

A 12-month revenue service demonstration began on January 1, 1973, utilizing three AC propulsion equipped cars and three standard control cars. An experimental design is being implemented by the project evaluator, TRW. WABCO is developing a compatibility package to trainline AC and DC equipped cars.

V. Project Number

OH-06-0006

VI. Contractor

Cleveland Transit System

Third Party Contractors

WABCO, Pittsburgh, Pennsylvania
TRW, Inc., Washington, D. C.

VII. Report(s)

WABCO Data Acquisition System -- AC Propulsion Project, PB-223-898, $4.25.

Project: Dual-Power Gas Turbine/Electric Commuter Rail Cars

I. Description

The project is a logical 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). New York Metropolitan Transportation Authority (MTA) was sufficiently encouraged by GT-2 tests that it funded a prototype design study (GT-3) with the General Electric Company. Feasibility has now been determined. The next step is perhaps the most difficult and certainly the most significant--the development, test and evaluation of revenue service gas-turbine (GT-E) cars.

In order to accomplish the project objective, two 4-car turbine/electric trains will be constructed, one by Garrett, the other by GE.

The MTA and its consultants will implement 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 electrification is justified. Rider reaction will be assessed regarding the comfort of the cars. Other transit authorites, railroad companies, and the public will be given an opportunity to observe and evaluate the cars on a national tour.

The estimated duration of the project is 36 months.

Commuter rail service presently exists in the following United States cities: New York, Chicago, Philadelphia, Boston, Cleveland, San Francisco and, to a lesser extent, in Washington, Pittsburgh and Detroit.

Discussions with the Federal Railroad Administration and AMTRAK will determine if this approach has applicability for inter-city passenger use.

II. Schedule

June 1971-October 1974

III. Funding

Federal:	$ 7,400,000
Local:	7,400,000
Total:	$14,800,000

IV. Recent Progress

All work progressing with no significant problems.

V. Project Number

NY-06-0005

VI. Contractor

Metropolitan Transportation Authority (New York)

Subcontractors

Garrett AiResearch Corp., Torrance, California
General Electric, Erie, Pennsylvania

VII. Report(s)

RAIL TRANSIT

Urban Light Rail Vehicles and Systems

The light rail area presents a particular challenge to UMTA and the transit industry. There has been no development in the United States light rail technology since the PCC car was first produced in 1935. Production of United States light rail vehicles ceased in 1952. Existing streetcar fleets are obsolete and frequently in poor condition. 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 utilizing advances in technology which have been made elsewhere.

The Massachusetts Bay Transportation Authority (MBTA), working with United States transit authorities, developed a standard specification for new light rail vehicles.

Project: Specification for Standard United States Light Rail Vehicles

I. Description

Despite the dormant state of light rail technology in the United States, there are some light rail properties in operation whose owners are committed to retaining and modernizing their systems and are in need of replacement vehicles. 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 utilizing advances in technology which have been made elsewhere. With this in mind, and with UMTA guidance, the Massachusetts Bay Transportation Authority (MBTA) headed the development of a standard specification satisfactory for United States operators considering new light rail vehicles. The basis for the new vehicle was the specification originally developed for the San Francisco Municipal Railway. Additional properties whose requirements were considered include SEPTA, Shaker Heights, Pittsburgh (PAT), State of New Jersey (Newark).

The specification was completed in August 1972 (see under Report(s) below). Its use should result in lower purchase price for new cars and in reduced maintenance costs.

II. Schedule

November 1971-October 1972.

III. Funding

Federal:	$134,000
Local:	29,000
Total:	$163,000

IV. Recent Progress

MBTA and SFMR have initiated the purchase of 230 light rail vehicles utilizing this standard specification.

This project has demonstrated how an R&D project can lead directly to a Capital Grant. It also stimulated both operators and builders to respond with new technology in an area which has been dormant in the United States since the 1930's.

V. Project Number

MA-06-0015

VI. Contractor

Massachusetts Bay Transportation Authority, Boston

Third Party Contractor

Parsons, Brinkerhoff-Tudor-Bechtel, San Francisco, California

VII. Report(s)

Standard Light Rail Vehicle Specification -- Contract Section Revised to Include Addenda 1-4, October 1972, PB-220-747, $3.00.

Standard Light Rail Vehicle Specification -- Technical Section Revised to include Addenda 1-4, October 1972, PB-220-748, $3.00.

Standard Light Rail Vehicle Specification -- Final Report, February 1973, PB-227-773, $3.75.

Rail Supporting Technology

In order to systematically study and advance supporting technology for all kinds of transit systems, the Department of Transportation is building the High Speed Ground Test Center near Pueblo, Colorado. The Center facilitates the testing of all types of track-guided vehicles under precise, controlled conditions. UMTA and the Federal Railroad Administration (FRA) are cooperating in the construction of test track facilities and laboratories for the testing of track, structures and vehicles.

Systems Manager for Rail Supporting Technology is the DOT Transportation Systems Center, Cambridge, Massachusetts.

The R&D Test Program being implemented at Pueblo focuses on the following areas identified by rail transit operators as of primary importance:

(a) Noise

(b) Ride Quality

(c) Reliability and Maintenance

(d) Propulsion, Braking and Power Collection

(e) Fire and Safety

(f) Derailment

The Pueblo site now has a 9-mile electrified Rail Transit Test Track, completed in October 1972.

Already the track has seen activity geared toward the development of a standard vehicle acceptance program. The track is being used to test new vehicles such as the State-of-the-Art Cars (SOAC), Light Rail Vehicles and Advanced Concept Train (ACT), as well as new vehicle innovations such as the Energy Storage Propulsion System.

A joint UMTA-FRA Wheel/Rail Dynamics Laboratory is being constructed at the Pueblo facility. This laboratory will be capable of detailed analysis of the interface between wheels and rails. When completed several years hence, it will be one of the world's most sophisticated facilities for simulating, isolating and analyzing the interaction of wheels and rails. The objective of this analysis is to gain a better understanding of vehicle dynamics, noise generation and adhesion phenomena. This understanding will aid in the design of more comfortable, safe and reliable equipment.

Rail Supporting Technology (cont.)

Future additions to the fixed facilities will include a tight radius loop to investigate the "screech" phenomena often found on rail transit systems, and experimental roadbed configuration including one-piece concrete slab tracks which show promise of reducing maintenance costs, and completion of the Wheel/Rail Dynamics Laboratory.

Other research efforts include a tunneling program designed to emphasize materials handling in urban areas, and development of standards for tunnel sizes. This program fits into the overall DOT tunneling research plan. A program whose goal is the reduction of noise and vibration on urban rail systems is also being formulated.

UMTA is sponsoring the development of an Environmental Control Handbook for Underground Systems. Working with a consortium of leading engineering and research firms, the Transit Development Corporation is developing criteria and methods for designing subway ventilation systems. The Handbook will fill a void in reference material available regarding design of tunnel systems evidenced by ventilation problems encountered in some new systems.

Project: UMTA Test Track at Pueblo

I. Description

UMTA has completed construction of an Urban Rail Transit Test Track at the DOT High Speed Ground Transportation Center in Pueblo, Colorado. This test track is designed for testing and experimentation with urban rapid transit equipment. Designed for 80 mph speeds and electrified with 600 volts DC current from a third rail, the track provides an unparalleled opportunity for research away from the hazards of revenue service operation.

Already operational are the 9.1 mile electrified oval test track, related access spurs and a maintenance building for transit cars.

Temporary power for the track is supplied by a diesel locomotive. The locomotive is able to switch rolling stock and was used in construction of the track, as well as to generate current for the third rail.

The initial test vehicles at Pueblo are two New York City R-42 rapid transit cars. The Transportation Systems Center (UMTA's systems manager for rail supporting technology) has instrumented the cars for analysis of ride quality, noise and vibration. These cars are being used to develop diagnostic test equipment for use by transit properties. Also undergoing comprehensive testing are two State-of-the-Art Cars (SOAC). These cars, built for UMTA by St. Louis Car Division of General Steel under contract to UMTA's systems manager, the Boeing Vertol Co., represent the best available off-the-shelf technology in transit car building.

Other vehicles scheduled for testing at Pueblo include two transit cars equipped with stored energy flywheel propulsion systems, and four light rail pilot cars.

Track diagnostic instrumentation is being developed to measure rail alignment and track geometry while running at operating speed on transit track. The first phase of the program involved the use of actual rail cars specially instrumented to perform these tests. The second phase of the program is developing the instrumentation into portable packages which can be readily transported between test sites and cars.

A Rail Dynamics Laboratory is being built where engineers will perform detailed analysis of the interface between rails and wheels. The objective of these analyses is to gain a better understanding of vehicle dynamics, noise generation and adhesion phenomena. This understanding will aid in the design of more comfortable, safe and reliable equipment.

I. Description (cont.)

The laboratory will contain a simulator/reproducer and hydraulic actuators controllable in 6 degrees of freedom. This equipment will permit the study and isolation of phenomena dealing with the interaction of wheels and rails, such as vibration, noise, hunting, suspension, and track and wheel geometry.

II. Schedule

December 1970-Continuing Project

III. Funding

$16,232,000

IV. Recent Progress

SOAC cars continue to be tested and debugged. Energy storage cars will be tested in early 1974. Rail Dynamics Laboratory under construction.

V. Project Numbers

CO-06-0001
MA-06-0025

VI. Contractors

Transportation Systems Center (Systems Manager), also Federal Railroad Administration and Federal Highway Administration (Region 9 - Denver).

VII. Report(s)

Light Rail Transit Systems -- A Definition and Evaluation, October 1972, PB-213-447, $3.00.

Fifteen-Oh-One to Sixteen-Thirty: Technical and Managerial Lessons From One Experience in Introducing New Technology to Improve Urban Mass Transportation, November 1972, PB-213-448, $3.00.

Urban Rail Supporting Technology Program Fiscal Year 1972 Year End Summary Status Report, April 1973, PB-220-846, $3.00.

Analysis of Rail Vehicle Dynamics in Support of Development of the Wheel Rail Dynamics Research Facility, June 1973, PB-222-654, $5.75.

Project: Environmental Control Handbook for Underground Rapid Transit Systems

I. Description

This project was developed to fill a gap in engineering knowledge relating to subway environmental design. Since the first subway systems were built at the turn of the century, "guesstimation" has been the principal ingredient of subway environmental criteria, analysis and control. Ventilation shafts (including surface property) and station air conditioning represent 8-10% of the total cost of underground subway construction. Not only is there uncertainty in the size, configuration and spacing of vent shafts, but there are also many unknowns about the interaction between vent shafts and other elements of the total underground environmental system such as air flow, heat dissipation and the requirement in new systems of station air conditioning. This project will produce an engineering handbook to provide subway system planners, designers and operators with methods for determining answers to these complex and interrelated problems which are made even more serious by the rapid escalation of subway costs in recent years. Twelve rapid transit properties in the United States and Canada, through the Transit Development Corporation, formulated a detailed 3-1/2-year research program to produce a handbook for environmental control.

II. Schedule

June 1970-March 1974

III. Funding

Federal:	$3,276,414
Local:	177,150
Total:	$3,453,564

IV. Recent Progress

The environmental simulation of a double track subway has been completed. The field validation test program was started.

V. Project Number

DC-06-0010

VI. Contractor

Transit Development Corporation, Washington, D.C.

VI. Contractor (cont.)

Subcontractors

Developmental Sciences, Inc.
Parsons, Brinkerhoff, Quade and Douglas
DeLeuw, Cather & Company
Henry J. Kaiser, Engineers
California Institute of Technology/Jet Propulsion Laboratory

VII. Report(s)

The Handbook will be published in early 1974. The following technical reports were a by-product of the project:

Subway Environmental Survey-Chicago Transit Authority, May 1971, PB-201-875, $3.00.

Research Bibliography Ventilation and Environmental Control in Subway Rapid Transit Systems, March 1971, PB-201-876, $3.00.

Single-Track Subway System Components Subway Environmental Research Project, January 1971, PB-201-877, $3.00.

Proposed Method for Aerodynamic Mathematical Analyses, December 1972, PB-201-878, $3.00.

Development of Basic Mathematical Models for Subway Environmental Simulation, March 1971, PB-201-879, $3.00.

Comments on Wave Compressibility on Subway Vehicle Performance, March 1971, PB-205-876, $3.00.

Preliminary Steady-State Subway Aerodynamic Analysis (Incompressible), May 1971, PB-305-877, $3.00.

Data Acquisition for Vehicles in Confined Spaces (VICS 70) Facility, May 1971, PB-205-878, $3.00.

Theoretical Scaling Laws for Subway Modeling, May 1971, PB-206-779, $3.00.

Application of Scaling Data to Model Tests to Obtain Full-Scale Results, March 1971, PB-201-880, $3.00.

Vent and Station (VST) Facility Design, March 1971, PB-201-881, $3.00.

Dynamics of a Model Vehicle Running on Imperfect Elastic Track, February 1971, PB-201-882, $3.00.

Subway Environmental Survey -- Southeasthern Pennsylvania Transportation Authority, August 1971, PB-206-780, $3.00.

VII. Report(s) (cont.)

Subway Environmental Survey -- Toronto Transit Commission, July 1971, PB-206-848, $6.00.

Vehicles in Confined Spaces (VICS 120) Facility Design, September 1971, PB-203-776, $3.00.

Subway Environmental Survey -- Massachusetts Bay Transportation Authority, September 1971, PB-206-781, $3.00.

Vent and Station Test (VST) Facility -- Vent Shaft Testing, August 1971, PB-207-755, $3.00.

Single-Track Subway Environmental Simulation Model, August 1971, PB-206-895, $3.00.

Subway Environmental Design Criteria, September 1971, PB-206-896, $3.00.

Research Bibliography Ventilation and Environmental Control in Subway Rapid Transit Systems -- Phase I, August 1971, PB-205-996, $3.00.

Physical and Geometrical Data for Subway System Components, September 1971, PB-205-879, $3.00.

Subway Environmental Survey -- Port Authority Transit Corporation (PATCO), October 1971, PB-206-897, $3.00.

Subway Environmental Survey -- Cleveland Transit System, October 1971, PB-206-898, $3.00.

Subway Environmental Survey -- Montreal Urban Community Transit Commission, October 1971, PB-206-782, $6.00.

Subway Environmental Survey -- Port Authority Trans-Hudson Corporation (PATH), October 1971, PB-210-322, $3.00.

Preliminary Wave Analysis of Unsteady Subway Vehicle Aerodynamics, October 1971, PB-208-248, $3.00.

Vent and Station Test (VST) Facility -- Station Testing, October 1971, PB-207-756, $3.00.

Initial Data Acquisition in Vehicles in Confined Spaces (VICS 120) Facility, and Final Results From VICS 120, October 1971, PB-211-031, $3.00.

Summary Report of Activities and Accomplishments of Phase I, October 1971, PB-205-259, $3.00.

VII. Report(s) (cont.)

Subway Environmental Survey -- New York City Transit Authority, December 1971, PB-211-073, $3.00.

Vent and Station Test (VST) Facility -- Chicago Transit Authority Scale Model Vent Shaft Testing, February 1972, PB-212-335, $3.00.

Thermal Behavior of Braking Resistor Grids, January 1973, PB-222-013, $4.50.

Subway Aerodynamic And Thermodynamic Test (SAT) Facility -- Single-Track Aerodynamic Data, August 1972, PB-213-158, $3.00.

Double-Track Aerodynamic Data, October 1972, PB-220-807, $3.00.

Single-Track System Concepts Study, PB-222-055, $7.25.

Vent And Station Test (VST) Facility -- Single And Double Track Station Testing, September 1972, PB-223-189, $6.00.

NEW SYSTEMS

By new systems, UMTA refers to all unconventional modes of urban mass transportation, ranging from personal rapid transit systems, which are intended to provide convenient point-to-point service to small groups of passengers traversing the system network, to high-speed line-haul systems, such as the urban tracked air cushion vehicle, which will be particularly well suited for airport access.

UMTA's general objective in developing and demonstrating new systems is to apply the best of advanced technology to urban mass transportation service. The expected benefits are analogous to those derived by both passengers and building managers from the introduction of automatic high-speed elevators in large buildings: faster, more responsive service without the expense of providing an operator in every car. Most new systems are designed to operate quietly under electric power (avoiding local pollution). Attractive vehicles and structures are proposed to facilitate their assimilation into the urban environment.

UMTA's RD&D effort in new systems includes the following categories:

Advanced Transit Planning Methods
Personal Rapid Transit Technology Development
Personal Rapid Transit System Development and Demonstration
Morgantown Personal Rapid Transit Demonstration
Demand-Responsive Transit Systems
Dual-Mode Transit Systems
Urban Tracked Air-Cushion Vehicle

Advanced Transit Planning

The goal of this program is to create and to disseminate a package of computer-based tools for multimodal urban transportation planning, known as "Urban Transportation Planning System (UTPS)". Planning tools already developed in this program are presently being used by over 100 public and private agencies concerned with the future of urban transportation. Over 1,500 members of the transportation community have reacted very favorably to UTPS and their cooperation with the UTPS researchers and developers gives hope for the early emergence of a planning input which will render transportation decision making more systematic and economical.

In the planning stage, transportation systems are represented parametrically in terms of route alignments, vehicle capacities, headways, delays, station capacities, etc. Effectiveness of a planned system is measured by predicted patronage, costs, benefits, effect on land use, etc. UTPS comprises the most advanced techniques for dealing with these complex factors. Using both computerized and manual approaches to planning, UTPS has been, and is currently, improving transportation planning methodology by incorporating the best available means of quantitative analysis. UTPS planning tools which are being used include 14 computer programs and supporting documentation for network design, demand forecasting and evaluation of multimodal urban transportation systems. These and future products result from a tactic which recognizes the need to:

1. Develop a "sketch planning" tool which will allow a quick and inexpensive preliminary evaluation of long-range transportation plans;

2. Augment traditional planning techniques to analyze multimodal urban transportation alternatives, and

3. Develop a microsimulation tool to assist in the detailed design of activity center networks and terminals.

Complementary support activities necessary to assure optimum utility of UTPS include:

1. Testing of all UTPS computer programs in pilot cities to exemplify their use and certify their correctness;

2. Distribution of UTPS to State and local transportation planners;

3. Enhancement of UTPS in light of knowledge gained in its local application and research and developments results, and

4. Sponsoring of symposia and training sessions for UTPS users.

Advanced Transit Planning (cont.)

UTPS users' enthusiasm is high. Over 300 people have attended the UMTA-sponsored symposia. Approximately half of the 400 applicants received the UTPS training in FY 73.

All of the above results support activities funded by UMTA Technical Studies grants, and will facilitate both the effective generation and efficient evaluation of Capital Grant applications. Due to the crucial need, near-term benefit and wide-spread utility of this program's products, UTPS is an essential link in solving the urban transportation crisis.

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

I. Description

This is one of three major projects comprising a program to create and to enhance the UMTA Transportation Planning System. The goals of the overall program are:

1) To build computer-based tools for multimodal transportation planning.

2) To demonstrate and validate use of tools in two pilot cities.

3) To disseminate tools to local planning agencies.

4) To continually reevaluate and improve the tools as the result of feedback from local communities and R&D results.

The specific objectives of this project are the following:

1) To develop a microsimulation tool for the detailed analysis of public transportation networks.

2) To improve traditional traffic assignment methodology to relate to transit systems.

3) To develop a "sketch planning" tool which will allow a quick and inexpensive preliminary evaluation of the feasibility of proposed multimodal urban transportation systems.

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

The project has three interrelated but distinct work items:

1) The development of an expandible software package of analytical techniques and computerized transportation planning tools, the UMTA Transportation Planning System (UTPS).

2) The design and development of a multimodal transportation sketch planning technique for inclusion in the UTPS.

3) The design and development of a computer microsimulation model for inclusion in the UTPS to assist in the detailed design of public transportation systems.

Upon completion of the above, methodologies and their related software will be disseminated to local transportation planning agencies for their use.

II. Schedule

March 1972-FY 1975

III. Funding

$734,000

IV. Recent Progress

1) Received the draft of manual sketch planning final report in May 1973. Reviewed and returned by UMTA.

2) Received draft of detailed specifications for multimodal sketch planning outline of User's Manual for manual technique software in May 1973.

3) Continued work on extensions to existing capability. Modifications to the UTPS program UMODE and unified network file design are progressing on schedule.

V. Project Number

IT-06-0044

VI. Contractor

Planning Research Corporation, McLean, Virginia

Subcontractors

Alan M. Voorhees and Associates, Inc.
Richard Pratt Associates
Creighton, Hamburg, Inc.
DTM, Inc.

Consultants

Peter Stopher, Cornell University
Earl Ruiter, MIT

VII. Reports

New Systems Requirements Analysis Program, Project Implementation Plan -- Work Item 5: Special Studies, July 1972, PB-214-288, $3.00.

New Systems Requirements Analysis Program, Software Standards -- Part 1, February 1973, PB- - , $.

Modal Choice in a Transportation Network -- A Travel Function and an Algorithm, October 1972, PB- - , $.

VII. Reports (cont.)

New Systems Requirements Analysis Program, UMTA Transportation Planning System (UTPS) -- Sketch Planning Workshop Proceeding, October 1972, PB-214-263, $3.00.

New Systems Requirements Analysis Program, Technical Development Plan, July 1972, PB-218-862, $5.45.

UMTA Transportation Planning System -- Network Development Manual, September 1972, PB-212-930, $3.00.

New Systems Requirements Analysis Program, A Procedure for Long Range Transportation (Sketch) Planning -- Technical Report, July 1973, PB-223-344, $3.00.

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

I. Description

This is one of three major projects comprising a program to create and to enhance the UMTA Transportation Planning System. The goals of the overall program are:

1) To build computer-based tools for multimodal transportation planning.

2) To demonstrate and validate use of tools in two pilot cities.

3) To disseminate tools to local planning agencies.

4) To continually reevaluate and improve the tools as the result of feedback from local communities and R&D results.

The specific objectives of this project are the following:

1) To build computer-based tools for multimodal transportation planning utilizing time-share computer and cathode ray tube technology.

2) To facilitate evaluation of multimodal transportation alternatives in an immediate-response analytical environment.

3) To facilitate transit terminal design.

The project has four interrelated but distinct work items:

1) The development of a set of indicators for use in evaluating existing and proposed transportation systems.

2) The design and development of an interactive transportation sketch planning technique which exploits to the greatest practical extent the present state-of-the-art in time-shared use of computers.

3) The design and development of a computer simulation model to assist in the design of public transportation terminal facilities.

4) The performance of special analyses required; e.g., the drafting of a transportation demand estimation manual.

Upon completion, all the above methodologies and their related software will be disseminated to local transportation planning agencies for their use.

II. Project Schedule

March 1972-FY 1975

III. Funding

$627,000

IV. Recent Progress

1) A draft of the final report on Transportation System Evaluation Indicators was reviewed and sent out for comment from industry representatives.

2) The Symposium notes for the December Industry Committee on Indicators and Sketch Planning were received February 6, 1973.

3) The PDP-10 software and draft documentation for the Interactive Graphics Transit Design System was received on February 28, 1973.

4) The draft report on the Technical Specifications for Station Simulation was received February 2, 1973.

5) Draft material on Interactive Sketch Planning Software was received.

6) UMTA computer requirements analysis report was received in May 1973.

V. Project Number

IT-06-0050

VI. Contractor

Peat, Marwick, Mitchell & Company, Washington, D. C.

Subcontractors

Barton-Aschman
Cambridge Systematics

VII. Reports

New Systems Requirements Analysis Program - General Functional Specifications for a Transit Station Simulation Model, November 1972, PB-214-337, $5.45.

New Systems Requirements Analysis Program, Station Simulation Symposium - Work Item 4: Station Simulation Capability, November 1972, PB-218-864, $4.85.

VII. Reports (cont.)

New Systems Requirements Analysis Program, Project Implementation Plan - Work Item 4: Station Simulation Capability, September 1972, PB-218-864, $4.85.

New Systems Requirements Analysis Program, Project Implementation Plan - Work Item 3: Development of Sketch Planning Techniques, July 1972, PB-218-865, $5.45.

New Systems Requirements Analysis Program, Technical Development Plan, August 1972, PB-218-866, $6.00.

New Systems Requirements Analysis Program, Indicators and Interactive Sketch Planning Symposium - Work Item 2: Transportation System Evaluation Indicators and Work Item 3: Interactive Sketch Planning Techniques, December 1972, PB-218-867, $4.85.

New Systems Requirements Analysis Program - Project Implementation Plan, Work Item 2: Transportation System Evaluation Indicators, September 1972, PB-218-868, $4.50.

New Systems Requirements Analysis Program, Transportation System Evaluation Indicators -- Final Report, May 1973, PB-221-572, $6.00.

Project: Software Pilot Testing and New Systems Development Engineering Coordination

I. Description

This is one of three major projects comprising a program to create and enhance the UMTA Transportation Planning System. The goals of the overall program are:

1) To build computer-based tools for multimodal transportation planning.

2) To demonstrate and validate use of tools in two pilot cities.

3) To disseminate tools to local planning agencies.

4) To continually reevaluate and improve the tools as the results of feedback from local communities and R&D results.

The specific objectives of this project are the following:

1) To demonstrate use of UTPS planning tools in two pilot cities.

2) To disseminate transportation planning tools to local planning agencies.

3) To analyze the results of the demonstration and feed these inputs back to the designers.

The project has three interrelated but distinct work items:

1) The virtual certification, as user-ready software, of the urban transportation planning packages being developed by PMM and PRC. This will be accomplished through a systematic process of checking and evaluation which will involve pilot applications in two selected localities.

2) Defining the interaction between new systems technology, its use in the software planning packages to be developed by PMM and PRC, and the New Systems Engineering Development Program (NSDEP). This will be accomplished in several steps which include:

a) the development of a systematic urban transportation new systems data structure keyed to the needs of the planning process and the related software which is suitable to updating in order to reflect progress in technology and planning methodology.

b) analysis of required performance and other related characteristics of transportation systems in the light of results and sensitivity analyses carried out in pilot applications of planning software and which can be related to the ongoing NSDEP.

I. Description (cont.)

3) Carrying out a number of special studies which will contribute to the further development of the planning methodology for new urban transportation systems; e.g., the documentation of needs for short-range transit planning.

II. Project Schedule

March 1972-FY 1975

III. Funding

$459,000

IV. Recent Progress

1) The pilot testing of the first version of UTPS is completed. All computer runs have been made and final documentation reviewed.

2) The draft of technical assessment of the pilot applications has been received, reviewed and returned for corrections.

3) The draft of the user tutorial has been received, reviewed and returned for corrections.

4) A short-range transit planning software requirements analysis was received and sent out for comment by industry representatives.

V. Project Number

IT-06-0049

VI. Contractor

TRW Systems Group, Redondo Beach, California

Subcontractors

Wilbur Smith and Company
Deleuw, Cather and Company
Consad Research Corporation

VII. Reports

New Systems Requirements Analysis Program, Project Implementation Plan - Work Item 2: UTPS Pilot Applications, November 1972, PB-218-863, $4.50.

Personal Rapid Transit (PRT)

The private automobile which is characterized by a very high level of personalized service has taken a competitive lead in the ground transportation environment. Public systems, such as conventional bus, which do not provide a significant increment in service compared to the automobile are decreasing in viability under these circumstances.

Concomitant with the popularity of the automobile is traffic congestion which poses a serious threat to urban mobility. The impracticability of constructing additional express highway facilities in most urban areas to relieve road congestion has resulted in renewed interest in the development of alternate public transportation solutions.

The attractiveness of public transportation is being primarily improved by the application of two approaches:

(a) reduce travel time compared to the automobile
(b) improve access to the public transportation system

Rapid rail system success is primarily based on the application of the first concept. By operating on exclusive guideways at high peak speeds, rapid rail achieves travel times competitive with those of the automobile.

Personal Rapid Transit (PRT) improves service by operating on exclusive guideways to avoid traffic congestion and by utilizing 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.

PRT offers a number of additional advantages over rapid rail. PRT service, for example, is characterized by shorter periods of acceleration compared to rapid rail service. PRT stations may be sized to local demand rather than train length. PRT is also adaptable to a much broader spectrum of urban sites than rapid rail as a result of lower capital cost. While current PRT systems achieve lower capacities than other modes, reductions in operating headways will permit rapid rail lane capacities to be reached with small 4- to 6-passenger vehicles.

A number of important automated vehicle system developments are indicated in Figure 1 (p. 64). The Westinghouse "Skybus" was the first UMTA sponsored automated rubber-tired vehicle development and was primarily designed to provide line haul service. The "Skybus" concept has found application at Tampa and Seattle-Tacoma airports. The "Skybus" was followed by the Dallas/Fort Worth, the Morgantown and the TRANSPO 72 system developments.

The development of even more advanced systems has been proceeding abroad. Cabtrack (Great Britain) was the first short headway PRT system concept. The Cabtrack investigations were followed by the studies at Aerospace and the prototype system developments at Messerschmitt-Bolkow-Blohm/Demag (Cabintaxi) and the Japan Society for the Promotion of Machine Industry (CVS "Controlled Vehicle System").

Urban deployments of automated vehicle systems are gaining momentum. Miami and Honolulu are planning systems which will feature technologies similar to Skybus; Denver and Toronto will utilize smaller (8-12 seats) vehicle systems with off-line stations while the Las Vegas system is expected to exploit six seated passenger vehicles at 8-second headways.

Two important areas where improvements in PRT performance can be achieved are:

(a) Passenger carrying capacity
(b) Capital cost

Capacity is defined as the number of passengers that a system can move past a fixed point per unit time per lane of guideway. The capacity is proportional to the size of the PRT 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 (p. 65). Current PRT systems achieve relatively modest capacities (3,000-5,000 seats per lane per hour) as a result of small vehicle size (6-12 seats) and relatively long headways (8-18 seconds). While such lane capacities can effectively meet transportation demands in limited configurations, higher capacities are required for more extensive networks in urban areas.

Improved capacity is also essential to assure that PRT realizes its potential cost-effectiveness advantages. Higher capacities permit more revenue passengers to utilize the expensive capital investment in guideways and stations thus increasing return on investment.

PRT, like other exclusive guideway urban transportation systems, is characterized by high capital cost. The most expensive components of exclusive guideway systems are the guideway and station structures. The cost of vehicles and the command and control system is generally a small percentage of the total system cost. By utilizing small vehicles on light guideway structures, PRT can realize significant economies in guideway and station cost compared with rapid rail as indicated in Table 1 (p. 66). Urban installation will increase costs and the development of less expensive, unobtrusive guideway and station structures for PRT is an important objective.

UMTA's major efforts aimed at developing PRT may be divided into two areas: technology development and system development. The technology development activities include:

(a) Command and Control Studies
(b) Development Engineering

while the system developments encompass:

(a) Morgantown PRT (First Generation PRT)
(b) TRANSPO 72 PRT Demonstration
(c) High Performance PRT (Second Generation PRT)
(d) Third Generation PRT (High Capacity PRT)

The following sections discuss these projects in more detail.

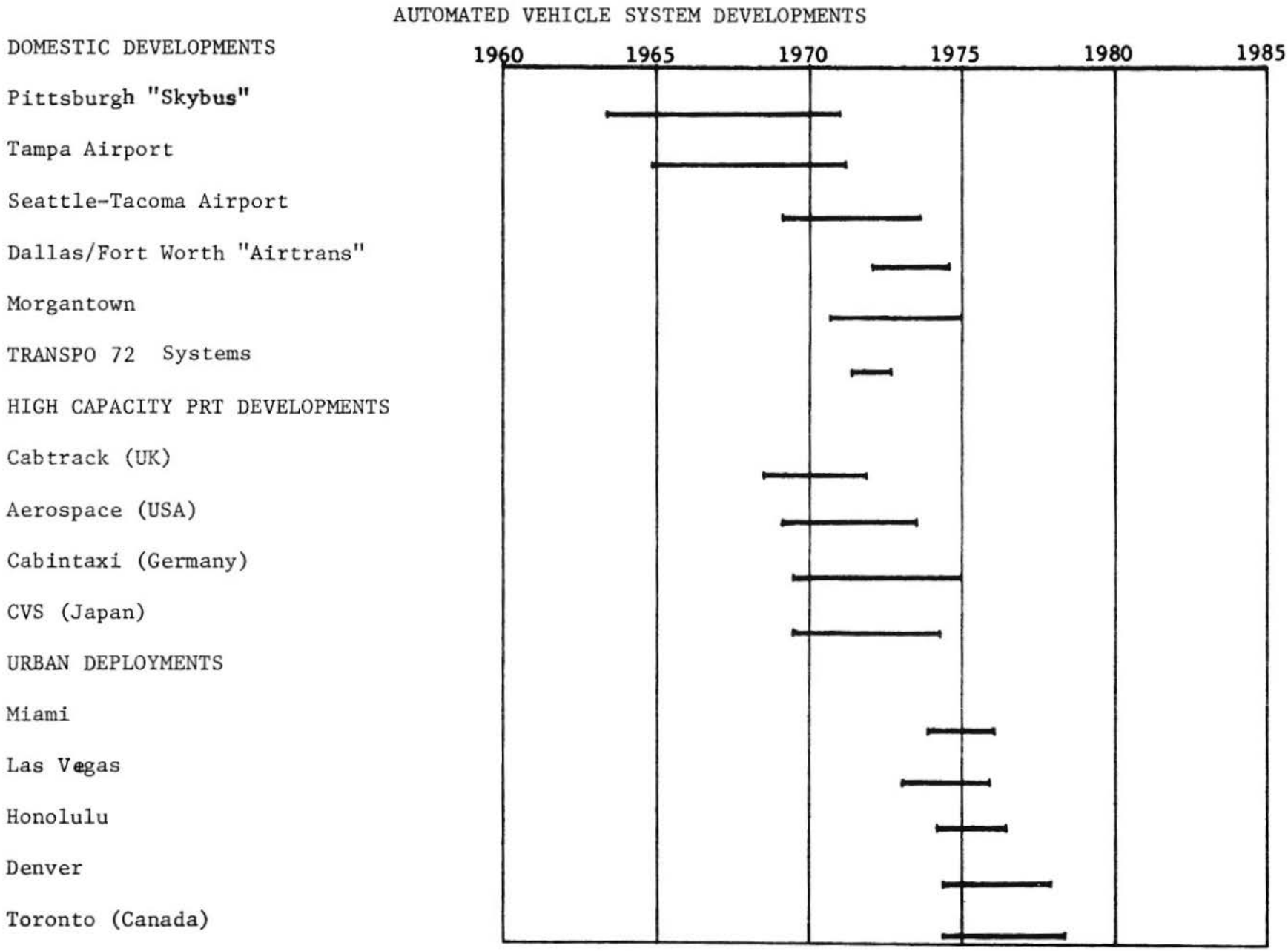

Figure 1: Automated vehicle system developments

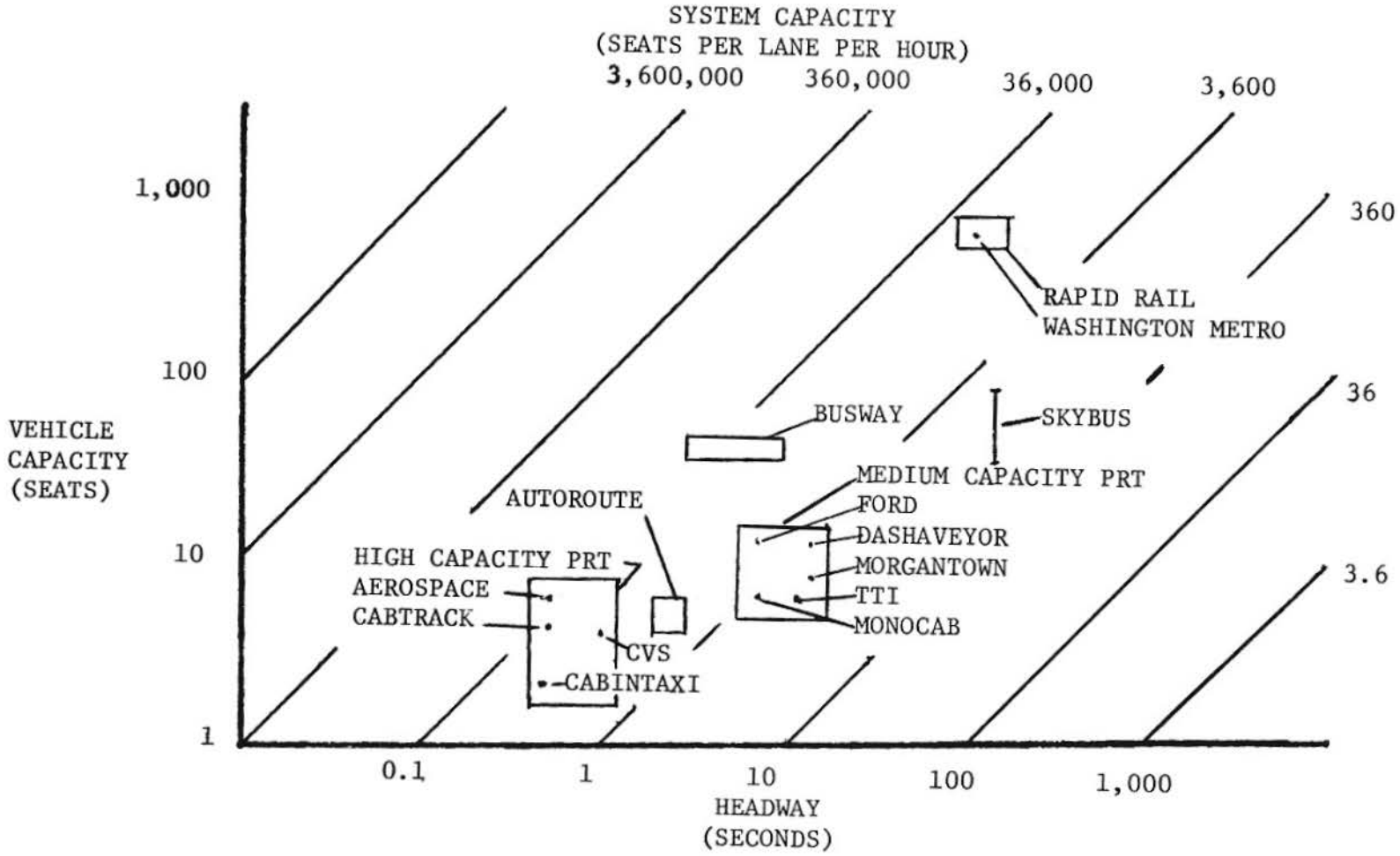

Figure 2: Vehicle capacity versus operating headway

TABLE 1

TYPICAL VALUES FOR CAPITAL UTILIZATION

MODE	CAPACITY*3 (SEATS PER HOUR PER LANE)	COST PER LANE MILE (MILLIONS)	COST PER LANE MILE / CAPACITY (DOLLARS PER MILE PER PASSENGER PER HOUR)
Rapid Rail*1	19,500	15.2M	$780.00
"Airtrans" PRT (16-passenger vehicles, 18-second headways)	3,200	2.6M	812.00
Improved TRANSPO PRT (12-passenger vehicles, 3-second headways)	14,400	4.0M*2	360.00
High Capacity PRT (4-passenger vehicles, 1/2-second headways)	28,800	6.0M*2	208.00

*

1. Washington Metro
2. Conservative value for urban installation
3. Scheduled operation

Project: Command and Control Studies for PRT Systems

I. Description

The command and control problems for PRT systems fall into three primary areas: problems of vehicle routing and storage, problems of individual vehicle control and problems of system hardware and software definition and implementation. The first problem area is usually called "vehicle management" and refers to the origin-to-destination routing of occupied vehicles and dispatch of unoccupied vehicles to stations and parking areas. Individual vehicle control deals with the task of headway maintenance, acceleration control, velocity regulation, parking and door operation. Implementation deals with such items as guideway instrumentation, vehicle-wayside-computer communications and regional and central computer complexes. An associated problem area is the nature of human operator monitoring and interaction with the system.

The novel character of PRT systems, and the complexity of the command and control problem has resulted in a PRT command and control technology which is still in a developmental stage. Because of the central role of automatic control for PRT's and the potential for efficient command and control to increase the effectiveness of vehicle utilization and thus the cost efficiency of PRT systems, a substantial UMTA command and control effort has been formulated and is in progress.

Program activities are already in progress at the Applied Physics Laboratory (APL) of Johns Hopkins University. The APL Command and Control Studies for PRT Systems project is part of a continuing effort which began in 1968. In previous phases of this program APL has managed the evaluation of a large number of PRT concepts (1969-1970). APL has also developed a number of vehicle headway control concepts and is probably best known for their research on vehicle-follower headway regulation methodology (1968-1972). APL has already expended significant effort in the area of vehicle management algorithm development. Their investigations have included synchronous, quasi-synchronous and asynchronous vehicle management programs although their attention has been primarily focused on the latter type.

Studies to date have mapped out the major problem areas providing the basis for a definitive program plan directed towards their solution. Specific contributions of APL include:

(a) vehicle management algorithm comparisons using a simple six-station network configuration.

(b) development of a vehicle-guideway dynamics simulation (APLDYN).

(c) investigation of a modified block headway control system.

I. Description (cont.)

(d) study of dual-mode vehicle management techniques utilizing trains of vehicles.

(e) documentation of their command and control studies work in 13 formal reports.

Recent activities at APL include investigation of:

(a) distribution of vehicle control authority between vehicle and wayside locations.

(b) asynchronous adaptive merging strategies.

(c) decentralized methods of vehicle management for large systems.

The results of these studies will be reported in five reports to be issued in the autumn of 1973.

II. Schedule

1971-1973

III. Funding

$1,196,000 (to June 30, 1973; incremental funding)

IV. Recent Progress

Five technical reports are being completed under the current APL contract and will be available from NTIS in the autumn of 1973.

V. Project Number(s)

MD-06-0018

VI. Contractor(s)

Applied Physics Laboratory
Johns Hopkins University
Silver Spring, Maryland

VII. Report(s)

Parametric Analysis of Generic Urban Transit Systems, December 1969, APL/JHU/TPR-001, PB-188-984, $3.00.

Acceleration and Comfort in Public Ground Transportation, February 1970, APL/JHU/TPR-002, PB-190-402, $3.00.

VII. Report(s) (cont.)

Human Sensitivity to Whole-Body Vibration in Urban Transportation Systems: A Literature Review, May 1970, APL/JHU/TPR-004, PB-192-257, $3.00.

Control Considerations for Short-Headway ACGV Systems, October 1971, APL/JHU/TPR-018, PB-205-013, $6.00.

Operating Strategies for Demand-Actuated ACGV Systems -- Volume I, Design and Simulation, August 1971, APL/JHU/CP-004/TPR-019, Volume I, PB-206-416, $6.75.

Evaluation of Operating Strategies for Demand-Actuated ACGV Systems -- Volume II, APL/JHU/CP-004/TPR-019, Volume II, PB-213-003, $3.00.

Control Concepts for the Morgantown Project, APL/JHU/CP-007/TPR-022, PB-214-746, $3.00.

Characteristics of a Linear Regulation Control Law for Vehicles in an Automatic Transit System, January 1972, APL/JHU/CP-009/TPR-020, PB-212-502, $3.00.

APLDYNE, A General Purpose Computer Program for the Dynamic Simulation of Vehicle-Guideway Integration, APL/JHU/CP-008/TPR-021, PB-214-399, $6.00.

Augmented Block Guidance for Short-Headway Transportation Systems, September 1971, APL/JHU/CP-019/TPR-023, PB-214-391, $6.00.

Point Follower Automatic Vehicle Control: A Generic Analysis, APL/JHU/TPR-025 (not at NTIS).

Headway Sensing for Automatically Controlled and Guided Vehicles, September 1970, APL/JHU/TCR-012, PB-198-452, $3.00.

Analyses of Some Dual-Mode Personal Rapid Transit Systems Operations, September 1972, CP-020/TPR-024, PB-220-157, $3.00.

Project: New Systems Development Engineering

I. Description

The New Systems Development Engineering program provides long range component development and support for small, creative groups without necessitating major program funding. The hardware developed under this program allows pre-demonstration evaluation and testing which will improve assessment of risks in the technology.

The Transportation Systems Center, Cambridge, Massachusetts, is assigned the role of System Manager.

First items for study are PRT and Dual Mode subsystems, covering assurance of headway separation, A.C. drive development, steel wheel on steel rail vehicles, passive vehicles and magnetic levitation technology.

II. Schedule

December 1971-December 1975

III. Funding

$1,832,000 (through FY 1973; incremental funding)

IV. Recent Progress

By the end of FY 1973:

1) Phase II of the Mobility Systems, Inc., effort had begun. It would test the drive system developed in Phase I on a vehicle.

2) Phase II had started on the passive vehicle development by Uniflo. In this phase, Uniflo will extend the guideway fabricated in Phase I, install a switch and test the system to verify switching. Acoustic shielding will be added to the Phase I vehicle to improve the interior vehicle acoustic characteristics. Propulsion will be redesigned to decrease exterior noise.

3) Alden Transit was testing the short headway, computer controlled collision avoidance system.

4) Pullman-Standard was testing their vehicle on a guideway at their plant.

V. Project Number(s)

MA-06-0027

VI. Contractor(s)

Alden Transit
Mobility Systems
Pullman-Standard
Uniflo

VII. Report(s)

Project: Morgantown Demonstration Project

I. Description

The Morgantown (W. VA.) project will build, test and evaluate a first generation personal rapid transit system linking the separated campuses of the University of West Virginia, and the downtown Central Business District. As a demonstration-research project for other small cities, the choice of Morgantown was advantageous for several reasons. Because of students changing classes, there will be at least five peak demands for transportation per day, thus assuring researchers the desired volume of data. The hills of Morgantown, as well as the varied climate (ice, snow, ran, fog and sunshine), will impose rugged operating conditions on the system.

Each vehicle will carry eight seated and 13 standing passengers and will travel at speeds up to 30 miles per hour. The system will have a peak capacity of 1,100 people every 20 minutes between two adjacent stations. The vehicles will operate in two modes -- on a scheduled basis during peak hours and on a demand basis during off hours. The movement and spacing between cars will be controlled by a system of computers.

The vehicles will run on four rubber-tired wheels and be propelled by electric motors. The elevated dual guideways, one for each direction of travel will facilitate movement and increase the safety of the system.

UMTA will test and evaluate the system and generate the necessary data to allow reproducing it in other locations in the United States that may have similar transportation needs.

II. Schedule

August 1970-September 1973 (i.e., from start of preliminary design to completion of testing under phase 1A).

III. Funding

$43,800,000 (to June 30, 1973; incremental funding)

IV. Recent Progress

The remaining painting effort has been completed and all testing required under the 1A program has been concluded. Operations of the four vehicles in Morgantown will be terminated in September 1973 in preparation for the planned modifications to the system.

One vehicle in Seattle continues to run on the test track in the automated mode for endurance testing of doors, brakes, tires, propulsion, ventilation and steering systems. A modified front axle is also undergoing cycling tests in the laboratory to measure the life of the modified design.

V. Project Number(s)

WV-06-0003
WV-06-0005
WV-06-0006
MA-06-0026

VI. Contractor(s)

The Boeing Company, Seattle, Washington

Third Party Contractors

The Bendix Corp., Ann Arbor, Mich. - for Control and Communications (C&CS)

Frederick R. Harris Co., Stamford, Conn. - for Architecture and Engineering (A&E)

Frank Irey, Jr., Inc., Monongahela, Pa.)
Melbourne Brox. Cons. Co., North Canton, Ohio) - for Construction
The Trumbull Corporation, Pittsburgh, Pa.)

Barnes & Brass, Clarksburg, West Virginia - for Electrical Installation

VII. Report(s)

Project: Personal Rapid Transit Demonstration at TRANSPO 72

I. Description

In May/June 1972, UMTA displayed full-size working models of four personal rapid transit (PRT) systems at TRANSPO/72, the U.S. International Transportation Exposition, at Dulles International Airport. The four contractors (Dashaveyor, Ford, Monocab and Transportation Technology, Inc.), showed a range of vehicle sizes, various types of suspensions and command and control systems, different propulsion techniques, as well as different types of guideways. Data were collected to obtain the reaction of the public to the systems.

From the close of TRANSPO until November 10, 1972, the four systems were tested. Extensive engineering data were obtained, measuring system performance, system parameters and performance of the command and control systems. The data provide a basis for comparison of the performance of the various systems for such things as ride quality, environmental impact, power consumption, merging and diverging, etc.

In addition, design improvements were identified by the testing so that the systems may be made more reliable and maintainable.

The data collected during the test program are essential in extending the Dulles systems to an urban environment.

II. Schedule

June-November 1972

III. Funding

$9,690,000

IV. Progress Report

Completed project.

V. Project Number(s)

IT-06-0032
IT-06-0054
IT-06-0055
IT-06-0056
MD-06-0008
IT-06-0052
IT-06-0064
VA-06-0012

VI. Contractor(s)

Ford; Transportation Technology, Inc.; Monocab; Dashaveyor; MITRE; Applied Physics Laboratory of Johns Hopkins University; DOT Transportation Systems Center

VII. Report(s)

Transportation Programs Report, Post-TRANSPO Test Program, Summary Report, Volume 1, Applied Physics Laboratory of Johns Hopkins University, June 1973.

Project: Survey of Public Response to TRANSPO 72 Personal Rapid Transit (PRT) System

I. Description

The goal of this project was to obtain the immediate reactions of the visiting public to the personal rapid transit (PRT) system demonstrations and to other UMTA-supported development efforts that were displayed at TRANSPO 72.

The specific objectives of the survey were the following:

1) To obtain reactions to vehicle and guideway characteristics.

2) To obtain reactions to vehicle acceptability for specific trips.

3) To obtain "indepth" reactions to the PRT system.

The project had four tasks:

1) Develop a questionnaire to determine visitor reactions to UMTA-sponsored demonstrations at TRANSPO 72.

2) Conduct a survey of a sample of the visitors at TRANSPO 72.

3) Code the information obtained and produce computer results of the survey.

4) Analyze the computer tables produced and summarized in a final report.

II. Project Schedule

March 1972-November 1972

III. Funding

FY 72
$40,000

IV. Recent Progress

1) A survey was developed and conducted during TRANSPO 72 to obtain reactions of the visiting public to personal rapid transit (PRT) system demonstrations.

2) The results of the interviews were coded and punched so that the information could be manipulated by a computer.

IV. Recent Progress (cont.)

3) The resulting tables were analyzed and a preliminary report submitted.

4) Final report was printed and distributed during January 1973.

V. Project Number

IT-06-0037

VI. Contractor

Century Research Corporation, Arlington, Virginia

VII. Report(s)

Survey of Public Reaction to TRANSPO Personal Rapid Transit Systems And UMTA-Sponsored Bus and Rail Exhibits, November 1972, PB-214-819, $6.00.

Project: High Performance PRT System

I. Description

This project will develop a second generation, medium capacity, Personal Rapid Transit (PRT) system capable of line haul capacities exceeding 14,000 passengers per lane per hour, using vehicles with 12 or less seated passengers. Light vehicles will allow construction of small guideways and, thus, greatly lower capital costs. The result would constitute a transportation mode providing capacity comparable to rapid rail but requiring one-third the capital investment.

The project will consist of a design phase to be followed by a test track development. Thorough testing will assure that the hardware satisfies performance specifications.

Urban deployability studies will provide support to the High Performance PRT System Development. Vehicle management studies will develop and evaluate techniques for routing full and empty vehicles in response to service demands. The task encompasses the evaluation of existing techniques, tradeoff studies considering service policies, development of new algorithms and examination of the effects of various failures.

System reliability is a prime requirement in any new transportation system. It is essential to assure passenger safety and uninterrupted service. Reliability is also an important determinant of costs. Because of the complexity of PRT systems, maintenance requires the attention of highly skilled and, therefore, highly paid technicians. Even a small increase in maintenance or back-up equipment beyond the norm would jeopardize or even eliminate the reduction in labor costs accomplished by automation. To assure the success of PRT systems, therefore, it is necessary to develop highly reliable, low maintenance, long life components and a well trained, expert working force.

The reliability and availablity of the High Performance PRT will be carefully evaluated through a careful study program. Failure mode effects analyses will be performed on components and the response of the system to online failures carefully investigated.

Guideway and station structural components are the most expensive elements in current PRT development, with costs ranging from one to three million dollars per lane-mile. Also, many existing guideway/station designs would require an inordinate amount of time for installation. Urban deployment of such systems would result in prolonged disruption of normal traffic as well as delay of the initiation of useful public service. 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 installation time.

I. Description (cont.)

Program outputs will include:

(a) Engineering designs of medium capacity PRT systems;

(b) One complete design with specifications;

(c) Standard simulation tools for vehicle management and vehicle system studies;

(d) A variety of network models and demand characteristics ranging from simple line haul implementations to area-wide network configurations;

(e) Comparisons of the different management approaches;

(f) Improved vehicle management algorithms;

(g) Economic analyses of PRT operating costs, and

(h) Extensive test results.

II. Schedule

Late 1972-Spring 1979

III. Funding

$2,683,000 (to June 30, 1973; incremental funding)

IV. Recent Progress

Study design underway to provide groundwork for issuance of RFP the end of 1973.

V. Project Number(s)

XX-06-0019

VI. Contractor(s)

Not yet selected.

VII. Report(s)

Project: Route Definition for Urban PRT System

I. Description

This project provided for route determination of the downtown segment of an advanced technology fixed guideway transit system. The project defined the specific alignment and profile including engineering studies and analysis to determine right-of-way geometrics and requirements, soils testing and utility relocation requirements. It documented the approach taken to system definition through a committee of local interests and community representatives. The study contributed to an understanding of the requirements for a downtown Denver guideway transit system and assisted the local authorities in developing their proposed Regional Transportation Program.

II. Schedule

October 1971-August 1972

III. Funding

$100,000

IV. Recent Progress

The RTD defined and detailed a route for a PRT system in downtown Denver and published a final report covering their work. Local officials are currently completing a plan for a regional PRT network and are further detailing both the downtown alignment and the urban-wide network.

V. Project Number(s)

CO-06-0002

VI. Contractor(s)

Regional Transportation District
56 Steele Street
Denver, Colorado 80206

VII. Report(s)

"Advanced Urban Transit Technology Study for Regional Transportation District, Denver, Colorado."

Project: Third Generation (High Capacity) PRT

I. Description

PRT systems have reached a significant stage of development with deployments planned, or in progress, in several sites including Tampa, Seattle-Tacoma and Dallas/Fort Worth airports, Denver, Morgantown, Miami, Las Vegas and Honolulu urban areas. While currently available PRT systems may be adequate for these sites, the limited line haul capacity of existing systems poses significant problems in large scale urban applications.

The systems currently nearing service have relatively low passenger carrying capacities (3-4,000 passengers per lane per hour). More passengers can be carried by using 12-15 passenger vehicles at higher frequencies (1,200 vehicles per lane per hour) or by using smaller vehicles (4-6 passengers) at very high frequencies (3,600-7,200 vehicles per lane per hour). The latter systems are designated as High Capacity Personal Rapid Transit (HCPRT) systems.

The primary technical problems in HCPRT operations are associated with attaining safe operation at short headways. Increased collision potential will require the use of individual passenger protective devices (e.g., seat belts), stronger vehicle structures, rapid failure detection, sophisticated emergency braking, better command and control and high levels of reliability.

UMTA's HCPRT project will begin with a systems analysis which will be integrated with other UMTA projects on PRT's and will also reap the benefit of private industry's experience with PRT development both in the United States and abroad. It will identify critical subsystems, especially braking, vehicle control and failure management. These subsystems can later be designed, fabricated and tested in suitable test configurations.

II. Schedule

1973-1979

III. Funding

$200,000 (to June 30, 1973; incremental funding)

IV. Recent Progress

Planning underway preparatory to issuance of RFP.

V. Project Number(s)

Not yet assigned.

VI. Contractor(s)

Not yet selected.

VII. Report(s)

Project: Dial-A-Ride Market and Technology Tests

I. Description

This project was designed to provide 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 is being tested in Haddonfield, N.J.

The Haddonfield Dial-A-Ride Demonstration began (Phase I) with 12 vehicles under manual control serving 25,000 people with varied 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 7-day week around-the-clock basis.

The plan is next to try (Phase II) minicomputer control with manual back-up and expand the fleet and the service area to the limits of manual control. The experience gained in Haddonfield is being documented in several reports for use by localities considering the feasibility of a Dial-A-Ride system and for use in procuring and operating Dial-A-Ride systems.

Throughout the project, such techniques as changing the fare structure, observing user patterns, and mathematical modeling, validation and calibration will be used to assure that maximum information is obtained.

II. Schedule

April 1971-October 1974

III. Funding

$7,865,000 (to June 30, 1973; incremental funding)

IV. Recent Progress

On October 25, 1972, the computer was delivered and phase-in began.

In November, an amendment of $1.3 million was approved to cover Phase II. In September 1972, March 1973, and August 1973, the service area has been expanded to handle over 39,000 persons. In August 1973, six new buses were added to the Dial-A-Ride fleet for a total of 18 vehicles and the service area was expanded. Within 10 weeks, ridership increased from 250 to over 800 daily.

V. Project Number(s)

VA-06-0012
MD-06-0001
NJ-06-0002
PA-06-0030
TN-06-0004

VI. Contractor(s)

The Mitre Corporation
University of Pittsburgh
University of Tennessee
Westinghouse Electric Corporation
New Jersey Department of Transportation

VII. Report(s)

Haddonfield Dial-A-Ride First Progress Report, July 1972, PB-220-171, $3.75.

A Conceptual Overview of Demand Responsive Systems, February 1973, PB-220-863, $3.00.

Project: Dual Mode Transit

I. Description

This project will develop and demonstrate a new transit mode that combines the features of scheduled and demand-responsive bus systems with the automated Personal Rapid Transit (PRT) systems. This system uses a dual purpose vehicle that is operated manually on the public streets and highways and automatically on exclusive guideways. It will provide a flexible transit system that is adaptive to the daily and seasonal needs of an urban area, offering the transit user as nearly point-to-point transportation as is practical.

Dual mode transit would present United States cities with a viable alternative that successfully fills the gap between the conventional bus and rapid rail transit systems with respect to such items as capacity (passengers/hour/lane), capital costs, operating costs and ease of expansion with urban growth. A dual mode system would have a much lower operating cost and a higher utilization of manpower and vehicles than is presently obtained with conventional bus service.

II. Schedule

February 1973-Spring 1976

III. Funding

$2,265,000 (to June 30, 1973; incremental funding)

IV. Recent Progress

RFP for design concept competition was issued on February 5, 1973. Contract award will be made in September 1973.

V. Project Number(s)

IT-06-0045
MA-06-0029
MD-06-0008
VA-06-0020

VI. Contractor(s)

Not yet selected.

VII. Report(s)

URBAN TRACKED AIR CUSHION VEHICLE

With the greatest population growth occurring on the fringes of metropolitan areas, travel distances to central business districts or other centers of activity are becoming greater. New systems, such as UTACV, must be developed to cover these greater distances in reduced times to complement and influence urban growth for both existing and new communities.

The urban tracked air cushion vehicle (UTACV) program will provide a completely tested state-of-the-art passenger carrying prototype vehicle system ready for installation in revenue service and the initial procurement of an advanced concept vehicle. The state-of-the-art system will satisfy at high speed and with minimum adverse environmental impact the requirement for line haul express links in an urban mass transportation system such as:

-- airport access from the central business district;

-- airport-to-airport interchange;

-- new communities development, and

-- travel between contiguous urban complexes.

Rapid advances in levitated vehicle technology require continuing developmental efforts to insure that the Department makes available the most advanced operational UTACV system for urban application. Thus, the UTACV program has included the design of an advanced concept levitated vehicle. This design will cover such innovations as a single-sided linear induction motor for propulsion, solid state variable frequency control, high-pressure air cushions mounted on tracks, and magnetic guidance. These advances will make the UTACV system more efficient, quieter and less polluting than the state-of-the-art system.

Eventual revenue system acquisition and guideway construction could be accomplished through the UMTA capital grant program after the necessary prerequisites have been satisfied. The system should be part of the comprehensive local urban transportation plan. Favorable economic analyses, a satisfactory environmental impact statement, a feasible route and availability of the one-third capital share would be required for Federal financial assistance of a revenue system.

Project: Urban Tracked Air Cushion Vehicle

I. Description

The purpose of this project is to design, fabricate, test and demonstrate a new pollution-free urban mass transportation vehicle for airport access, airport-to-airport interchange, new community access and travel between contiguous urban complexes.

Two contractors (LTV Aerospace Corporation and Rohr Industries, Inc.) were selected to prepare the Phase I detailed engineering design for a 60-passenger Urban Tracked Air Cushioned Vehicle (UTACV) with linear induction propulsion and automatic control. Phase I (engineering design) was successfully completed by both contractors. Rohr was selected for Phase II to fabricate a passenger-carrying prototype of their design. Phase III (test operations) will be conducted on facilities of the Department's High Speed Ground Test Center at Pueblo, Colorado.

Rohr will provide:

-- A fully operational prototype vehicle including linear motor propulsion, air cushion suspension and guidance, and automatic train control;

-- A 500-foot guideway section for function checkout and a checkout test plan;

-- A detailed Phase III system test and operations plan;

-- "As-built" drawings and specifications from which the prototype was fabricated, and

-- A complete, useable test facility at Pueblo, including a maintenance building, test track, service road and power supply.

LTV will provide:

-- The design analyses and test results of components for an advanced tracked levitated vehicle system.

On July 1, 1973, sponsorship of the UTACV project was transferred from UMTA to the Federal Railroad Administration.

II. Schedule

June 1971-June 1976 (subject to change by FRA)

III. Funding

$17,315,000 (from 1971 through June 30, 1973)

IV. Recent Progress

Fabrication of the prototype UTACV by Rohr Industries, Inc., is 99% completed. System checkouts are nearing completion and on-site acceptance checks are scheduled to start about October 1, 1973.

The power conditioning unit is being tested and will be shipped from England some time in October.

Construction of maintenance building is nearing completion and guideway is nearing completion for 3.13 miles. Power rail contract negotiations were held up and did not resume until September 10, 1973. Test track will not be ready for vehicle until second quarter of calendar 1974.

V. Project Number(s)

MA-06-0018
IT-06-0031
CO-06-0004

VI. Contractor(s)

Rohr Industries, Inc., Chula Vista, California
LTV Aerospace Corporation, Dallas, Texas

VII. Report(s)

SYSTEMS ANALYSIS AND EVALUATION PROGRAM

The Systems Analysis and Evaluation Program comprises four functions: RD&D program rationale, experimental design, analytical work and the intermodal integration program.

RD&D program rationale has three parts: pre-project analysis, ongoing RD&D program composition and balance, and post-project analysis. Pre-project analysis primarily involves review of new submittals and conduct of program design studies. Ongoing program composition and balance is a continual review of the RD&D program. Post-project analysis to date has mostly taken the form of a review of primary outputs of the RD&D program: draft final reports.

The purpose of the experimental design program is to develop maximum information for national application from locally conducted demonstration and RD&D projects.

Analytical work provides support to other RD&D divisions and individual analyses as required for developing and monitoring the RD&D program.

The fourth function, intermodal integration, has been conducted by the UMTA System Analysis staff to date. As the function has grown and developed, it has been subsumed under UMTA's Transit Operations and Management Systems Program (see pp. 179 to 185 below).

Project: Generic Urban Transportation System Program Design

I. Description

This study covers a series of 10 individual tasks with the two-fold objective of providing a basis for assessment of appropriate RD&D activities called for in particular areas of potential improvement in urban mass transportation and providing specificiations of RD&D project activities in those subject areas where potential improvement through RD&D is identified.

The tasks are: 1) Identify potential areas for an over-the-water application and outline a demonstration program; 2) Establish functional specifications to provide a base upon which detailed technical engineering specifications for new generic types of urban mass transportation systems may be developed; 3) Provide a framework for the cost evaluation of proposed new mass transportation systems; 4) Estimate the potential for reduction in costs of new urban mass transportation systems, identify the primary sub-system cost reduction potential through application of alternative technologies and estimate expected economy of scale in industry production for post-demonstration implemented on a national scale; 5) Define a program to continually assess and improve the state-of-the-art in urban mass transportation modal split and planning models; 6) Recommend a role for Federal support and prepare several alternative program designs for UMTA research, development and demonstration directed to urban goods movement; 7) Provide an analytical tool for evaluating alternative system operating configurations for PRT systems, and 8) Assess the potential for intermodal tie-in of existing transit systems within certain major urban areas throughout the country.

II. Schedule

February 1971-April 1973

III. Funding

$274,000

IV. Recent Progress

Completed project.

V. Project Number(s)

IT-06-0029

VI. Contractor(s)

Mark Battle Associates, Inc.
Washington, D. C.

VII. Report(s)

Project: The State of Urban Mass Transportation RD&D

I. Description

This project assesses the knowledge gained from RD&D activities and identifies the areas needing more research, development and demonstration. It covers the technical, economic, passenger response/passenger demand and institutional considerations associated with urban mass transportation RD&D.

II. Schedule

January 1972-April 1972

III. Funding

$94,378

IV. Recent Progress

Completed project.

V. Project Number(s)

VA-06-0007

VI. Contractor(s)

Institute for Defense Analysis

VII. Report(s)

Original report for internal UMTA use only. A revised and updated version will be published about December 1973.

Project: Background Studies for Intermodal Integration

I. Description

The project comprises five disparate studies intended primarily for internal use by UMTA's Office of Research, Development and Demonstration in planning its future work particularly in the area of intermodal integration. The studies are:

1) Transit Systems Operations, which includes: a) paratransit as a supplement to urban mass transit; b) ways to reduce the needs for travel; c) study of intermodal integration in the United States and European cities; d) urban goods movement in urban areas; e) over-the-water transit in urban areas; f) the potential of introducing transportation cooperatives in urban areas.

2) PRT System Simulation/Analysis. A PRT system was simulated so that a variety of questions, not easily answerable by other means, could be explored. The objective was to identify a variety of operating conditions creating hazards of costly mistakes and to find ways to improve operating efficiency.

3) Water-Bus Demonstration Design. The study evaluated and ranked 80 major United States cities according to their suitability for an over-the-water demonstration and provided an experimental design for a suitable demonstration.

4) Technical Analysis of New Submittals. The contractor provided technical, economic and feasibility analyses of unsolicited proposals and reviewed draft final reports received by the UMTA Office of RD&D.

5) Safety and Reliability Study. It applied an overall systems safety and reliability approach to all modes of urban mass transit. It assimilated and incorporated safety and reliability experience gained in DOT and other industries and agencies such as commercial airlines, AEC, NASA, railroads, etc.

II. Schedule

May 1972-June 1973

III. Funding

$256,000

IV. Recent Progress

All the studies, except the fifth (Safety and Reliability), were completed by June 30, 1973, and final reports are under review.

For the PRT study a simulation model was constructed with a user-computer interactive capability through a keyboard and a CRT-light pen combination. The CRT actually displays the vehicles moving on guideways between stations and six actual problems in the operation of the Morgantown PRT were solved.

V. Project Number(s)

RI-06-0005

VI. Contractor(s)

Naval Underwater Systems Center
Newport, Rhode Island

VII. Report(s)

Project: Use of Mathematical Models in Transit Planning: Analyze Weakness and Recommend Improvements

I. Description

Although large sums have been spent in recent years on transportation mathematical and simulation models, very few have been used extensively for actual decision-making. This study investigated the reason for this condition and provides guidance for improvement.

The models in question were intended to be useful in studying and solving the socio-economic problems which affect urban and inter-urban transportation.

The contractor examined several transportation modeling projects to determine the nature and deficiencies of the model-development process.

The study contains recommendations and useful criteria for devising improved models.

II. Schedule

1970-1973

III. Funding

$25,000

IV. Recent Progress

Completed project.

V. Project Number(s)

MA-06-0019

VI. Contractor(s)

Harvard University

VII. Report(s)

The Administration of Transportation Modeling Projects, May 1972, PB-224-846, $15.50.

Project: HRB Program Support on Special Tasks

I. Description

This research program was designed to provide general support through the following activities:

1) Advise on and assist with the development of a national mass transportation program.

2) Encourage the conduct of research by highway and transportation departments in the States, by universities and by industry.

3) Collect information on urban mass transportation research whether in progress, completed or proposed.

4) Provide and maintain a national clearinghouse and correlation service with respect to urban mass transportation research activities for the purpose of advancing mass transportation technology and administration.

II. Schedule

May 1972-May 1974

III. Funding

$300,000

IV. Recent Progress

Draft final report of Transit Safety Standards Task Force received and under review. Transit Engineering Performance and Standards Task Force formed and work begun.

V. Project Number(s)

DC-06-0015

VI. Contractor(s)

National Academy of Science
Highway Research Board
Washington, D. C.

VII. Report(s)

Experimental Design and Analytical Support

Incorporation of a formal experimental design in demonstration and certain R&D projects develops maximum information for national application from locally conducted projects. Analytical support supplies RD&D program rationale, including pre-project analysis, review of ongoing RD&D program composition and balance, and post-project analysis. Other individual analyses are conducted as required.

Each RD&D project which incorporates an experimental design establishes project objectives in consonance with an overall UMTA impact measurement program and is particularly designed to elicit maximum information which may be of use to other urban areas across the nation. The purpose of this is to develop the most useful information possible from each element of RD&D project funding. Broad analytical support to all phases of RD&D program inception, formulation, conduct and evaluation provides a balanced program intended to achieve maximum effectiveness from RD&D program activities.

Nearly 60% of ongoing or planned FY-72 and FY-73 RD&D projects, as well as the Morgantown Project, the UTACV Project and the Service Development Program, have established experimental design or designs in preparation. Analytical work including new submittal processing, conduct of program design studies, RD&D program review, UMTA impact measurement framework development, and individual supporting analyses have been performed as required during FY '73 and will continue in FY '74 and beyond.

As the UMTA staff is increased more of this work will be performed in-house, although a percentage of the work, perhaps 25% to 40%, will continue to be obtained through contractual support, thereby continuing to draw upon specialized skills and breadth unavailable through sole reliance upon in-house analysis.

Project: Experimental Design

I. Description

By incorporating a formal experimental design in demonstration and certain R&D projects, UMTA hopes to develop maximum information for national application from locally conducted projects. Analytical support supplies RD&D program rationale, including pre-project analysis, review of ongoing RD&D program composition and balance, and post-project analysis. Other individual analyses are conducted as required.

Each RD&D project which incorporates an experimental design establishes project objectives in consonance with an overall UMTA impact measurement program and is particularly designed to elicit maximum information which may be of use to other urban areas across the nation. The purpose is to develop the most useful information possible from each element of RD&D project funding. Broad analytical support to all phases of RD&D program inception, formulation, conduct and evaluation provides a balanced program intended to provide maximum effectiveness from RD&D program activities.

RD&D projects are incorporated into the experimental design program on a project by project basis. Concurrent research is conducted to improve the theory in the new fields.

II. Schedule

1971-Continuing

III. Funding

$128,000

IV. Recent Progress

Nearly 90% of ongoing or plannned FY 72 and FY 73 RD&D projects, as well as the Morgantown Project, the TACV Project and the Service Development Program have established experimental design or designs in preparation. Analytical work including new submittal processing, conduct of program design studies, RD&D program review, UMTA impact measurement framework development, and individual supporting analyses have been performed as required.

V. Project Number(s)

MD-06-0013

VI. Contractor(s)

U.S. National Bureau of Standards

VII. Report(s)

Project: Experimental Design for Seattle "Blue Streak" Express Bus Demonstration

I. Description

This study will be a thorough analysis of the experience with the Seattle "Blue Streak" bus on exclusive lane demonstration. It is based on an experimental design specially devised for this demonstration. It is using three basic experiments which seek data on the achievements of seven objectives of the project.

The three experiments are: 1) passenger counting; 2) origin and destination survey; 3) travel time. The seven basic questions are: 1) What is the magnitude of the modal shift including newly generated ridership, obtained in the corridor, in-peak and off-peak periods? Identify the relative importance of the following factors: a) exclusive roadway (time advantage); b) fare; c) convenience of access (trip before boarding including wait time); d) convenience of egress; e) availability of park-ride; f) availability of bus shelter; g) quality of the vehicle; h) non-fare costs (parking fees, etc.). 2) What is the economic (i.e., the revenue-cost relation) impact of the service modification on the bus operator? 3) What is the reduction in volume of auto usage during peak hours? 4) What is the reduction in total trip time of corridor users: a) former transit users; b) former auto users; c) continuing auto users? 5) What is the actual and the potential increase in volume of people moved on the freeway facility during peak conditions? 6) Separate the effects of the parking lot feature from effects of the express feature. 7) Identify the effect of exclusive bus versus mixed use of the ramp.

II. Schedule

December 1970-September 1973

III. Funding

$94,000

IV. Recent Progress

The project has been completed. A draft of the final report is under review.

V. Project Number(s)

IL-06-0021

VI. Contractor(s)

Northwestern University

VII. Report(s)

See IV above.

Project: Experimental Design for the Morgantown PRT Demonstration

I. Description

The Morgantown Personal Rapid Transit System (PRT) Demonstration (see p.) should provide a wealth of engineering and system-oriented information as well as passenger acceptance information useful not only in current system evaluation, but also in relating Morgantown findings to similar communities.

Because of the importance of this project, particularly as it is the first major demonstration of a PRT in an actual urban area, comprehensive evaluation of the system (embracing the principles of scientific design to ensure that findings are valid, and to the extent possible, transferrable to other cities) is essential. This will be accomplished through the Morgantown Project Experimental Design, which involves: (a) setting up the objectives and assuring national applicability; (b) establishing the appropriate data collection plans and analysis procedures, and (c) stating the form that the results will take, assuring that the project findings can be easily assimilated by other regional and local jurisdictions which might be interested in adopting certain aspects of this transportation demonstration.

II. Schedule

January 1973-April 1974

III. Funding

$80,000 (to June 30, 1973; incremental funding)

IV. Recent Progress

The design is being developed.

V. Project Number(s)

MA-06-0026

VI. Contractor(s)

Transportation Systems Center (TSC)
Cambridge, Massachusetts

VII. Report(s)

PLANNING RESEARCH

This sub-activity finances special policy studies, research on planning methods and development of data and techniques for systematic program evaluation.

The following are examples of studies which were worked on during FY 73:

-- Design and analysis of rapid bus alternatives; a joint project with the Office of the Secretary and the Federal Highway Administration. (DC-06-0078)

-- Identify and develop alternative policy responses for dealing with impacts of transportation facilities outside of right-of-way; a joint project with the Office of the Secretary and the Federal Highway Administration. (DC-06-0087)

-- Study extent of authority invested in existing metropolitan agencies to plan and carry out transportation programs; a joint project with the Federal Highway Administration. (DC-06-0088)

-- Review, develop and support Bay Area Rapid Transit impact studies; a joint project with Department of Housing and Urban Development. (DC-96-0003)

Emphasis in FY 1973 will be placed on improving methods and data for systematic evaluation of UMTA activities. This activity will include further development of indicators and continuing development of theory and methodology for "before-and-after" studies.

SERVICE DEVELOPMENT

The Urban Mass Transportation Service Development effort is designed to develop and demonstrate new transit services which affect users of transit facilities with special emphasis upon the transportation deprived; i.e., the elderly, handicapped, poor, unemployed and youth. These will involve new methods of planning, implementing, managing and disseminating information nationally.

The Urban Mass Transportation Act of 1964, as amended, in 1970, (Section 16) declares it to be national policy that "elderly and handicapped persons have the same right as other persons to utilize mass transportation facilities and services," provides that "special efforts shall be made in the planning and design of mass transportation facilities and services so that the availability to elderly and handicapped persons of mass transportation which they can effectively utilize will be assured," and earmarked 1-1/2 percent of UMTA's funds (raised to 2 percent by the Federal Aid Highway Act of 1973) for improved transportation planned and designed to meet the special needs of the elderly and handicapped.

This section of the Act has generated a heightened awareness and interest in improved mobility for the handicapped and elderly. Recommendations made at the White House Conference on the Aging and subsequent conferences held at the local level have produced a quantum jump in applications for transit demonstrations for the elderly and handicapped.

Demonstrations are designed, managed and evaluated so as to expand the data base regarding the marketing, managing and financing of transit services to the transportation disadvantaged. Activity resulting from the Service Development effort brings together in local communities, the transit deprived, local governments and transportation carriers in the development and demonstration of effective tools for overcoming problems of mobility. These inter-actions and demonstrations will ultimately enable the transit industry to provide, at the least cost, the best services for the respective target groups. Such special services as variations of demand responsive systems, fare sharing techniques, marketing and information techniques and special vehicles are demonstrated. These demonstrations are held in cities classified by size and by economic, climatic and demographic characteristics.

Project: Transit for Low-Density Urban Areas

I. Description

This planning grant will permit the Tuskegee Institute to identify the unfulfilled transportation requirements of the City of Tuskegee, and of Macon County, Alabama, particularly for the elderly and poor. Appropriate methods of meeting these needs will be enumerated. The most feasible method(s) will be selected as the basis of subsequent implementation as a working demonstration.

There is currently no mass transportation in the City or County. This demonstration can have significant implications for other urban-low density areas throughout the nation. This is particularly true of these areas that are gradually shifting from agricultural economy and which lack the services necessary to support increasing urbanization.

II. Schedule

December 1972-March 1973

III. Funding

$20,000

IV. Recent Progress

Planning effort has been completed and a draft final report is under review.

V. Project Number

AL-06-0001

VI. Contractor(s) (Grantee(s))

The Tuskegee Institute

VII. Report(s)

Project: Combined Fixed Routes and Demand-Responsive Transit

I. Description

The objective is to develop a combination of fixed route and demand activated transportation systems in an area with limited mass transportation services. Groups that will be served by this demonstration include the elderly, handicapped, Indians, Native Eskimos, poor, unemployed and youth.

The demonstration will include several concepts:

A. Inner-city circulation which will enable transit users to travel between different areas of the city. These routes provide resident access to health, employment, business and social service facilities.

B. Home-to-work and work-to-home services within the area served by the project.

C. Demand responsive service which will allow portal to portal service within different neighborhoods.

The resultant effectiveness and benefits of such an operation will be measured and evaluated.

II. Schedule

June 1972-February 1974

III. Funding

Federal:	$295,130
Local:	147,566
Total:	$442,696

IV. Recent Progress

Fixed route portion of project is currently serving the citizens of Anchorage. Patronage is approximately 400 percent of the grantee's original projections.

V. Project Number

AK-06-0001

VI. Contractor(s) (Grantee(s))

City of Anchorage, Alaska

VII. Report(s)

A final report will be submitted at the close of the project.

Project: Combined Subscription and Demand-Responsive Transit

I. Description

This project undertook to develop 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 residents of the neighborhood with access to health and social services, shopping centers and cultural and recreational facilities. The effectiveness and benefits of such service are being measured. Alternative cost sharing financial techniques will be designed, tested and evaluated.

II. Schedule

August 1971-August 1974

III. Funding

Federal:	$300,469
Local:	150,231
Total:	$450,700

IV. Recent Progress

The planning and programming phase of the project have been completed. Vehicles are presently being acquired.

V. Project Number

CA-06-0017

VI. Contractor(s) (Grantee(s))

City of Los Angeles Model Cities Program

VII. Report(s)

Preliminary Report, "Plans and Specifications for a Demand-Responsive Transportation System -- East/Northeast and Watts Model Cities Neighborhood -- Los Angeles", has been completed.

A final report will be submitted at the close of the project.

Project: Advertising and Promoting Bus Transit

I. Description

This demonstration project was designed to evaluate the effectiveness of an extensive transit marketing information program as a means of increasing the use of mass transportation. The goal was to convince the public that mass transportation is an acceptable, economical and convenient way to travel. The elderly and poor were the primary target groups.

The program employed six "community representatives" whose function was to familiarize Long Beach citizens with the advantage of bus travel in general and, specifically, the services of the Long Beach Public Transportation Company. Special advertising, person-to-person contact and "on-board" promotions were coordinated with the outreach effort.

The project was conducted and documented in such a manner that its methods and conclusions will assist other transportation agencies to increase ridership.

II. Schedule

December 1971-December 1972

III. Funding

Federal:	$ 96,700
Local:	30,128
Total:	$126,828

IV. Recent Progress

Demonstration project has been completed. Final report is now being prepared.

V. Project Number

CA-06-0018

VI. Contractor(s) (Grantee(s))

Long Beach Public Transportation Company

VII. Report(s)

Final report is in preparation.

Project: Development and Demonstration of Transit System for the Elderly and Handicapped

I. Description

To develop and evaluate a flexible transit system for residents of a "Deep Suburban" type community now completely lacking public transportation. The primary concern is for transport to health and social services, but with a capability to serve the general public through orderly extension.

The project will design, fabricate and experimentally test several factory modifications to presently available transit buses which will aid elderly and handicapped persons in using the bus without affecting the comfort and convenience features for general public use.

Three types of service will be provided by the Valley Transit Program: normal schedule route service, charter service and door-to-door reservation service. A unique aspect of the system is an automatic credit card fare collection system which allows monthly billing to users. The system also allows fare-sharing between social service agencies and clients and complex fare structures based on mileage.

II. Schedule

June 1971-June 1974

III. Funding

Federal:	$625,050
Local:	67,700
Total:	$692,750

IV. Recent Progress

Six vehicles are in full operation. Ridership is meeting system capacity. Application is being made for a capital grant to expand the system.

V. Project Number

CT-06-0003

VI. Contractor(s) (Grantee(s))

Valley Transit District

VII. Report(s)

Project: Transportation Systems to Aid the Unemployed (Hartford)

I. Description

This project will demonstrate a new transportation service using existing transportation facilities to transport inner-city unemployed and underemployed to jobs and training at suburban plants previously inaccessible or inconvenient by public transportation and to measure the resultant benefits and costs of this service.

Phase I of the project investigated the supply of existing facilities, employers, potential job openings and alternative approaches to connecting inner-city residents with job sites. The direct result of Phase I is the proposed New Employees Transportation Center. This Center will set up a series of special transportation services which meet specific needs of groups of new employees going to jobs at single suburban plants or to clustered groups of plants. It is intended that the employers will pay any operational deficits of these services. The Center will also develop information services which will include:

a. Data bank: transportation facilities-suburban plants-potential riders;
b. Transportation newsletter: to employers and public agencies;
c. Bus schedules: simplified and rider-oriented;
d. People-to-people campaign: to potential riders.

Phase 2 set up and operated the Center for 1 year.

II. Schedule

May 1969-August 1972

III. Funding

Federal:	$110,034
Local:	12,419
Total:	$122,453

IV. Recent Progress

Completed project.

V. Project Number

CT-06-0005

VI. Contractor(s) (Grantee(s))

Urban League of Greater Hartford

VII. Report(s)

Technical reports are available from Office of Transit Planning, UMTA.

Project: Mobility Patterns of the Elderly

I. Description

Fisk University was awarded a joint HUD/HEW/DOT grant to conduct a research study of mobility patterns of the elderly using as a sample the elderly population of Nashville, Tennessee. The study of the elderly was cast in the framework of their position in the late stage of the life cycle.

Social and demographic data were analyzed including health, income, race, family setting, type of residence and locations. The means and extent of elderly movement was examined, looking at mobility and destinations, types of transportation and the relationships of mobility to life style and demographic characteristics.

II. Schedule

June 1972-June 1973

III. Funding

Federal:	$ 53,951	(HUD/DOT)
	80,516	(HEW/AOA)
Local:	10,000	
Total:	$144,467	

IV. Recent Progress

Completed project.

V. Project Number

DC-06-0001

VI. Contractor(s) (Grantee(s))

Fisk University
Nashville, Tennessee

VII. Report(s)

Project: Effective Transit Marketing and Public Information Techniques for the Disadvantaged

I. Description

There has been a notable lack of success in providing basic "How to Use It" information about available transit service. Persons who are transportation disadvantaged in other ways are particularly affected adversely. This project is to develop effective transit marketing and public information techniques that can be particularly helpful to the elderly and handicapped. By conducting case studies in four cities, the grantee also will be able to evaluate the needs of the elderly and handicapped on mass transit. These studies addressed such issues as fares, service and equipment.

II. Schedule

June 1971-August 1972

III. Funding

$226,637

IV. Recent Progress

Completed project.

V. Project Number

DC-06-0020

VI. Contractor(s) (Grantee(s))

National Urban League

VII. Report(s)

Marketing Techniques and the Mass Transit System: A Handbook, July 1973, PB-223-736, $4.25.

Marketing Techniques and the Mass Transit System, July 1973, PB-233-736, $4.25.

Transportation for the Elderly and Handicapped, July 1973.

Project: The Special Needs of Transit Dependent Groups

I. Description

A 3-day conference explored and analyzed current methods, as well as those that could be employed by public transit bodies to meet the special needs of transit dependent groups. These groups include the handicapped, elderly, urban and rural, poor, unemployed, youth and others who have lack of auto accessibility. Participants in the conference included Federal, State and local government officials, transit dependent groups and the transit industry. The conference concerned itself with areas such as:

1. existing transit alternatives, costs, availability;
2. strategies for solving mobility constraints;
3. the responsibility of the planners, operators, citizens and government, in providing adequate transportation for the transit dependent, and
4. refining and utilizing community inputs into transit planning.

II. Schedule

Three-day conference (June 19-21, 1972). Completion of final report, August 7, 1972.

III. Funding

$57,132

IV. Recent Progress

Completed project.

V. Project Number

DC-06-0070

VI. Contractor(s) (Grantee(s))

The American University

VII. Report(s)

Conference on Transportation and Human Needs in the 1970's, Final Report, , PB- - , $.

Project: Marketing Information for Spanish Speaking Groups

I. Description

The purpose of this research and demonstration program is to explore methods of transit marketing and informational services addressed to the Mexican Americans in four representative southwestern cities. The program will include a demonstration of bilingual information techniques in each city and a pre- and post-demonstration survey of each site to determine the effectiveness of the demonstration.

Marketing effectiveness of newspaper advertising, spot announcement on radio or television, community mailing advertising and door-to-door or carrier based advertising, all tailored for appeal to Mexican Americans will be considered as a means of increasing urban transit ridership.

The program will:

(1) Measure the effectiveness of present marketing information programs;
(2) Identify marketing informational programs especially attractive to bilingual populations;
(3) Conduct a demonstration of chosen marketing informational techniques within the environs of the target population in cities of San Diego, San Antonio, Corpus Christi and Albuquerque, and
(4) Reevaluate effectiveness of the demonstration based upon ridership.

II. Schedule

July 1972-August 1973

III. Funding

$123,000

IV. Recent Progress

Project completed.

V. Project Number

DC-06-0073

VI. Contractor(s) (Grantee(s))

J. A. Reyes Associates, Inc.

VII. Report(s)

Project: Special Transit Service for the Elderly

I. Description

This was a demonstration planning project leading to the definition of a multi-faceted transportation demonstration program aimed at providing improved mobility for the elderly.

New transportation service concepts were applied, including in part, a mix of subscription, rotating fixed route and demand-responsive concepts. Specific transportation needs of the elderly were examined and transportation demonstration services defined. Alternative solutions were evaluated in relationship to demographic characteristics and existing transportation services in St. Petersburg.

II. Schedule

April-August 1972

III. Funding

Federal:	$33,333
Local:	16,667
Total:	$50,000

IV. Recent Progress

Completed project.

V. Project Number

FL-06-0002

VI. Contractor(s) (Grantee(s))

The City of St. Petersburg

VII. Report(s)

Project: Special Transportation Needs of the Elderly

I. Description

This was a demonstration planning project in a tri-county area leading to the definition of a multi-faceted transportation demonstration program aimed at providing improved mobility for the elderly. Specific transportation needs of the elderly were examined and transportation demonstration services defined. New transportation services were applied such as semi-fixed routes and subscription service. A method of combining proposed demonstration services with the existing transportation system was developed.

Planning activites carried out in the project were:

1. Examine the specific transportation needs of the elderly in the Orange-Seminole-Osceola county area;
2. Identify the location of the elderly population in the area to aid in route construction and identification of modes of services;
3. Evaluate alternative solutions with respect to area characteristics and the present transportation service;
4. Describe in detail the recommended demonstration services including vehicles, facilities, routes, operations, service and fare policies, and
5. Yield a plan of implementation, including phased extension of service to the area, community interaction and a means for evaluating and monitoring service.

II. Schedule

June-September 1972

III. Funding

Federal:	$20,000
Local:	10,000
Total:	$30,000

IV. Recent Progress

Completed project.

V. Project Number

FL-06-0005

VI. Contractor(s) (Grantee(s))

Orange-Seminole-Osceola Transportation Authority

VII. Report(s)

Draft final report completed.

Project: Personalized Transit Service for Elderly and Handicapped

I. Description

The project will implement a demand-responsive transit system to increase mobility for the elderly in a medium size urbanized area with a large concentration of elderly people. Several types of service will be provided, allowing for extreme schedule flexibility, high utilization of vehicles and maximum personal safety.

Primary service will be 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 will be available on a limited basis. Two of the fleet of small buses and van sized vehicles will be equipped with hydraulic lifts to accomodate wheelchairs. Senior citizens over age 60 and the handicapped will be eligible to use the sytem by registering with the city.

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

II. Schedule

December 1972-August 1974

III. Funding

Federal:	$300,000
Local:	150,000
Total	$450,000

IV. Recent Progress

Vehicles ordered. Start-up operations anticipated in September 1973.

V. Project Number

FL-06-0007

VI. Contractor(s) (Grantee(s))

City of St. Petersburg

VII. Report(s)

Project: Services for Youths for Summer Activities

I. Description

Pursuant to the provision of Section 6(a) of the Urban Mass Transportation Act of 1964, as amended, this agreement provides for the transfer of funds to the Manpower Administration, U.S. Department of Labor for the purpose of conducting a demonstration of the impact and effect of providing transportation services to youth for employment and recreational, cultural and educational activities, during the summer.

II. Schedule

May-October 1972

III. Funding

Federal:	$1,000,000	(Department of Labor)
	500,000	(UMTA)
Total:	$1,500,000	

IV. Recent Progress

Completed project.

V. Project Number

IT-06-0021

VI. Contractor(s) (Grantee(s))

National League of Cities

VII. Report(s)

Summer Youth Transportation Project: A Demonstration Project, December 1969.

Project: Transit Services for the Physically Handicapped

I. Description

This demonstration project is designed to test a combination fixed-route -- demand responsive transportation system for the physically handicapped. Modified vehicles to accommodate wheelchairs will be demonstrated and evaluated.

Some of the vehicles will operate on a fixed route for clients who must be served on a regular basis. The remaining vehicles will be used on a demand responsive basis primarily reservation by subscription. Two way radio communications will facilitate the efficient and expeditious routing of the vehicles to health services, social services, employment and cultural opportunities.

No changes will be made in existing services or facilities of the Baton Rouge Transportation System. This demonstration project will represent an additional specialized transportation service to be operated in coordination with the Baton Rouge transportation system.

II. Schedule

June 1971-December 1973

III. Funding

Federal:	$171,050
Local:	85,525
Total	$256,575

IV. Recent Progress

Demonstration is not yet operational.

V. Project Number

LA-06-0001

VI. Contractor(s) (Grantee(s))

The City of Baton Rouge and Parish of East Baton Rouge, Louisiana

VII. Report(s)

Project: Analysis of the Transportation Needs of the Elderly and Handicapped

I. Description

The Transportation Systems Center of the Department of Transportation is conducting an analysis of urban public transportation and the extent to which it is currently used by the elderly and handicapped. The study includes an analysis of census and other statistics on the elderly and handicapped population, types of disabilities and their transportation needs. It also includes a review of all literature and research produced on this subject. The final report will delineate the market for urban mass transit by the elderly and handicapped.

II. Schedule

July 1972-October 1973

III. Funding

$137,000

IV. Recent Progress

Draft report completed and under review.

V. Project Number

MA-06-0034

VI. Contractor(s) (Grantee(s))

Transportation Systems Center, Cambridge, Massachusetts

VII. Report(s)

The Handicapped and Elderly Market for Urban Mass Transit, July 1973, PB-224-821, $4.75.

Project: Demand-Responsive Public Transportation for Poor and Elderly Persons

I. Description

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

II. Schedule

June 1971-June 1974

III. Funding

Federal:	$193,600	(estimated)
Local:	96,800	"
Total:	$290,400	"

IV. Recent Progress

Service was inaugurated July 2, 1973.

V. Project Number

MI-06-0004

VI. Contractor(s) (Grantee(s))

City of Grand Rapids, Michigan

VII. Report(s)

Final report will be submitted at the close of the project.

Project: Demonstrate Bus System for Small Urban Area

I. Description

The project will demonstrate whether a small city can develop and support a mass transit system based on the market of potential ridership from that part of the population presently without a mode of transportation within their economic means. The system is to be primarily oriented to senior citizens and will be integrated into the local taxi operation. Two 25-passenger buses will operate through the residential neighborhoods with concentrations of older and poor persons and bring them to the Central Business District and other centers of activity. The resultant effectiveness and benefits of such an operation will be measured and evaluated.

The unique and key element of this project is the integration of two levels of transportation service, bus and taxi, into one system and one operation. The economic, operational and managerial benefits in this kind of system will be evaluated.

II. Schedule

June 1971-October 1974

III. Funding

Federal:	$ 83,387
Local:	41,693
Total:	$125,080

IV. Recent Progress

Demonstration is operational.

V. Project Number

MT-06-0002

VI. Contractor(s) (Grantee(s))

City of Helena Model Cities Department

VII. Report(s)

Project: Demand-Responsive Transportation for the Handicapped

I. Description

The purpose of this project is to test the feasibility, effectiveness and economics of providing public transportation for the physically handicapped, who presently have no accessibility to regular public transit. Vehicles will operate on a dynamically flexible routing system in which riders telephone to a radio-dispatcher for scheduling pick-up and delivery from homes to the specific point of destination. The operating system will be 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 will represent an additional specialized transportation service to be incorporated into the Lincoln Transportation System and will be evaluated as to performance of the service for an urban handicapped population.

II. Schedule

June 1972-June 1974

III. Funding

Federal:	$136,384
Local:	15,000
Total:	$151,384

IV. Recent Progress

Service has been inaugurated and is being monitored by a consultant.

V. Project Number

NE-06-0002

VI. Contractor(s) (Grantee(s))

City of Lincoln, Nebraska

VII. Report(s)

A final report will be submitted at the close of the project.

Project: Demand-Responsive Transportation for Elderly and Handicapped

I. Description

The project will design and implement a demand-activated transportation system utilizing four specially-equipped vehicles, which will serve the special transportation needs of the elderly and disabled in the City of Syracuse and Onondaga County.

The project will determine the latent travel demand of approximately 85,000 elderly and disabled residents, many of whom are completely transit dependent, when they are provided a well publicized, high level of service geared to their special needs. This service will permit the accommodation of regularly scheduled work trips, as well as school, medical and social trips on a 7-day a week basis throughout the urbanized area.

Sponsored by the local transit authority, the project will involve close coordination of service among supplier, customer and destination activity. Project activity will include an analysis and evaluation of social and economic benefits to the user, as well as the feasibility, cost effectiveness and latent demand of such a service which is available to an entire medium-size urbanized area.

II. Schedule

May 1973-May 1975

III. Funding

Federal:	$333,000
Local:	167,000
Total:	$500,000

IV. Recent Progress

Vehicle specifications are being written.

V. Project Number

NY-06-0041

VI. Contractor(s) (Grantee(s))

Central New York Regional Transportation Authority

VII. Report(s)

A final report will be submitted at the close of the project.

Project: Develop and Evaluate Transit System in Developing Urban-Rural Region

I. Description

The project is designed to develop and evaluate a transit system in a developing, urban-rural Indian Region. The primary concern is to support 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.

An element of the project will be to search out ways of incorporating all the transit services in the region into a package that will sustain the system at a point where it is economically self-sufficient. This demonstration is expected to provide data concerning ways in which an environment characterized by low socio-economic conditions and limited transit expertise can support a badly needed transportation.

II. Schedule

June 1971-January 1974

III. Funding

$236,713

IV. Recent Progress

System is operational.

V. Project Number

ND-06-0001

VI. Contractor(s) (Grantee(s))

Three Affiliated Tribes

VII. Report(s)

Project: A Neighborhood Transportation System for the Elderly

I. Description

Jointly sponsored by UMTA and the HEW Social and Rehabilitation Service, the project will design and implement 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 has been developed to:

-- 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.

-- 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.

-- Determine the economic and social impact of a system which 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 a total of 7.6 square miles and containing a high percentage of elderly persons.

II. Schedule

June 1973-December 1974

III. Funding

Federal:	$ 450,000 (UMTA)
	250,000 (HEW)
Local:	304,675
Total:	$1,004,675

IV. Recent Progress

Vehicle specifications are being prepared.

V. Project Number

OH-06-0018

VI. Contractor(s) (Grantee(s))

The City of Cleveland, Ohio

VII. Report(s)

A final report will be submitted at the close of this project.

Project: Use of School Buses for Transit for Deprived Persons

I. Description

This project is exploring the feasibility of, and developing a model for, the use of school buses for public transportation. The project will test the concept of using school buses, during available hours, to transport citizens of Klamath Falls, Oregon. The proposed system will be oriented to the elderly and other transit deprived persons with no other means of transportation.

The objectives of this project are to: (1) determine the feasibility of using idle school bus equipment to provide transportation in small urban areas and (2) explore and report all alternatives for maximizing the use of school equipment for a pilot local transportation system.

II. Schedule

March 1972-September 1973

III. Funding

Federal:	$ 77,710
Local:	38,726
Total:	$116,436

IV. Recent Progress

Service was expanded during the summer months to take advantage of full-time availability of school buses.

V. Project Number

OR-06-0001

VI. Contractor(s) (Grantee(s))

Oregon State Department of Transportation

VII. Report(s)

Six-month report available from Office of Transit Planning, UMTA.

Final report in preparation.

Project: Transit System for Disaster Stricken Area

I. Description

The purpose of this demonstration is to design and implement a transit system after a natual disaster, with maximum retention of emergency-generated riders. With incremental increase in the fare structure, preferential treatment for transit vehicles and restrictions for automobiles will be implemented including: 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 is to prepare a transit operations manual for communities experiencing a civil emergency.

II. Schedule

October 1972-July 1974

III. Funding

Federal:	$ 300,000
Local:	1,235,000
Total:	$1,535,000

IV. Recent Progress

A working outline has been developed for the handbook entitled "Transit Operations Manual for Civil Emergencies."

V. Project Number

PA-06-0028

VI. Contractor(s) (Grantee(s))

Luzerne County Transportation Authority

VII. Report(s)

A final report will be submitted at the close of the project.

Project: Demand-Responsive and Subscription Transit for the Elderly and Handicapped

I. Description

This program for provision of special transportation services for the elderly and handicapped residents of Cranston, Rhode Island, has two components:

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

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

The program is designed to meet the public transportation needs of persons who by reason of trip orientation or personal physical handicap cannot make effective use of existing public transit services. The objective is to provide public transportation not otherwise available to the elderly and handicapped -- who represent the sector of the community with greatest mobility problems.

II. Schedule

May 1972-November 1973

III. Funding

Federal:	$156,000
Local:	23,036
Total:	$179,036

IV. Recent Progress

Project operational.

V. Project Number

RI-06-0006

VI. Contractor(s) (Grantee(s))

City of Cranston, Rhode Island

VII. Report(s)

Operations Manual available from Office of Transit Planning, UMTA.

Project: Special Transportation Extension Routes for Isolated Poverty Areas

I. Description

This project developed a fixed route schedule transportation service for two isolated, outlying communities without any mass transit. The residents of Palo Alto and Villa Coronado are predominately Mexican-American migrant laborers living at poverty level in areas three miles from the nearest commercial development. Transportation service was provided from the two communities to an employment and shopping corridor as well as transfer connections for direct bus service into the San Antonio's central business district.

The effectiveness of the special transportation extension routes and the impact on the target groups due to increased mobility were measured and evaluated.

II. Schedule

December 1971-May 1973

III. Funding

Federal:	$28,654
Local:	14,327
Total:	$42,981

IV. Recent Progress

Project is completed.

V. Project Number

TX-06-0002

VI. Contractor(s) (Grantee(s))

San Antonio Transit System

VII. Report(s)

Final report is now being prepared.

Project: Transit Facilities for Unemployed and Low Income Groups

I. Description

This project studied the feasibility of, and developed a system for, the demonstration of mass transit service for the low income and unemployed, of Corpus Christi and nearby Robstown, Texas, particularly Mexican-American residents. The study focused on the need and development of a transportation system to and from human resource facilities and employment centers located in Corpus Christi, Texas. Included in this planning effort prior to the demonstration was an evaluation of the institutional arrangements to finance and permanently operate the service.

II. Schedule

June-October 1972

III. Funding

Federal:	$23,730
Local:	7,270
Total:	$31,000

IV. Recent Progress

Completed project.

V. Project Number

TX-06-0012

VI. Contractor(s) (Grantee(s))

Coastal Bend Council of Governments

VII. Report(s)

TRANSIT OPERATIONS AND MANAGEMENT

The Transit Operations and Management (TOM) effort is a family of related procedures, techniques and tools sponsored by the Urban Mass Transportation Administration for use by transit companies. The objective is to enable transit companies to improve service and financial position through increased efficiency of operations. This objective will be attained through optimum allocation of resources, increased productivity of labor and capital and the provision of better tools for planning and marketing services.

Over the last few years the operating losses of the transit industry have not permitted it to apply funds to tool development to improve the profit and loss situation. In the TOM program, UMTA is providing the requisite funding.

Short-range goals of the TOM program are the completion of the specific projects for development of various techniques, procedures and tools which are implicit in the program objective and the demonstration and implementation of these management aids in the operating transit property environment.

The activities of TOM are divided into four categories:

- Transit Research Information;
- Transit Operations;
- Transit Management, and
- Intermodal Integration

Specific projects in each of these subject areas may be concerned with operational considerations or with the design and engineering of appropriate equipment and facilities. Many activities in these and other areas may involve simultaneous development of both operating and physical plant concepts. Projects addressed to fare collection and assessment systems, methods for the management and control of maintenance, and operational communications schemes characteristically exhibit hardware as well as software RD&D program impacts.

Transit Research Information

The Transit Research Information Program (TRIP) is a recent innovation designed to improve the availability of the results of UMTA research and development efforts by more actively attempting to reach the users of this information. TRIP makes available and disseminates research results from UMTA RD&D projects including the software outputs of the Bus, Rail and New Systems divisions developed for the improvement of urban transportation systems.

As it develops, TRIP will adapt technical findings to formats convenient to the specialized interests and positions of different groups of information users. Announcements of reports, executive summaries, business staff and technical summaries, transit R&D conferences, audio-visual aids and reportage will be included among the formats made available.

At least three groups of beneficiaries can be identified in connection with the overall information program. A variety of technicians, researchers and interested citizens may gain ready access to up-to-date technical data, an improved knowledge of R&D efforts in behalf of urban mass transportation, and a better picture of the role mass transportation can play in meeting the needs of cities across the nation. Secondly, governmental users, including city, state and other Federal agencies, benefit by having more convenient forms of information through which an understanding and appreciation of current R&D activities may be gained. Finally, the UMTA program itself is strengthened through a feedback process as information flows become more complete and pervasive.

TRANSIT OPERATIONS AND MANAGEMENT

Transit Operations

The Transit Operations effort will provide the transit industry with technological developments, methods and software developed and demonstrated by UMTA RD&D program to assist in modernizing and improving transit operations. During FY 1973, it concentrated its attention on the following areas:

- Transit Service Innovations
- Bus Priority Systems
- Automatic Vehicle Monitoring (AVM) and Communications Systems
- Systems Safety
- Prevention of Crime and Vandalism
- Needs of the Elderly and Handicapped

Transit Operations: Transit Service Innovations

UMTA is conducting a variety of transit service demonstrations designed to identify and "prove out" readily available means for improving transit. These include the following:

- The Shirley Highway express bus on freeway project has had outstanding success in attracting new transit users. Over half the commuters traveling on Shirley Highway in the peak period are now being carried on buses.

- In Seattle, the "Blue Streak" demonstration project involves express bus service linking north Seattle to the downtown, using a freeway ramp made available for the exclusive use of buses.

- In New York City, there is a demonstration of a contra flow reserved lane for buses that has been operating for 2 years without a major accident. This one lane is carrying 80 percent of the people approaching the Lincoln Tunnel in morning peak period and 35,000 people are now saving 10 to 20 minutes on their journey to Manhattan each day.

In Minneapolis, the I-34W freeway ramps are in the process of being instrumented to meter the amount of traffic given access to the freeway. Bus bypass ramps are being constructed that will provide buses preferential access at select on-ramps. In Miami, Florida, the planning is complete for a demonstration project that will reserve one lane of I-95 north of Miami for buses and carpools.

Project: Shirley Highway Express-Bus-on-Freeway (jointly with FHWA)

I. Description

This project involves the operation of express buses between Northern Virginia and downtown Washington, D.C., utilizing bus service innovations such as a 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 produced on riders' attitudes, project costs and benefit demand relationships and other matters which should be valuable as guidance for other communities contemplating similar service.

Now well into the fourth year of service (it began in September 1969), the number of riders using it has increased over 375 percent. The original goal was to attract over 5,000 new riders by 1975. By mid-1973, there were over 7,000 new riders. The Northern Virginia Transportation Commission, sponsor of the project, has recognized the value of the Shirley Highway service and obtained State and local fund support for its continuation at the end of the demonstration (December 1974).

II. Schedule

June 1971-December 1974

III. Funding

Federal:	$5,868,419
Local:	308,864
Total:	$6,177,283

IV. Recent Progress

With the opening of another completed section of Shirley Highway, the auto trip times were considerably reduced and the number of automobiles crossing the project screenline on Shirley Highway almost doubled. Most of these autos were diverted from other arterials in the corridor. In spite of the considerable decrease in time advantage, bus ridership still continues to climb.

V. Project Number

IT-06-0024

VI. Contractors

Northern Virginia Transportation Commission, Arlington, Va.

Subcontractors

Washington Metropolitan Area Transit Authority

VII. Report(s)

The Shirley Highway Express Bus-on-Freeway Demonstration Project/ First Year Results, November 1972, PB-214-333, $3.00.

Shirley Highway Express Bus-on-Freeway Demonstration Project -- Project Description, August 1971, PB-218-983, $3.00.

Bus User Reactions to Innovative Bus Features, June 1973, PB- - , $

Interim Report expected October 1973.

Final Report due April 1975.

Project: Evaluation of Shirley Highway Express-Bus-On-Freeway Project

I. Description

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

This project has 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. The significance of the project will be reported so that other urban areas may relate the importance of the demonstrated improvements to the solution of their particular transportation problems.

II. Schedule

December 1970-April 1975

III. Funding

$563,000

IV. Recent Progress

A second year results report, including park-ride analysis results and an analysis of demand relationships in the corridor, will be published in October 1973.

V. Project Number

DC-06-0066

VI. Contractor(s)

U.S. Department of Commerce, National Bureau of Standards

VII. Report(s)

See IV and VI above.

Project: Innovations in Downtown Traffic Circulation

I. Description

To increase the attractiveness of the downtown area, the District of Columbia's Department of Highways and Traffic (DCHT) has established a CBD bus circulation system using buses purchased under an UMTA Capital Grant. The buses are used during off-peak hours to provide access to commercial areas and provide improved mobility in the retail core. The service has a unique zone fare structure, which is simple to administer, providing a low fare for short trips in the shopping area and a higher fare for longer trips in the CBD.

II. Schedule

December 1972-July 1974

III. Funding

$346,000

IV. Recent Progress

An extension of the route into the Southwest residential area is current being studied. This routing should improve patronage during slack periods before and after lunch time.

V. Project Number

DC-06-0069

VI. Contractor(s)

Washington, D.C., Department of Highways

VII. Report(s)

Interim Report on Ridership Survey, , PB- - , $

Project: Seattle "Blue Streak" Express Bus on Freeway Project

I. Description

The bus demonstration project in Seattle, Washington, was designed to measure the effect of substantial improvements in bus transit service and to measure the impact of a park-and-ride lot with express service to the downtown area. In this project, Blue Streak buses use the reversible lanes of Interstate 5 (the Seattle Freeway) from the CBD north to the city limits.

The Blue Streak demonstration project produced patronage increases in the face of system-wide ridership losses and a general decline in area travel. If the economic and travel conditions of the study area had not declined during the demonstration, advantages of Blue Streak would have been more dramatically demonstrated in a greater patronage shift. Nevertheless, ridership increased from about 7,500 to over 10,000 passengers per day. The greatest increases occurred on routes that included the park-and-ride lot in their service for a round trip of 70 cents.

Typical transit travel time southbound in the morning peak period went from 49 minutes to 38 minutes. Blue Streak routes averaged nearly 17 mph where non-Blue Streak routes are around 11 mph. The safety record of Blue Streak buses was impressively good, with an average of 11.1 collisions per million bus-miles as compared to system-wide ratios of over 50. Maintenance costs were low, at $0.079 per mile as compared to non-Blue Streak buses at an average of $0.129.

The Blue Streak modal split model, calibrated for downtown travel in a major transportation corridor, showed the relationship between transit use and trip purpose, user income, auto and transit running time differences, auto and transit waiting time differences, fare, parking cost and auto out-of-pocket costs. Also, developed in the project was a ramp simulation model to test the impact of exclusive bus ramps. A procedure was also devised to test the location of park-and-ride facilities.

II. Schedule

September 1970-December 1972

III. Funding

UMTA:	$1,293,000
Local:	646,000
Total:	$1,939,000

IV. Recent Progress

In September 1972, voters approved by a wide margin funding to expand the "Blue Streak" concept on a regional basis. Express bus service will be expanded to include each corridor and approximately 24 park-ride locations will be developed. UMTA support for the demonstration ended in December 1972 and the service is continuing.

V. Project Number

WA-06-0004

VI. Contractor(s)

Seattle Transit System, Seattle, Washington

Third Party Contractor

Allan M. Voorhees, Seattle, Washington

VII. Report(s)

Blue Streak Bus Rapid Transit Demonstration Project -- Phase I, Interim Report, 1971, PB-206-629, $3.00.

Blue Streak Bus Rapid Transit Demonstration Project -- Phase II, Interim Report, July 1972, PB-218-879, $3.00.

Blue Streak Bus Rapid Transit Demonstration Project -- Final Report, June 1973, PB-222-126, $7.00.

Blue Streak Bus Rapid Transit Demonstration Project -- Final Report Appendix, June 1973, PB-222-128, $4.85.

Project: Miami I-95/NW 7th Avenue Bus/Carpool Priority System

I. Description

This two-phase project will demonstrate a bus and carpool priority system for the Miami, Florida, area. Under Phase I, express commuter bus service will be operated on a reserved regular lane of NW 7th Avenue from a new park-ride facility into the CBD. Preemption of traffic signals will be employed to speed the buses through this high-volume traffic corridor north of Miami.

Under Phase II of the project, one lane will be added to the adjacent I-95 freeway and reserved for buses and carpools for some 10 miles approaching downtown Miami. Additional bus service will be added in the corridor to test the extent to which this type of limited bus preference will encourage both carpool formation and a modal shift to buses.

II. Schedule

January 1972-October 1976

III. Funding

Local:	$ 2,030,000
FHWA:	13,176,000
UMTA (RD&D):	750,000
UMTA (Other):	1,400,000
Total:	$17,356,000

IV. Recent Progress

A unified funding plan for all elements of the project has been approved. Work is underway to implement Phase I of the project and finalize the evaluation plan.

V. Project Number

FL-06-0006

VI. Contractor

Florida Department of Transportation
Tallahassee, Florida

Subcontractors

Metropolitan Dade County Transit Authority
University of Florida

VII. Report(s)

Project: Urban Corridor Demonstration

I. Description

There are several traffic corridors in each of the 60 major urban areas with 500,000 to 3 million people; most of these corridors become highly congested in peak hours. By coordinated use of existing FHWA and UMTA programs, 8 cities will undertake to improve the efficiency of existing transportation facilities. Emphasis is placed on coordinating the planning of highway and transit improvements. These include fringe parking and associated bus service including reserved lanes and express routes, widening and adding freeway ramp controls, remote signal activation devices on buses, staggered work hours and increased transit service. Successful demonstrations should provide examples for other cities to follow. The following cities are active in this program: Cincinnati, Dallas, Dayton, Louisville, Minneapolis/St. Paul, New York, Philadelphia and Washington, D. C.

II. Schedule

June 26, 1970-December 1974

III. Funding

UMTA:	$ 3,500,000
FHWA:	9,443,000
Total:	$12,943,000

IV. Recent Progress

Phase I of the Minneapolis Bus-on-Metered Freeway Project began operating on December 11, 1972. It is a new express bus service connecting 13 park-ride locations in the I-35 corridor to downtown Minneapolis. Public response was so great that the number of trips had to be increased.

The City of Louisville has agreed to subsidize the local transit system. This decision was brought about in large part by the demonstration project.

Express bus service in Cincinnati is schedule to start on October 15, 1973.

V. Project Number

DC-06-0062

VI. Contractor(s)

Washington:	Metropolitan Washington Council of Governments
New York:	Tri-State Transportation Commission
Philadelphia:	Delaware Valley Regional Planning Commission

VI. Contractor(s) (cont.)

Cincinnati:	Ohio-Kentucky-Indiana Regional Planning Authority
Dayton:	Montgomery County Planning Commission
Louisville:	Falls of the Ohio Metropolitan Council of Governments
Dallas:	City of Dallas
Minneapolis-St. Paul:	Metropolitan Council of the Twin Cities Area

In addition, Alan Voorhees Associates has been contracted for the above-mentioned work.

VII. Report(s)

Project: A Test of No-Fare Bus Service

I. Description

This project will measure in a full-scale field experiment what effect free transportation will have on an auto dependent community. The potential of free transportation in other urban areas will also be assessed.

Free public transportation has the potential of reducing traffic congestion by making transit a more attractive alternative for commuters and shoppers. The effects of this are not limited to reduced congestion, but also include reduced air pollution, wiser land use and possibly revitalized activity concentrations.

The Amherst area is comprised of two distinct communities; the city proper and the university community. They are presently linked by a small bus line supplemented by a large number of automobiles. This project will double and up-grade the bus line and establish a local commuter service to many apartment complexes along two high-density residential arteries. Restricted parking and auto-free zones will complement the free transit and thus permit a measurement of the effects and potentialities if the project is applied to large metropolitan areas.

II. Schedule

October 1972-March 1974

III. Funding

$475,000

IV. Recent Progress

Bus service was initiated on January 25, 1973, and data collection, measurement and analysis planned for the spring term was initiated. A detailed experimental design was approved by UMTA in April 1973.

V. Project Number

MA-06-0006

VI. Contractor(s)

University of Massachusetts, Amherst, Massachusetts

VII. Report(s)

Due March 1974

Project: Innovative Bus Service Demonstration in Palo Alto and San Jose: Phase I, Planning and Systems Design

I. Description

Both Palo Alto and San Jose have been suffering the same spiral decline of bus service which afflicts most small cities where the density of population is low, and the residents affluent and automobile-oriented. Each city decided that only a comprehensive program of innovations in transit service could make mass transportation feasible.

The San Jose-Palo Alto Transit Authority conducted a comprehensive design of bus services in both San Jose and Palo Alto. Innovations were proposed affecting every element of financing, community involvement, etc. The Authority hoped to organize and carry out a 30-month operational test of a new system. The present project developed a detailed plan for such a system. The plan called for a demand-actuated bus service (the passengers would telephone a request for bus service and be picked up at, or near, a specified location); the costs would be shared by the rider, his destination and the general public; both transit management and drivers would be given financial incentives for increasing ridership; average bus speeds would be increased by providing preferential treatment (exclusive lanes, directional flows, traffic signals); special bus routes would be tailored to meet peculiar and regular demands (to and from motel, senior citizen centers, nursery schools, etc.); a versatile fare collection system would be established; a computer-oriented information center would be set up to handle "dial-a-ride" reservations and answer telephone inquiries about the variety of services provided by the system.

II. Schedule

October 1971-August 1973

III. Funding

$75,000

IV. Recent Progress

A final report was issued in August 1973. The Santa Clara County Transit District, which replaced the San Jose-Palo Alto Transit Authority, is considering the recommendations in the report for possible implementation.

V. Project Number

CA-06-0016

VI. Contractor(s)

The San Jose-Palo Alto Transit Authority

VII. Report(s)

Will be available from NTIS.

Transit Operations: Bus Priority Systems

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

A demonstration of an integrated urban traffic control and bus priority system in Washington, D. C., undertaken in cooperation with FHWA, uses a central computer to optimize the flow of traffic throughout a network of controlled signals. Under certain conditions, it will grant buses a longer "green" phase in the traffic signal cycle; future developments may also provide truncation of the red phase to reduce delay still further.

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 utilizing devices (either optically or electronically actuated) which (1) "recognize" buses requesting priority passage at given intersections, (2) provide that preferential treatment and then (3) 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 may also be competitive for use in environments where a central control system, lacking BPS features, already exists. A series of demonstrations will be carried out with the purpose of testing different technologies, measuring benefits, determining the costs of representative installations and assessing ridership impacts. Operation in conjunction with busways, as well as with buses in local and line-haul express service, will be included in the investigation.

Project: Urban Traffic Control and Bus Priority System

I. Description

The Bus Priority System (BPS) is an effort designed to give preferential treatment to transit vehicles. The BPS will operate as part of the Urban Traffic Control System (UTCS), a computerized system developed to control traffic signals so as to optimize vehicle flow through center city intersections. The BPS will "recognize" buses on their approach to an interesection and if possible give them priority to move through the intersection by holding the "green" phase for a longer period of time than usual.

Under this project, traffic signals at 112 major intersections in the downtown Washington, D.C., area will be controlled by the UTCS. Of these, 34 will include the BPS feature; 450 transit buses will be equipped to activate the priority override feature. The project will contribute to urban mobility by increasing the operational efficiency of transit vehicles on city streets.

II. Schedule

April 1970-April 1976

III. Funding

UMTA:	$1,657,000
FHWA:	3,273,000
Total:	$4,930,000

IV. Recent Progress

The control center was completed in May 1972, and on-board equipment has been installed. Baseline traffic data surveys are underway in conjunction with system calibration, for which the contract was awarded in August 1972. RFP for evaluation and support contractors have been issued and pre-award negotiations are underway.

V. Project Number

DC-06-0057

VI. Contractor(s)

Sperry Rand Corporation, New York, New York
TRW, Inc., McLean, Virginia
KLD Associates, New York, New York

VII. Report(s)

Advanced Control Technology in Urban Control Systems, Volume I, System Description, October 1969, PB-188-963, $3.00.

Advanced Control Technology in Urban Control Systems, Volume IA, Bus Priority System Description, March 1970, PB-190-847, $3.00.

Advanced Control Technology in Urban Control Systems, Volume IB, Enhanced UTCS Control System Description, October 1970, PB-196-396, $3.00.

Advanced Control Technology in Urban Control Systems, Volume II, UTCS/BPS Programming Specifications, March 1970, PB-190-848, $3.00.

Advanced Control Technology in Urban Control Systems, Volume IIB, Enhanced UTCS/BPS System Program Specifications, October 1970, PB-196-397, $3.00.

Advanced Control Technology in Urban Control Systems, Volume III, UTCS/BPS System Program Specifications, March 1970, PB-190-849, $3.00.

Advanced Control Technology in Urban Control Systems, Volume IIIB, Enhanced UTCS/BPS System Equipment Specifications, October 1970, PB-196-398, $3.00.

Advanced Control Technology in Urban Control Systems, Volume IV, Vehicle Detector Tests, October 1969, PB-188-966, $3.00.

Advanced Control Technology in Urban Control Systems, Bus Detector Development Program, June 1971, PB-204-084, $3.00.

Urban Traffic Control and Bus Priority System, Volume I, Design and Installation, November 1972, PB-214-788, $9.00.

Urban Traffic Control and Bus Priority System, Volume II, Operator's Manual, September 1972, PB-214-641, $5.45.

Urban Traffic Control and Bus Priority System, Volume III, Maintenance Manual, December 1972, PB-217-317, $3.00.

Urban Traffic Control and Bus Priority System Software Manual, Volume I, Functional Description and Flow Charts, December 1972, PB-220-867, $9.00 [Set of Volumes I and II, PB-220-866, $14.00].

Urban Traffic Control and Bus Priority System Software Manual, Volume II, Variable Definitions; Algorithm and Off-Line Software Descriptions, December 1972, PB-220-868, $6.00 [Set of Volumes I and II, PB-220-866, $14.00].

VII. Report(s) (cont.)

SIGOP: Traffic Signal Optimization Program, Computer Program to Calculate Optimum Coordination in a Grid Network of Synchronized Traffic Signals, PB-173-738, $6.00.

SIGOP: Traffic Signal Optimization Program, Users Manual, PB-182-835, $6.00.

SIGOP: Field Tests and Sensitivity Studies, PB-182-836, $6.00.

SIGOP: Source Tape, PB-222-295, $250.00/year (U.S.), $312.50/year (foreign) [Tapes are leased rather than sold].

UTCS-1 Simulation, Technical Report, PB-207-268, $3.00.

UTCS-1 Simulation, Appendix 1, Program Manual, PB-207-269, $3.00.

UTCS-1 Simulation, Appendix 2, Subroutine Documentation, PB-207-270, $3.00.

Transit Operations: Automatic Vehicle Monitoring (AVM) and Communications Systems

UMTA's RD&D in AVM and communications systems encompasses 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-users vehicle systems.

The Chicago Transit Authority's "Monitor" demonstration project employs a relatively simple location technology capable of providing estimates of the deviation between actual and scheduled vehicle location over predetermined, fixed routes. This demonstration was designed 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, now concluded, consisted of a series of four carefully planned, government-monitored field tests of advanced vehicle location technologies. The field tests were conducted in Philadelphia from the fall of 1971 through mid-year 1972. The tests 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, but not constrained by fixed routes. The availabiiity of such location systems makes it possible to extend AVM to vehicle fleets used in law enforcement, taxi operations, commercial delivery and even marine operations; this flexibility will allow development of multi-user systems with a resultant lower cost to transit.

Project: Automatic Vehicle Monitoring

I. Description

Four competing technologies for electronically locating transit or other public service vehicles as they move over urban streets were tested in Philadelphia. This tracking capability will provide transit operators with real time information on the location and schedule adherence of all their vehicles. The dispatch center will then be able to take action as needed to keep each route on schedule and maintain the proper level of service. The rider will be spared the now-too-common occurrence of a long wait for an overdue bus followed by the arrival of two or three buses running in tandem.

The techniques investigated were: LORAN-C, X-band proximity, narrow-band phase multilateration, and wide-band phase multilateration.

II. Schedule

June 1970-May 1973

III. Funding

Project No.

IT-06-0041	$196,000
IT-06-0046	188,000
IT-06-0047	271,000
IT-06-0048	203,000
Total:	$858,000

IV. Recent Progress

Field tests were completed by July 1972. Final reports were completed and made available to the public. (See VII.)

V. Project Numbers and
VI. Contractors

IT-06-0041	Teledyne Systems Company
IT-06-0046	Cubic Corporation
IT-06-0047	Sierra Research Corporation
IT-06-0048	RCA Corporation

VII. Report(s)

Automatic Vehicle Monitoring Technology Review, August 1971, PB-207-849, $3.00.

VII. Report(s) (cont.)

LORAN-C Automatic Vehicle Monitoring Systems -- Volume I: Study Results, July 1972, PB-216-332, $9.00.

LORAN-C Automatic Vehicle Monitoring System -- Volume III: Appendices, July 1972, PB- - , $.

Automatic Vehicle Monitoring Systems, [describes narrow-band phase multilateration system], February 1973, PB-216-165, $9.00.

Automatic Vehicle Monitoring Systems, [describes X-band proximity system], March 1973, PB-219-083, $6.00.

Automatic Vehicle Monitoring Systems, [describes medium bandwidth phase multilateration system], October 1972, PB-221-046, $6.00.

Project: Chicago Vehicle Location System Demonstration Project

I. Description

This project is designed to develop, test and evaluate an on-line, real-time electronic information system to: (a) automatically monitor the location and identity of transit buses in the Chicago metropolitan area; (b) provide two-way digital and voice communication bus/central control, and (c) furnish a constant flow of management information for purposes such as improving adherence to schedules and routes, developing better bus operating techniques, reducing crime and the hazards of other emergencies and for fleet maintenance.

The principal tasks are:

a. To determine the practicality of automatically comparing schedule adherence with a prepared schedule at selected points.

b. To determine how such a system can result in more effective use of personnel, less premium time to operators and more efficient bus use.

c. To study and develop a special alarm for extreme emergencies.

d. To determine how computer analysis can provide advantages in daily operation.

e. The grant was amended to include a test of a passenger counting device in conjunction with the original location and communication system.

II. Schedule

June 1968-July 1973

III. Funding

Federal:	$1,860,000
Local:	451,000
Total:	$2,311,000

IV. Recent Progress

Transportation Systems Center evaluation report under review. Project final report draft has been approved and publication is underway.

V. Project Number

IL-06-0010

VI. Contractor(s)

Chicago Transit Authority

Third Party Contractor(s)

Motorola Corporation

VII. Report(s)

Monitor -- CTA, Final Report, PB-223-878, $4.25.

Transit Operations: Systems Safety

The Safety Program for RD&D is an integral part of the equipment and facility development programs conducted for bus, rail and new systems. Each division conducts safety studies that are directly applicable to the specific hardware under study.

In addition, a series of safety manuals will be developed to provide general guidance in conducting safety studies relative to RD&D projects in both operations and hardware development. The safety manuals as now projected will address the following areas: project management, safety/reliability data base, system safety planning, safety trade-offs, safety interfaces, safety specification and analysis techniques. Information concerning the results of safety studies will be exchanged between the divisions as they progress to prevent overlapping efforts.

Transit Operations: Prevention of Crime and Vandalism

Research has been initiated on innovations designed to reduce crime on transit systems and on methods for improving passenger security -- both actual and perceived. The objective is to limit and deter crime on transit vehicles, at stations and in loading zones. Better passenger security is expected to alleviate fears which operate as a barrier to the use of public transportation.

Chicago--a city with bus, rapid rail and commuter transportation--has been chosen as the initial site for developing and demonstrating methods and devices for discerning and rapidly reacting to criminal incidents. A consortium task force of transit and law enforcement has been formed to direct and execute the project. Specific measures will be selected, effectiveness criteria adopted and implementation will be planned to demonstrate the impact of particular devices and communication and control apparatus.

UMTA's first attacks on the crime and security problem were the introduction of "exact fare" systems on buses and installation of a clandestine alarm system coupled with a vehicle location system at Chicago. The present project will carry this effort forward extending the techniques to additional applications. Candidate systems include surveillance devices, citizen alarm phones tied to police control posts and unobtrusive communications between trains and the roadway. Crime deterrent approaches developed will be tested for applicability to new personal rapid transit concepts.

Initial demonstrations of effective actions that may be taken to prevent vandalism are also underway. These include testing methods for rapid removal of graffiti from interior panels of buses, tear-resistant seat materials, breakage-resistant windows and community relations programs in which transit representatives work with local schools.

Project: Reduction of Crime on Transit Properties

I. Description

This project will develop and demonstrate methods of and devices for discerning and reacting rapidly to criminal incidents occurring in transit vehicles, stations and loading zones. A consortium of transportation, law enforcement and public works agencies was formed to manage the project, undertake initial data collection and recommend a specific demonstration plan. If the plan of measures to be implemented is approved and the desirability of an UMTA grant determined, installation and operation of the selected devices will be carried out at sufficient length to observe their effectiveness.

Examples of candidate devices for demonstration under this project include surveillance systems (possibly including closed-circuit TV on subway cars); citizen alarm phones tied to police control posts; communications between trains and the roadway that can be used unobtrusively, etc. The principal objective of this project is to deter crime on transit properties so as to reduce the element of fear presently evident and, thus, remove a barrier to the use of public transit.

II. Schedule

Demonstration plans received June 1973

Further scheduling to be determined contingent upon acceptance of demonstration plans.

III. Funding

$148,000

IV. Recent Progress

The grantee is conducting a survey to determine rider attitude toward the transit system and public perception of the crime problem. Subcontractors have delivered their reports with recommendations of methods to deter crime.

V. Project Number

IL-06-0023

VI. Contractor(s)

Public Works Department of Chicago

VII. Report(s)

Not yet available.

Project: Vandalism and Passenger Security Problem on Transit Vehicles

I. Description

The American Transit Association (ATA) will conduct a series of projects investigating various aspects of vandalism and passenger security related to urban bus operations throughout the country. The first project will survey available literature and bus properties to identify and categorize the types of vandalism and to quantify the dollar costs to the industry. The second project will survey the types and effectiveness of various anti-vandalism campaigns which have been conducted in the past including measures for control, prevention and apprehension. The third will be an investigation of vandal-resistant vehicle equipment and materials. The fourth will survey bus stops, shelters, etc., and other problems of passenger security. The fifth will investigate the potentials of public vs. private police protection. The sixth will be a questionnaire survey of the transit and related industries pertaining to the fifth project. The seventh will be an in-depth series of interviews at a number of bus properties to survey answers to the questions raised above. The eighth will conduct separate demonstrations of vandalism control techniques. The ninth will develop detailed courses of action which can be recommended for implementation and additional research. The tenth will prepare a final report.

II. Schedule

May 1971-September 1973

III. Funding

Federal:	$194,000
Local:	35,000
Total:	$229,000

IV. Recent Progress

Interviews for national crime and vandalism survey have been completed. The total vandalism cost nationally was determined to be $9 million, or about 1/2% of total operating expenses. The interim reports on Vandal-Resistant Materials for Transit Vehicles and National Vandalism Statistics are in preparation. The project was extended to September 1973 to allow for the completion of final reports and publication. Draft sections are presently under review by UMTA.

V. Project Number

DC-06-0017

VI. Contractor(s)

American Transit Association

VII. Report(s)

Not yet available. (See reports in preparation under IV.)

Transit Operations: Needs of the Elderly and Handicapped

Specifications for accommodating the elderly and handicapped are incorporated in prototype equipment now being built. These include TRANSBUS, the State of the Art Rail Car, the Advanced Concept Train and Personalized Rapid Transit vehicles. Demonstrations are currently underway in Haddonfield with Dial-A-Ride and on Shirley Highway which combine services for the elderly with rush-hour services.

Other UMTA offices have six demonstrations underway specifically addressed to the needs of the elderly and handicapped. These concern experiments with idle school buses, buses modified for wheelchairs, demand response services, modified vans, semi-fixed routes for taxicabs and bus services connecting several towns. A study is also being undertaken to determine need and analyze alternative impacts.

Capital grants have been awarded two cities to purchase modified buses. BART stations and equipment which are designed to accommodate wheelchair users were, of course, also partially funded through the capital grants program. Requests for future grants can be expected to reflect RD&D findings on the needs of the elderly and handicapped.

Transit Management

The principal emphasis of UMTA's Management Program has been on computer-aided management systems and standardized accounting and reporting practices. This work also includes related items such as transit marketing and user information, financial planning and personnel selection and training.

Computer-Aided Management Systems

Relative to other industries, transit properties have not focused on detailed development or extensive use of computer-aided management systems. Consequently, significant near-term benefits may be realizable by introducing more extensive use of computer programs designed to meet the needs of transit management. Specific projects under contract relate to vehicle servicing and maintenance practices, parts inventories and run cutting. The use of computers in the industry is also expected to be advanced by establishing standardized reporting elements -- an output of the FARE project -- and through analytical by-products of the automatic fare collection (AFC), oil analysis and personnel training and selection activities.

- Service, Inventory and Maintenance System (SIMS) is a set of computer programs that will supply bus transit management with information relating to (1) daily servicing of vehicles, (2) control of maintenance parts inventory and (3) periodic inspection and maintenance of vehicles, including major repair activities. SIMS will provide source information relating to the cost of operating transit vehicles, including the daily use of consumables, the cost of repairs for each vehicle and statistical and control information concerning repairs and the use of materials.

- Run Cutting and Vehicle Scheduling (RUCUS) is a set of computer programs that automate the functions performed in a typical bus transit department of scheduling. These computer programs can be used by a bus transit operator to adjust or create the headway sheets used to assign vehicles to trips and drivers to vehicles. Use of RUCUS will enhance the quality and improve the efficiency of vehicle and driver assignment schedules, and also provide a capability to subject proposed transit plans, developed in conjunction with UMTA planning programs, to detailed operating cost analyses.

- Rail Maintenance Planning System (MPS) is a set of computer programs designed for use by rapid rail transit managements to provide (1) maintenance cost reporting, (2) a reduction in maintenance cost and (3) an extension of maintenance periods and of system life. General design and the definition of system requirements were established through deliberations by and approval of an industry advisory committee consisting of members from rapid rail transit operations in Chicago, Illinois; Washington, D.C.; Atlanta, Georgia, and New York, New York. MPS is being developed and tested at the Bay Area Rapid Transit District (BART) in Oakland, California. The system is being developed in a fashion that will allow any rapid rail operators to use its procedures and computer programs.

Project: Transit Operations and Management (TOM)

I. Description

TOM 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 presently amount to $1.9 billion; a substantial reduction in these costs can be achieved and, at the same time, a better service can be provided by modernizing outdated management practices. This objective will be attained through optimum allocation of resources, increased productivity of labor and capital, and better planning and marketing of services.

Allocation of resources will be accomplished by using procedures for resource accounting coupled with management information for rational decision-making. Computer-aided management systems will embrace service, inventory and maintenance functions; driver run cutting and vehicle scheduling; rail maintenance planning; and equipment development of automatic fare collection and operational data collection systems for buses.

Productivity of labor will be increased by applying techniques for identifying characteristics of potential employees which are highly correlated with job performance. Planning and marketing of service will be facilitated by the development of improved techniques for route planning and selection, for measuring service demand, by identification of effective marketing strategies and information procedures, and by quantifying and predicting the impact of various service levels for incorporation in resource allocation and financial planning programs.

At present, automated service and maintenance information systems have been installed in Dallas and Oakland; initial experience has indicated their value, but has also suggested revisions that are currently underway. Automated driver and vehicle assignment methods are being established in San Diego, Washington, D.C., and Baltimore. Transit industry interest and intention to adopt these methods once their development and testing is completed is widespread.

II. Schedule

In June 1971, projects concerned with transit operations and management were put into a Systems Manager contract with the Mitre Corporation. Various individual sub-projects in this program have different schedules. Major component completion dates are noted below. Prior to June 1971, Mitre activities in this program included an evaluation of work conducted at Kent State University on the TRANSMAN run-cutting program, a requirements analysis for the RUCUS program and a limited investigation of state-of-the-art for fare collection.

II. Schedule (cont.)

Maintenance information system: demonstration completed by 9/73.

Maintenance planning system: demonstration completed by 12/73.

Automated vehicle and driver assignment system: demonstration completed by 6/73.

Automated passenger counter development and evaluation completed by 6/74.

Entire program completed by 6/74.

Blue-collar training study will begin 7/73.

III. Funding

$2,500,000

IV. Recent Progress

A) Service Inventory and Maintenance System (SIMS): Documentation for Inventory Control System has been completed. Maintenance Cost System is being tested at Oakland and Dallas.

B) Run Cutting and Scheduling System (RUCUS): All field tests have been completed. Recently regional seminars for bus transit properties were held. Non-recurring costs incident to establishing the use of a computer software system are eligible for capital grant aid. Hand-over of responsibility for RUCUS from Mitre to the Transportation System Center is in progress.

C) Automatic Fare Collection (AFC): Conceptual design for an AFC System for buses is in process. UMTA has begun negotiating the elements of a demonstration plan with the Washington Metropolitan Area Transit Authority.

V. Project Number

VA-06-0004

VI. Contractor(s)

Mitre Corporation

Subcontractor(s)

Dallas Transit System
A.C. Transit District
D.C. Transit System
San Diego Transit
Baltimore Metro
Bay Area Rapid Transit District

VII. Report(s)

Application of Computers to Transit Information Services -- Volume I, November 1972, PB-221-748, $3.00 [Set, Volumes I and II, PB-221-747, $7.00].

Application of Computers of Transit Information Services -- Volume II, January 1973, PB-221-749, $4.85 [Set, Volumes I and II, PB-221-747, $7.00].

Transit Telephone Information Systems, March 1973, PB-221-459, $4.50.

Automatic Fare Collection, October 1972, PB-221-448, $4.85.

Vehicle Scheduling and Driver Run Cutting, RUCUS Package Overview, May 1973, PB-222-675, $3.00.

Project: Urban Bus Transit -- Computerized Management Information

I. Description

This project is designed to improve bus operations by financing operational tests of a computerized management information program, specifically for urban bus transit systems. The project will test and evaluate a semi-automatic data collection device for maintenance, inventory and service operations. The collected data can be used for budget project, fleet modernization analysis and maintenance and service operations analysis.

Both maintenance and service personnel will be trained to operate the system. Streamlining current operations, as well as reducing fleet service and maintenance costs, will provide assistance to transit decision makers.

This a companion project with TX-06-0005.

II. Schedule

June 1969-December 1973

III. Funding

UMTA:	$225,242
Local:	90,122
Total:	$315,364

IV. Recent Progress

Hardware has been installed and operational utility has been proven. Suggested revisions and modifications are in progress.

V. Project Number

CA-06-0033

VI. Contractor(s)

Alameda-Contra Costa Transit District, Oakland, California

VII. Report(s)

Not yet available.

Project: Automated Information System for Bus Transit Operations

I. Description

This project will finance operational tests of an automated information program for bus transit systems. Specifically, the project will demonstrate the benefits to be achieved from using a computer system to collect and report service data, inventory control data, maintenance cost data and coach unit history data for management.

This is a companion project with CA-06-0033.

II. Schedule

June 1969-December 1973

III. Funding

$251,000

IV. Recent Progress

Hardware has been installed and operational utility has been proven. Suggested revisions and modifications are in process.

V. Project Number

TX-06-0005

VI. Contractor(s)

Dallas Public Transit Board

VII. Report(s)

Not yet available.

Transit Management: Training and Driver Selection

Personnel training programs are being developed for industry-wide use in areas of bus operations, bus and rail car repair and bus operator and repairman trainers. Driver selection techniques are being advanced by developing validated procedures which will minimize the effect of racial, ethnic and cultural factors. These programs are also being planned to reduce the turnover in transit employment. These studies will assist in eliminating dead-end jobs and in providing a career ladder for new entrants. Projects directed to the training of shop foremen and other intermediate supervisory personnel are also contemplated as in training for rail rapid transit operators in right-of-way signals, control systems and electronics.

- Personnel Selection. A grant to the Massachusetts Bay Transportation Authority (MBTA) at Boston authorized the development of a test battery to be used in screening and selecting applicants for the position of bus driver. This test battery is being developed in a manner to eliminate racial and social biases. Preliminary test results indicate that the test design is in fact free of these biases. There is high confidence that the test will successfully predict which applicants are most likely to succeed as vehicle operators.

- Personnel Training. This project is concerned with identifying the training needs of the transit industry and defining a training plan which will provide the scope, cost and implementation techniques necessary to establish training programs for:

    a. Bus operators.

    b. Bus repairmen.

    c. Bus repairmen trainers.

    d. Rapid rail repairmen.

    e. Rapid rail repairmen.

Project: Urban Mass Transit Training Program

I. Description

The purpose of this project is to assess the needs of the transit industry for improved training techniques and technology for bus and rapid transit operators, mechanics, etc. Having completed this assessment, the grantee will make appropriate recommendations to UMTA concerning the types of training devices, methods and organizations that should be fostered.

II. Schedule

September 1970-November 1973

III. Funding

UMTA:	$ 98,000
Local:	25,000
Total:	$123,000

IV. Recent Progress

Subcontractor has presented findings of operator and mechanic training needs. The final report has been transmitted to NTIS (see VII) for public availability. Development of recommendations for implementing improved training techniques is on-going and will be completed by November 1973, by which time the demonstration of such techniques will begin.

V. Project Number

DC-06-0011

VI. Contractor(s)

American Transit Association

Subcontractor(s)

Intext Corporation

VII. Report(s)

A Study of Operator and Mechanic Training Needs in the Transit Industry -- Volume I: Findings and Conclusions, December 1971, PB-221-359, $9.00 [Set of Volumes I and II, PB-221-358, $13.00].

A Study of Operator and Mechanic Training Needs in the Transit Industry -- Volume II: Appendices, December 1971, PB-221-360, $5.45 [Set of Volumes I and II, PB-221-358, $13.00].

Project: Validation of Employment Testing and Selection Procedure

I. Description

The objective of this project is to validate a testing and selection procedure which would help identify applicants who have the potential to be successful transit equipment operators.

Five major mass transit operators have been cooperating in this project, utilizing the professional services of the University of Chicago's Industrial Relations Center. The project consists of two phases operating concurrently.

Phase I Predictive Study - Applicants for transit operator positions were asked to take certain tests, although the test results will not be a factor in determining employment acceptability. Prior to the testing, an attribute profile was developed through observation of on-the-job behavior and in-depth interviews of present operators and supervisory personnel. These profiles indicate the general intellectual and behavioral attributes and the special skills which appear to be required of "good operators."

Phase II Validation Study - This phase requires testing and evaluation of operators already employed, using racially mixed control groups. To ensure comparability with the Predictive Study, the same performance criteria will be used.

II. Schedule

August 1970-December 1973

III. Funding

UMTA:	$382,000
Local:	59,000
Total:	$441,000

IV. Recent Progress

Two sets of variables for analyzing employment acceptability have been developed under Phase I of the project. Phase II validation, using control groups of racially-mixed transit operators, is expected to be completed by December 1973.

V. Project Number

MA-06-0011

VI. Contractor(s)

Massachusetts Bay Transportation Authority

Subcontractor(s)

University of Chicago, Industrial Relations Center

VII. Report(s)

A Study of Operator and Mechanic Training Needs in the Transit Industry -- Volume I: Findings and Conclusions, December 1971, PB-221-359, $9.00 [Set of Volumes I and II, PB-221-358, $13.00].

A Study of Operator and Mechanic Training Needs in the Transit Industry -- Volume II: Appendices, December 1971, PB-221-360, $5.45 [Set of Volumes I and II, PB-221-358, $13.00].

TRANSIT OPERATIONS AND MANAGEMENT

Transit Management: Financial, Accounting and Reporting

The contractor developing standardized financial, accounting and reporting elements (FARE) is working with an advisory board of transit comptrollers to plan data collection activities. The objective is to establish a transit-wide information system that will permit individual transit properties and their opposite numbers in the American Transit Association, the Institute of Rapid Transit and various Federal, state and local agencies to communicate with one another in a common definitional language.

As this activity moves forward, plans will be developed for collecting and analyzing uniform data on the impact of specific changes in the level of service on the market for transit services.

Transit Management: Passenger Counters and Automatic Fare Collection Systems (AFC)

A study of Automatic Fare Collection Systems and procedures has been completed. This study will provide input information required to formulate and define a demonstration program concerned with the test of new AFC equipment and related institutional procedures. An important complement to AFC is expected to come from mechanized means for instantly counting passengers and compiling ridership data. Such tools are expected to provide management with new opportunities for service adjustments which are immediately responsive to shifts in demand.

Project: Financial Accounting and Reporting Elements (FARE)

I. Description

Financial and statistical information reported by transit operators has proven to be unreliable or incompatible due to varying accounting practices and procedures. This project, conducted with the advice of relevant transit officials, is an attempt to create a comparable reporting scheme and to provide transit operators and government (local, state and Federal) with a basis for planning, decision and action.

The contractor will develop the reporting scheme, working in consort with an industry board of 13 comptrollers drawn from transit properties which represent the total spectrum of transit operations. The desired final result will be a compatible data base for transit properties to permit analysis and comparisons which will allow an insight as to the strengths and needs of individual transit operations. The base is needed to aid in determining the operating and financial status of the nation's transit operations and to aid in analyses related to capital grants and operating subsidies.

The system will be tested in a representative sample of transit properties.

II. Schedule

August 1972-October 1973

III. Funding

$325,000

IV. Recent Progress

The contractor has completed the validation testing. The Industry Control Board has agreed to modifications in the detailed system design. The Task IV Report will be delivered to UMTA on October 31, 1973.

V. Project Number

IT-06-0034

VI. Contractor(s)

Arthur Andersen & Co., (Washington, D. C., office)

VII. Report(s)

Project FARE Task II Report, Urban Mass Transportation Industry Reporting Capability -- Part I: Survey Findings, November 1972, PB-213-474, $3.00.

Project FARE Task II Report, Urban Mass Transportation Industry Reporting Capability -- Part II: Sample Questionnaire, November 1972, PB-213-475, $3.00.

Project FARE Task III Report, Urban Mass Transportation Industry Reporting System Design -- Interim Task III Report for November 1972-June 1973 Period -- Part I - Task Summary, June 1973, PB-222-042, $3.75.

Project FARE Task III Report, Urban Mass Transportation Industry Reporting System Design -- Interim Task III Report for November 1972-June 1973 Period -- Part II - Reporting System Instructions, June 1973, PB-222-043, $10.60.

Set of all four above, PB-222-041, $20.00.

Transit Management: Transit Marketing

Current elements of the transit marketing program are organized as cooperative projects in which the UMTA program manager utilizes both contractors and advisory services from the National Mass Transit Marketing Committee of the American Transit Association. Rider attitude and behavioral studies will be used as a foundation to develop transit marketing aids and analytical tools. Foremost among marketing aids under development are the design and production of rider informational and promotional studies relating to schedules, routes, fares and other material bearing on the availability of transit services.

One important source of consumer information requirements research is being provided through the Transit Information Phone Services (TIPS) project. The TIPS study provides information concerning optimum equipment configurations and operator techniques necessary for a successful telephone information service dealing with route and schedule information for the public.

Behavioral surveys are also conducted as a basis for efforts to adapt the Maloney Model (Professor John Maloney of Northwestern University) for a continuous advertising planning program specifically addressed to the needs of the transit industry. If successful, new and more effective tools will become available for analyzing the transit market, modifying services to tap that market and making the merits of available services known to potential users.

Two outputs of the marketing program which will be contracted for in the near future will be a manual of transit promotional concepts and a methodology for evaluating transit marketing effectiveness based on appropriate modifications of the Maloney Model.

Project: Transit Marketing Demonstrations

I. Description

Two concurrent demonstrations of transit marketing will be undertaken at sites of "large" and "medium" size with the objective of improving the attitudinal disposition of potential transit riders. Four integral elements of the project include: (1) market research, (2) transit service planning, (3) fare and schedule modification and (4) promotional techniques.

The contractor will conduct extensive market research at the sites and 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 will also be conducted to familiarize relevant transit industry personnel with marketing techniques.

II. Schedule

April 1973-March 1976

III. Funding

$200,000 (through June 30, 1973; incremental funding)

IV. Recent Progress

The RFP was issued on April 24, 1973, bids were received, and the proposals were under evaluation at the end of Fiscal Year 1973. Contract award is expected by late summer.

V. Project Number

Not yet assigned.

VI. Contractor(s)

To be selected.

VII. Report(s)

Project: Transportation Information Display in a High Density Employment Center

I. Description

The objective of this project was to design and test a transportation information display which, through various information aids, can facilitate peak-hour movement of persons to and from a developing high-density employment area. The display provided information concerning car pool arrangements, bus routes and schedules. A car pool selector board assisted persons wanting to form or join car pools. Cards and a ballot-box type of receptacle were provided to receive written suggestions and complaints concerning transportation problems, and generally to collect data with which to evaluate the display and its effect on transit planning.

At the time this project began, the Southwest Employment area (Washington, D.C.) had about 38,000 employees and could be expected to grow to about 95,000. As a result of urban renewal, Southwest is being transformed from a slum area to a new residential and employment complex. This employment growth has already caused a critical transportation problem for Federal and private employees. The transportation problem exemplifies itself in several aspects:

a. Peak-hour traffic congestion;
b. Inadequate bus service;
c. Insufficient parking, and
d. Difficult pedestrian movement.

II. Schedule

August 1968–May 1973

III. Funding

$25,000

IV. Recent Progress

Final report completed and available for sale (see VII).

V. Project Number

IT-06-0019

VI. Contractor(s)

Design and Production, Inc.
Washington Metropolitan Area Transit Commission

VII. Report(s)

Transportation Information Center in the Southwest Employment Area of Washington, D.C., PB-220-319, $3.00.

Project: Passenger Shelters for Bus Systems

I. Description

This program developed urban bus shelter criteria. These criteria were utilized in the preparation of a prototype design, including plans and specifications for the shelter. Several prototypes were constructed as part of the Shirley Highway Express Bus on Freeway Project.

Among the difficulties with present bus shelters is the high cost of construction and maintenance. This project, using the systems approach, sought to develop and improve a standard design to eliminate faults and provide transit user comfort and safety at minimum cost.

II. Schedule

June 1969-July 1972

III. Funding

Federal:	$101,311
Local:	10,173
Total:	$111,484

IV. Recent Progress

Completed project.

V. Project Number

VA-06-0003

VI. Contractor(s)

Virginia Polytechnic Institute
Blacksburg, Virginia

VII. Report(s)

Transit Passenger Shelters, Basic Design Principles, January 1973, PB-220-303, $5.45.

Project: Horticultural Handbook

I. Description

UMTA has assisted in the funding of a handbook which provides guidance for the horticultural improvement of transit facilities. The American Horticultural Society, which is sharing the funding, has prepared the handbook. It develops guidelines and techniques for the effective use of plant materials to enhance the surroundings of transit users. It is intended for use by local action groups and transit planners and operators.

II. Schedule

October 1971-September 1973

III. Funding

UMTA:	$ 30,000
AHS:	83,000
Total:	$113,000

IV. Recent Progress

A draft final report was approved in June 1973.

V. Project Number

VA-06-0006

VI. Contractor

American Horticultural Society, Alexandria, Virginia

VII. Report

Transit Planting: A Manual, July 1973, PB-223-570, $3.50.

Intermodal Integration Program

UMTA is planning and developing a comprehensive RD&D program intended to lead to integrated urban transit systems in many United States urban areas. The goal is to:

- achieve true rider mobility by providing every individual opportunity to complete journeys into and through cities quickly and pleasantly even though many trips may be segmented and require transfer to other vehicles;

- subordinate individual operator interests to the interests of total system effectiveness, overall operating efficiency and increased revenue for all operators; i.e., operational coordination.

UMTA designates this program "Intermodal Integration", a phrase intended to suggest coordination not only of two or more different conventional modes--such as bus and rail--but of all means of public transportation. For example, the method could be applied to cities where buses are the sole mode and the desired rider mobility and operational coordination could be achieved by coordinating the services of different bus properties and, in turn, the services of buses with para-transit operations, such as taxis, jitneys, etc.

The Intermodal Integration Program consists of five sub-programs:

- Integrated System Demonstrations. Initiation of urban area demonstration programs leading to totally integrated transit systems.

- Component Demonstrations. In selected cities, demonstration of specific techniques, thereby developing information which may be easily assimilated by other cities.

- Para-Transit. Design and conduct of demonstrations to determine the best role for taxis, mini-buses, shuttles, charters, rental vehicles and other flexible forms of urban transportation.

- Urban Goods Movement. Design and conduct of demonstrations to determine the best ways of coordinating passenger traffic with the movement of goods by truck or other vehicles within cities.

- Program Research. Continuation of ongoing general RD&D research and specific back-up research.

Considerations of land use planning, pollution control, energy conservation and other major issues affecting United States cities are also among the broader implications of intermodal integration.

Only cities in Europe whose transit systems have achieved intermodal integration have been successful in reversing the worldwide trend of declining transit usage. These cities have, in some cases, developed extremely

heavy transit patronage and commensurately favorable revenue/cost ratios. The program proposed here is intended to lead to widespread efforts to integrate transit systems, with a potentially desirable effect on nationwide transit.

Efforts to integrate transit services can be directed to three main groups of requirements: institutional integration, operational integration and physical integration.

- Institutional integration deals with the procedural and organizational structures under which transit operations function. These may relate to transit itself or the broader framework of the public institutional environment in which transit-type services are provided. The managements of the individual transportation properties may enter into joint arrangements regarding the operation, financing or other aspects of management, such as establishing system-wide fare and transfer policies. The means for this can range from federa tions and communities or tariff associations.

  Also included in institutional integration is coordinated action by municipal authorities to enhance transit effectiveness by reducing traffic peaking; e.g., by staggered work hours or disincentives for auto use. Intermodal integration through institutional means may include some or all of the following characteristics:

  Operator/municipality administrative coordination;

  Operator/operator administrative coordination;

  Intra-municipality administrative or regulatory coordination;

  Area-wide financing arrangements;

  Area-wide fare structures;

  Area-wide transfer policies;

  Fares and services adapted to land-use and transit market requirements;

  Staggered work hours at employment centers;

  Auto parking policies conducive to transit use;

  Auto use pricing policies designed to encourage community mobility;

  Market-oriented fare differentials;

  Street traffic management directed toward optimal citizen mobility.

- Operational integration is the provision of coordinated transit services that complement rather than compete with each other. This requires individual operators to create a single system with coordinated schedules and without redundant operating services or managerial functions. The separate features of intermodal integration which may be classified as contributing to operational integration include:

  Coordinated schedules;

  Complementary route structures;

  Unified information services;

  Para-transit service integration (taxis, jitneys, charter buses, demand-responsive systems, etc.);

  A development of approach to new routes and route extensions;

  Systematically reviewed operating and management procedures, and

  Park/ride facilities using adapted sites or existing lots; e.g., shopping centers.

  As with institutional integration, some of these features of operational integration may be considered minimum necessary requirements while others are optional acitivies.

- Physical integration is concerned with the physical connections among separate modes and services. This includes standardization of vehicles, standardization of fare collection equipment, joint utilization of rolling stock, construction of intermodal terminals, transfer points and establishment of interchanges and multi-level facilities capable of effecting the efficient and pleasant transfer of passengers.

  The features of intermodal integration which may be classified as actions contributing to physical integration include:

  Intermodal transfer facilities;

  Joint use of capital equipment;

  Joint use of personnel;

  Standardized equipment;

  Common spare parts pools;

  Common maintenance facilities, and

  Park/ride lots which are new construction on newly acquired sites.

Integrated System Demonstrations are projected for 15 major cities--three at analytically selected locations and 12 at competitively chosen sites. The number and specific composition of the component demonstrations will be considerably influenced by the character of responses generated by the cities. Similarly, the precise nature of the para-transit and urban goods movement studies must go through a guided self-selection process -- an approach that results in greatly strengthening local-level participation.

In the studies and designs for all intermodal integration program components, it is UMTA's intention to concentrate initially on actions which are less capital intensive and which will lead to early program impacts. Gradually, the program will encompass those actions which are more capital intensive and require longer time to show results. The eventual combination of non-capital and capital intensive actions will result in high quality, efficient urban public transportation systems in the 1980's.

Project: Intermodal Transit Improvements Program Design: Potential For Establishing Integrated Transit

I. Description

This is a series of discrete studies aimed at several neglected or innovative aspects of urban transportation. These will be short term but in-depth studies that could lead to demonstrations and/or provide a basis for assessing potentially important areas requiring additional research and development. Together the studies in this "package" are basically intended to result in reduced urban traffic congestion, improved transit operating efficiency, increased mobility for passengers and lower pollution.

The studies cover: 1) Improved methods of reporting and disseminating information on research and demonstration projects sponsored by UMTA; 2) Assessment of the potential of certain forms of para-transit (e.g., taxicabs, bus-cooperatives, car pools, rental cars, minicars) to satisfy a portion of urban transportation needs; 3) Identification of alternative modes of conducting work, recreation and daily activities which would reduce present requirements for transportation in cities and their environs. The contractor is studying such factors as substitution of communication for travel; locational changes of offices, households, facilities, etc.; substitution of delivery of goods for shopping trips; staggered work hours; changes in work schedule such as the 4-day, 40-hour week; 4) Development of a methodology for evaluating the passenger demand and economic viability of new systems, such as personal rapid transit, demand-repsponsive systems, etc. The methodology includes a standardized measure of cost/effectiveness for use in comparing new and conventional systems, and scrutiny of institutional constraints and environmental effects, and 5) Assessment of the feasibility of establishing neighborhood urban transportation cooperatives to provide local residents with transportation that is responsive to their needs.

II. Schedule

March 1972-November 1973

III. Funding

$218,000

IV. Recent Progress

The project is nearing completion.

V. Project Number(s)

CA-06-0045

VI. Contractor(s)

Urban Interface Group
Laguna Beach, California

VII. Report(s)

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