

Integration of Para-Transit with Conventional Transit Systems

A REPORT
OF THE
TRANSPORTATION TASK FORCE
OF THE

URBAN
CONSORTIUM
FOR TECHNOLOGY INITIATIVES



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October, 1978

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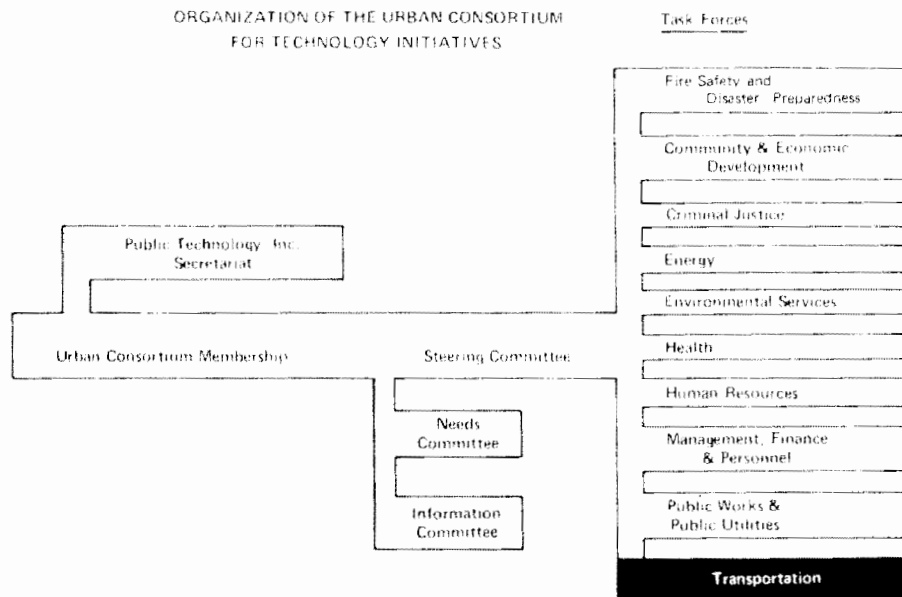
The Urban Consortium for Technology Initiatives was formed to actively pursue technological solutions to pressing urban problems. The Urban Consortium is a coalition of 34 major urban governments, 28 cities and 6 counties, with populations over 500,000. These 34 governments represent over 20% of the nation's population and have a combined purchasing power of over \$25 billion.

Formed in 1974, the Urban Consortium represents a unified local government market for new technologies. The Consortium is organized to encourage public and private investment to develop new products or systems which will improve delivery of local public services and provide cost-effective solutions to urban problems. The Consortium also serves as a clearing-house in the coordination and application of existing technology and information.

To achieve its goal, the Urban Consortium identifies the common needs of its members, establishes priorities, stimulates investment from federal, private and other sources and then provides on-site technical assistance to assure that solutions will be applied.

Public Technology, Inc. (PTI), a non-profit, tax-exempt, public interest organization serves as Secretariat to the Urban Consortium. PTI was established in December 1971, by The Council of State Governments, The International City Management Association, The National Association of Counties, The National Governors' Conference, The National League of Cities and The U. S. Conference of Mayors. The staff of PTI provides both technical and organizational services to the Urban Consortium and its Task Forces.

The work of the Urban Consortium for Technology Initiatives is focused through the ten Task Forces shown below. These Task Forces were formed as a result of the needs identification process used by the Consortium. An eleven member Steering Committee, whose members are chosen from among the participating jurisdictions, guides the activities of the Urban Consortium for Technology Initiatives.



Initial funding for the Urban Consortium for Technology Initiatives was obtained from the National Science Foundation / Research Applied to National Needs and from the Office of the Secretary, Department of Transportation. Additional funding has been provided by the Department of Housing and Urban Development, the Environmental Protection Agency, the Urban Mass Transportation Administration and the Federal Highway Administration of the U.S. Department of Transportation, and the National Fire Prevention and Control Administration of the U.S. Department of Commerce.

This report is a product of the activities of the Transportation Task Force. The work has been supported by the U. S. Department of Transportation; Office of the Secretary, Urban Mass Transportation Administration and Federal Highway Administration.

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Prepared by

PUBLIC TECHNOLOGY, INC.
1140 Connecticut Avenue, N.W.
Washington, D.C. 20036

Secretariat
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PREFACE

This is one of ten in the second series of Information Bulletins produced by the Transportation Task Force of the Urban Consortium for Technology Initiatives. Each Bulletin in this series addresses a priority transportation need area identified in the second annual needs selection by member jurisdictions of the Urban Consortium. The Bulletins are prepared by the staff of Public Technology, Inc. (PTI) for the Transportation Task Force.

The eight transportation needs which this second series of Information Bulletins covers are:

- Accelerated Implementation Procedures
- Center City Circulation
- Neighborhood Traffic Controls
- Parking Management
- Transit Marketing
- Alternative Work Schedules
- Traffic Performance Measurement
- Urban Goods Movement

There will also be two Updates to Information Bulletins printed in 1977:

- Improving Transit Systems Productivity
- Institutional Framework for Integrated Transportation Planning

The needs highlighted by the Information Bulletins are selected in an annual process of needs identification used by the Urban Consortium. By identifying and then focusing on the priority needs of member jurisdictions, the Consortium assures that resultant research and development efforts are directly responsive to existing or anticipated local government problems.

Each Bulletin provides a nontechnical overview, from the local government perspective, of issues and problems associated with each need. Current research efforts and approaches to the problem used by local governments are also briefly identified. The Bulletins are not meant to be an in-depth review of the state-of-the-art or the state-of-the-practice. Rather, they serve as an information base from which the Transportation Task Force selects several needs for more attention.

The Information Bulletins have also proven useful to persons such as elected officials for whom transportation represents but one of many areas of concern.

The results of the needs selection process used by the Urban Consortium have been promising. Of the ten priority needs identified in the first annual needs selection, four were addressed by subsequent Transportation Task Force projects.

- To pursue the need for Preferential and Exclusive Lanes, a Manual for Planning and Implementing Priority Techniques for High Occupancy Vehicles (composed of a Chief Executive Report, Program Manager's Report, and Technical Guide) was developed. The methodology outlined in the manual is now being tested in Buffalo, St. Louis, San Francisco, and San Jose. A revised manual based on these demonstrations will be available in July, 1978.
- A National Conference on Transit Performance was organized to address the need for Transit System Productivity. The Conference, held in Norfolk, Virginia, in September, 1977, was attended by 200 government, industry, labor, and academic participants.
- To facilitate the provision of Transportation for Elderly and Handicapped Persons, an outline for a manual on techniques of providing such transportation services is being developed.
- Finally, two documents relating to the need for Transportation Planning and Impact Forecasting Tools are being prepared: (1) a paper describing local transportation planning issues and concerns directed to the Urban Mass Transportation Administration (UMTA); and (2) a management-level document for local officials describing UMTA's currently available tools and how they can be applied to local government.

Of the remaining six needs identified in the first annual selection, two remained as priority needs in the second annual needs selection. The Information Bulletin for "Institutional Framework for Integrated Transportation Planning" was included in the first series of Bulletins and will be revised as necessary. The Information Bulletin for "Accelerated Implementation Procedures" is part of this second series of Bulletins.

For the remaining four needs, the Transportation Task Force felt that current research directed toward them was adequate and that the Information Bulletins themselves fulfilled the Task Force's information dissemination goals. Thus, these needs have been dropped from the priority list.

Two major projects related to the second needs selection have already been completed. To help improve Center City Circulation (with the objectives of downtown revitalization and economic development) two projects have been completed. A recently published report--Center City Environment and Transportation: Local Government Solutions--shows how seven cities use transportation and pedestrian improvements as tools in downtown revitalization. Another project, addressing the coordination of public transportation investments with real estate development, culminated in a major national conference--The Joint Development Marketplace. The Marketplace, held in Washington, D.C. in June, 1978, was attended by over 500 people, including delegations from 37 cities and counties and representatives of over 100 private development and financial organizations. It is hoped that further research projects will be directed to the remaining new priority transportation needs of the Urban Consortium for Technology Initiatives.

The support of the Technology Sharing Division, Office of the Secretary; Federal Highway Administration; and the Urban Mass Transportation Administration of the U.S. Department of Transportation has been invaluable in the work of the Transportation Task Force of the Urban Consortium for Technology Initiatives and its staff from Public Technology, Inc. The guidance offered by the Task Force members will continue to insure that the work of the staff will meet the urgent needs which have been identified by members of the Urban Consortium for Technology Initiatives.

The members of the Transportation Task Force are listed below:

- Stewart Fischer (Chairperson)
Director, Traffic and Transportation Department
San Antonio, Texas
- John A. Dyer
Transportation Coordinator
Dade County, Florida
Miami, Florida
- James E. Clark, III
Assistant Director
D.C. Department of Transportation
Washington, D.C.
- Norm Emerson
Executive Assistant to the Mayor
City of Los Angeles
Los Angeles, California

Transportation Task Force (continued)

- Barry Goodman
Administrator of Public
Transportation
Houston, Texas
- George Hague
Assistant to the Managing Director
City of Philadelphia
Philadelphia, Pennsylvania
- Edward M. Hall
Executive Assistant to the City
Manager
Phoenix, Arizona
- Robert P. Hicks
Administrator, Planning and
Traffic Engineering Division
Department of Transportation
Detroit, Michigan
- Daniel Hoyt
Director, Planning & Environment
Niagara Frontier Transportation
Authority
Buffalo, New York
- Gary Kruger
Transportation Planner
Office of Policy Planning
Seattle, Washington
- Emily Lloyd
Commissioner of Traffic & Parking
City of Boston
Boston, Massachusetts
- Alan Lubliner
Chief, Transportation Planning
Department of City Planning
San Francisco, California
- Elizabeth J. McLean
First Deputy Commissioner
Department of Public Works
Chicago, Illinois
- Edward A. Mueller
Executive Director, Jacksonville
Transportation Authority
Jacksonville, Florida
- Jim Self
Councilman
City Council
San Jose, California
- Robert Selsam
Director of Planning
The Metropolitan Transportation
Authority
New York, New York
- George Simpson
Director
Department of Transportation
City of San Diego
San Diego, California
- William Wilson
Director
Department of Streets
St. Louis, Missouri

FEDERAL REPRESENTATIVES

- Alfonso B. Linhares
Chief, Technology Sharing Division
Office of the Assistant Secretary for
Governmental Affairs
- Norman G. Paulhus, Jr.
Technical Coordinator
Technology Sharing Division
Office of the Assistant Secretary for
Governmental Affairs
- Milton P. Criswell
Chief, Implementation Division
Federal Highway Administration
- Robert B. Dial
Director, Planning and Methodology
and Technical Support Division
Urban Mass Transportation
Administration
- Ronald J. Fisher
Director, Office of Service and
Methods Demonstration
Urban Mass Transportation
Administration

U.S. Department of Transportation
400 Seventh Street, S.W.
Washington, D.C. 20590

PUBLIC TECHNOLOGY, INC.--
SECRETARIAT

Gary L. Barrett
Melvin D. Boffman
Alinda C. Burke
Martha H. Feagin
Earlene O. Guinn
Gary L. Hebert
Keith Jones
Deborah Knuckles
Helene M. Overly
David J. Pearl
Katherine A. Perry

Public Technology, Inc.
1140 Connecticut Avenue, N.W.
Washington, D.C. 20036
(202) 452-7700

PROJECT CONSULTANTS

Fred B. Burke

William B. Hurd

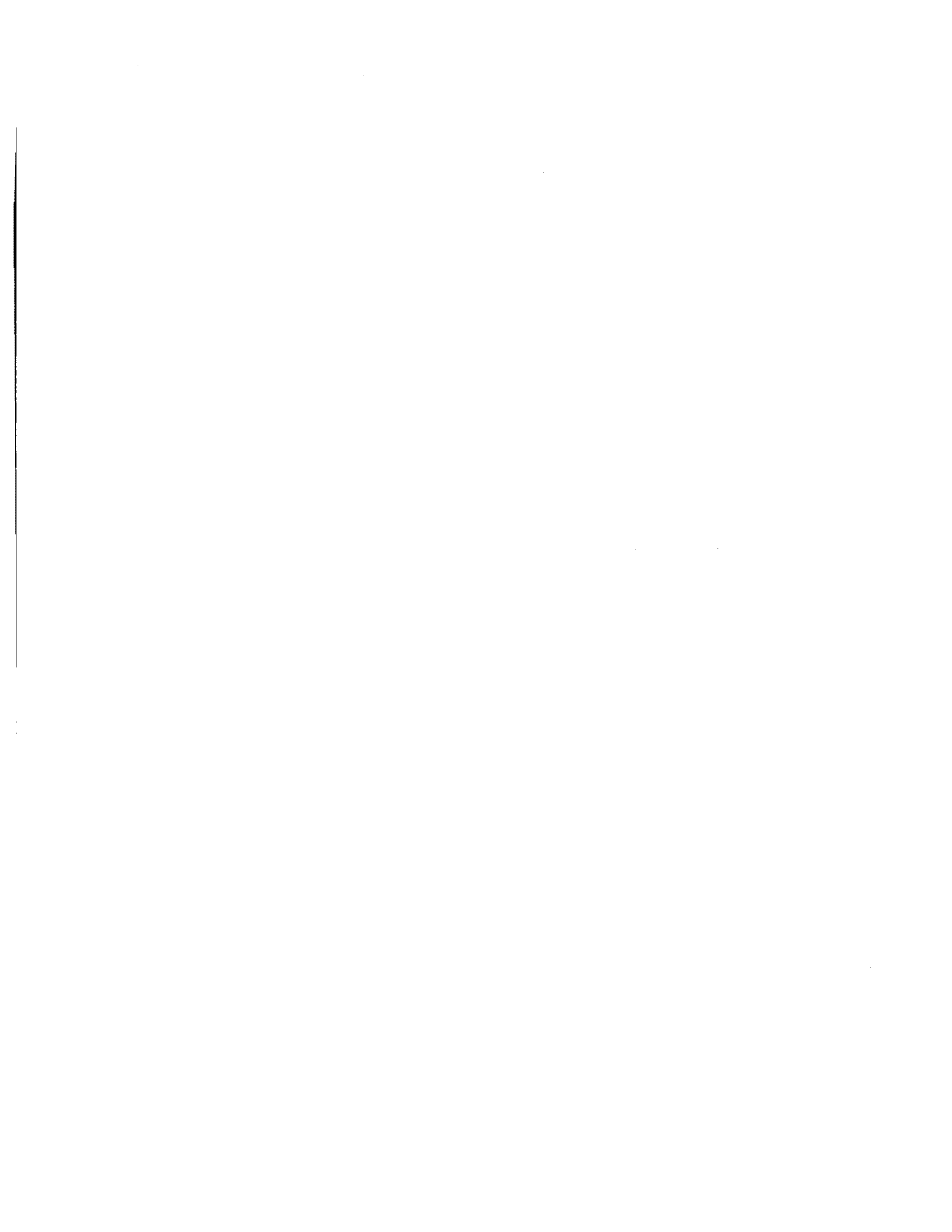


TABLE OF CONTENTS

<u>Chapter</u>		<u>Page</u>
I	ISSUES AND PROBLEMS	1
	The Market for Paratransit Services	3
	Planning for Paratransit Integration with Other Services	4
	Regulation	5
	Operations	6
	Labor Issues	7
	Financial Issues	8
	Other Providers	8
	Maintenance	8
II	CONTACTS AND CURRENT PROBLEMS	10
	Contacts	10
	UMTA	10
	FHWA	11
	FEA	11
	EPA	13
	Current Programs	13
III	ANNOTATED BIBLIOGRAPHY	15
	General	15
	Planning	17
	Regulation	19
	Operations	20
	Labor Issues	21
	Financial	26
	Maintenance	26
	Integration of Services	27

LIST OF TABLES

I	UMTA FIELD OFFICES	12
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Chapter I

ISSUES AND PROBLEMS

The first issue in addressing the integration of paratransit with conventional transit services is the controversy over a basic definition of paratransit. Paratransit means many things to many people--carpools, vanpools, jitneys, taxis, limousine service and many others. To some, the type of vehicle defines paratransit; to others, the type of service is more important than the type of vehicle.

The Urban Institute publication, Para-transit: Neglected Options for Urban Mobility, a comprehensive analysis of the field, defines paratransit service as

...those forms of intraurban passenger transportation which are available to the public, are distinct from conventional transit [scheduled bus and rail], and can operate over the highway and street system.¹

The Urban Institute work classifies paratransit by type of service and divides it into the following three major types:

1. Hire and Drive Services

- Daily and short term rental cars - Although some U.S. rental car companies do offer cars for less than a day, there are no full-scale U.S. examples of what is often called "mini-car," "a system of small electric cars which could be accessed by a computerized check-out system, driven for a short trip, checked in at one of the many system terminals, and then checked out shortly afterward by another user."² Possible uses for the mini-car concept include feeder service to bus or rapid transit or circulation within dense urban areas.

2. Hail or Phone Services

- Taxi - Regular taxi services are a major component of intra-metropolitan travel providing door-to-door service.

¹ Kirby, Ronald F., et al. Para-transit: Neglected Options for Urban Mobility. Washington, D.C.: The Urban Institute, 1974.

² Ibid., p. 12.

They are privately owned, but publicly regulated. Drivers may own their own cabs, lease them or drive for an hourly wage plus tips and may be or may not be unionized.

- Dial-a-ride - This name is applied to service which is shared-ride, door-to-door and requested by telephone.¹ The service is usually provided by taxi-cabs or vans and can be either privately or publicly operated. Many dial-a-ride operations also provide package delivery and subscription service. Dial-a-ride services have been operated in the United States in many areas including: Rochester-Batavia, New York; Haddonfield, New Jersey; Ann Arbor and many other communities in Michigan; and numerous other cities. (Dial-a-ride services are part of the broader concept of demand-responsive systems which include a variety of services which pick-up at pre-arranged points.)
- Jitney - Jitney service usually operates on fixed routes (with some deviations) with no fixed schedules and stops on hail. Jitneys currently operate in Atlantic City, San Francisco, Miami, Chicago, Pittsburgh, Cleveland, and Chattanooga.²

3. Pre-arranged Ride-Sharing Services

- Carpool - Members of a carpool pre-arrange a pick-up point and time, with one of the members usually serving as the operator. The cost per passenger is normally quite low (between 1.6 and 3.0 cents per passenger trip mile for carpools and vanpools.³) Carpools are privately owned and operated, and, if (as is the usual case) they operate on a shared-expense basis, are not subject to public regulation. There are a number of variations of the carpool concept. The best known is the vanpool, in which a vehicle is typically provided by the employer and driven by one of the pool members. Fares paid by the other members cover operating expenses and amortize the cost of the vehicle.
- Subscription bus - This service operates similarly to a carpool. The bus may be owned or chartered by the employer and operated by a bus pool member or professional driver.

There is still much confusion and controversy about the role and objectives of paratransit. Many regard paratransit as a panacea which will reduce large transit operating deficits while providing very high levels of service. Realistically, paratransit can work well in extending transit coverage, particularly to low-density areas and special groups like youth, the elderly and handicapped. Financially, it may be more cost-effective when compared to conventional transit service in these areas, but it is not

¹ Ibid., p 12

² Ibid., p 13

³ Ibid., p 31

always inexpensive. Paratransit is not a substitute for conventional transit in major metropolitan areas, but it might be a very useful complement.

Given this role recognition, it would be beneficial to closely coordinate transit and paratransit coverage. The American Public Transit Association's Task Force on Paratransit analysis suggests that "Coordination is one of the primary needs in introducing paratransit. Coordination is critical to the achievement of maximum benefits from the transportation system in a region."¹ The joint planning regulations for Transportation Improvement Programs issued by Urban Mass Transportation Administration and Federal Highway Administration on September 17, 1974 ² are intended to foster such coordination.

Paratransit services must be carefully tailored for each individual area. This Information Bulletin will address the following issues which are of major importance in developing paratransit services:

- The Market for Paratransit Services
- Planning for Paratransit Integration with Other Services
- Regulation
- Operations
- Labor Issues
- Financial Issues
- Other Providers
- Maintenance

Chapter II provides sources of further information on current paratransit programs and research. Chapter III gives an annotated bibliography.

THE MARKET FOR PARATRANSIT SERVICES

The private automobile presently dominates the urban transportation picture, yet the need to reduce the construction of new highways, energy consumption, air pollution, and congestion, and to conserve other scarce resources represents a serious obstacle to continued reliance upon this mode. Conventional public transit is currently struggling with its own set of problems including: increased costs for labor and equipment (this is compounded by the sharply peaked demands requiring a heavy investment in labor and vehicles, which are fully used only during morning and afternoon commuting periods); legal requirements to make transit service available to the elderly and handicapped; the need to provide service to rapidly growing suburban areas where lower densities make service less economical; and other problems.

¹ American Public Transit Association. "Paratransit in the Family of Transit Services." Transit Journal, Vol. 2, No. 2, May 1976, pp 5-26.

² U.S. Department of Transportation. "Transportation Improvement Program." Federal Register 40, No. 181, September 17, 1975, pp 42976-42984.

Paratransit provides an option which could fill the gap between the private automobile and conventional transit, offering a potential solution to some of the problems of each existing mode. To adequately describe and project the market for paratransit, it is important to distinguish between peak and off-peak services.

The major market for peak-hour paratransit services is commuters who must be diverted from their cars. Paratransit can supplement conventional transit service during peak hours through the following types of services:

- Carpooling and vanpooling which reduce vehicle miles travelled with concomitant reductions in energy usage and pollution emissions.
- Dial-a-ride/shared-ride taxi/subscription bus which collects commuters in medium-to-low density areas and either takes them to their destinations directly or transfer points to line-haul bus and rail for the remainder of their trip.

During off-peak hours, paratransit can provide opportunities for some auto-diversion. Examples include jitneys to replace short auto trips (or to serve a collection/distribution function for transit) or subscription bus services for employers with early or late shifts. The predominant market for paratransit during the off-peak is serving those who do not have drivers licenses (about 20% of the population) or those who do not own cars (20% of American households).¹ For example, the use of paratransit to provide transportation for elderly and handicapped persons provides a very high level of service to these patrons, while at the same time freeing transit operators of the need for costly (\$8-10,000 per bus) retrofitting of transit equipment to make the entire transit fleet accessible to this special group of consumers.

PLANNING FOR PARATRANSIT INTEGRATION WITH OTHER SERVICES

No well-established planning methodology exists for considering paratransit alternatives. The Urban Mass Transportation Administration is taking some steps to deal with this problem. For example, planning guidelines for paratransit are being developed, existing guidelines for planning demand-responsive systems are being updated² and demand and supply models for dial-a-ride services are nearing completion.³ Work on the implications of major mode shifts in integrated transportation systems is also continuing.⁴

¹ Motor Vehicle Manufacturers Association. Motor Vehicle Facts and Figures '76. Detroit, Michigan: MVMA, 1976.

² See annotation of the study by Mitre Corp. in Chapter III, Annotated Bibliography - Planning.

³ See annotation of the study by Cambridge Systematics, Inc. in Chapter III, Annotated Bibliography - Planning.

⁴ See Multisystems, Inc. and SYSTAN, Inc. in Chapter III, Annotated Bibliography - Integration of Services.

Some attention is also being devoted to modifying the Urban Transportation Planning System, with new short-range planning models being developed for the Planning Methodology and Technical Support Division of the UMTA Office of Transportation Planning so that UTPS can also be used for paratransit planning.

Very little data exists at the local level on the true demand for paratransit services. Such poor data bases complicate the planning process. One of the important concepts behind integration of paratransit with regular transit is to maximize the strengths of both. Regular transit is well-equipped to serve work trips oriented to the central business district (CBD) and much research has been done on these kinds of trips. However, there are a large and growing number of non-CBD oriented work trips and off-peak, non-work trips. Comparatively little research has been done in this area and, therefore, little is known about these travel patterns. Since the trips are a significant part of the market for paratransit, this void in knowledge has a large impact on the difficulty of effectively planning for paratransit services.

Very little is known about present taxi travel demand, for the following reasons¹:

1. Household origin-destination surveys exclude the large number of out-of-towners using taxis;
2. Taxi trip sheets give origins and destinations but no socio-economic data on riders; and
3. Attempts at mail-back post card surveys of taxi-riders have had poor response rates.

REGULATION

Regulation represents a key problem area. Since early transit services were private operations, legislation usually gave the operators a monopoly in exchange for their observance of certain service standards, fare levels or other restrictions. The shift to public ownership has obviated the need for many of these regulations.

Current regulations often limit the variety, range and flexibility of transportation services. For example, vanpools are not adequately defined in most existing regulations and consequently are mislabeled. This lack of definition sometimes makes it difficult to start vanpool operations. Several states have acted to address some of these problems by revising their regulations.

¹ Kirby, et al., op. cit., pp 112-113.

Presently, state laws regulate inter-city transportation, usually through a state public utility commission. Regulation of intra-city transportation tends to be through local public utility boards, police departments or airport authorities. Legislation often limits the number of vehicles; the areas the vehicles can serve; whether and where there is to be closed or open door operation; and whether flat fares, zone charges or meters will be used.

There is some controversy within the taxi industry between taxicab fleet owners and independent cab operators, particularly over fare levels. Because owners of large fleets are most frequently dealing with unionized drivers, they have to pay fringe benefits and other extra expenses which cut into their profit margin and capital replacement. They feel this puts them at a disadvantage vis-a-vis independent operators.

Another major problem area is insurance. High rates cause problems for taxis, but the biggest insurance headache comes with respect to vanpooling. Where a vanpool is organized through a large employer, the insurance can usually be handled through the company's policy. However, when a public agency tries to organize vanpooling with vehicles shared by employees of several smaller companies, there are not only problems from the firms themselves (who are not sure they want their employees sharing rides with others) but also from insurance companies who have set premiums as high as \$1,500 per van. Knoxville, Tennessee has been successful in negotiating lower rates, however.

Another major class of regulation involves union and other labor rules. These will be addressed in the subsequent section on labor.

Obviously, these regulations will play a large part in determining the success or failure of a paratransit operation. For example, territorial restrictions significantly impact vehicle productivity (number of passengers/vehicle/hour) because of dead-heading. Many of the issues surrounding regulation remain to be resolved.

OPERATIONS

A major operational problem for dial-a-ride and taxi services is low vehicle productivity particularly during off-peak hours. For example, The Urban Institute notes that taxis in Washington, D.C. "are empty for 40 percent of their trips."¹ There are a number of causes for low productivity. For dial-a-ride, planning issues such as service area design, including size and relationship to shopping centers, are not well understood. Expanding the service area may increase trip time and thus reduce productivity; but at the same time, the area must be large enough to provide enough demand and give sufficiently broad coverage to discourage use of a car.

¹ Kirby, Ronald F., et al., op. cit., p 16.

Control technology is also important. Estimates of the number of vehicles for which manual control becomes inadequate range from 10-15 vehicles (shared-ride, demand-responsive, with central dispatching and scheduling where maximization of vehicle productivity is desired) to 50-60 vehicles (non-shared-ride taxis with central dispatching and decentralized scheduling).¹ Fragmentation of control over public transportation reduces the possibilities of coordination by purchase of sophisticated control hardware and software. Development of improved software and coordination of efforts to use automated scheduling equipment could bring significant benefits. For example, Yellow Cab Company of Los Angeles, which already has computer assisted dispatching, estimates that productivity could be improved by 50% with automatic vehicle monitoring. Other problems with manual scheduling and dispatching include inadequate management information compared with automatic processes, very long training time (2 months to 3 years) for dispatchers and lack of schedule reliability (long waiting time for pick-ups).

LABOR ISSUES

Since transit and paratransit services are quite labor-intensive, labor costs and work rules play a large role in determining total operating costs. Section 13(c) of the Urban Mass Transportation Act of 1964 as amended provides that capital assistance can be provided only if "fair and equitable arrangements" including "provisions protecting individual employees against a worsening of their positions with respect to their employment" have been specified. For example, if there is an application to UMTA for capital assistance to build a rail rapid transit system, the transit workers' union must sign-off on the application indicating they have received satisfactory assurances that this will not result in lay-offs or a worsening of their employment condition. The application of 13(c) to paratransit leaves many questions, including: How to measure the impacts? Are contractors to grantees covered by 13(c)? When paratransit services are run by private, non-profit enterprises, are they covered by 13(c)? UMTA is currently reviewing 13(c) issues, including those that relate to paratransit, with the U.S. Department of Labor with the goal of developing a consistent labor policy for all UMTA programs.

The Knoxville vanpool project 13(c) agreement is widely regarded as a model for the industry to build upon. It is an illustration of the need to tailor each paratransit service to local conditions, carefully negotiating the issues. In Knoxville, the transit authority agreed not to reduce the size of the bargaining unit for four years and to have van maintenance done by the union mechanics in the transit authority shops.

¹ It should be noted that differences of opinion between the taxi industry and the Urban Mass Transportation Administration exist as to the maximum number of vehicles which can be manually controlled and still achieve optimal vehicle productivity.

FINANCIAL ISSUES

Like most of the major issues, financial problems are closely inter-related with problems in other areas, particularly regulations. The cost per vehicle hour for dial-a-ride usually ranges between \$3.60 to \$15.00.¹ Costs for pre-arranged ride-sharing would normally be less.

A related issue is UMTA grant policy: capital and operating grants can not go directly to a private operator. This is usually solved by setting up a public body to contract with the private operator for the service, sometimes using public vehicles.

OTHER PROVIDERS

In most jurisdictions, a number of social service agencies, churches and other private operations also provide transportation services. The large number of providers, with each often having only a small number of vehicles, makes coordination of these operations difficult. Compounding that difficulty are restrictions put on the use of those vehicles by the public agencies that fund them or by the private agencies themselves. The UMTA Service and Methods Demonstration Program demonstration in Knoxville, Tennessee is attempting to evaluate the effectiveness of establishing a transportation "broker" to coordinate these types of services (see the first page of the "Current Programs" section of this report). As suggested in the Information Bulletin, Transportation for Elderly and Handicapped Persons, effective coordination of these existing services may offer one solution to meeting legal requirements for transportation services to these special groups.

Another promising concept which may foster coordination and more efficient use of existing paratransit services and provide transportation service to the disadvantaged is to give subsidies to the users instead of the providers. Further research is being done on this concept.

MAINTENANCE

Maintenance is another operations issue in need of further analysis. Smaller paratransit vehicles have been attacked as unsafe or unreliable. Problems with conventional equipment have often resulted from the type of operation of many paratransit services-many stops, frequent vehicle overloads and slow speeds in congested areas. UMTA's Paratransit Vehicle Project is working to develop a prototype vehicle which would provide passenger comfort but reduce maintenance needs.

¹ Ibid., p 17.

Experience in the taxi industry, where intensive preventive maintenance programs exist, shows significant increases in the life and miles per vehicle over that of the privately owned vehicle. The average age of some fleets is about 30 months with an approximate average of 165,000 miles per vehicle.¹ Ann Arbor, Michigan and Orange County, California have instituted preventive maintenance programs which have shown some success.

¹ Glassman, Marvin A. "Operational Issues for Paratransit: Operator's Perspective." Paper presented to the Paratransit Conference sponsored by the Transportation Research Board and the Urban Mass Transportation Administration, USDOT, Willimasburg, Va., November 9-12, 1975.

Chapter II

CONTACTS AND CURRENT PROGRAMS

CONTACTS

Responsibility for paratransit programs on the federal level is shared by various offices in the Urban Mass Transportation Administration, the Federal Highway Administration, the Federal Energy Agency, and the U.S. Environmental Protection Agency. Please note that Urban Mass Transportation Administration (UMTA) staff is housed in two offices:

- Departmental Headquarters (DOT)
Nassif Building
400 - 7th Street, S.W.
Washington, D.C. 20590
- TransPoint Building (TRPT)
2100 - 2nd Street, S.W.
Washington, D.C. 20590

Program activities and contact persons are listed below. The code following each name is for identification and should be included in written correspondence.

URBAN MASS TRANSPORTATION ADMINISTRATION

- Office of Technology Development and Deployment, Bus and Paratransit Division. Deals with systems analysis of paratransit (economic analysis, service integration, market characteristics) and refinement of control technology. Contact: Edward Neigut, UTD-22, TRPT-Room 6104A, (202) 426-8483.

Monitoring development of prototype small bus suitable for paratransit operations. Contact: Charles Daniels, UTD-21, TRPT-Room 6104B, (202) 426-4035.

Monitoring development of prototype taxi vehicle suitable for paratransit operations. Contact: Wilhelm Raithel, UTD-23, TRPT-Room 6104E, (202) 426-4035.

- Office of Service and Methods Demonstrations. Conducts service demonstrations regarding paratransit. Contact: Jim Bautz, UPM-30, TRPT-Room 6419, (202) 426-4984.

- Office of Policy and Program Development.
Most questions regarding UMTA's paratransit policy can be answered by UMTA regional representatives. However, responsibility for policy development rests with this office, and they should be contacted if field personnel are unable to respond. Contact: Green Miller, UPP-10, DOT-Room 9313, (202) 426-4060.

- Office of Transit Assistance.
Administers capital and operating assistance programs. Contact: UMTA regional representative. (see Table 1)

Administers the "16(b)(2) program" which provides capital assistance to private non-profit groups wishing to operate transportation service for elderly and handicapped persons. Contact: Lorraine Harris, UTA-30, DOT-Room 9306E, (202) 472-6997.

- Office of Transportation Planning.
Develops planning methodology, including computer and non-computer based models. Contact: Robert B. Dial, UTP-10, DOT-Room 9307, (202) 426-9271.

- Office of the Chief Counsel.
Deals with legal questions regarding development of paratransit. Contact: Ted Munter, UCC-30, DOT-Room 9315, (202) 426-1938.

Conducts litigation.
Contact: Robert W. Batchelder, UCC-20, DOT-Room 9320, (202) 426-1906.

For questions regarding paratransit-related legislation. Contact: John Collins, UCC-10, DOT-Room 9320B, (202) 426-1909.

FEDERAL HIGHWAY ADMINISTRATION

- Office of Public Transportation Management Division.
Concerned with public transportation, particularly in non-urbanized areas. Administers UMTA Section 18 funds for public transportation in non-urbanized areas. Contact: Donald A. Morin, Chief, Office of Public Transportation Management Division, HHP-30, DOT-Room 3303, (202) 426-0210.

Ridesharing branch of the Office of Public Transportation Management Division is concerned with carpooling and vanpooling. Contact: Barbara Reichart, Chief, Ridesharing Branch, HHP-33, DOT-Room 3303, (202) 426-0210.

FEDERAL ENERGY ADMINISTRATION

- Office of Transportation Programs.
Questions about vanpooling, particularly those related to marketing and insurance. Contact: Lew Pratsch, Office of Passenger Systems, Room 6514, New Post Office Building, 12th & Pennsylvania Ave., N.W., Washington, D. C. 20461 (202) 961-8136.

Table I
UMTA FIELD OFFICES

Region I	Transportation Systems Center, Kendall Square, 55 Broadway, Cambridge, MA 02142, Tel: (617) 494-2055; FTS 837-2055.
Region II	Suite 1811, 26 Federal Plaza, New York, NY 10007, Tel: (212) 264-8162; FTS 264-8162.
Region III	Suite 1010, 434 Walnut Street, Philadelphia, PA 19106, Tel: (215) 597-8098; FTS 597- 8098.
Region IV	Suite 400, 1720 Peachtree Road, N.W., Atlanta, GA 30309; Tel: (404) 526-3948, FTS 285-3948.
Region V	Suite 1740, 300 S. Wacker Drive, Chicago, IL 60606, Tel: (312) 353-0100; FTS 353-0100.
Region VI	Suite 9A32, 819 Taylor Street, Fort Worth, TX 76102; Tel: (817) 334-3787; FTS 334-3787.
Region VII	Room 303, 6301 Rock Hill Road, Kansas City, MO 64131, Tel: (816) 926-5053, FTS 926-5053.
Region VIII	Suite 1822, Prudential Plaza, 1050 17th Street, Denver, CO 80202, Tel: (303) 837-3242; FTS 327-3242.
Region IX	Suite 620, Two Embarcadero Center, San Francisco, CA 94111, Tel: (415) 556-2884, FTS 556-2884.
Region X	Suite 3106, Federal Building, 915 Second Avenue, Seattle, WA 98174, Tel: (206) 442-4210, FTS 399-4210.
TTC	Transportation Test Center, UMTA Programs Director, Pueblo, CO 81001, Tel: (303) 545-5660, FTS 323-9341.

U.S. ENVIRONMENTAL PROTECTION AGENCY

- Office of Transportation and Land Use Policy.
This office encourages the use of paratransit strategies as a methods of reducing air pollution from mobile sources. Various publications have been developed toward this end. Contact: Ed Twomey, AW-445, Environmental Protection Agency, 4th & M Streets, S.W., Washington, D.C. 20460, (202) 755-0603.

CURRENT PROGRAMS

The Service and Methods Demonstration (SMD) Program, within the Office of Transportation Management and Demonstrations, UMTA, is the focal point for paratransit service demonstration projects. The Bus and Paratransit Division of UMTA's Office of Technology Development and Deployment, working in coordination with SMD, sponsors technology development demonstration projects.

In general, the SMD program attempts, through actual service demonstrations in local areas, to develop innovative techniques to make better use of existing forms of transit. Some SMD projects are familiar: buses on reserved lanes, fringe parking, dial-a-ride, fare variations and special services for elderly and handicapped persons. The program is also conducting research into areas which are experimental, such as auto restricted zones, congestion pricing, and user-side subsidies.

The objectives of the SMD program are to reduce transit travel time, to increase transit reliability, to improve service for the transit dependent, to increase transit coverage and to improve transit vehicle productivity. Most of these objectives have been addressed by a variety of service demonstrations, including the following:

- Knoxville, Tennessee - The City of Knoxville acts as coordinator of public transit and private transportation resources (taxis, subscription van service) to form an integrated transportation system. First emphasis is on the use of subscription vans driven by commuters to divert auto drivers to multiple-occupant vehicles at little or no continuing cost to the city once the service is underway.
- Rochester, New York - The Rochester dial-a-ride demonstration involves the operation of a demand responsive "small bus" system in medium density suburbs. It is being conducted in the Greece, Irondequot, Henrietta, and Brighton suburbs of Rochester, N.Y. The significant areas of innovation is the introduction of a minicomputer dispatching system, expansion of service to multiple service areas, provision of subscription services, and integration of dial-a-ride with the existing fixed-route system.

The project began on April 1, 1975 and will run until November 1979.

- Naugatuck Valley, Connecticut - A multifaceted demonstration with special emphasis on the elderly and handicapped, operational since January, 1973. The system has included limited fixed-route service, flexible route, demand-responsive service over a wider area and contract bus service for social service agencies and other groups in the Valley. An automated fare collection system uses credit cards and monthly billings to eliminate the need for cash payment. Fare subsidization of agency-sponsored handicapped and elderly citizens is facilitated by a computerized billing system which bills sponsoring agencies according to use of the service by their clients during the previous billing period.
- Albuquerque, New Mexico - Will transfer the demand-responsive transit service model for the elderly and handicapped developed under an earlier demonstration in Naugatuck Valley, Connecticut to a medium size urban area of approximately 300,000 population. Special transportation services will be coordinated and integrated with the regular transit service and with transportation services provided by health and social service agencies.
- Portland, Oregon - A program to transfer the service model developed in Naugatuck Valley, Connecticut to a medium size city of approximately 400,000 population.
- Cleveland, Ohio - In March 1975, the city of Cleveland inaugurated the Neighborhood Elderly Transportation (NET) demonstration project intended to coordinate transportation services to meet the needs of the elderly, those 60 years of age and over. Within three demonstration neighborhoods, small buses provide advanced reservation and demand-responsive service that is coordinated with regular public transit.
- Cranston, Rhode Island - TRANSVAN, a low-cost door-to-door system begun in April 1973 and extended through December 1974, when demonstration funds ceased. The city has continued to operate this successful service with local funds.
- Chicago, Illinois - An implementation planning study for a pilot demonstration of convenient, barrier-free transportation for elderly and handicapped citizens in a large urban area. It will analyze data to determine the travel needs of the mobility-limited and the most effective approach to meeting these needs in one geographic area of Chicago. Once an effective service model is demonstrated, it is expected to be continued and expanded throughout the Chicago area with assistance from UMTA's regular programs.

In addition to these programs focusing on paratransit, there are additional SMD programs which have or will have paratransit components.

To find out more about the program, contact: Ronald J. Fisher, Director, Service and Methods Demonstrations, UPM-30, TRPT-Room 6412, (202) 426-4995.

Chapter III

ANNOTATED BIBLIOGRAPHY

This bibliography was compiled primarily from sources included in the Transportation Research Information Service (TRIS) network of the U.S. Department of Transportation as edited and supplemented by the staff of Public Technology, Inc. On-going research projects which may be pertinent are also given. The title, location, project manager, sponsor and projected completion date are provided for these projects. This bibliography endeavors to give a sampling of the available literature rather than an exhaustive list of all sources of information on the topic.

GENERAL

American Public Transit Association. "Paratransit in the Family of Transit Services." Transit Journal, Vol. 2, No. 2, May 1976, p. 5-26.

The transportation service concepts generally referred to as paratransit have been receiving increasing attention as possible responses to changes in transportation demand. Increasingly dispersed development patterns, unfulfilled mobility needs of the transportation disadvantaged and reduced predictability of petroleum availability all require the exploration of innovations in transport service.

Institute of Public Administration. Demand - Actuated Road Transit (DART) - Performance and Demand Estimation. Washington, D.C.: Institute of Public Administration, 1969. (NTIS PB 189 330)

"DART" is a demand-responsive bus transportation system which provides direct point-to-point service in a variety of urban situations. A model that would compute cost per trip as a function of demand distribution, passenger boarding and unloading time, size and shape of the service area, average vehicle speed and hourly operating costs is described. The assumption that peak-hour demands tend to place diseconomies on transit operations by concentrating service requests at certain times was incorporated in the mode. It is concluded that carefully controlled manipulation of DART fares, schedules and services may facilitate a redistribution of demand to nearly uniform proportions between the hours of 7:00 a.m. and 10:00 p.m.

Kirby, R.F., et al. Para-Transit: Neglected Options for Urban Mobility. Washington, D.C.: Urban Institute, 1974. (NTIS PB 234 320)

The study reviews the experience to date with paratransit services, assesses their potential for servicing urban transportation demand and proposes a research, development and demonstration program for the provision of paratransit services. Services studied were grouped into

three categories: (1) "Hire and Drive" - daily car rentals and forms of short-term car rentals including mini-car and public automobile system; (2) "Hail or Phone" - taxi, dial-a-ride, jitney and related services; and (3) Pre-arranged ride-sharing - forms of carpool, van pool and subscription bus services. Chapters include comparative studies of paratransit modes, innovations in paratransit regulations and case studies. An extensive bibliography is furnished.

Medville, D. A Conceptual Overview of Demand Responsive Transportation Systems. McLean, Va.: Mitre Corp., 1973. (NTIS PB 220 863)

Various issues related to the implementation of demand-responsive transportation systems are discussed in light of data obtained from systems that have been or are in operation. These issues involve system dynamics, potential market vehicle productivity, economic viability and the utility of computer control.

Transportation Research Board. Demand-Responsive Transportation Systems and Services. Special Report 154. Washington, D.C.: Transportation Research Board, 1974.

This reports the proceedings of the Fifth Annual International Conference on Demand-Responsive Transportation Systems conducted by the Transportation Research Board on November 11-13, 1974, Oakland, California. The following issues concerning demand-responsive systems were addressed: state-of-the-art; planning, implementation and operation; equipment and maintenance; taxis and other private services; research and development; marketing and promotion; evaluation; political and public policy issues; and several other concerns.

Transportation Research Board. Paratransit. Special Report 164. Washington, D.C.: Transportation Research Board, 1976.

This reports the proceedings of a conference on paratransit held in Williamsburg, Virginia on November 9-12, 1975, conducted by the Transportation Research Board and sponsored by the Urban Mass Transportation Administration. The following six workshops provided the major areas of focus for the conference:

1. Role of Paratransit in an Integrated Urban Transportation System
2. Effect of Governmental Capital and Operating Assistance on the Development of Paratransit
3. Institutional Changes Needed to Foster the Development of Paratransit
4. Paratransit in Small Communities and Nonurbanized Areas
5. Operation Issues for Paratransit: Productivity, Vehicles, Dispatching, Management
6. Role of Paratransit in Serving the Needs of Special Groups

U.S. Department of Transportation. A Directory of Research Development and Demonstration Projects: Fiscal Year 1975. Washington, D.C.: USDOT, 1975.

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

PLANNING

Cambridge Systematics, Inc. Development of a Method for Estimating Patronage of Demand-Responsive Transportation Systems. USDOT/Transportation Systems Center Contract OS-445. Late 1976. Contact Howard Simkowitz, Code 231-TSC, Kendall Square, Cambridge, Mass. 02142. (617) 494-2552 for more information.

Objectives of this study are: (1) assess existing DRT systems and select areas for calibration and verification of calibrated models; (2) develop functional specifications for all required demand models and define methods of calibration and application; (3) using data gathered through household interviews and/or acquired elsewhere, use mathematical techniques to produce an acceptable set for calibrated disaggregate models which have appropriate policy sensitivity, are logically structured, have reasonable coefficients, are based on commonly available data and are statistically sound; and (4) test calibrated models in three selected DRT service areas and develop model.

Gurin, D. and J. Wofford. Implications of Dial-a-Ride for the Poor. Cambridge, Mass. Massachusetts Institute of Technology, 1971. (NTIS PB 199 406)

Implications of dial-a-ride for the poor are examined with respect to: (1) the extent to which dial-a-ride can overcome general problems of existing public transportation for the poor; (2) special problems which dial-a-ride may generate for the poor; (3) the potential for dial-a-ride to create employment opportunities for the poor; and (4) criteria by which the implications of dial-a-ride for the poor may be demonstrated.

Henderson, C. "Seminar on System Evaluation." Highway Research Board Special Report #124. Washington, D. C.: Highway Research Board, 1971.

In this seminar, an effort was made to consider the value of existing demand-actuated urban public transportation services (taxis, buses and jitneys) from the viewpoints of several other groups who must lend support if the system is to enjoy significant success. The following topics are considered: (1) Operators - alternative operating patterns, the national potential problems; (2) Owners - public versus private ownership and costs and fares; (3) Patrons - identification of the target ridership; and (4) Labor - potential labor-management problems.

Kirby, Ronald F. & Kiran U. Bhatt. Guidelines on the Operation of Subscription Bus Service. Report for USDOT, UMTA. Washington, D.C.: The Urban Institute, August 1974. (NTIS PB 237 076/AS)

This report provides guidelines on the planning, organization, and operation of specialized bus services, termed subscription, which are tailored to serve urban travelers who agree to patronize them on a regular basis. Based on ten detailed case studies of such services, the report develops guidelines on identifying and informing potential riders, obtaining vehicles and drivers, meeting regulatory requirements, setting routes, schedules, and fares, and obtaining special privileges such as the use of express lanes and close-in parking. The report concludes with a discussion of the potential impacts of these services on the congestion, pollution, and fuel consumption associated with urban travel.

Lerman, S. and N.H. Wilson. "Analytic Model for Predicting Dial-a-Ride System Performance, Transportation Research Board Special Report #147. Washington, D.C.: Transportation Research Board, 1974.

Though much work has been done on the supply side of dial-a-ride systems, little has been done which allows for prediction of the demand aspects of such a system. In this paper, a model is presented which includes both supply and demand, and allows transit planners to explore a variety of design and policy options.

Miller, Gerald K. & Melinda A. Green. An Analysis of Commuter Van Experience. Report for USDOT, UMTA. Washington, D. C.: The Urban Institute, February 1976.

This report analyzes the planning, organization and operation of commuter van programs (often called van pools) in the U.S. and Canada. More than 30 existing operations have been examined and classified by considering the major organizational arrangements for providing the service. The potential benefits van commuting generates for the users, employers and community are discussed, and the paper presents guidelines on the demand environment and indicates the service characteristics that are likely to be important in attracting riders. Major legal issues including public regulation, competition with bus transit, liability and insurance and implications of driver compensation are also reviewed. The potential for widespread van programs and the proposals for large-scale, areawide van service are also discussed.

Miller, Gerald K. & Melinda A. Green. Guidelines for the Organization of Commuter Van Programs. Report for USDOT, UMTA. Washington, D.C.: The Urban Institute, February 1976.

This is the follow-up report to An Analysis of Commuter Van Experience. This document describes the major stages in the development of a company sponsored commuter van program including: the investigation of program feasibility, the promotion and organization of the service and

the operation and administration of an on-going operation. These guidelines are based on the experience of several successful programs and potential sponsors should find them useful for their particular situation. Seven detailed case studies which are representative of the major types of commuter van services are also presented in the Appendix.

Mitre Corporation. Demand-Responsive Transportation System Planning Guidelines. Report for USDOT. McLean, Va.: Mitre Corp., 1974. (NTIS PB 232 970/7).

Based on the limited empirical information of 12 demand-responsive transportation systems, preliminary planning guidelines have been developed to aid in the design of new demand-responsive systems. These guidelines facilitate the estimation of ridership, fleet size, staff requirements and costs. A summary is also presented of the major characteristics of these 12 demand-responsive systems that are operating in the United States and Canada.

Vitt, J.E., et al. "Determining the Importance of User Related Attributes for a Demand-Responsive Transportation System." Highway Research Record #318. Washington, D.C.: Highway Research Board, 1970.

A demand-responsive transit system must be based on a discriminating analysis of the needs of potential patrons and other interest groups. A method is discussed for quantifying this analysis and making it pertinent to system design. A questionnaire is devised that provides a continuum from patron responses to system characteristics and design variables. Analytic techniques and survey applications are described. Nine steps involved in the integration of this method with design and marketing for civil systems are discussed as parts of a process of modelling, evaluation and decision-making.

REGULATION

International Taxicab Association. A Compendium of Provisions for a Model Ordinance for the Regulation of Public Paratransit. Report for USDOT, UMTA. Chicago, Ill.: International Taxicab Association, February 1976.

This publication comprises a complete set of provisions for the regulation of various types of public paratransit transportation. The preparation was undertaken by the International Taxicab Association under the supervision of special counsel and consisted of five stages: the collection and analysis of the statutes of every state, the ordinances of some 600 municipalities and several multi-state compacts; the compilation, comparison and the organization and drafting of the sections; consideration of varying attitudes concerning several philosophies of regulation as revealed by the existing regulations; research into the needs which would appear from the implementation of new forms of public paratransit transportation; and the assembly of the Compendium.

Hines, J.M. and D.W. Sloan. Legal Analysis of Transportation Regulation and Innovation - The Dial-a-Ride. Cambridge, Mass.: Massachusetts Institute of Technology, 1971.

State and federal motor carrier regulations are examined as they may impinge on a new concept of transportation, the dial-a-ride. An experimental exemption from regulation is proposed to encourage the testing and implementation of new technological and service concepts. The problem of acquiring permission to operate is explored under the assumption that dial-a-ride would not qualify for an exemption from regulation. Part of the report is essentially advocacy, anticipating some of the obstacles a dial-a-ride application would meet in state law and marshalling arguments and authorities to overcome them. A second section considers developing federal law as it would affect dial-a-ride.

Lax, J. "Dial-a-Ride Project in Ann Arbor - Legality," Highway Research Board Special Report #136. Washington, D.C.: Highway Research Board, 1973.

A lawsuit was commenced by Ann Arbor's two major taxicab companies requesting an injunction against the operation of the dial-a-ride service. The reasons advanced for the illegality of the operation were: (1) dial-a-ride vehicles must obtain licenses under the taxicab ordinance; (2) issuance of licenses to existing taxicab companies constituted an agreement not to engage in competing activity; and (3) the Ford Motor Company was being greatly enriched without giving adequately in return. The city, joined by the Ford Motor Company, filed a motion for summary judgment. The motion answering the contentions is detailed. The Circuit Court decision affirming the legality of the dial-a-ride system was upheld by the Court of Appeals and the transcripts of the proceedings are included in the appendix. The taxicab companies have decided not to appeal this decision, thus establishing the legal basis for the dial-a-ride service in Ann Arbor, Michigan.

OPERATIONS

Bevans, P. Computer Configurations for a Dial-a-Ride System. Cambridge, Mass.: Massachusetts Institute of Technology, 1971. (NTIS PB 205 190)

The design philosophy for the computer configuration is discussed with reference to several variables, including type of system (experimental, demonstration or operational), size (number of vehicles, passenger demand and service area) and performance. Typical dial-a-ride computer systems are cited with reference to programming and scheduling operations. Criteria for selection of computer hardware are outlined for both medium and small-sized units. The report concludes with detailed time and cost estimates for development of all hardware and software components of the dial-a-ride computer subsystem. Appended material outlines the proposed dial-a-ride software organization with reference to assumptions, programs and files, security, core list specifications, drum file specifications and programming operations. In addition, an implementation and user's guide is provided for the computer-aided routing system (CARS).

Dallas, Texas. Dallas Carpool/Buspool Program Evaluation.
FHWA Contract No. DOT-FH-11-8313, Mid 1977, Contact: H.G. Gale, DOT-
Room 4404, HEP-1, FHWA, (202) 755-9370 for more information.

The research will evaluate the methods used, and their effectiveness, in initiating and maintaining a carpool/buspool matching program in the City of Dallas using the FHWA computer program.

Davidson, J. "Use of Data Processing in Taxicab Control," Highway Research Board Special Report #136. Washington, D.C.: Highway Research Board, 1973.

Dispatching is recognized as the most critical problem facing operators of demand-responsive vehicles. Three technically and economically feasible improvements in the field are suggested: (1) data processing for receipt, assignment, retention and matching of requests for service and units available for service; (2) digital communications equipment for transmission of messages between mobile units and base; and (3) automatic vehicle monitoring. Experiences of the taxicab company in implementation of the first improvement is described and it is concluded to be technically and economically feasible.

International Taxicab Association. An Analysis of Taxicab Operating Characteristics. Report for UMTA, USDOT. Chicago, Ill.: International Taxicab Association, August 1975.

This report presents the results of a survey of taxicab company operating characteristics conducted by the International Taxicab Association during the fall of 1974. A mail questionnaire was sent to 6,467 active operators. Of these, 696 (10.8%) responded. In spite of this rather low response rate, the sample provides broad geographic coverage and covers all sizes of operations (1 to over 2,000 cabs). The sample appears to be representative of the industry, although it falls short of being a true scientific (random) sample. It is believed that the sample statistics can be accepted as being reasonably close to their corresponding universe values and that projections based on these statistics will be useful as preliminary estimates. Information on characteristics, services provided, types of operations, vehicles in operation, operating characteristics and fare structure are provided.

Kendall, Donald C. Carpooling: Status and Potential. USDOT Report No. DOT-TSC-OST-75-23. Cambridge, Mass.: Transportation Systems Center, USDOT, June 1975.

This report contains the findings of studies conducted to analyze the status and potential of work-trip carpooling as a means of achieving more efficient use of the automobile. Current and estimated maximum potential levels of carpooling are presented, together with analyses revealing characteristics of carpool trips, incentives, impacts of increased carpooling and issues related to carpool matching services. A model was developed to predict the maximum potential level of

carpooling in an urban area. Results from applying the model to the Boston region were extrapolated to estimate a maximum nationwide potential between 47 and 71% of peak period auto commuters. Maximum benefits of increased carpooling include up to 10% savings in auto fuel consumption. A technique was developed for estimating the number of participants required in a carpool matching service to achieve a chosen level of matching among respondents, providing insight into tradeoffs between employer and regional or centralized matching services.

Pratsch, L. Carpool and Buspool Matching Guide. Washington, D.C.: Public Transportation Branch, Federal Highway Administration, 1973. (NTIS PB 22 017 015)

The report summarizes available information on the results of different programs that encouraged the use of carpools and buspools to decrease the use of individually occupied automobiles for commuting purposes, and thus provide more efficient use of urban highway facilities. In addition to the important public relations and incentives aspects, the use of computer matching techniques to provide commuters with information to enable them to share rides with others is discussed.

Rebibo, K.K., et al. Summary of an Automated Scheduling System for Demand Responsive Public Transportation. McLean, Va.: Mitre Corp., 1974. (NTIS PB 232 419/2)

The dial-a-ride automated scheduling system is a package of computer programs developed on a Westinghouse 2500 minicomputer by the Mitre Corporation under sponsorship of the Urban Mass Transportation Administration. The system contains an automated scheduler that dynamically assigns customer requests for trips to vehicle tours and dispatches the vehicles through their stops; data analysis programs that produce statistical reports on system performance; and programs to generate and maintain the data files required by the scheduler, such as the file of related street names.

Remak, Roberta. Potential for Flexicab Services: Innovative Uses of Taxis and Jitneys for Public Transportation. Report No. DOT-TSC-OST-75-52 for USDOT. Santa Barbara, CA: INTERPLAN Corp., December 1975.

The term flexicab has been coined to refer to the range of demand-responsive and fixed-route services that can be offered as extensions of existing taxi/jitney operations. The taxi industry, with its experience in small vehicles, dispatching and flexible routing is particularly suited to flexicab operations. Opportunities for profit exist, particularly when several types of flexicab services are offered by the same operator, permitting him to make maximum use of his labor force and equipment. Three examples of multi-service, flexicab systems are presented in the form of scenarios set in hypothetical urban areas (small, medium and large). The examples include the calculation of revenues, operating costs and net earnings.

The report also reviews the present status of the taxi and jitney industry and makes policy and research recommendations. A bibliography and a list of contacts are included in appendices.

Roos, D. "Operational Experiences with Demand-Responsive Transportation Systems," Highway Research Record #397. Washington, D.C.: Highway Research Board, 1972.

Demand-responsive transportation systems have been implemented in Ann Arbor, Michigan; Batavia, New York; Mansfield, Ohio; Columbia, Maryland; Columbus, Ohio, Bay Ridges, Ontario; Emmen, The Netherlands; and Regina, Saskatchewan. These new systems are examined with respect to vehicle dispatching, ridership, economic feasibility, type of service and overall impact. Future directions in demand-responsive transportation based on observed system performance are discussed.

Shackson, R.H. "Automation in Dispatching Demand-Responsive Vehicles," Transportation Research Board Special Report #147. Washington, D.C.: Transportation Research Board, 1974.

This is contained in the proceedings of the Fourth Annual International Conference on Demand-Responsive Transportation Systems conducted by the Highway Research Board on October 3-5, 1973, Rochester, New York.

The role of automation in dispatching demand-responsive transportation vehicles is discussed. Panelists discussed the justification for, and performance of the system. A computerized dispatch system alleviated two problem areas of the taxicab industry: piracy and favoritism. Costs are considered in terms of time and money saved. Future plans such as dial-a-ride application for cabs, computer digital systems and data communications between cab and dispatch center are discussed.

Taylor, W.C. and T.K. Datta. "Technique for Selecting Operating Characteristics of Demand-Actuated Bus System," Transportation Research Board Special Report #147. Washington, D.C.: Transportation Research Board, 1974.

As the number of applications of demand-actuated public transit systems increases, careful consideration must be given to the selection of operating policies. The effect of several variables including scheduling dynamics and routing dynamics on the economic and service characteristics of demand-actuated systems are explored. Comparative tables and charts describe a process for selecting the "best" system for prescribed service area and potential demand. The selection of a system will necessitate a tradeoff between service and operating costs. Techniques for formalizing these decisions and results of applying these techniques are presented.

Transportation Systems Center. Small City Transit Characteristics: An Overview. Washington, D.C.: USDOT, March 1976.

This report is based on information and operating data from thirteen small community transit systems which were studied as part of a larger project on small community transit and its potential. It summarizes organizational, institutional and operational aspects of the case studies and contains an analysis of some of the relationships among service, cost and community response. Hypotheses are offered regarding the types of trips which are served, the cost and service tradeoffs which are relevant when choosing between fixed-route and demand-responsive modes of operation, the critical variables such as labor agreements and maintenance arrangements which affect operating costs, the level of subsidy which may be anticipated and the tradeoffs between single-ride fares and transit passes as a means of fare collection. Individual case study reports on each of the following thirteen cities are also available:

- Amherst, Mass.
- Ann Arbor, Mich.
- Bremerton, Wash.
- Chapel Hill, N.C.
- East Chicago, Ill.
- El Cajon, Calif.
- Eugene, Ore.
- Evansville, Ind.
- Merced, Calif.
- Merrill, Wis.
- Sudbury, Mass.
- Westport, Conn.
- Xenia, Ohio

University of Tennessee. An Analysis of Two Privately Owned Shared-Ride Taxi Systems: Executive Summary. Report for UMTA, USDOT. Knoxville, Tennessee: University of Tennessee, Transportation Center, April 1975.

A comprehensive study of the markets, economic characteristics and operation of two privately owned demand-responsive transportation systems in operation in Davenport, Iowa and Hicksville, New York. Except for the movement of masses of commuters during rush hours, the shared-ride taxi systems performed most of the functions of their scheduled bus competitors; moreover, the composition of the markets for the bus and shared-ride taxi systems was found to be remarkably similar. With the adoption of a vehicle leasing arrangement with the drivers, the economic structure of each of the economically viable shared-ride cab systems was considerably more flexible than that of the fixed-route, fixed-schedule bus systems. The success of the private demand-responsive transportation systems was attributable to the innovativeness of the management and the high level of competency of the dispatching personnel and the drivers. A major conclusion was that a taxi company under the direction of a skilled manager and entrepreneur can be an effective public transportation service.

Voorhees (Alan M.) and Assoc., Inc. Transportation Pooling. McLean, Va.: Alan M. Voorhees and Assoc., Inc., 1974 (NTIS PB 236 157)

With the advent of impending energy shortages in the winter of 1973-74, the U.S. Department of Transportation embarked on an accelerated program to promote increased use of high-occupancy vehicles--transit and carpools. As part of this program a series of reports was prepared that should be considered as a guide to the development of a sound program in a metropolitan area. The individual reports contained in this volume are: review of carpool activities, organization for carpooling, approaches to matching, legal and institutional issues, incentives to carpooling, transit/taxi coordination, vanpools, buspools, pooling for the disadvantaged and carpool backup systems.

Wilson, N.H. et al. "Simulation of a Computer Aided Routing Systems (CARS)," Highway Research Record #318. Washington, D.C.: Highway Research Board, 1970.

A simulation model that contains such inputs as number, capacity and velocity of vehicles; time distribution of demands; spatial distribution of origins, destinations and intermediate points; and output options has been exercised on an IBM 360/67 to evaluate the effectiveness of a real-time routing algorithm for a demand-response taxi service named CARS (Computer-Aided Routing System). The algorithm is heuristic because of the inapplicability of existing optimization techniques. The Fortran model was designed to evaluate various heuristics based on time-versus-cost tradeoffs. The operating variables and interactive characteristics of the model are described and illustrated. Further investigation is planned to simulate the system instead of merely the algorithm.

LABOR ISSUES

Elliott, J.M. "Demand-Responsive Transportation as Seen by the Transit Worker," Highway Research Board Special Report #136. Washington, D.C.: Highway Research Board, 1973.

Concerned as the transit worker is with the economic difficulties and declining productivity of the fixed route transit system and the failure of government and the industry to respond adequately, the dial-a-bus is reviewed as an alternative improvement, offering jobs and economic progress both to the worker and the industry. The system is seen to offer opportunity for new markets in the low density areas and other areas where conventional line-haul is not feasible. It is also seen to stabilize the number of jobs and reduce the need for split-shift schedules. The improved convenience, reliability and speed of transit of the dial-a-bus would increase its patronage, thus enabling the transit system to function more productively.

FINANCIAL

GoJob, T.F. and R.L. Gustafson. "Economic Analysis of a Demand-Responsive Public Transportation System," Highway Research Record #367. Washington, D.C.: Highway Research Board, 1971.

This paper discusses the methodology and results of a case study analysis of the economic feasibility of a many-to-many, demand-responsive transportation system in a chosen U.S. city. Ridership was estimated by means of market research tools, in-depth group surveys and home interviews. A flexible cost model was developed to evaluate the cost of serving various hourly distributions of demand. The estimated demands for each of a series of alternative levels of service and fare were then applied to this cost model and the profit or loss was calculated for each level of service and fare. The sensitivity of the profit or loss to changes in demand distributions and to changes in various cost parameters was also investigated.

Stafford, J. Economic Considerations for Dial-a-Ride. Cambridge, Mass.: Massachusetts Institute of Technology, 1971. (NTIS PB 204 054)

An analysis of the market environment concludes that dial-a-ride would effectively supplement bus and taxi services by providing transportation to 8-15 passengers per hour at rates of less than one dollar. Alternative methods for computing probable market demand are discussed. A detailed cost summary is provided with reference to: average estimated costs per trip (approximately 51 cents); total operating costs (vehicles, labor, maintenance and overhead); communications and control (the costs of receiving service requests, computer processing and dispatching vehicles); computer operation costs; and general management costs. The economic attractiveness of dial-a-ride as compared with private transportation is discussed according to a variety of assumptions. The report concludes with an analysis of pricing policies for dial-a-ride based on time of day and trip length and location or trip time. The probable value of commuting time to riders in different income categories is also computed. Appendices document methods of driver costing and the results of an attitude survey conducted among users of different commuter modes.

MAINTENANCE

Flusberg, Martin, et al. Small Transit Vehicle Survey. Cambridge, Mass.: ECI Systems, Inc. and Transportation Systems Center, USDOT, December, 1975.

Small transit vehicles, defined as those vehicles seating 7-25 passengers and intended for public transportation use, are available in a variety of makes and models, with markedly different characteristics, affecting both operators and users. This report documents the specifications and operating experience of small transit vehicles available in the United States. Vehicles are divided into three main categories:

vans and van conversions, small buses and converted motor homes. Operating experience was obtained by sampling from manufacturer provided user lists. Vehicle specifications were obtained directly from the manufacturer.

No vehicle has been completely free of problems; no one vehicle is clearly superior to all others, nor is any one category of vehicle clearly superior to any other. A vehicle operator must weigh a number of variables before determining which vehicle is best for a particular application.

Suomala, J.B. Dial-a-Ride Vehicle Specifications. Cambridge, Mass.: Massachusetts Institute of Technology, 1971. (NTIS PB 202 027)

The purpose of this report is to provide a set of specifications which would enable early procurement of vehicles for a dial-a-ride (DAR) experiment. Conformance to the following specifications is mandatory: (1) all applicable federal motor vehicle safety standards; (2) static test code for school bus body structure, Truck Body and Equipment Association, Washington, D.C.; and (3) Society of Automotive Engineers Handbook Supplement 19. The minimum standards represent a practical point of departure for specification of the DAR vehicle since they describe a passenger-carrying vehicle designed around reasonable safety criteria. Detailed specifications are provided for vehicles in terms of: the interior configuration; exterior configuration; construction; safety; braking; steering; heating; ventilating, and air conditioning; performance; propulsion; running gear; and electrical systems.

INTEGRATION OF SERVICES

Multisystems, Inc. Operational Implications of a Major Modal Diversion to Transit, A Macro-Analysis. Report No. DOT-TST-76-72 for U.S. Department of Transportation, Washington, D.C., U.S. Department of Transportation, April 1976.

This study examined the implications of dramatic increases in transit patronage on system structure and performance for medium-sized urban areas (800,000 population). Models were developed to examine the cost and service attributes of a variety of system components, including express bus, exclusive lane operation, subscription service, dial-a-ride and several route-based feeder options. These models were applied in a regional context over a range of patronage assumptions to evaluate both the individual components and synergisms resulting from various service combinations. The analysis provided insights into the structure of integrated transit systems and the expansion of these systems to serve increasing shares of urban travel.

Multisystems, Inc. The Evolution of Integrated Transit, Three Parables. Report for U.S. Department of Transportation, Contract No. DOT-TST-76T-4. Washington, D.C.: U.S. Department of Transportation, June 1976.

This study examines the implications of embarking on a ten-year strategy to implement a comprehensive, regional transit system integrated operationally,

physically, and institutionally for medium-sized urban areas (800,000 population). Three levels of ridership response are assumed which affect system scale and operating policy decisions at biennial intervals. The operating cost and deficit implications of these three response parables are then traced to yield insight into the feasibility of an evolutionary strategy.

SYSTAN, Inc. Deployment Scenarios for Integrated Regional Transportation Networks. Report for U.S. Department of Transportation, Report No. DOT-TST-76T-7. Washington, D.C.: U.S. Department of Transportation, August 1976.

This report describes the cost and service implications of four alternative scenarios for the deployment of an integrated regional transportation system in a hypothetical, large urban city. The impacts of various levels of user acceptance on the cost and service characteristics of integrated systems are investigated parametrically. Although the results obtained are heavily dependent on the size and population density of the study region, sensitivity analyses indicate the likely effect of varying certain key assumptions. For the selected study area, a limited incremental expansion of integrated transit service to certain suburbs currently unserved by transit appears possible, and the improvement of off-peak suburban service through the use of flexible-route systems appears desirable. Limited incremental expansion of integrated service holds the promise of reducing system deficits if guided by judicious planning and accompanied by service-related fare increases. In view of the large areas and low suburban population densities characterizing the study region, full coverage of the entire suburbs appears to be economically feasible only at reduced service frequencies.

SYSTAN, Inc. Macroanalysis of the Implications of Major Modal Shifts in Integrated Regional Transportation Networks. Report No. DOT-TST-76-65 for U.S. Department of Transportation. Washington, D.C.: U.S. Department of Transportation, April 1976.

This report describes a macroanalytic approach to the problem of analyzing changing travel patterns in an integrated regionwide transportation network for large urban areas. Separate models of residential areas, transportation corridors and central business districts are combined in a modular representation of urban structure suitable for use in policy analysis and transportation planning. This analytic approach treats demand parametrically, has minimal data requirements and provides rapid insights into the impacts of alternative patterns of transit and automobile usage. Such impacts as travel time, user costs, congestion and energy consumption are examined explicitly. Application examples discuss the potential economies of scale available from major shifts in current transit usage patterns, tradeoffs between flexible-route and fixed-route systems and the potential benefits available from policies to reduce the effects of demand peaking.

