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PARATRANSIT INTEGRATION

SYMPOSIUM

October 14, 1977

PROCEEDINGS

Systems Architects, Inc.
Transportation Systems Division
Randolph MA 02368

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16. Abstract

Paratransit innovation is considered by DOT/UMTA to be an essential part of the provision of public transportation. A variety of service options, ranging from many-to-many dial-a-ride to subscription ridership, offer cost-effective options to conventional fixed-route transit. UMTA's Paratransit Integration Research and Development Program is exploring a wide variety of service components and options.

The purpose of the Paratransit Integration Symposium was to inform professionals in the paratransit field - i.e., planners, public and private transit operators, elected officials, and consultants, of the components of UMTA's Paratransit Integration Research and Development Program. Fourteen presentations were made by UMTA officials and various experts in demand responsive transportation who were conducting projects for UMTA. The presentations focused on five areas: 1) Paratransit Integration Program Overview, 2) Integration of Services, 3) Paratransit Alternatives, 4) Taxis as a Public Transportation Provider, and 5) Development of Support Tools and Dissemination of Information.

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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
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lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
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yd^3	cubic yards	0.76	cubic meters	m^3
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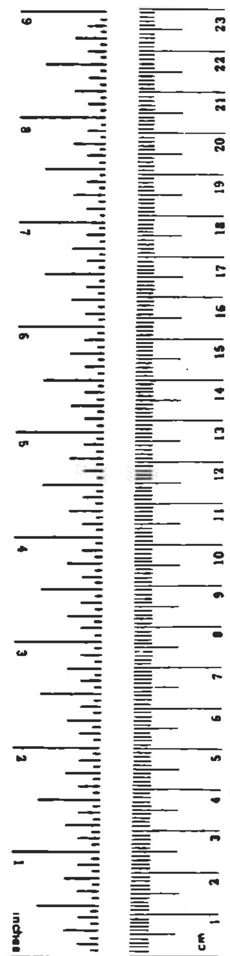

Approximate Conversions from Metric Measures

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cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
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l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
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m^3	cubic meters	1.3	cubic yards	yd^3
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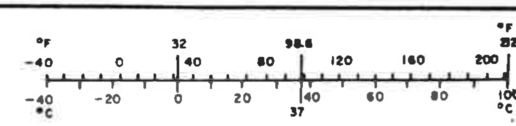

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PARATRANSIT INTEGRATION SYMPOSIUM INTRODUCTION

TRANSPORTATION SYSTEMS CENTER
CAMBRIDGE, MASS
OCTOBER 14, 1977

The Paratransit Integration Symposium, sponsored by the Transportation Systems Center was held on October 14, 1977. The symposium was directed toward professionals in the paratransit field; planners, public and private operators and consultants. It was designed to inform those working in the paratransit field of current policies and programs at the Federal level. Perhaps even more importantly, those attending the symposium were able to get a feeling for the current thinking of experts in the paratransit field. It is important for them to know what future directions the state-of-the-art may take and what changes may impact their work. Several of the speakers were deeply involved in the development of prototype paratransit systems and were able to describe in detail the successes and failures of these systems.

With the paratransit field moving rapidly forward on a number of fronts, it is important that professionals involved in the planning and design of systems be cognizant of current developments. The lessons learned from major demonstration projects such as those in Rochester and Knoxville provide an important input into Federal policy decisions. These policy decisions, in turn, help determine future funding decisions and regulations. UMTA/TSC has sponsored research and demonstration projects in a number of areas of paratransit development, including service integration, estimation techniques, automation, legal considerations, vehicle development, shared-ride taxi and involvement of the private operator. The symposium speakers covered current developments in these areas.

The first three speakers provided an overview of the UMTA Paratransit Integration Program. Doug Birnie of the UMTA Office of Policy Development spoke on UMTA's policy on paratransit, including the proposed regulations on private operator involvement. Eldon Ziegler, the Chief of UMTA's Operational Technology Development Program, then reviewed the goals of the Paratransit Integration Program. Ann

Muzyka of the Transportation Systems Center is serving as Project Manager of the Paratransit Integration Program. She provided the details of the actual program plan.

The next group of speakers covered recent developments in service integration. Martin Flusberg of Multisystems, Inc., reviewed a Market Analysis Study which that company is conducting for UMTA/TSC. Eldon Ziegler then covered UMTA's efforts in the development of automated scheduling aids and the results of experiments to date. John Beeson of the Knoxville, TN., Department of Public Transportation Service then spoke on the successful "brokerage" program now underway in Knoxville.

Taxis as a public transportation provider was the topic of the next group of speakers. A. U. Simpson, President of DAVE Systems, Inc., gave some preliminary results of a study his company is conducting on the Shared-Ride Taxi Market. Thomas Carberry of the Transportation Systems Center then spoke on recent developments in automation in the taxi industry. Richard Gundersen, also of the Transportation Systems Center, provided a review of recent litigation involving taxi companies and publicly funded paratransit services.

The lunchtime speaker was Daniel Roos of Multisystems, Inc.,and M.I.T. His speech covered recent developments in the UMTA-funded, dial-a-ride service integration project in Rochester, N.Y. This project has attempted to deal with a number of difficult problems, including automated scheduling and dispatching, 13(c) union considerations and flexible route/fixed route service integration.

The final group of speakers covered the Development of Support Tools and Dissemination of Information. John Billheimer of Systan, Inc., spoke on model development. B. Paul Bushueff of the Transportation Systems Center served as Coordinator for the Paratransit Integration Workshop held at TSC, October 12-13, 1977. He reviewed the workshop and the process for developing the Paratransit Integration Planning Handbook. John Ridgely of UMTA spoke on the development of paratransit vehicle prototypes. James Bautz of UMTA finished with a review of UMTA Service and Methods Demonstrations in the area of paratransit development.

A brief summary of each presentation follows.

UMTA POLICY

M. Douglas Birnie
Program Analyst
Office of Policy Development
Urban Mass Transportation Administration
U.S. Department of Transportation
Washington, D.C.

Mr. Douglas Birnie of the UMTA Office of Policy Development made the initial presentation of the symposium with his discussion of the UMTA paratransit policy.

UMTA's policy on paratransit services has been emerging over the last several years. The proposed paratransit policy, issued in October 1976, is really a consolidation of various policy elements issued under other subjects such as transportation system management and elderly and handicapped transportation regulations.

As one would expect, the new UMTA administrator, Richard Page, has been carefully reviewing the elements of the paratransit policy. However, he already has indicated his clear support for paratransit. That support is articulated in a letter by Mr. Page to Passenger Transport, the APTA weekly. Mr. Page stated that he considers paratransit a high priority item on his own agenda.

When the policy is issued, UMTA plans to hold regional seminars to discuss its implementation with localities.

The UMTA paratransit policy will address those transportation services classified as public paratransit. These services emphasize the shared-ride element of paratransit and include dial-a-ride, shared-ride taxi, and publicly-sponsored vanpools, subscription bus and other types of shared-ride services which are available to the public, or special categories of users such as the elderly and handicapped. UMTA fully endorses the provision of public paratransit as a legitimate part of a mass transportation system.

Paratransit in its various forms when coordinated in an integrated program of services can satisfy a wide variety of local transportation needs which otherwise would be less effectively served. It can provide economical service in rural and suburban communities and for the transit dependent. Coordinating paratransit with conventional transit will provide a feeder system to line haul routes, thereby increasing transit patronage and expanding services. Paratransit service can also replace less productive fixed route services, thus increasing productivity and efficiency.

In metropolitan areas, a family of transit services is needed to respond to the different market needs of the community. An effective metropolitan transportation system should take the form of a cooperative partnership between paratransit and conventional transit modes with closely coordinated services and with varied ownership of its components. Such a system offers promise of attaining the greatest overall operating efficiency and effectiveness.

Many people involved in the provision of transportation -- both public and private -- are skeptical as to whether paratransit will be accepted in local areas. This is especially true in view of the rising cost of conventional transit systems. However, the increasing cost of conventional transit will promote greater interest in less costly paratransit services. A number of paratransit services such as car and vanpools are low cost and may possibly be provided by the public sector with little subsidy.

Pressures for an even spread of services throughout the metropolitan area is another reason why paratransit will receive serious consideration. Today, conventional transit systems suffer from a perception problem. Often suburban groups view transit as primarily serving urban residents, while urban residents hold the opposite view. The needs of these various constituencies particularly neighborhood and community circulation must be satisfied if transit is to receive continued local support. There are a variety of paratransit services which can effectively serve community travel needs. This is also in line with the evolving Administration urban policy of neighborhood revitalization. The recent Supreme Court decision upholding a community's right to ban commuter parking may provide an incentive to develop pooling and other transit services in suburban areas.

In addition, Congress also has expressed concern as to the status of transportation services in rural areas. Paratransit provides in many instances an efficient and effective tool for handling rural transportation needs.

In response to these political considerations, the Department of Transportation has taken several actions to underscore local consideration of paratransit service when it promises to be a viable option.

The proposed UMTA paratransit policy will encourage each urban area to consider public paratransit whenever such services offer a more effective and economical way to provide needed public transportation services. This will be accomplished through scrutiny of the local planning process used to develop transportation plans and programs. UMTA is supportive of local paratransit through their planning requirements; however, it is not mandating paratransit service.

The framework for the paratransit policy is formed by the existing regulations, i.e., TIP/TSM, Elderly and Handicapped, and Capital Improvements. UMTA, however, is taking additional steps to involve private transportation providers in the planning and operation of paratransit service. The local, regional transportation planning agency will be responsible for involving the private operator. UMTA, as a condition for its assistance, will seek assurance that private transportation carriers have been consulted in the development of the local transportation plan/program. Private operators must also be given an opportunity to compete for provision of public paratransit services.

UMTA intends, therefore, to provide financial assistance to public or non-profit agencies for the purpose of operating new public paratransit services only if the local program under which this assistance is being sought includes suitable arrangements for assuring that private operators have had an adequate opportunity to compete for the provision of these services. UMTA is also encouraging reviews of state and local mass transit regulations in light of today's transit needs. Section 9 money is available to undertake these reviews.

UMTA can support paratransit services financially. Capital assistance is available to all transportation companies involved in providing public paratransit services; operating assistance is available in urbanized areas over 50,000 population. Private operators can receive UMTA assistance only if they are under contract to a public agency. The local, regional transportation planning agency has been designated as the responsible party to bring about the coordination and integration between the public and private sector. UMTA has pledged its continuing support and assistance to the planning agencies in fulfilling their responsibilities.

PARATRANSIT INTEGRATION PROGRAM GOALS

Eldon Ziegler, Jr.
Program Manager
Office of Research and Development
Urban Mass Transportation Administration
U.S. Department of Transportation
Washington, D.C.

A major purpose of the Paratransit Integration Program is to facilitate the implementation of UMTA's paratransit policy. This policy and our program address the growing conflict between a need for strong public transportation and the unsustainable growth in transit subsidies. Although 95% of all trips nationwide are by private auto, a significant percentage of the population is dependent on public transportation.

In addition, the movement of people from cities to suburbs has resulted in a diversification of trip patterns and a reduction in demand densities. Unfortunately, conventional transit is not particularly well suited to serve this market, yet conventional transit is needed in higher density corridors. As a result, transit planners have been forced to take a more market oriented approach. Transportation needs are now identified for different population groups rather than by geographic corridors alone.

Then the transportation service is designed to serve the particular market in the most efficient and cost effective manner, utilizing both public and private operations and in coordination with other services. Some of the markets include school, social service, work and shopping trips for such transit dependent groups as the handicapped, elderly, youth and others without private autos.

These markets are served by a variety of potential service options that the Paratransit Integration Program has grouped into three categories:

1. conventional transit services - which include line haul, express bus and shuttle bus services operating along fixed routes according to fixed schedules.

2. public paratransit services - as defined by UMTA policy, which include collection/distribution services, subscription bus, dial-a-ride, publicly sponsored shared-ride taxi and ride sharing.

3. exclusive paratransit services - which include taxis, private van and car pools.

One can conceptualize an urban area made up of these services as depicted in Figure 1. The line haul and high density services are represented by the solid lines and the dotted lines represent the community level services which are the primary focus of the paratransit program. These community services would then be augmented by van pools and commuter buses for the longer work trip.

Then, with the wide variety of service options available to transit planners, the intent of the program is to assure the availability of information, procedures and technology to maximize the "wise" deployment of paratransit. This equates to a set of formal goals which are as follows:

a. Develop paratransit services in an orderly fashion.

b. Develop analysis tools and implementation guidelines to limit the number of major mistakes which are made in the develop-

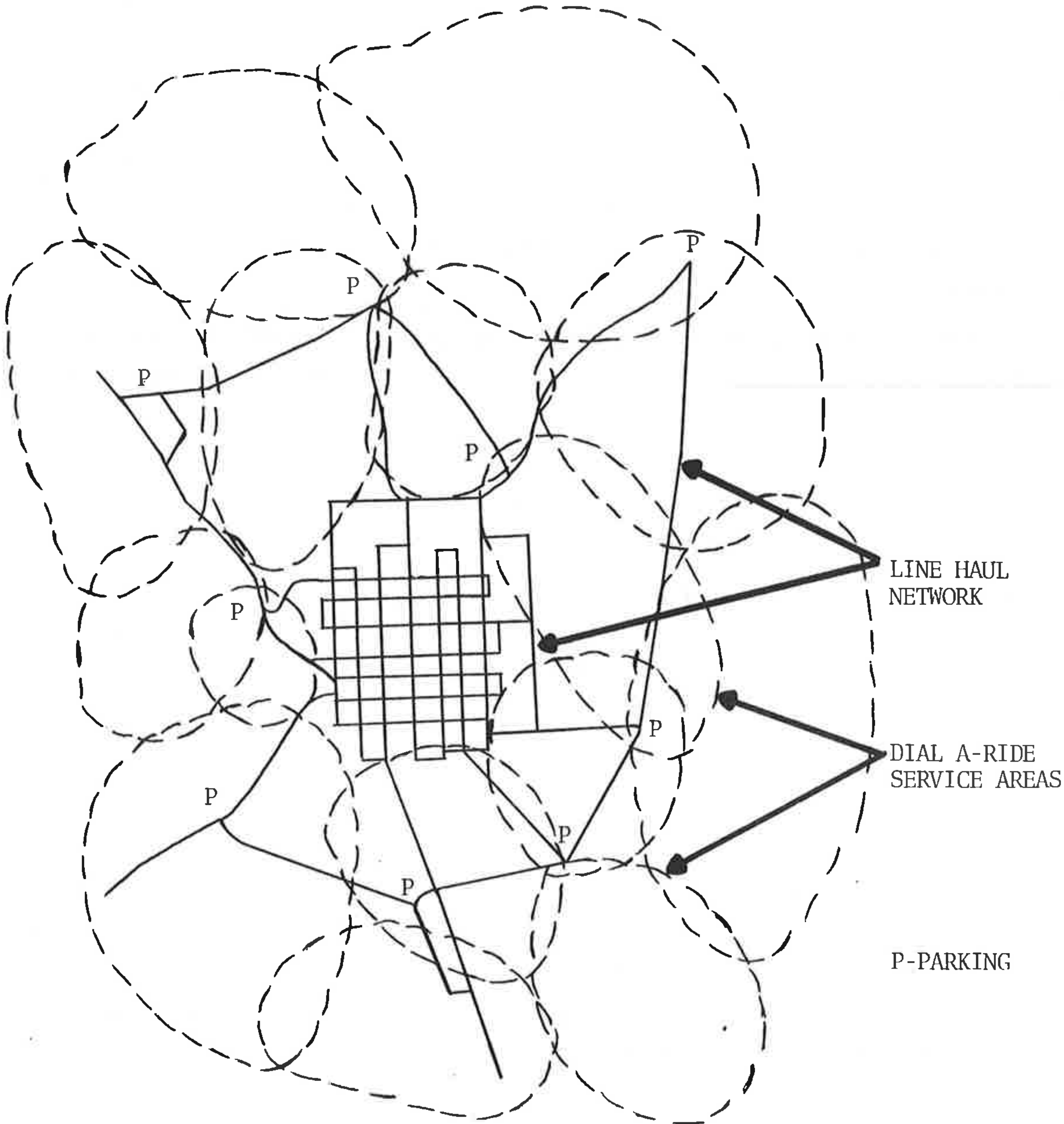

FIGURE 1. TOMMORROW'S TYPICAL TRANSIT SERVICE

ment of paratransit services.

c. Design a class of services where the quality of service is predictable and high and is within cost constraints.

The Paratransit Integration Program supports overall policy development, implementation of paratransit systems, and demonstration programs. The program is organized into four functional areas: (1) analysis and system design, (2) technology development and deployment, (3) dissemination and evaluation, and (4) program support and independent studies.

The approach the Paratransit Integration Program takes to developing paratransit systems consists of three steps. The first step is the development of assessment and analysis tools and technology for paratransit systems. The second step is to validate and test these assessment tools, the methodology, and technology through UMTA's Service and Methods Demonsration Program (SMD). The third step is to disseminate the information developed by the program to the public through handbooks, guidebooks, and assessment criteria.

PARATRANSIT INTEGRATION PROGRAM PLAN

Ann Muzyka
Project Manager
Transportation Systems Center
U.S. Department of Transportation
Cambridge, MA

Ms. Ann Muzyka, Project Manager of the Paratransit Integration Program at TSC described the Paratransit Integration Program Plan.

The Paratransit Integration effort is directed to the development of critical information, procedures and technology which will provide the foundation for the successful evolution of today's fixed route transit into area-wide systems. The program is not directed to the development of completely deployable systems but to the development of system components which can be tailored to local needs and situations.

Over fifty percent of the work effort will be done under contract to the private sector. This approach is being utilized in order to incorporate into the program the skills possessed by the private sector and its contacts in the field and its awareness of the problems in specific areas.

Specific studies being undertaken during the present fiscal year fall within the following four categories.

1. Market Analysis/Benefit and Cost

   The first study area is the estimation of demand, benefits, costs and impacts of integrated paratransit systems. This study will also include the identification of markets suitable for paratransit systems. These studies are central to establishing the scope and direction of Phase II efforts.

2. Institutional Issues

   Another area of study will focus upon the institutional requirements of implementing a demand-responsive transportation system. These studies will review, among others, federal, state and local regulations, insurance needs, labor agreements, and the procedures which must be followed to implement integrated paratransit services.

3. Technology Development

   The special technological needs of demand responsive transportation will comprise a third area of study. Among the subject areas of study will be the requirements of communication systems; in particular, automated call-back systems and in-vehicle digital communication systems will be developed. The thresholds at which a change in dispatching techniques is appropriate will be studied along with ways of identifying the most effective and efficient tour design techniques. In addition, the dispatching software developed at MIT will be transformed for use on a small dedicated computer. To facilitate these efforts, a computer simulation model for paratransit systems is being developed.

4. System Implementation

   The fourth phase of the study effort will be the establishment of dialogues with communities contemplating implementation of paratransit systems. Included in this study phase is the development of pilot system guidelines and a comprehensive handbook for the implementation of paratransit systems.

The preceding studies are critical to the Paratransit Intregration Program but until they are all brought together in a real world situation, the process is an academic exercise. Recognizing this fact, TSC is undertaking an in-depth study of shared-ride taxi systems. This study will analyze all aspects of shared ride taxi operations. As part of this study, a shared-ride taxi workshop is scheduled to take place at TSC in the Spring of 1978.

MARKETING ANALYSIS

Martin Flusberg
Senior Transportation Systems Analyst
Multisystems, Inc.
Cambridge, MA

Mr. Martin Flusberg, Senior Transportation Systems Analyst, Multisystems, Inc. and Project Manager of the Benefits/Costs Study of Paratransit Systems spoke on the market for integrated paratransit systems.

This presentation focused on a detailed study of the estimation of the costs and benefits of areawide, demand-responsive systems. Paratransit systems implemented over the past decade have been well-documented. It is now necessary to step back and look at the implications of more extensive applications of paratransit.

Integrated paratransit can be defined by the following minimum components: (1) transportation service is provided to nearly all residents in the area, (2) paratransit components make up part of the overall system, and (3) fixed-route and paratransit services are integrated to some degree.

The preliminary phase of the market analysis study utilized available data and looked at the demand-responsive transportation services in existence today, the type of markets these services are serving, and the settings in which these services have been implemented. To help structure and understand the differences between service concepts, the study developed a service classification scheme and identified within this scheme a number of key factors which differentiate services. The classification scheme was based on two components:

1. module factors - factors which affect the particular system and service area (e.g., service pattern, dispatching strategy, operating entity, target market).
2. global factors - factors which affect the area-wide systems (e.g., service mix, modularity, integration, administration).

The study analyzed data from existing systems in smaller urban areas. The scope of this review was to gain an understanding of which groups used the service and which services were attractive to particular markets. The results of this analysis indicate that the markets served by paratransit tend to be similar to the markets served by conventional transit. Paratransit systems, however, seem to be serving greater numbers of the elderly, the young, and zero-car households than conventional transit. Greater emphasis is also placed on shopping trips as opposed to work trips. Paratransit, because it is a premium service, is also replacing "chauffered trips" made by multi-car households.

Since the benefit/cost study involves making estimates of the impacts of implementing integrated paratransit systems, a method was needed for projecting impacts on a national level. The approach taken began with the identification of a range of area characteristics that were felt to be important to paratransit system implementation. Data were collected for all 276 SMSA's in the United States. A cluster analysis program was conducted on the SMSA data, and nine classifications were identified. From each class, a sample city "representative" of all cities in that class was identified; and actual data from that city was used to construct a hypothetical integrated paratransit system. The advantage of this technique is that it will allow for better aggregation and transferability of results.

The analysis is currently identifying and measuring the impacts of these hypothetical systems on the sample communities. The impacts (benefits and costs) of the system are being measured on an impact incidence matrix; the project is making no attempt to quantify the net benefits/costs of the system in a single measure. The elements of the impact matrix are shown in Table 1. The impact analysis will be segmented by market groups.

The impacts of the hypothetical system will be measured for a base year, and preliminary projections will be made of potential impacts which will occur in twenty years. The market analysis will compare areawide, integrated paratransit systems with existing, fixed route systems and potential expanded conventional systems. This analysis will hopefully lead to a greater understanding of what will be the impacts of an integrated paratransit program on a national level.

TABLE 1. IMPACT INCIDENCE MATRIX

<u>USERS</u> (BY MARKET SEGMENT)

- CONSUMER SURPLUS

<u>COMMUNITY</u> (BY MARKET SEGMENT)

- COVERAGE
- MOBILITY
- REDUCED VMT
- REDUCED CHAUFFER TRIPS
- CHANGE IN EMPLOYMENT
- REDUCED AUTOMOBILE COSTS

<u>OPERATOR</u>

- MARGINAL COSTS
- MARGINAL REVENUE

<u>LOCAL PROVIDERS</u>

- IMPACT ON NET REVENUE
- IMPACT ON RETURN ON INVESTMENT

<u>MAJOR EMPLOYERS</u>

- REDUCED PARKING REQUIREMENTS

<u>GOVERNMENT - LOCAL</u>

- SHARE OF MARGINAL CAPITAL/OPERATING COSTS
- REDUCED PARKING REVENUES
- REDUCED PARKING CONSTRUCTION COSTS

<u>GOVERNMENT - FEDERAL</u>

- SHARE OF MARGINAL CAPITAL/OPERATING COSTS

EXPERIMENTAL RESULTS AND DEVELOPMENT OF SCHEDULING AIDS

Eldon Ziegler, Jr.
Program Manager
Office of Research and Development
Urban Mass Transportation Administration
U.S. Department of Transportation
Washington, D.C.

The need for the paratransit operator to maintain information on each passenger is a unique problem for the paratransit industry, and one which is not faced by conventional transit operators. At a minimum, the paratransit operator must know the origin and destination for each passenger. An information system for a paratransit service consists of five parts, each of which is capable of being successfully automated to some degree. The parts are: (1) receipt of information from the customer, (2) organization of service needs, (3) scheduling, (4) dispatching, and (5) reporting on system performance and travel patterns.

There have been a variety of attempts to apply automated information technology to each of these parts. The most significant results of these applications will be summarized. In terms of customer information and scheduling, if this information is entered directly into a computer, the computer has been shown to be able to estimate pick-up time within a five-minute range. This information technology has been successfully implemented in many-to-many dial-a-ride systems in Rochester, NY, and Ann Arbor, MI, as well as in cab companies in Los Angeles, Montreal, and Toronto.

Digital communications systems have been successfully applied in Rochester, Ann Arbor, and a number of taxi systems to improve communication between the vehicle driver and the dispatching center.

A major problem for shared-ride taxi service which can potentially be solved through automated information technology is the equitable computation of fares. Conventional taxi meters penalize the shared-ride mode because it becomes more expensive for the passenger to go out of his way. In addition, taxi meters make it difficult to predict the fare. The use of zonal systems to calculate shared-ride fares also has inequities, especially if the zones are large. Short trips which cross zone boundaries may cost more than longer trips within a large zone.

Carnegie-Mellon University is currently developing a "meter" which will serve a variety of service types. It can work as a conventional taxi meter or will display a pre-calculated fare for shared-ride service. This device will allow fares to be determined for various classes of service and will make fares for shared-ride service predictable.

There are three more experimental applications of automated information technology:

1. conventional taxi dispatching - Los Angeles Yellow Cab,
2. ride-sharing matching information for brokers - Knoxville, Tennessee,
3. simulation for detailed service design - Haddonfield, N.J., Rochester, N.Y.

The results of these applications of automated information technology indicate that those used for information handling or digital radio control are more successful to date than those which require computer decision-making. They are also supported by commercially available products. The government's role in this area is two-pronged. One, the government should promote promising new applications of conventional computer technology, such as the microprocessor computer ride-sharing support system for Knoxville. Two, the government should encourage limited application of automated decision-making systems. It is still unclear whether automated scheduling is cost effective. While the quality of service is improved, productivity has not increased to cover the additional costs.

In summary, automated information processing systems have improved operating reports which result in better service, evaluation, planning, and service refinement. Training time for dispatchers has also been reduced. The use of digital communications has improved the quality of communications and service and has reduced radio channel loadings. Computer scheduling improves service quality, but its cost effectiveness has not been firmly established. Simulations can serve as valuable detailed design tools, providing an idea of what to expect in system operation.

PARATRANSIT ALTERNATIVES

John Beeson
Administrator
Ridesharing Brokerage Bureau
City of Knoxville
Knoxville, TN

The "transportation broker" concept in Knoxville started at the University of Tennessee but has since moved operations into the city government. Since it is difficult to cut back even the most unproductive transit routes, new solutions to transportation problems must be found. Medium-sized cities such as Knoxville are experiencing rapidly increasing transit deficits, which are becoming a severe burden to local taxpayers. Traffic congestion is also becoming a more serious problem.

The real costs of transportation to local government are much greater than is generally believed. Costs are fragmented among a number of different agencies (social service, school dept.,etc.). Duplication of service and increased governmental control over private operators have also negatively impacted the transportation system.

The transportation brokerage concept is operating in Knoxville. The broker attempts to match transportation needs and resources by improving the market and advocating needed change. It is not appropriate for the broker to promote one mode over another. A single agency has been established to coordinate all transportation, the Knoxville Department of Public Transportation Services, also known as the Knoxville Commuter Pool (KCP).

KCP decided to concentrate initial efforts on the work trip. This was seen as the greatest challenge and the area of greatest potential energy savings. Several obstacles were encountered and immediately overcome, including:

1. resistance from the Public Service Commission,
2. insurance which was either too costly or unobtainable,
3. large geographic size of the metropolitan area.

KCP established itself with the business community and worked to eliminate regulatory obstacles. State control over carpooling and vanpooling was removed, and a city ordinance was passed to allow taxi ride-sharing. Changes were made to allow vanpooling insurance to be obtained at a reasonable rate.

The ride-sharing program now has over 300 participating businesses with over 18,000 employees out of a total workforce of 100,000 involved. A goal to have over 25,000 employees involved in the program by spring 1978 is anticipated. Now 85% of all people can be provided with a list of five or more people they can rideshare to work with. This has been accomplished through employee survey and telephone information service. A marketing and administrative organization is the heart of the KCP organization. Information processing is now done by the batch system, but an on-line computer package with display terminal is being developed.

Twenty-eight express buses now serve the Knoxville CBD, evenly split between public and private operators. Further expansion of this service will only be accomplished through the private sector.

KCP purchased 51 vans to lease to drivers who carry employees to work. With KCP assistance, the drivers make their own arrangements with riders and pay a lease fee to KCP. KCP does not want to build a fleet of its own and plans to sell the vans to the drivers, keeping a few for back-up. A vanpool drivers' association is being formed. Eighty vanpools are operating in the Knoxville area now but a KCP survey found 400 suitable vans in company parking lots which were not being used for vanpooling. KCP's goal is to have 300 operating vanpools by 1979, carrying 3300 people and saving 1.8 million gallons of gas annually.

KCP has actively promoted carpooling, a mode used by 37% of the area workforce. An active brokerage program for social service agencies has been undertaken. A number of social service transportation programs have been brokered to private carriers. A consortium of handicapped providers is being formed. Other participants include senior citizens' groups, YMCA, YWCA and private schools. KCP feels that social service applications are an extremely fertile area for the brokerage concept.

KCP has talked to downtown employers in an attempt to alleviate traffic congestion and parking shortages in the CBD. KCP hopes to encourage CBD-bound employees to use the ride-sharing program with a goal of eliminating 2000 cars from the CBD. It is hoped that CBD employers will provide an incentive to employees who ride-share or use transit. A free-fare transit zone is being implemented in the CBD.

SHARED-RIDE TAXI MARKET

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Transmax Division of DAVE Systems, Inc., is now conducting a study for UMTA/TSC on shared-ride taxi, computer-control system requirements. Preliminary findings are available.

Twenty year projections, assuming modest increases in gasoline costs and population growth, indicate that shared-ride is a potentially profitable mode of operation for taxi companies.

Private automobile transportation is expected to decrease its share of trips from 89% to 85%. Taxis will increase their share from 2.3% to 5%. Exclusive-Ride Taxi (ERT) will decline and Shared-Ride Taxi (SRT) will become the dominant taxi mode by 1995. With better system integration, public transit will also increase its share of the market from 3.9% to 5.5% by 1995.

A number of potential pitfalls must be avoided when taxi companies convert from ERT to SRT. If fleet size is reduced and productivity increased without a fare reduction, major increases in profitability could result; excessive profits, however, will induce either more competition or additional regulation. On the other hand, simply cutting fares without sufficiently increasing productivity may result in a net revenue loss. Thus, it is important to choose the right combination of parameters (fare, fleet size, productivity, level of service) for SRT operation.

It appears that in medium-sized cities (Tucson, AZ, Birmingham, AL)

SRT fare should be set at approximately 70% of ERT fare in order to obtain the same profitability. Below 70% of the ERT fare, additional SRT riders will not compensate for lost revenue.

The impacts of fare reduction vary between cities on the basis of demographic and transit characteristics. In large, dense cities, a cut in fares should result in increased ridership as riders are attracted from other transit modes. Taxi operators may be able to reduce SRT fares to about 50% of ERT fares before profitability is reduced. At 25-30% of ERT fare, SRT may be profitably converted into jitney service.

In small cities and rural areas, most taxi riders are captive and thus a fare change will have little impact on ridership levels. Revenue declines when fares are reduced, making it unlikely that small-city companies will increase profits significantly when and if they convert to SRT. Subsidies will probably be necessary to encourage conversion in less populous areas.

Conversion from ERT to SRT affects the quality of service due to detours and increases uncertainty for the passenger. These impacts tend to reduce demand. SRT service cannot operate effectively, however, unless demand per taxi increases. Thus, reduced fleet size will often be needed to increase demand per taxi and permit higher productivity and revenue.

Fleet size will generally decrease with initial implementation of SRT but should increase over the long run, especially as the energy shortage will become a more significant factor. SRT operations should be approached with caution to ensure that they remain economically viable.

ROLE OF AUTOMATION

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Automated control systems for Shared-Ride Taxi (SRT) will have a major impact on the industry. Most taxi operations have less than 40 cabs, and many are family-owned and economically marginal. Most operate exclusively in the Exclusive-Ride Taxi (ERT) mode and use no automation at all. The initial application of automation has been in larger taxi companies and primarily for accounting and business functions. The acceptance of automation has been slow; and it is estimated that fewer than 10% of all taxi operators have in-house automated accounting systems.

Automated systems can be used to collect fleet performance statistics and assess driver productivity on a regular basis. Storage of advance orders can be used to aid dispatchers. Driver misuse of voice channels, such as obscenities, can be prevented by digitizing the vehicle identification number and transmitting it automatically when the driver hits the microphone button. This may also increase operational efficiency.

Completely automated dispatching requires the use of on-line, real-time data processing. Current applications include (1) systems with computer-aided dispatching, where the dispatcher still gives commands through voice control, or (2) "state-of-the-art" or fully automated digital control systems in which the computer schedules and dispatches via a digital link with the vehicle mobile unit.

Impacts of automation vary with the type of operation. Among the potential benefits are:

1. improved driver workload equalization,
2. reduced dead mileage,
3. improved operational efficiency,
4. reduced passenger waiting time,
5. reduced paperwork.

Thus far, automation technology in private operations has been completely privately funded. Further, all applications have been in ERT systems. Presently, UMTA has initiated the Paratransit Integration Program to develop the necessary technological change factors to support paratransit, including Shared-Ride Taxi (SRT). A contract has been awarded to DAVE Systems, Inc., of Anaheim, CA, to establish control system requirements and functional design for automated SRT systems.

Scheduling and dispatching SRT is much more complex than ERT. The DAVE System computer design will automate scheduling and dispatching in a method similar to that used in the Rochester dial-a-ride system. No human dispatchers are used except for supervisors who are needed to handle special requests (estimated at 5% of all orders). A mobile unit display is placed in each taxicab. The system has a number of add-on features, including management reports, auto call-back equipment, and fare calculations, which can help reduce driver theft.

Cab owners are very cost conscious and have generally been unwilling to invest in automated systems. Taxi companies must be convinced that automation is useful, but implementation should proceed incrementally. Further study is needed to make them suitable to the needs of the small taxi operator.

The DAVE Systems report will be widely disseminated, and an SRT conference will be sponsored by DOT next spring.

LEGAL ASPECTS OF PARATRANSIT DEVELOPMENT

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Although it is difficult to substantiate, it appears that private transportation companies have been seriously impacted by the implementation of government-assisted paratransit services. Accordingly, the deployment of these competitive systems has resulted in litigation in at least a half dozen localities since 1971. The litigation, initiated predominantly by taxi operators, has addressed a number of important legal issues associated with government-assisted deployment of paratransit. The following conclusions can be made from the analysis of the litigation:

1. The Urban Mass Transportation Act clearly distinguishes the prerequisites for capital assistance grants from those of demonstration assistance grants. Private transportation companies have been unsuccessful in their claim that the more stringent capital grant requirements should apply to situations where federal demonstration subsidy is used to implement competition. Furthermore, if private transportation companies are affected by capital assistance then, in order to receive additional statutory protections, they must meet the criterion that they be mass transportation companies. To date, conventional, exclusive-ride taxi services have not qualified as such and, therefore, have been denied these added safeguards. The more difficult question which may have to be addressed in the near future is how to handle an existing transportation company, offering both shared-ride and exclusive-ride service. Since shared-ride services are recognized as mass transportation, the issue then becomes what protections would such a company qualify for under this new status. From the cases analyzed in this study it appears that the status of an existing competitive transportation company is irrelevant when it comes to demonstration project grants. Capital grant approval, on the other hand, would require Section 3(e) protections since the existing competitive system now would come under the definition of mass transportation. On the other hand UMTA's proposed policy requires a finding that the shared-ride portion be more than an "incidental adjunct to its main business" before such provisions apply. How the courts will interpret this administrative direction remains an open question.

2. Implementation of paratransit services by the municipality has not, at present, been considered a violation of the license granted by the government unless there is an express agreement not to compete contained in the licensing ordinance. Public utility licenses granted by state law have been interpreted strictly and, without an express duty not to compete, the government is free to provide similar services. However, where the municipality itself may be able to compete, a transportation company under contract to the municipality might very well be prohibited.

3. Private transportation companies have been unsuccessful in

claiming constitutional violations resulting from paratransit implementation. To substantiate the constitutional claim of deprivation of property (business franchise) without just compensation it is necessary to show that there was a taking of private property by the government. The cases have held that there is no taking unless the existing company had a legally-protected right (such as an express agreement by the government not to compete) to be free from competition. Another constitutional claim which has been unsuccessful is denial of equal protection of the laws. The one case which analyzed this claim held that the paratransit service was not similar to exclusive-ride taxi service and, therefore, the taxi licensing laws did not pertain.

4. To date the only successful law suit brought by a private transportation company against the municipal transit district implementing paratransit was a result of a state transit enabling statute. Generally, statutes creating transit districts require that the government purchase existing transit services prior to implementing competitive services. The key to qualifying for the buy-out provision is that the transportation service must come within the definition of "existing transit service." It is important that the full definition be analyzed to determine whether existing transit service is liberally defined as it was in Santa Clara or rigidly defined as in Orange County.

5. Paratransit implementation by a government entity has not been considered unfair competition in the common law sense. The transit district is not imitating taxi service. On the contrary, it generally exerts efforts to clearly distinguish the two services by using different vehicles, fares and service options. Therefore, without a passing off or pawning off of the paratransit service as that of a taxi service, there is no valid claim of unfair competition. In addition, states may have applicable unfair competition statutes which should be analyzed prior to deployment of government subsidized paratransit.

With the exception of Santa Clara, none of the law suits resulted in a decision for the existing transportation company. This does not mean that in the future a taxi company should not consider litigation as an ultimate weapon against illegal actions of competing transit districts. Admittedly, new laws, new regulations, and changing social climate may alter the legal protections available to private taxi companies. In addition, it should be recognized that the litigation discussed here may only be persuasive authority and would not be binding on other jurisdictions. However, the analysis of the relevant case law, coupled with current federal policy promoting competitive opportunities for private transportation, suggests that, at present, it would be best for taxi companies to first think of how they can join in paratransit deployment rather than how to fight it.

THE ROCHESTER EXPERIENCE

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This presentation was an attempt to put the experiences of the Rochester demonstration project into proper perspective. It has provided an opportunity to study many aspects of public transportation, in particular, how a transportation service must reflect changing priorities, changing constraints in a local area, and the evolving conceptual framework for a variety of different service concepts and service delivery systems. What then was the Rochester project to achieve, and what is its current status?

Rochester, NY, is a metropolitan area of 700,000. Over the past several decades it has experienced significant shifts of population and activity from the center city to suburban areas. Ninety percent of the existing transit service is located in the center city, however, creating a distinct imbalance between where service was provided and where people wanted to go.

When the Rochester demand-responsive transportation project was initiated three years ago, Rochester was in a "transit expansion mood." There was ample funding available at all government levels for both operating and capital costs. The community had ambitious plans and a positive attitude toward innovation. It was a good institutional setting for implementing an innovative service. Both the transit authority (RTA) and the transit service were well-run.

The RTA undertook a short-range study which recommended the development of an integrated public transportation service. Eight suburban locations were identified as potential sites for demand-responsive transportation projects. As a first step, a demand-responsive system was implemented in a portion of one of the identified sites (Greece). The RTA ran the system for a short period of time and then entered into discussions with UMTA and jointly developed a Service and Methods Demonstration. The demonstration project was to expand the original service area and add one or two additional locations. There was to be an emphasis not only on new service, but also on revising and modifying the existing, fixed-route service to integrate with the demand-responsive component. The service was to be operated by the transit company and was to test new concepts with respect to automation and communications.

There have been three phases during the two and one-half years the project has been in operation. During the first phase -- roughly one-third of the time the system has been operating -- the system experienced few problems. It was manually operated and ridership steadily increased.

The second phase of the demonstration project experienced three types of problems. The first type of problem was the reliability of both the vehicles and the computer system. There were instances when more than fifty per cent of the vehicles were not in service. The vehicle reliability problem had several components. First, there were the fundamental problems inherent in operating a small bus; a satisfactory small transit bus simply does not exist. Second, in an attempt to determine which small bus was "best", Rochester operated seven different types of vehicles. This created problems in terms of maintenance, maintaining an adequate spare parts inventory, and driver training. Third, there was a need to re-train maintenance personnel as to the maintenance requirements of a small bus. Finally, within the RTA's union maintenance facilities, there was an implied, lesser status associated with working on the smaller vehicles rather than fullsize buses.

The computer reliability problems were concerned with human engineering. It was necessary to familiarize the driver with the interface between him and the control system. A fire which destroyed the computer center set the project back six to eight months.

The second type of problem which was experienced during the second phase of the project was design mistakes in the implementation of service modifications to the fixed-route system. The public's resistance to change was underestimated, and there were too many changes in too short a timeframe. The reliability problems of the demand-responsive service compounded the resistance to change. Much was learned about the way to introduce change to the public.

The third type of problem was institutional in nature. The New York state financial crisis greatly affected the state's ability to meet its financial commitments. The state had committed itself to increased transit funding, and the Rochester project had included these commitments in their financial projections. The most serious consequence of this was that the RTA was unable to draw down all of its allocated UMTA Section 5 money when state transit assistance funds were frozen. This resulted in a crisis atmosphere, where the community began to question why they were trying to build a new transit service if they could not support the existing one.

The actors in the planning process were continually changing. The management of the transit operations changed from National City Management Co. to the RTA. The executive director of the RTA resigned, and the post was vacant for eight months. The chairman of the RTA board of commissioners changed three times during the project. This unstable atmosphere was not a good environment for innovation. In addition, various changes in the political context-i.e., Rochester voted Democratic for the first time in its history-contributed to the instability.

The third phase of the demonstration project can be characterized as a "significant recovery". A new executive director was hired who provided leadership in solving the project's problems. The vehicle reliability problem was greatly improved by leasing vans from automobile dealers, expanding the spare parts inventory, and instituting a preventive maintenance program. The dealers were responsible for maintaining the leased vehicles. Some service was revised from a many-to-many, demand-responsive service to a hybrid service with fixed- and flexible-route elements. The computer system reliability was improved, so that it could be used for full day operation.

Near the end of the demonstration project an assessment was conducted to outline the community's options relating to the project. The staff's recommendations based on the assessment were: 1) the present demonstration project should be extended for three months; and 2) a follow-on demonstration should be implemented which would a) continue the existing demand-responsive service in Greece and Irondoquoit, and b) develop two new service areas. The new service areas would be developed along the lines of the Michigan program; that is, after the demonstration period, the communities would be responsible for funding the local share of the cost rather than the RTA. The new service was to have a strong elderly and handicapped orientation, and it would be open to competitive bid.

After lengthy deliberation, the RTA commissioners approved the staff recommendations pending: (1) two communities expressing formal interest in developing the new service, (2) the attainment of an UMTA Section 13(c) sign-off from the local transit union, and (3) UMTA demonstration funding. The commissioners saw the new program as a way to expand their constituency and to provide service in those communities without fixed-route service. Within two weeks of the RTA vote, two communities had made a formal commitment to provide the local share of the cost. The amount of interest in the local communities to provide this type of service was substantially underestimated.

UMTA indicated that it would provide demonstration funding if all of the RTA's conditions were met. This was an excellent opportunity to test how the concept of demand-responsive transportation would evolve under changing conditions.

Obtaining an UMTA Section 13(c) sign-off was the final condition which had to be met. A Section 13(c) agreement was already in effect which stated that all transit service was to be provided by the transit company and union personnel. The union (ATU), therefore, would have to agree to change this existing agreement and allow a competitive bid situation. To complicate this situation, the local ATU branch had just elected a new president; and this was his first negotiation.

International ATU policy stated that a competitive bid situation for the provision of transit service was unacceptable. The local issue in Rochester was that there would be no project or service if competitive bidding was not allowed. After much discussion, the international union agreed, in Rochester's case, to change the Section 13(c) agreement and allow competitive bidding. The issue was approached as not whether there was competitive bidding, but rather what was the basis for the competition; was it a fair competition with an equal opportunity to compete and win? Ultimately, the international ATU stressed, it would be the local union's decision as to whether to allow competitive bids.

The local ATU branch agreed verbally to accept competitive bidding for service, and different wage rates and work rules for members involved with demand-responsive service. When it came time to sign the new Section 13(c) agreement, however, the new union president refused; he had changed his mind. On the morning this speech was being presented, there was a meeting at the Department of Labor with representatives from the local ATU branch, the international ATU, the Rochester transit company, and the RTA to examine the negotiation process in Rochester and its implications with respect to Section 13(c). The probability of obtaining the Section 13(c) sign-off necessary to allow the new demand-responsive, demonstration project to go forward is questionable.

The Rochester experiment has evolved dramatically over a relatively short period of time. It has gone from a many-to-many service to a range of integrated services. It has evolved from a transit operation into one which recognizes competition, coordination of a public authority and movement towards a brokerage concept. It has gone from one autonomous funding source, the RTA, to a diffusion of funding sources from throughout the community. The Rochester experience has many implications for other urban areas. All urban areas are under severe financial pressure. As the local contribution toward the transit operating deficit increases, communities are demanding service. New demand-responsive, integrated programs are the response to this demand. To further reduce operating costs, communities are also examining the possibility of substituting demand-responsive service for expensive, under-utilized fixed-route service. This concept has been successfully implemented in several Canadian cities. In conjunction with lower-cost service concepts, serious consideration is also being given to competition and using private operators to provide service. It is hoped that by involving private operators operating costs can be reduced. Communities are increasingly recognizing that there are many different markets, services, and service providers and that the key issue in providing service is interfacing and integrating those various components. During the next several years the evolution of demand-responsive service and resulting learning experiences will continue.

Postscript - A 13(c) agreement was finally worked out between Rochester and the International ATU who felt it was important for the project to proceed. Funding approval from UMTA is anticipated in the next several days.

MODEL DEVELOPMENT

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INTRODUCTION

A range of different models has been developed to address paratransit integration problems. These models can generally be grouped into two distinct types:

1. Micromodels, which deal with a fine level of detail

and focus on the relationships between individual vehicles and passengers. Examples include detailed simulations and disaggregate supply/demand models.

2. Macromodels, which deal with a coarser level of detail and focus on individual service areas and regionwide performance. These models are generally used to study interrelationships between groups of service areas and between demand/responsive service areas and fixed-route elements.

MODULAR AND TRADITIONAL APPROACHES TO MACROMODELING

The remainder of the presentation focused on macromodels and within this category, on the modular approach developed by SYSTAN, Inc. The traditional multizonal network analysis approach divides the urban area into a large number of origin-destination zones, specifies the detailed nature of the transportation network linking the centroids of each zone pair, and requires extensive data inputs identifying travel demand between all combinations of interzonal pairs. The number of zones considered in the modular approach, however, is much smaller, consisting of a limited number of representative residential areas, line-haul corridors, and activity centers. The level of system detail recorded within these elements is greater than that addressed by traditional approaches, but this detail is formally contained within the model structure. The analysis need only specify the type of service available in an area and identify the minimum level of service to be provided. The model then fills in the remaining system specifications from a knowledge of area size, demand density, and corridor length and congestion. This minimization of data requirements results in a more flexible model and permits the analyst to examine a large number of system configurations in a wide range of urban settings with relative ease.

TYPICAL MACROMODEL APPLICATION

Macromodels have a variety of applications, ranging from sketch planning to the estimation of local and regional performance and cost levels. They also provide a basis for comparing the applicability of different system components at different demand levels.

Figure 2 compares the cost of fixed-route services with the cost of flexibly-routed service for a range of demand levels within a specific residential area. The cost of fixed-route service is relatively high for low levels of demand, and drops to a relatively constant level once the minimum service level is exceeded. Since flexibly-routed service can be tailored to fit any demand level, subscription service is less costly at low demand levels than fixed-route service. As demand increases, however, fixed-route service becomes less costly than flexibly-routed service. The demand level at which this crossover occurs is governed by a number of factors, including service area size, population density, minimum service levels, and peak/off-peak demand patterns.

Since flexible-route service enjoys the greatest cost advantages for low demand levels in less densely populated areas, as demand increases, some demand-responsive runs should evolve into fixed-route service. Experience suggests, however, that the evolution process should be gradual, since public response has been poor when service has been changed abruptly. This suggests that during the transition phase both fixed-route and flexibly-routed service should be offered.

A good deal of judgement needs to be applied in interpreting the crossover point shown in Figure 2. At low transit mode shares, flexible-route service is considerably less risky than fixed-route service. That is, the cost of providing fixed-route service for a demand that fails to materialize can be considerably higher than the cost of providing flexible-route service sized to fit whatever demand exists. If demand does materialize, moreover, there is an upper-bound on the per-trip savings available from conventional fixed-route operations. This suggests an incremental approach using flexible-route service might be a more appropriate means of introducing transit service in a currently unserved area, even if it is expected that the demand may be large enough to justify fixed-route service.

In the modular macroanalytic approach developed by SYSTAN, separate feeder, line-haul and distribution system models can be

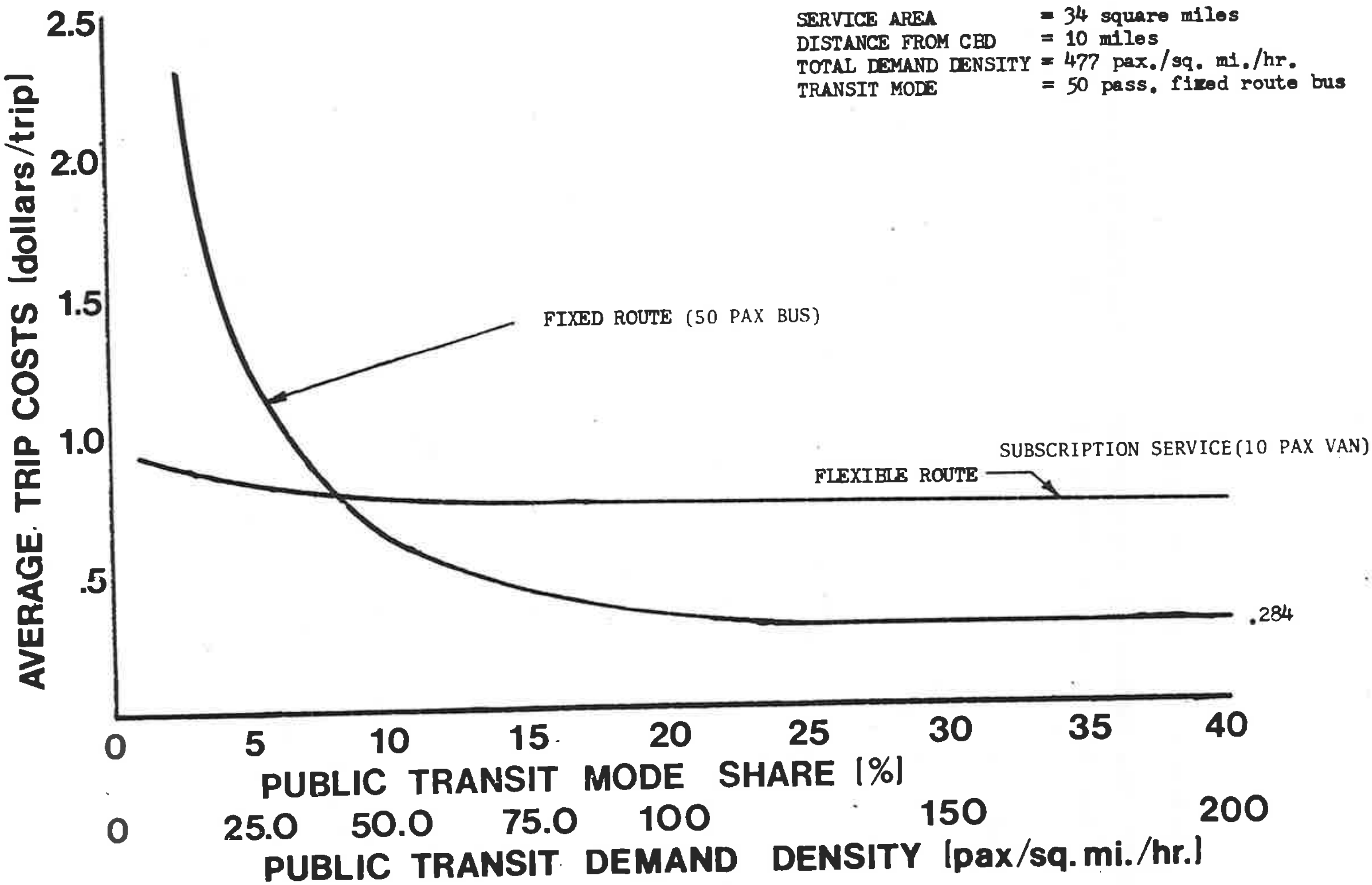

FIGURE 2. SUBURBAN RING RESIDENTIAL FEEDER SERVICE: FIXED ROUTE-FLEXIBLE ROUTE COST TRADE OFF

integrated to reflect the characteristics of door-to-door service and costs between representative urban origins and destinations. For a specific urban framework and regional peak and off-peak trip patterns, these door-to-door characteristics can be aggregated to provide total regionwide measures of system costs and performance.

USES OF MICROMODELS AND MACROMODELS

In summary, the potential applications of macromodels and micromodels in the design and analysis of integrated paratransit systems are listed below.

Micromodels:

- Design and evaluation of algorithms for pick-up priorities and vehicle dispatching;
- Development of transfer strategies;
- Detailed exploration of relationships between demand patterns and service structures;
- Detailed analysis of waiting times to service reliability;
- Determination of performance to capacity data for a range of service options; and
- Formulation of supply and demand relationships for use in macro-modeling.

Macromodels:

- Development of fleet management techniques;
- Investigation of peak and off-peak labor costs and operating policies;
- Assessment of the relationships between demand-responsive feeder services and fixed-route services;
- Optimization of service area structures for peak and off-peak periods;
- Estimation of demand, service levels, costs and revenues;
- Exploration of trade-offs between demand-responsive service and fixed-route service;

- Estimation of overall performance and capacity of a range of areawide deployments;
- Assessment of alternative scenarios for the evolution of integrated systems from today's systems; and
- Sketch planning.

A detailed survey of existing micromodels and macromodels has recently been prepared by SYSTAN, Inc., as part of a state-of-the-art review of paratransit modeling procedures developed for the U.S. Department of Transportation. Readers desiring more information regarding this survey should contact the authors.

REVIEW AND ASSESSMENT

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The Review and Assessment portion of the Paratransit Integration Program focuses on defining the state-of-the-art in paratransit experience. The primary task of this portion of the program is to develop a comprehensive manual for the design, development, implementation, and operation of paratransit systems. It is intended to be used by transportation planners and operators at all government levels.

The development of the Paratransit Integration Planning Handbook will proceed in two phases. The first phase will require a thorough review of current paratransit experience. From this, a detailed outline of the Handbook's format and content will be prepared, and procedures will be proposed for obtaining needed information. Pilot guidelines for implementing paratransit service, based on current experience, will then be developed. Areas where model development is needed will be identified and a micro-level simulation will be built. This first phase is currently underway through a contract to SYSTAN, Inc., of Los Altos, CA.

The second phase of the project will involve the completion of model development, the conducting of various analyses to supply the identified information needs, and the completion of the Handbook. The second phase will be conducted through one or more competitively awarded procurements.

We are currently at the beginning of the first phase. Fifty experts in demand/responsive transportation participated in a workshop to provide initial guidance as to the format and content of the proposed Handbook to assure that this document meets the needs of the transit community. It was apparent from the workshop that the most difficult problems hindering paratransit implementation are institutional and legal in nature rather than technical. Identified in this workshop held at TSC October 12-13, were the five most critical problems impacting paratransit. They are as follows:

Issue 1: The Handbook should provide guidance to the planning community. The workshop participants felt that the Handbook should serve the planning community by supplying needed reference material as to how to fit paratransit service concepts into the existing institutional structure.

Issue 2: The manual should educate the planning community as to the potential of private operators to provide paratransit service.

Issue 3: The impacts of the proposed UMTA regulations on involving the private operator in planning and operating paratransit services are not yet fully understood. The workshop felt that the Handbook should illustrate strategies that will foster the intended results of the regulations.

Issue 4: Strategies for involving the private operator in the planning process should be included in the Handbook. There was general consensus that the private operator should be brought into the planning process at the earliest possible stage. It was also recommended that the planning agency provide staff support to inform the private operator of their function in the process, what expertise and input they can provide, and how they can best present their capabilities.

Issue 5: There are local legal and institutional problems impeding the operation and integration of private sector paratransit services.

It is this environment which has prompted the recent evolution of the transportation broker, but even this concept requires the proper regulatory climate to be effective.

The initial direction given to the Handbook development process by the workshop can be summed up as an urgent message to (1) provide the planning community with the necessary tools to survive and evolve the institution in which it must work, and (2) take advantage of the private operator and the free enterprise system before it is too late.

PARATRANSIT VEHICLE DEVELOPMENT

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The UMTA Paratransit Vehicle Program began in FY 1974 when Congress funded the development of an "improved, efficient, quiet, non-polluting taxi." The vehicle to be developed was considered to be a paratransit vehicle because it was intended to be used for handicapped service, shared-ride service, and some dial-a-ride service in addition to conventional taxi service. Two contracts were awarded in March, 1975, for the development of engineering prototypes. Both manufacturers proposed to equip the vehicles with experimental steam engines to meet emissions criteria. The two prototype vehicles were exhibited at the Museum of Modern Art's "City Taxi Exhibition", which served as "an international forum and focal point for urban taxi design." After the exhibition, the prototype vehicles were equipped with production gasoline engines, tested by an independent testing laboratory, and are currently on exhibition across the country.

In February 1977, the Transportation Research Board conducted a workshop on paratransit vehicles. The workshop made ten conclusions, the most important of which follow:

Increasing costs will force taxi operators to provide additional service such as ride sharing, elderly and handicapped service, and package deliveries;

- Ride sharing experiments have been hampered by the lack of a suitable vehicle;
- Industry is unlikely to develop such a vehicle on its own; however, it is interested in participating under government leadership;
- Evaluation of new vehicles in passenger service is a necessary step prior to production; and
- It is recommended that government fund prototype development and evaluation.

In April 1977, the ITA made a statement before the Senate Subcommittee on Transportation, Committee on Appropriations. The most important points were: (1) standard passenger cars are inadequate for ride sharing and for handicapped persons, (2)the automotive industry has not been responsive to ITA requests for improved vehicles, and (3)government support is necessary to obtain improved vehicles.

In response to this testimony, Congress provided UMTA with an additional $1,000,000 for "the design and construction of two or more production prototypes (vehicles)." The prototype vehicles will be designed to be used in a variety of paratransit services at the lower end of the capacity spectrum - i.e., shared-ride taxi service; elderly and handicapped, door-to-door transportation; replacement of under-used buses; and regular taxi service and package delivery. The prototype vehicles will have the following distinctive characteristics: (1) improved accessibility to accommodate wheelchair passengers, and (2)easy conversion from one vehicle type to another.

The objectives of the UMTA Paratransit Vehicle Program are:

1. To make available to the paratransit operator a vehicle which enables him to broaden his range of services and to provide his services at a reasonable cost.

2. To stimulate the motor vehicle industry through UMTA R&D funding to provide a vehicle designated for paratransit services.

3. To obtain assessment and evaluation of these new vehicles by paratransit operators.

The program plan to implement these objectives is to issue an RFP, pending the approval of the Secretary of Transportation, for the design and manufacture of paratransit vehicle prototypes. UMTA intends to award three contracts by the Fall of 1978. Each contract will be for the development of three prototypes to be completed in Spring 1980. One prototype vehicle from each contractor will be tested by an independent testing laboratory for compliance with UMTA requirements. The remaining two prototypes from each contractor will be exhibited at ten regional centers for assessment by local paratransit operators and elderly and handicapped organizations. Table 2 shows the vehicle requirements for the prototype vehicles.

SERVICE AND METHODS DEMONSTRATIONS

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Urban Mass Transportation Administration
U.S. Department of Transportation
Washington, DC

The UMTA Office of Service and Methods Demonstrations implements innovative transportation service concepts and technologies in urban settings in order to evaluate their usefulness in solving recognized problems. There are two major types of demonstration projects in the Paratransit Demonstration Program: (1) component demonstration projects where specific service technologies are evaluated, and (2) institutional or management demonstration projects where the institutional structure necessary to accommodate a demonstration service is analyzed and evaluated. Current demonstration projects are focused on evaluating several service concepts - demand-responsive service, subscription commuter service, special

TABLE 2. VEHICLE REQUIREMENTS

CAPACITY: TYPE A - 4 TO 6 REGULAR PASSENGERS + 100 LB
TYPE B - 1 WHEELCHAIR PASSENGER + 2-4 REGULAR PASSENGERS + 100 LB
TYPE C - 1000 LB OF CARGO, NO PASSENGERS

CONVERTIBILITY: NO MORE THAN 2 HOURS BETWEEN TYPES A, B & C

FLOOR: 12-14 INCHES ABOVE STREET AND FLAT

DIMENSIONS:

FLOOR TO ROOF	$>$ 58"
HEIGHT OF DOOR OPENING	$>$ 56"
WIDTH OF DOOR OPENING	$>$ 32"
OVERALL HEIGHT	$<$ 75"

ACCELERATION FROM 0-40 MPH: 10 SECONDS

FUEL ECONOMY IN EPA URBAN CYCLE: $>$ 22 MP GAL

MAINTAINABILITY: MINIMUM DOWNTIME AND LABOR FOR INSPECTION AND REPLACEMENT OF POWER TRAIN
DISC BRAKES ON 4 WHEELS

ACCESS: EASY AND FAST ENTRY AND EXIT FOR ALL PASSENGERS
SUITABLE FOR SHARED RIDE SERVICE
WHEELCHAIR ACCESS BY RAMP

COST GOAL: NO MORE THAN 25% ABOVE CONVENTIONAL TAXICAB

STANDARDS: MEETS ALL FEDERAL MOTOR VEHICLE STANDARDS user group service and transportation brokerage.

Demand-responsive service encompasses several types of service and constitutes the major area for involving private taxi operators. It has proven extremely difficult to interest taxi operators in becoming involved in demonstration projects due primarily to institutional constraints and inertia. Currently, demonstration projects are being developed which will integrate taxi service with fixed-route transit. The project in Westport, CT, is a successful example of this concept.

Demand-responsive service is experiencing renewed interest among planners and operators. The UMTA regulations mandating transportation services for the elderly and handicapped, which in most cases means demand-responsive service, and the growing awareness that the taxi industry can play a useful role as part of a total transportation system are contributing to this revival of interest. It is hoped that by involving taxi operators in the provision of public transportation, the cost of demand-responsive service can be kept at an affordable level.

Vanpool programs are the major focus of subscription commuter service demonstration projects. Various administrative structures are currently being evaluated. In the Knoxville, TN, program, an entrepreneurial approach is being used. All of the vans are driver-owned with the drivers then congregating in an association for their mutual benefit. In Norfolk, VA, the public transit authority owns the vans and administers the program. In Minneapolis, MN, a third party has been contracted to operate the van pool program. Finally, in Marin County, CA, the program focuses on having employers lease or purchase vans and set up riding arrangements for their employees. Each of these approaches will be evaluated as to their effect on the market for this service.

The bus-pool concept is being tested in an "employment-centered bus service" demonstration project. The objective of this project is to coordinate subscription commuter bus service with staggered work hours in a major employment center. Because of the relatively short work trips, customized service can be offered to commuters at a relatively low fare, and buses will be able to make multiple trips during peak periods. It is hoped that by having each bus make multiple trips marginal operating costs will be met. The demonstration project is being run by the Southern California Rapid Transit District in the El Segundo employment district.

Special user service demonstration projects have focused primarily on services for the elderly and handicapped. Primary emphasis is being given to evaluate the applicability of user-side subsidies; that is, subsidies which are given to the user rather than to the transportation provider. There are currently four projects underway in Danville, IL, Montgomery, AL, Lawrence, MA, and Kingston, NC. The project in Danville, IL, is the only one from which preliminary conclusions can be drawn. In Danville, there have been no administrative problems involved in running the subsidy program, and there has been an increase of 10% in the taxi business. It seems that 20%-30% of the eligible population is taking advantage of the program, and 4%-5% of those eligible are providing the most significant demand for the service.

The brokerage concept can be defined as a marketing approach to transportation. The broker researches the transportation needs of various market segments and then, designs service to meet those individual market needs. Frequently, legal, institutional, or regulatory barriers prevent the selection of the best service design. The broker must then work to get these barriers removed. The broker becomes the focal point for the transportation structure.

The idea of transportation brokerage is to maximize the utilization of existing resources. In developing new services, the broker will use existing transit service; taxis, limousines and even school buses as much as possible before starting new services. In addition, the broker will promote commuter ride-sharing in the form of carpools, vanpools and buspools.

APPENDIX

PARATRANSIT INTEGRATION

AREAWIDE

Demand·Responsive Transportation

DETAILED SYMPOSIUM AGENDA

October 14, 1977

8:15	REGISTRATION
9:00	WELCOME - Dr. Robert Whitford
9:10	SYMPOSIUM OVERVIEW
	UMTA POLICY - D. Birnie
	PARATRANSIT INTEGRATION PROGRAM GOALS - E. Ziegler
	PARATRANSIT INTEGRATION PROGRAM PLAN - A. Muzyka
10:00	INTEGRATION OF SERVICES
	MARKET ANALYSIS - M. Flusburg
	EXPERIMENTAL RESULTS & DEVELOPMENT OF SCHEDULING AIDS - E. Ziegler
10:45	Coffee Break
11:15	PARATRANSIT ALTERNATIVES - J. Beeson
11:45	TAXIS AS A PUBLIC TRANSPORTATION PROVIDER
	SRT MARKET - T. Simpson
	ROLE OF AUTOMATION - T. Carberry
	LEGAL ASPECTS OF PARATRANSIT - R. Gundersen
1:00	Lunch - THE ROCHESTER EXPERIENCE - D. Roos
2:30	DEVELOPMENT OF SUPPORT TOOLS & DISSEMINATION OF INFORMATION
	MODEL DEVELOPMENT - J. Billheimer
	REVIEW & ASSESSMENT - P. Bushueff
	PARATRANSIT VEHICLE DEVELOPMENT - J. Ridgley
	SERVICE & METHODS DEMONSTRATIONS - J. Bautz
3:30	CONCLUDING REMARKS

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