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General Community Paratransit Services in Urban Areas

January 1982

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The cover shows Mr. Larry Morris, Operations Manager, and Mr. Terry Young, General Manager, with one of the vehicles of the Brazos Transit System (BTS). The system provides door-to-door neighborhood transit service to more than 12 communities in central Texas.

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General Community Paratransit Services in Urban Areas

A Report in the Series
Paratransit: Options for the Future

Final Report
January 1982

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TRANSPORTATION
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Prepared by
Multisystems, Inc
1050 Massachusetts Avenue
Cambridge, Massachusetts 02138

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Office of Policy Research
Urban Mass Transportation Administration
Washington, D.C. 20590

In Cooperation With
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NOTE: This report is one of a series commissioned to assess future options for the evolution of paratransit. Part of its content includes policy and other recommendations based upon this contractor's perception of the issues involved. Recognizing that there may be many alternative approaches to resolving transportation problems, these positions may not necessarily reflect those of the U. S. Government. As such, no endorsement of these recommendations is either expressed or implied by the U. S. Department of Transportation.

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Acknowledgements

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Foreword

Paratransit - the "family" of transportation services between the private drive-alone auto and fixed route transit - is a concept which formally emerged in the early 1970's. Much has occurred since the seminal UMTA-sponsored Urban Institute study - Paratransit: Neglected Options for Urban Mobility (1) - popularized the term and the concept around 1975. However, despite the fact that paratransit is no longer a neglected option, there is still considerable controversy regarding what paratransit is and what it might accomplish. The attitudes towards paratransit are as diverse as the range of services which are included under the paratransit mantle.

Paratransit: Options for the Future is intended to unravel some of the controversy concerning paratransit. Specifically, the overall report is aimed at developing an understanding of the nature of the various paratransit concepts, the results and impacts they have had, and what roles they might play in the future.

The assessment of the experience of paratransit to-date is based on in-depth case studies of a number of services. These studies were designed to identify institutional, site-specific, and operational factors which have most directly influenced the impacts of various types of services. The effort has differed from other recent projects, in that no attempt has been made to develop a comprehensive list of paratransit systems. (Indeed, to provide a broader perspective, we have drawn upon the results of a number of previous studies, notably Barb and Cook (2), Multisystems (3), Systan (4), and Voorhees (5).) Instead, we have attempted to utilize a subset of experiences to provide a better understanding of what paratransit services can and cannot be expected to do. In adopting this approach, we are cognizant of the fact that, by focusing on specific cases, some of the important experiences of paratransit may be missed. However, it was felt that this approach would allow a more in-depth assessment of paratransit than would be possible if an attempt were made to review a greater number of services. The cases selected were intended to cover as wide a range of service permutations as possible. However, where appropriate, information on services not included as case studies has been incorporated as well.

The assessment of the "state-of-the-art" of paratransit traces the evolution of the concept for each market sector considered. Unlike the treatment of the individual paratransit experiences, this discussion is oriented towards an assessment of the forms to which paratransit has evolved, rather than a judgemental analysis of specific services.

Finally, the report addresses possible future directions for paratransit. The aim is to explore the potential future roles and forms of paratransit, partly to aid in guiding its future development in the most effective directions. An emphasis is placed on trying to explore how various future factors will influence paratransit, as well as the way paratransit itself may impact future trends.

The report itself is divided into stand-alone volumes addressing the specific market areas into which paratransit services generally fall: Paratransit for the Work Trip - Commuter Ridesharing; Paratransit for the Transportation Handicapped; General Community Paratransit (in Urban Areas); and Paratransit in Rural Areas. In addition, the report includes a volume on The European Paratransit Experience, covering the development of all types of paratransit in Europe. Finally, the Overview volume summarizes the characteristics of the individual types of service, and identifies issues and themes which are common to more than one specific market area.

1 *Introduction: General Community Paratransit Services in Urban Areas*

Paratransit services can be designed to serve a particular specialized market, such as the elderly and handicapped, and an entire category of paratransit services - ridesharing - is intended to serve a particular trip: the work trip. However, a significant number of paratransit services have no such narrowly defined focus, having been designed to serve both work and non-work trips, and both the transportation handicapped and the non-transportation handicapped. For the purposes of this study we have elected to use the term "general community paratransit" to refer to the entire range of paratransit services which attempt to serve a broad cross-section of community travel needs.

This volume addresses general community paratransit services in small cities and metropolitan areas, with the latter seperated into suburban and inner city areas.* The volume examines both systems designed for neighborhood/community circulation and those designed to be integrated with existing line haul transit. Within these contexts, we consider a range of services options, including dial-a-ride/shared-ride taxi, route and point deviation, checkpoint services, jitney, and intra-community "flexible" fixed route services.

Background

The growth in general community paratransit services can be traced to two basic premises: 1) that the lower density development patterns predominating since World War II required a form of public transportation more flexible than fixed route, approaching the flexibility of the auto; and, 2) that this flexible service could be integrated with fixed route service to form a regional transit network in larger metropolitan areas.

The first premise was the foundation for much of the research that initiated the formal history of general community paratransit in the mid-1960's. This research, carried out at the Massachusetts Institute of

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* Rural paratransit services are addressed in a separate **volume** , since it was felt that the special characteristics of rural transportation (e.g., very low population densities and long trip distances) warrant separate treatment.

Technology (M.I.T.), General Motors, and elsewhere, looked at paratransit* as a public service, although examples of privately-provided paratransit service in the form of shared-ride taxis and jitneys can be traced back much further.

The M.I.T. research focussed on a concept called "dial-a-bus" or "dial-a-ride," and envisioned large scale, computer-controlled systems in which vehicles responded to demands for door-to-door service. However, the early demonstrations of this concept tended to be much less ambitious than originally conceived, in terms of both the number of vehicles operated and the flexibility of service provided. By the early 1970's, the range of flexibly-routed services, which included point to point dial-a-ride systems, systems which served only a single destination (such as a subscription bus service initiated in Flint, Michigan in 1968), and systems that utilized fixed route but allowed "deviations" on request (such as the route deviation system initiated in Mansfield, Ohio in 1969) became collectively known as "demand-responsive transportation" (DRT).

The first major federally-sponsored demonstration of DRT took place in Haddonfield, New Jersey, beginning in 1972. The Haddonfield project lasted for about four years and successfully demonstrated both the operational feasibility of DRT and the feasibility of computerized dispatching. However, because the community chose not to continue the service beyond the demonstration period, and because of relatively high per-passenger costs, the demonstration was not generally viewed as a complete success.

At roughly the same time that the Haddonfield project ended, the largest scale paratransit system yet attempted - that in Santa Clara County, California was discontinued after six months of operation. (Reasons for the failure of this system are discussed later.) The Santa Clara system was truly an integrated regional system, with both demand-responsive and fixed route elements, involving computerized dispatch and over two-hundred vehicles. The results of the Santa Clara and Haddonfield demonstrations received wide scale publicity, casting a fairly negative light on general community demand-responsive services.

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* The term "paratransit" actually did not come into use until the 1974 UMTA/ Urban Institute study.

Nevertheless, general community paratransit services continued to be implemented in various parts of the country Funding programs in states such as California and Michigan generated dozens of new projects. Services began to shift from a regional, publicly-provided basis to a local, often privately-provided framework. (Reasons for such shifts are described in this chapter.)

At the present time, the existence of a few hundred general community paratransit services has been documented.* There are undoubtedly many more small scale examples of such systems; the exact number is impossible to determine, since a wide range of services can be considered to be general community paratransit and many systems are never reported on. Most general community paratransit systems are demand-responsive to some extent; however, some fixed route systems, such as jitneys or community minibus systems, are often characterized as paratransit. Most such systems truly serve a "general" market; however, some which may serve a more specific market, such as shopping trips, are also examined in this chapter.

Overview

This volume reviews the experience to-date with general community paratransit systems, draws some conclusions about what we have learned, and explores potential future directions for such services. The volume is organized as follows. Chapter 2. provides a retrospective on general community paratransit. Using a case study approach, the chapter addresses the history of this component of paratransit over the past decade and presents key findings. Chapter 3. presents a perspective on where general community paratransit is today. Chapter 4. addresses possible evolving roles and structures and the future potential for general community paratransit services over the coming few decades.

The case studies consider the manner in which services have been developed, the general operating experience, the nature of service integration, and reasons for apparent success or failure. The cases represent a variety of institutional settings, operating/contractual arrangements, and

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* Systan (4) reported a total of 122 such systems identified from a survey in 1979.

service types, as described below; their operating and institutional characteristics are summarized in Tables 1 and 2, respectively.

- Merrill-Go-Round (Merrill, Wisconsin) - The small city (population 9500) of Merrill operates a three-vehicle point deviation system known as the "Merrill-Go-Round." The service was implemented in 1975, under the Wisconsin Transit Demonstration Program.

- DART Program (State of Michigan) - The Michigan Bureau of Urban and Public Transportation (UPTRAN) has provided first year demonstration funding to smaller cities and towns for Dial-A-Ride Transportation (DART) systems. DART services provide short notice demand-responsive services to the public. The UPTRAN program has generally resulted in the continuing operation of DART systems on a regular basis after demonstration funding ended. Many of the communities which received DART funds have held property tax millage elections, 85% of which have been approved by the voters.

- Westport (Connecticut) Integrated Transit System - The Westport Transit District operates an integrated transportation system, which, until 1981, included two different sets of fixed-routes, as well as demand-responsive services provided through a private shared-ride taxi operation. The fixed-route services - peak hour commuter routes and off-peak loop (pulse-point) routes - began in 1974, and these were supplemented beginning in 1975. The shared-ride taxi service, which began in 1977, through an UMTA demonstration grant, was terminated in 1981, following the end of the demonstration period. The fixed route service was cut back at that time, but continues to operate on a dual commuter-loop basis.

- Arterial Personalized Transit (Santa Clara County, California) - The Santa Clara County Transit District (SCCTD) operated a large scale integrated paratransit system known as Arterial/Personalized Transit (APT) for six months, from 1974 to 1975. APT was the most extensive integrated system ever attemped, involving about 200 vehicles in county-wide express fixed-routes and 18 different demand-responsive zones. The total service area included over 1 million people. APT was terminated in response to numerous problems, which included excessive demand, high costs, low level of service, complaints about fixed-route cut-backs, and a court-ordered taxi company buy-out.

- TELTRAN - (Ann Arbor, Michigan) - The Ann Arbor Transportation Authority (AATA) has operated a citywide integrated parantransit system (TELTRAN) which included a well-coordinated set of fixed-routes and demand-responsive services. Service began with a state-funded limited-area demonstration in 1971. In 1973, voters approved a property tax millage for city-wide service. TELTRAN began full operation in 1976; the demand-responsive component was significantly scaled down in 1979.

- Community Services Program (Orange County, California) - The Orange County Transit District (OCTD) has sponsored community demand-responsive services since 1973. All dial-a-ride services are operated by private contractors under contract to the OCTD. Service began with a demonstration in La Habra, which was continued on a permanent basis. Subsequently, dial-a-ride service began in the cities of Orange (1975), Fullerton (1977), and Saddleback and Anaheim (1978). In late 1980, the Community Services Program was restructured; in the current program - the Neighborhood Dial-a-Ride - the County is divided into 24 service zones, each served by one or more vehicle. Transfers are available for travel between zones.

- Trans-Cab (Peterborough, Ontario) - Peterborough has operated a taxi feeder system known as Trans-Cab since 1974. Shared-taxi service is coordinated with fixed-route bus service in two zones; the integration has succeeded in significantly lowering overall operating deficits by improving the level of service and keeping administrative costs at a minimum.

- Badger Cab Co. (Madison, Wisconsin) - The Badger Cab Co. of Madison, Wisconsin operates one of the oldest shared-ride taxi services in the country. The completely private, unsubsidized operation has been in existence since 1946, and successfully competes with exclusive-ride taxi services.

- Mission Street Jitneys (San Francisco, California) - Privately-owned and operated jitneys operate along a 10-mile route through San Francisco business district, offering an alternative to mass transit.

- Laclede's Landing/Hotel Shuttle (St. Louis, Missouri) - A non-profit cooperative was established among several hotels and restaurants to provide transportation to and from the hotels and various restaurants and entertainment spots in Laclede's Landing, an entertainment district in St. Louis. The Laclede's Landing/Hotel Shuttle provided loop service in the evenings during 1979 and 1980; service was discontinued because of administrative problems and a lack of sufficient funding.

Table 1

Operating Characteristics: General Community Services

System	Location	Target Pop.	Service Area (sq. miles)	Density (pop./sq. mile)	Average Weekday Ridership	Trips/ Day/ Resident	Passengers/ Veh.-Hr.	Revenue/ Passenger	Net Operating Cost/ Passenger	Net Operating Cost/ Veh.-Hr.	Yr. of Data
Merrill-Go-Round	Merrill, WI	9,500	5.5	1,727	280	0.029	10.4	$0.35	$1.37	$14.25	1980
DART: Outstate Systems (Avg.)	Michigan (21 systems)	14,400	9.0	1,600	243	0.017	6.5	0.34	1.50	9.70	1978
DART:County Systems (Avg.)	Michigan (7 systems)	19,200	46.7	411	160	0.008	4.1	0.40	2.70	10.50	1978
DART:SEMTA Systems (Avg.)	Michigan (11 systems)	39,300	35.7	1,100	277	0.007	6.3	0.33	1.60	10.05	1978
Minnybus/ Maxytaxy	Westport, CT	30,000	22.0	1,350	2,200	0.073	14.0	0.27	1.70	$20.03	1980
Aterial Personal Transit	Santa Clara Co., CA	1,200,000	241.0 (urbanized area)	4,979	6,400	0.005	5.0	N/A	4.00	20.00	1975
Teltran	Ann Arbor, MI	106,000	23.5	4,510	2,500	0.024	5.6	0.23	3.54	19.85	1977
Dial-A-Ride	La Habra/ Brea, CA	65,000	16.2	4,012	287	0.004	3.8	0.60	4.24	15.87	1980
Dial-A-Ride	Orange/Villa Park,CA	92,500	19.6	4,625	407	0.004	4.2	0.56	3.99	16.75	1980
Dial-A-Ride	Fullerton, CA	94,000	22.0	4,270	385	0.004	3.5	0.56	4.69	16.30	1980
Trans-Cab	Peterborough, Ont.	3,400	4.4	773	350	0.100	N/A	0.29	0.90	N/A	1978
Badger Cab	Madison, WI	170,000	52.1	3,263	2,000	0.012	N/A	0.90	N/A	N/A	1980
Mission St. Jitneys	San Francisco	63,000	5	12,600	N/A	N/A	N/A	0.50	N/A	N/A	1980
Laclede's Landing Hotel Shuttle	St. Louis	N/A	N/A	N/A	70	N/A	1.5	N/A	N/A	N/A	1980
median - "Dial-A-Bus"*	50 Systems	18,000	7.6	2,059	206	0.011	5.9	0.29	1.82	10.00	1978
median - "Shared Ride Taxi"*	28 Systems	34,200	11.4	4,110	260	0.007	5.5	0.45	1.70	9.95	1978

Sources: project directors and/or reports
*Source: (4)

Table 2

Institutional Characteristics: General Community Services

System	Type of Service	Opening Date	Initiator/ Lead Agency	Sponsoring Agency	Operator	Source of Funding	Nature of Integration	Major Problems/ Barriers
Merrill-Go-Round	Point deviation	April 1975	city	Wisc. DOT	city	Wisc. DOT, city		Uncertainty of continued funding
Michigan DART Program	Demand-responsive	Feb. 1974	Michigan UPTRAN	Michigan UPTRAN	Localities, private operators	Mich. UPTRAN (gas tax revenues), localities	Coordination with human service programs	
Minnybus/ Maxytaxy	Flexible fixed route/demand-responsive	April 1977	WTD	WTD	WTD, taxi co.	UMTA, city	Fully integrated, comprehensive operation	Taxi suit, insurance
Arterial Personal Transit	Demand-responsive fixed route	Nov. 1974	SCCTD	SCCTD	SCCTD	SCCTD, state	Spatial and temporal integration	Taxi suit; service inadequate for demand; community protests
Teltran	Zonal demand-responsive	Sept. 1971	Ford Motor Co., AATA	AATA	AATA	UMTA, city	Spatial and temporal integration (d-r with f-r)	Taxi suit : d-r service cut back due to high cost
Orange County Community Services	Demand-responsive	Feb 1973	OCTD	OCTD	taxi cos., bus co.	OCTD, cities, state	Temporal integration (f-r/d-r in W./ Central Anaheim)	Taxi suit; defeat of co. millage election, Proposition 13, operational problems
Trans-Cab	Zonal demand-responsive	1974	Border Transit Ltd.	Border Transit Ltd.	taxi co.	Ontario, city	Spatial integration (taxi-feeder)	
Badger Cab Shared-Ride Taxi	Demand-responsive	1946	Citicar	Badger Cab Co.	Badger	operating revenues		Rising costs; declining demand
Mission St. Jitneys	Fixed route	1900	individual owner/ operators	same	same	operating revenues		Rising costs
Laclede's Landing/ Hotel Shuttle	Fixed route/ shuttle	1979	hotels/ restaurants	hotels/ restaurants	non-profit cooperative	hotels/ restaurants		Administrative problems; lack of funding

2 General Community Paratransit: A Retrospective

Introduction

In this chapter, a series of general community paratransit service case studies is reviewed in order to provide a picture of the history of paratransit over the past decade. The case studies were selected to provide a broad cross-section of service types, settings, operators, and service functions, and represent both systems perceived as successes and some perceived as failures. Some of the systems were implemented in small cities, some in suburban communities, and some in urban neighborhoods. Some were/are operated exclusively by the private sector, some by the public sector, and some by a combination of the two. Some utilized only two or three vehicles, while some utilized fifty or more. Some involved integration with fixed route services, while others did not. The intention behind including such a diversity of cases is to cover as broad a range of paratransit-related issues as possible.

The discussion is divided into two sections. The first briefly summarizes the key results of each project. The second section reviews key findings from the case studies (and other systems), focussing on operational factors which influenced project results, the impact of institutional factors, barriers to service implementation, and factors that had a positive impact on system initiation and public acceptance.

Program Summaries and Results

This volume focuses on general community paratransit in urban settings. It is useful however to distinguish those systems implemented in small cities* from those initiated in larger urban areas. First of all, the issue of integration of paratransit with fixed route is often an issue in the latter setting, but seldom in the former. Barriers posed by transit labor or management are also typically greater in larger cities. Furthermore, larger cities may face special problems associated with inner city neighborhood

* For the purpose of this report, we have considered non-standard metropolitan statistical areas, or cities under 50,000, as "small cities." Suburban communities are considered in the section on metropolitan areas.

transportation. Therefore, we have separated small city and large city services in the following discussion, and metropolitan area services are futher subdivided into integrated systems, areawide systems, and inner city services.

General Community Paratransit in Small Urban Areas

Systan (4) has pointed out that the majority of general community paratransit systems have been implemented in smaller urban areas. We have selected several such cases to review and analyze.

We begin with the point deviation* system operating in Merrill, Wisconsin - a community of just under 10,000 persons - since April, 1975. In its first year of operation, this system produced a ridership level of 80,000 trips per year, which was higher than that on any previous fixed-route system in Merrill. The system has experienced relatively low costs per per passenger(as compared to the other systems studied). This can be traced largely to the higher productivity achieved on the point deviation service, as well as the relatively low prevailing wage rates in Merrill, where the system is operated directly by the municipality. System costs have been rising over the past several years, however, resulting in some cutbacks in service hours (on weekends and evenings). The Merrill system has now been operating for six years and appears to have reached a steady-state condition. The point deviation concept has proven to be a feasible one, with a sizeable percentage of passengers (as high as 70% depending upon weather conditions) requesting deviations.

The Michigan Dial-a-Ride Transportation (DART) Program has fostered over forty small city paratransit systems designed to serve the general community. The overall program has proven extremely successful, in that over 90% of all demonstrations have been continued by the local grantees after the initial 100% state-funded demonstration ended. A key factor in the program's success has been the low costs achieved by the individual systems. The costs per vehicle-hour and per passenger have been maintained at rather uniformly low levels (see Table 3), due to low prevailing wage rates and extensive use of low cost taxi or human service agency operators, combined with fairly high

* See GLOSSARY for a definition of the point deviation concept.

Table 3

DART Cost and Service Characteristics

	1970 Service Area Pop. (to nearest 100)	Density (Pop./ sq.mi.) (to nearest 100)	Pass./ Veh.-hr.	Average Weekday/ Rider-ship	Average Cost/ Veh.-hr.	Average Cost/ Pass.
Outstate Systems						
Adrian	20,400	3,800	7.7	315	$ 7.15	$0.93
Alma	9,800	2,100	6.8	199	10.38	1.53
Alpena	19,800	1,900	6.0	226	10.15	1.68
Belding	5,100	1,200	7.0	102	6.15	0.88
Benton Harbor	46,600	1,100	5.9	521	13.91	2.37
Big Rapids	12,000	2,400	8.4	376	7.54	0.90
Cadillac	10,500	1,700	7.7	295	10.00	1.29
Davison	5,300	3,300	6.5	197	6.60	1.02
Dowagiac	6,600	1,900	5.9	82	4.37	0.75
Eaton Rapids	4,500	1,700	4.5	44	7.24	1.62
Gladwin	2,100	1,300	6.4	113	6.23	0.97
Grand Haven	17,100	2,300	7.1	366	7.29	1.02
Hillsdale	7,700	1,800	7.3	191	10.21	1.40
Holland	27,100	1,900	6.4	305	9.46	1.47
Ishpenning	8,200	900	6.2	82	12.75	2.06
Ludington	9,500	2,200	9.0	258	12.82	1.43
Marshall	7,300	1,600	7.9	165	13.01	1.65
Midland	35,200	1,400	5.4	432	12.73	2.34
Niles	13,000	2,500	5.5	262	9.72	1.78
Sault Ste. Marie	15,000	1,000	5.9	320	6.46	1.10
Traverse City	20,000	2,500	5.1	244	8.94	1.77
Subtotals (average)	14,400	1,600	6.5	243	$ 9.69	$1.49
County Systems						
Antrim County	12,600	27	2.8	127	$ 8.61	$3.09
Crawford County	6,500	12	4.3	150	8.76	2.02
Gogebic County	19,300	36	5.7	46	9.68	1.70
Isabella County	44,600	78	4.7	351	13.36	2.85
Lake County	2,600	22	2.5	54	7.99	3.14
Manistee County	20,100	45	6.5	235	10.31	1.58
Midland County	28,600	58	2.2	157	10.06	4.65
Subtotals (average)	19,200	411	4.1	160	$10.47	$2.69
SEMTA Sytems						
Birmingham	34,000	5,700	5.2	148	$11.39	$2.19
Ferndale	32,100	6,700	7.1	229	8.06	1.14
Harper Woods	18,600	7,200	9.0	133	8.97	0.99
Lakes Area	25,000	1,600	1.1	11	5.33	4.66
Monroe	40,100	800	4.4	358	N/A	N/A
Mount Clemens	20,300	5,100	8.2	304	9.87	1.20
N.E. Oakland Co.	54,200	300	2.7	131	11.87	4.41
Port Huron	56,100	1,300	7.8	1,020	11.12	1.43
Redford Twp.	66,600	5,900	5.3	227	8.47	1.59
Trenton	24,400	3,700	8.0	241	11.83	1.49
Waterford Twp.	60,400	1,700	4.3	245	7.48	1.81
Subtotals (average)	39,300	1,100	6.3	277	$10.06	$1.59
Sec. 147 Systems						
Baraga County	7,800	9	4.0	144	$ 9.18	$2.41
Eastern U.P.	33,700	10	3.5	134	15.51	5.81
W. Mich. Four Co.	61,800	25	1.0	101	9.86	9.42
Subtotals (average)	34,400	15	2.1	116	$10.49	$5.03

Source of data: (6)

productivities. The "outstate" (i.e., small urban) DART systems have been carrying an average of 6.5 passengers per vehicle-hour, at an average cost of approximately $1.50 per passenger trip. The system in the town of Ludington (population 9500) for instance, has had a productivity of 9 passengers per vehicle-hour - a very high figure for demand-responsive service. The largest of the outstate sites - Benton Harbor (population 46,000) has had a productivity of nearly 6, also quite high, although the per trip cost has been the highest of the outstate systems at $2.37. The per trip cost has been as low as $0.75 (in the town of Dowagiac). Community support for these systems has been fairly high, as evidenced by local millage elections; 85% of localities holding such elections have voted to tax themselves to pay one-third of continuing DART system operating deficits.

Despite the level of popular support, however, ridership is fairly low on many of the systems, particularly those in the Detroit area. Although DART is the only public transportation service in many of the locations outside of the Detroit-area, the systems are commonly regarded as being "for the elderly" (3), and are patronized predominantly by the elderly and those too young to drive. The elderly, who actually comprise only one-third of the DART riders, have actively and effectively supported the millage elections.

The success of the DART program has contributed to the overall expansion of Michigan's public transportation program. A 2¢/gallon increase in the portion of gasoline sales tax revenues allocated to transportation was passed by the Legislature in 1979. The DART program itself has been reorganized - it is now called the Small Vehicle Program, and has become a regular line item in the budget - a breakthrough in the consideration of paratransit as a viable public transportation option.

One of the most comprehensive approaches to the provision of public transportation in general is represented by the original integrated system in Westport, Connecticut. Until 1981, the Westport Transit District (WTD) provided a range of integrated transit and paratransit services.* The basic services, the fixed-route Minnybus and the shared-ride Maxytaxy (which

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* The funding for the Maxytaxy and part of the Minnybus service came through UMTA SMD grants. When demonstration funding expired, the WTD was unable to generate sufficient state and local funds to continue operating the Maxytaxy and the full fixed route system; thus the former was terminated and the latter was considerably reduced.

provided both demand-responsive and fixed route service), were complemented by an innovative pricing policy (involving low-priced prepaid annual passes) and a transportation information center. The system coverage was quite comprehensive and service was extremely reliable. The overall system ridership (2200 per weekday in 1980) and productivity (14 passengers per vehicle-hour) are very high for a city of Westport's size (28,000 persons) and density (under 1,500 persons per square mile). The WTD clearly demonstrated the effectiveness of creative and comprehensive marketing and fare programs. However, despite the development of fairly strong community support during the demonstration, the town's residents were unwilling to authorize the funding necessary to continue operating the full system once the demonstration period ended.

In summary, paratransit has been successfully used to provide general community service in a variety of smaller cities. Svstems have been operated by transit agencies, taxi companies, and the municipalities themselves. Service types have included door-to-door dial-a-ride, fixed route, and hybrid services such as the point deviation system operating in Merrill. The costs have been sufficiently low, in most cases, to enable the systems to remain in operation. As is described in the next section, this is in marked contrast to the situation in some larger areas.

General Community Paratransit in Metropolitan Areas

Integrated Systems

To begin, let us discuss the largest scale paratransit demonstration to-date, the Santa Clara County Arterial Personal Transit (APT) System.* This county-wide system, introduced in December 1974, involved some 200 vehicles providing both local demand-responsive service in designated zones and fixed route services operating along major corridors. The system, operated by the Santa Clara County Transit District (SCCTD), served a region of 1,000,000 persons.

The primary objective in developing the APT has been described as providing "complete and equitable" transit coverage throughout the County

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* One might argue that Santa Clara County and, to an even greater extent, Orange County, discussed later, are not examples of metropolitan areas (although they have SMSA status) but rather agglomerations of suburban communities. While it is true that these areas have characteristics which are somewhat different from those of older, more established cities, the nature of the cases described here are more in line with what one might find in metropolitan areas than in smaller cities.

(7). SCCTD designed the integrated fixed route and demand-responsive system in an attempt to make the most effective use of a limited number of vehicles. There was an enthusiastic response to the system-ridership averaged 6400 per weekday on the demand-responsive portion alone, 4000 more than the ridership of the next most intensively used system among the case studies. However, APT could not adquately meet the demand. The high level of demand resulted in long telephone delays and a rather low level of service, which created bad feelings among would-be patrons and the community at large. This situation was compounded by protests from certain segments of the population who felt they had become "displaced riders;" APT did not provide replacement service for certain parts of the county which had been served by the previous fixed route system. Thus, APT failed to meet its major objective of complete and equitable coverage. The demand-responsive component of the system ceased operating in May 1975.

There were a variety of other factors which contributed to the demise of demand-responsive service. The SCCTD was sued by a consortium of eight taxi companies, which contended that the SCCTD had failed to conform to a buy-out provision incorporated in its enabling legislation. The taxi companies won this suit, and SCCTD was ordered to either cease demand-responsive operations or buy out the taxi companies. In addition, the costs of operating the APT were very high. As shown in Table 1, the 1975 costs per passenger and per vehicle-hour are higher than those of any of the other systems studied, even at their more recent levels. Finally, the introduction of the complete system all at once did not allow time to iron out operational problems, compounding the other difficulties. Probably the most important result of the APT operation was the set of lessons learned regarding how <u>not</u> to implement an integrated transit/paratransit system.

Ann Arbor's Teltran system represents a case of differing perceptions of the degree of success. The Teltran system was a pioneering paratransit effort, which originated in 1971 with a pilot project and later expanded into an areawide integrated transit/paratransit system. The Ann Arbor system, which formed a basis for the design of the Santa Clara system, involved an integration of demand-responsive and fixed-route service, with the former operating in a zonal structure (which changed in the evenings and again on weekends) interfacing with the line-haul routes at designated transfer

points. Even given the smaller scale of this system, which covered a city of only 20 square miles, a majority of trips required at least one transfer (8).

Despite the inconvenience associated with transfers, ridership on Teltran was higher than on the previous (though much less extensive) fixed-route system in Ann Arbor. By March, 1976, the average daily ridership (for the overall system) was 6500, a 250% increase over the ridership on the 1971 fixed route system. However, system costs were quite high. As shown in Table 1, system cost per passenger was exceeded only by that of the Santa Clara system.

Despite the long history of public support and critical acclaim, the system was determined not cost-effective by the Ann Arbor Transportation Authority (AATA) Board of Directors, and was scaled down dramatically in mid-1979. At that time, day-time demand-responsive service was retained only for elderly and handicapped passengers (except in some fringe areas of the region). Evening and weekend demand-responsive service remained unchanged. However, in early 1982, the AATA implemented a new demonstration, involving the subsidization of privately-operated shared-ride service between the hours of 12 (midnight) and 6 a.m.

At each stage of its existence, Ann Arbor's paratransit system has produced valuable insights, primarily into service design potential (see ref. 8). The original pilot project demonstrated the viability of the demand-responsive transportation concept, and influenced the development of other similar systems (most notably the State of Michigan DART Program). The use of a small scale demonstration project also proved to be valuable, as it allowed time for system bugs to be worked out, while developing community awareness and support. The voters approved a 2.5 mill property tax to support public transportation in 1973, soon after the end of the pilot program. In its subsequent structure, Teltran experimented with the concept of integrated paratransit. The advantages of service integration have been widely debated and discussed in research efforts, but Teltran offered one of the first full-scale (and relatively successful) applications of the concept.

The most recent evolution raises some interesting questions. When one looks at linked trips, (i.e., counting transferring passengers as one trip) ridership has apparently increased since the replacement of most of the demand-responsive service with fixed route service. The implications of this are unclear. One interpretation, held by some members of the AATA staff, is

that this is an example of the hypothesis that paratransit can act as a "stepping stone" toward the use of conventional transit.* Alternatively, it can be speculated that a total fixed route service (or another paratransit design) would have produced similar or better results. On the other hand, in this case, because the integrated system was so celebrated, Teltran certainly increased general awareness of public transportation in Ann Arbor in a way that a more conventional system would not have.

Like the above two systems, the Orange County Transit District (OCTD) transportation system includes both fixed-route and demand-responsive services; however, there has not been any significant attempt to spatially integrate the two. Currently, OCTD operates county-wide fixed route service and sponsors intra-neighborhood demand-responsive services. The county is divided into 33 "neighborhood" zones (each 10-12 square miles in area), and each zone is served by one or more vehicles on an immediate-request demand-responsive basis. The Neighborhood Dial-a-Ride Program includes a total of 109 vehicles (87 of these are lift-equipped); these are operated under contract by four different private operators: two taxi companies, a charter bus company, and a paratransit management company. The dial-a-ride services are targeted at short-distance local trips (e.g., for shopping, medical visits, etc.), and, as of early 1981, roughly 90% of all users traveled within zones only. Transfers between dial-a-ride zones can be requested, and some transfer points are fixed route transit stops, so as to allow for direct transfers to transit; however, the $1 per zone dial-a-ride fare and the transit fare of $0.50 tend to limit the amount of inter-zone travel. Approximately 50% of the system's patrons are elderly or handicapped.

The Neighborhood Dial-a-Ride Program has been in operation only since December 1980. Prior to its initiation, the OCTD ran the Community Services Program, in which eight towns had their own separate intra-community demand-responsive and fixed route services; in addition to those, there was a county-wide service for the elderly and handicapped. These systems were fairly successful for a number of years, but ridership levels and productivities had begun to drop, and county fiscal problems (partially the result of Proposition 13) necessitated a revision of the system's structure.

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* This concept was introduced by by Ward (9).

After about two months of the new arrangement, average weekday ridership was approximately 2600 and was on the upswing; before it started to decline, the daily ridership on the Community Services systems had been as high as 3400. However, the OCTD has yet to really market the new structure.

In examining the evolution of general community paratransit, it is instructive to review the history and accomplishments of the OCTD Community Services Program. Overall, OCTD's paratransit efforts have proved quite successful in meeting its initial objectives of providing intra-community service and testing "new" service concepts. The OCTD was able to test, first, the general dial-a-ride concept with an initial demonstration system (La Habra), and then the concept of "temporal integration" (in West/Central Anaheim).* The County has also received an UMTA Service and Methods Demonstration grant to establish an integrated transit management system which will eventually provide computerized control of all demand-responsive operations in the county.

The individual community systems in Orange County experienced mixed results. Ridership peaked in mid-1978, and then declined when a 40% fare increase was put in effect. By early 1979, ridership had nearly returned to pre-fare increase levels on the Orange/Villa Park and Fullerton Services. Ridership subsequently increased significantly following the local gasoline shortages in 1979 (demand-responsive ridership for the entire county increased by 22% during the month of April 1979), until supply capacity was reached. Ridership then decreased again slightly when the new service structure was introduced.

Although popularly supported by the communities, and generally considered successful operations, the Orange County systems attracted the lowest market shares of any of the systems studied (see Table 1). Furthermore, the operating costs in the Orange County systems were, as of the change in the

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* The system in West/Central Anaheim was temporally-integrated, in that it operated as fixed-route service during peak hours and demand-responsive service during off-peak hours. However, this resulted in a number of problems concerning: 1) differences in drivers' wages; and 2) confusion by passengers during the period of transition between fixed-route and demand-responsive service. These problems led to a decision to change the service design; unlike the cases in Ann Arbor and Santa Clara County, however, Orange County decided to make the West/Central Anaheim system completely demand-responsive.

system's structure, the highest of any of the privately-operated systems studied (see Table 1), although Hollinden and Blair (10) report that the paratransit systems were more cost-effective than previous fixed route systems in the region. La Habra's ridership remained at basically the same level from the initial year of service until it decreased following the fare increase. The lack of growth may be attributable, in part, to the decreasing level of service provided; average wait times grew to 35 minutes, as compared to 25 minutes in Fullerton and Orange/Villa Park. Furthermore, the minimal ridership increase in La Habra and the low market shares throughout the County also likely reflect the general "automobile mentality" prevalent in Southern California; many residents support the concept of public transportation, but do not use it themselves.

One can look at La Habra as one of the few systems in the country which was operated in a consistent manner (1972-1980) long enough to reach a steady-state level. As such, the ridership level in La Habra (which was not really constrained by supply until later years) may be a reasonable indication of the maximum one could expect from a community service operating in a similar environment. The trip generation rate in La Habra, measured in terms of passenger-trips per capita per year, reached 2.7 prior to the fare increase. Interestingly, the only older existing dial-a-ride service in the country - implemented in 1971 in Batavia, N.Y. - has also been operating with a fairly steady ridership level. However, the trip generation rate in this smaller, less auto-oriented community, has averaged close to 8 passenger-trips per capita per year. In contrast, the higher capacity point deviation system in (the even smaller city of) Merrill, operating since 1975, carries 9 passengers per capita per year, while the Westport system carries 25 passengers per capita per year on its overall system, 6 of which are carried on the demand-responsive service.

The final integrated case study service - Trans-Cab - is a taxi-based feeder service to conventional line-haul routes in Peterborough, Ontario (population 60,000). The feeder service area is divided into two zones, with Zone A feeding riders to transfer points on three bus routes running into downtown Peterborough, and Zone B feeding one bus route. Taxi service is coordinated with bus service to minimize transfer time. Passengers desiring inbound service phone for a cab at least one hour before a bus is scheduled to

depart from the transfer point. The average wait time is 40 minutes for pick up after a call, and the charge is a 10¢ premium over the regular fixed route bus fare. Fares are paid to the cab operator, who issues a transfer for a bus ride. Outbound, passengers notify the bus driver that they wish taxi service, and pay the same charge. The bus operator then issues a cab transfer and radios ahead for service.

This feeder service has proven to be quite successful to-date. The major objective in instituting the service was to provide a cost-effective alternative to a high cost transit route in an isolated section of Peterborough (11), and Trans-Cab, operated by a taxi company under contract to Border Transit, Ltd., achieved this objective. The number of transit riders from this neighborhood tripled within the first year demonstration period, and the operating deficit per passenger was reduced substantially (the cost per passenger for the taxi component is $0.90 - lower than all the other case study systems). Thus, this service clearly achieved its major objectives, while demonstrating the feasibility of feeder/line haul integration.

Areawide Systems

The previous cases include several in which the private (taxi) sector is under contract to the public sector to provide service. This type of arrangement has increased markedly in recent years, in response to: (1) recognition on the part of the public sector of potential cost reductions possible through contracts with the private sector; and (2) increased opposition on the part of the private sector towards (what it views as) directly competitive public sector services. The private sector is also quick to point out that it has successfully provided a variety of (unsubsidized) paratransit operations on its own over the years. The most visible of these operations are shared-ride taxi services, of which the most widely cited examples are the systems in Little Rock (Arkansas) and Davenport (Iowa). Shared-ride services are also offered in numerous smaller communities, and, on a less extensive basis, in Washington D.C. and on Long Island, New York. We have selected as a case study one of the oldest (in operation since 1946) and largest such systems, and yet one of the least well known - that operated by the Badger Cab Company in Madison, Wisconsin.

Badger is unique in that it operates in direct competition with a number of exclusive-ride operations. The 30-vehicle service, currently the largest fleet in Madison, is operated with a zonal fare structure, with fares synificantly lower than exclusive-ride fare. Ridership has dropped from over 2800 passengers per day (1977) to approximately 2000 (1980), but this latter figure represents a significant increase over a ridership low of 1200, which was reached in 1978 following a change in company management. Costs have risen over the past few years because of increases in vehicle maintenance and fuel costs, driving the service into a slight operating deficit. Nevertheless, as of this writing, Badger was still operating with no subsidies, although the company did file for a rate increase in early 1981.

The Madison case provides an interesting contrast to the Ann Arbor case, in that the two cities, both sites of major public universities, are similar in many respects (although Madison has a significantly larger population and is the state capital). In Ann Arbor, shared-ride service was offered by the public sector and was integrated with fixed route service. In Madison, shared-ride service was offered entirely by the private sector and overlaid onto the fixed route system. Despite significantly higher fares, the Madison system achieved almost equivalent ridership levels and required no government subsidies.

Inner City Services

Another type of private sector paratransit service is the jitney. The jitney is an unscheduled fixed route (or route deviation) service, operating on short but variable headways. The jitney vehicle, holding six to eighteen passengers, is owned and operated by a self-employed individual.

Jitneys were once very widespread in the U.S. However, they were legislated out of business largely as a result of the efforts of their major competitors - the streetcar companies. Since 1930, jitneys have been able to operate legally in only a few locations. Legal jitneys are currently found in Atlantic City and San Francisco (and jitneys have recently been legalized in San Diego, Dade County, and Indianapolis);* illegal operations are known to

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* As of late 1981, the City of Boston had plans to implement a jitney-type (i.e., fixed route, fixed stop) shared-ride taxi demonstration along a single designated route. Any taxi licensed to operate in Boston would be eligible to participate.

exist in Chicago, Pittsburgh, Newark, Chattanooga (Tennessee) and Winston-Salem (North Carolina) (12). In contrast to the situation in this country, the jitney is a major form of public transportation in many foreign cities, especially in Latin America, Africa, and the Middle and Far East. Lagos, Nigeria, for example, has approximately 2300 jitneys; Trinidad and Caracas each have roughly 6,000; Hong Kong reports 3,800; and Manila has nearly 15,000 "jeepneys."

Our case study jitney operation is San Francisco's Mission Street jitneys. There are currently approximately 35 jitney owner-operators providing service along a 10-mile route through San Francisco's Central Business District; the population within half a mile of the route is over 63,000. Along this route, the jitneys compete with buses and rail transit (the latter actually operates along a parallel route), although the jitneys' headways are shorter, at roughly 4 minutes, and they can be hailed all along the route; the jitneys charge a fare of 50¢ - the same as that of the transit buses. The Mission Street jitneys operate nearly 16 hours each day, using 12-passenger vans.

Jitneys have been operating in San Francisco since the early 1900's. However, as rising costs have made it increasingly difficult to make a profit through such an operation (i.e., without any kind of public subsidy), the number of jitney operators has decreased steadily over the years; at one time (1917), there were over 1400 jitney owner-operators in San Fransico. Many of the remaining 35 operators are either retired or hold other jobs as well. (The potential future role of jitneys in providing general community service is addressed in Sec. 4.)

The final case study system - Laclede's Landing/Hotel Shuttle - represents a rather different approach to paratransit; it was initiated by the activity center generating the need for transportation. As such, this system is akin to employer-sponsored ridersharing programs or social service agency-sponsored transportation handicapped services.

This service was operated in Laclede's Landing, a revitalized entertainment district located adjacent to the Gateway Arch in St. Louis, Missouri. Although this district constitutes most of downtown St. Louis' nightlife, it is poorly served by both transit and taxi, especially in the evening. In response, a non-profit cooperative was established among three downtown hotels and several restaurants located in Laclede's Landing; its

purpose was to improve access from the hotels to movie theaters and restaurants during the evening. In July 1979, a fixed-route loop shuttle was initiated by the cooperative. The shuttle operated on Mondays through Saturdays between 6:00 p.m. and 2:00 a.m., with seven scheduled stops on a twenty minute headway. The service was available to the general public at no charge (free fare). The 16-passenger minibus used to provide the service was owned, operated and maintained by one of the hotels in the cooperative. Ridership averaged between 60 and 80 trips per day until service was discontinued because of administrative problems and a lack of funding in 1980.

Key Findings

The case studies, examination of other systems, and other research efforts have yielded a number of important findings concerning the implementation and operation of general community paratransit services. The key findings are discussed below.

General Results

As suggested by the results of the case studies and the systems, the experience to date of general community paratransit services has been rather mixed. While such systems have proven to be quite viable (i.e., in terms of continued operation with reasonable operating costs) in many locations, other systems have been terminated due to lack of use, high costs, inappropriateness of design, or political opposition. In some of the "unsuccessful" cases, expectations were simply too high; in others, the planning and implementation processes were not carried out effectively, essentially dooming the systems before they even became operational.

Paratransit systems, in general, have been marked by rather high costs (the reasons for this are discussed elsewhere in the chapter). Many of the "successful" operations represent situations in which community support has been strong enough to mitigate concern over the level of costs In a number of the succcessful cases, the actual service provided has changed over the years, reflecting changing local needs and priorities. Of course, paratransit service and organizational options are by their very nature flexible arrangements, and are therefore adaptable to such changes. In some instances,

service has evolved over the years - progressing through different demand-responsive arrangements to eventual replacement by fixed route transit service.

What has become increasingly evident in examining the paratransit experience to date is that no particular service type or organizational framework is most appropriate for any particular setting. For instance, it has been the prevailing belief that population density plays a significant role in determining what type of service is best for a particular area; the higher the density, the less flexible the service should be (leading ultimately to fixed route). While this makes sense intuitively, and research has even begun to place ranges on the "best" population densities for various services (3), the case studies provide no real evidence of the impact of density. The population density of the study sites ranged from 773 persons/square mile (Peterborough) to 4979 persons/square mile (Santa Clara). Dial-a-ride service, which presumably requires the lowest density of any service, operates in Orange County, where the services areas have population densities in the 4,000 to 4,600 range, while point deviation service operates in Merrill, which has a population density of 1700. Meanwhile, fixed route service operates very effectively (with a productivity of over 20 passengers per vehicle-hour) in Westport, which has an overall density of only 1300. Obviously, factors other than density (including the location of major activity centers) play the key role in deciding what type of service makes most sense.

Paratransit/Transit Integration

One of the key paratransit-related concepts developed during of 1970's was that of paratransit/transit integration. Ward and Paulhus (13) fully developed the concept of integrated systems, in which flexible paratransit services provide feeder/circulation services in low density portions of metropolitan areas, while fixed route service operates along high density corridors. The concept is intended to allow each service to be used in the environment in which it works best.

Of the case study sites, Santa Clara, Ann Arbor, and Peterborough were all designed as integrated transit/paratransit systems. The results of these

projects provide a somewhat mixed picture of the suitability of the integration concept.

In fact, the Santa Clara system probably provides no evidence at all. Santa Clara did not have a sufficient number of vehicles to meet the demand, and had many other problems as well. Thus, one cannot determine whether the system design itself was appropriate. The Santa Clara failure can be attributed more to inadequate planning and mis-timed implementation than to any inherent weaknesses in the integrated service concept.

The Ann Arbor experience, on the other hand, demonstrated that an integrated service can work effectively. Ann Arbor was able to achieve coordinated transfers, and passengers demonstrated a willingness to transfer. The use of cycled service, rather than purely demand-responsive service, helped achieve transfer coordination. Approximately 70% of all Teltran passengers used both fixed route and demand-responsive service as part of their trip. On the other hand, the fact that total linked trips has increased following the scale back of demand-responsive service suggests that the integrated service design may not have been the most appropriate one for that community.

While the Ann Arbor model is, in some ways, identical to that proposed by Ward and Paulhus, it differs in one critical way. Ward and Paulhus envisioned the demand-responsive service operating in lower density suburbs of relatively large SMSA's. In Ann Arbor, the demand-responsive services operated within the limits of a small (20 square mile) city. The demand-responsive zones were extremely small (some under 1 square mile) and resulted in transfers for even very short trips. This may not be the most appropriate structure for an integrated system.

The Peterborough system is the only unqualified success story of the three. In Peterborough, the introduction of feeder service resulted in both increased ridership and decreased cost. Differences between the Peterborough and Ann Arbor systems include the following: 1) in Peterborough, because of system design, feeder trips tend to be much shorter than line haul trips, which is not the case in Ann Arbor; 2) in Peterborough, demand-responsive service is provided by a private operator. The result of the latter is that cost per passenger in Peterborough is considerably lower than in Ann Arbor

(see Table 1). The Peterborough approach has recently been copied in the Tidewater area of Virginia, where taxis are being used to both replace the ends of some fixed routes and to expand routes into new areas. It is conceivable that the demand-responsive component of the Ann Arbor system would have been deemed cost-effective had it been operated by a taxi company.*

In summary, then, spatial integration is a concept that can work and be relatively cost-effective, if it is designed properly. It is a concept which has seen only limited experimentation to-date (the case studies have a disproportionate number of such examples) but which could see greater use over the coming years, as reduced funding forces transit operators to seek new, lower cost service arrangements (See 4: FUTURE DIRECTIONS).

Another form of integration is temporal integration, in which the same resources are used to provide different services at different times of day. This concept was also espoused by Ward and Paulhus, who argued that service must change in response to varying demands over the course of the day. Some form of temporal integration was attempted in Ann Arbor, Orange County, and Westport.

In Ann Arbor, fixed route service was reduced during evening and weekend hours, at which time demand-responsive service was expanded. This change was reported to have caused confusion on the part of passengers but, once a consistent policy was established, it remained in effect for a number of years. Of course, there is no way of knowing whether it would have been more effective to keep the same service in effect all day.

In West/Central Anaheim (Orange County), the shift between fixed route and demand-responsive service (peak/off-peak) also proved confusing. However, there was one additional problem at this site - the driver wage rate was different for fixed route and demand-responsive service. This caused serious problems among drivers, who resented the transition. As a result, this experiment with temporal integration was terminated.

The Westport case is somewhat different from either of the above. In Westport, temporal integration began with fixed route service, which focussed

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* It is interesting to note in this regard the AATA's current demonstration involving the subsidization of shared-ride taxi service late at night; this service began in early 1982.

on a commuter rail station during peak hours and the downtown during off-peak. This design worked effectively, as evidenced by ridership levels, although there were some complaints. Subsequent elements of temporal integration represented additions to service, rather than changes. When the taxi component was added, taxis were assigned to the downtown-oriented fixed routes during the periods in which the buses focussed on the rail station. Taxis also provided "straggler" fixed route service from the commuter rail station after the PM peak. During the remainder of the day, including evening periods when there had been no service previously, shared-ride taxi service was provided. The use of different services at different times of day did not seem to present a problem in Westport.

While service design itself is one of the factors that has influenced the results of paratransit projects, a variety of other factors, typically institutional in nature, also had significant impacts. Some of these factors are reviewed in the following section.

Institutional Issues Impacting Paratransit

General community paratransit services have typically been developed, implemented and/or operated by local government bodies, transit agencies, or private transportation companies, although the Mission Street and Laclede's Landing examples represent alternative arrangements. Public bodies have either provided service on their own or have contracted with private operators. Funding, as well as initiative, for paratransit services has come from the federal government and state governments (e.g., Michigan, Minnesota, Wisconsin, California) and, to a lesser extent, local governments.

In four of the cases studied here, paratransit services were developed and implemented within existing public transit agencies: Teltran (Ann Arbor Transportation Authority), APT (Santa Clara County Transit District), Maxytaxy (Westport Transit District), and the Orange County Community Services (Orange County Transit District). In each of the first three cases, the paratransit service is (was) provided in a complementary (i.e., integrated) role to fixed-route transit, whereas in Orange County, the paratransit services are are targeted at a completely different market (i.e., shoppers and others making short, local trips) than that served by transit and are thus designed to be stand-alone services (although, they do generally interface with the

county's intercity routes). The institutional context in which each of the above systems/programs was developed is quite different, and these differences are reflected in the results of the projects.

In the case of the APT system, the demand-responsive component was introduced at a scale never before attempted, replacing fixed-route service in certain areas of the country. It may have been an inappropriate setting for a concept that was unfamiliar to most potential users. Similarly, it may have been inappropriate for the Transit District to be attempting to operate, on such a large scale, a type of service with which it had no experience; a demonstration and staged implementation would have made practical, if not political, sense.

The Ann Arbor Tranportation Authority and, to some extent, the Westport Transit District and the Orange County Transit District, did make use of demonstrations to test out demand-responsive services. All of these agencies were successful in implementing and integrating paratransit services within a transit framework.* This has not traditionally been true, however, for transit authorities. All three of these agencies, from their inceptions, considered the potential of paratransit within a comprehensive transit approach; none had a historical "commitment" to conventional fixed-route transit. More "traditional" transit authorities are often constrained with respect to paratransit by labor requirements and a highly structured management philosophy that may not be compatible with the needs for flexible paratransit services. When paratransit services have been developed by transit authorities, they have most often been targeted at special user groups (e.g., the elderly and handicapped).

Jones (14) and others have argued that the transit authority is not, in fact, an appropriate framework in which to implement and administer general community paratransit services. The primary problem with these organizations, reasons Jones, is that they do not operate at a "community" level, but rather are generally oriented to a regional scale; development of paratransit services is best done at the community level, where the process of building local political and community support is not hindered by the traditional technical planning process required at the regional level. Of course, this

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* As noted earlier, however, Westport was unable to continue its demand-responsive service following the close of the demonstration period.

argument is less applicable to smaller transit agencies, such as WTD, since it functions on a community rather than regional level.

The case study systems administered by local governments have, by and large, been successful. One of the key differences between these operations and those provided by transit agencies is the level of operating costs. As noted earlier, the costs for Santa Clara County and Ann Arbor were considerably higher than those of the other cases; this is largely attributable to the higher wage rates of the unionized transit operations in those areas.

Another factor contributing to lower costs is the role of the private operator. Contracting out service to taxi companies and other private operators has often proved less expensive than operating the service publicly; this is, again, due largely to wage rates - drivers in the private sector typically make less than those in the public sector. In addition, taxi systems generally have more flexible work rules, which are appropriate for paratransit operation. Additional cost savings may result in cases where the private operator already has vehicles and dispatching capability. Thus, a contract for service may eliminate the need for the contracting agency to purchase its own equipment. Among the case sites, service is/was contracted to private operators in Westport, Orange County, Peterborough, and some of the systems in Michigan.

As illustrated by the Badger Cab case, general community paratransit services can also be provided completely within the private sector (i.e., without any direct public subsidization). Share-ride taxi operations such as Badger Cab and the one in Little Rock, (Arkansas) have managed to be self-supporting for many years. Because of the increased productivity achievable under a shared-ride arrangement, the average fares and the costs of providing service are lower than those in of exclusive-ride service (15). This should make shared-ride service an attractive arrangement for taxi companies, particularly given rapidly escalating operational costs. However, few taxi companies are entering the shared-ride market on their own. This is due partly to the presence of restrictive local regulations, partly to a general reluctance (and perceived financial risk) on the part of private operators to change their service structures, and partly to the entrance of

private operators into the public sector through service contracts. Contracting with a public agency generally stands to be more lucrative (and less risky) to a taxi company than does operating its own service, since the contract usually guarantees some minimum return. Publicly-subsidized shared-ride taxi service also presents certain advantages to the sponsor: 1) lower fares can be offered to the users (through provider or user-side subsidies; and 2) quality can be monitored through data reporting requirements and the use of incentives for good service. This latter point is important, since the public sector is often concerned about the quality of service which might be provided by the taxi industry.

Factors Influencing General Community Paratransit Implementation

The case studies and other research has provided insight into factors which may stimulate or discourage implementation and/or of general community paratransit service. These are discussed below.

On the negative side, perhaps the most common and frustrating barriers to successful implementation of general community paratransit services have been those associated with labor and competition. The former deals with opposition from local transit labor, typically based on "Section 13(c)" of the UMT Act of 1964. Section 13(c) requires that the position of existing workers "not be diminished" through projects initiated with UMTA funds. The key 13(c) problem occurs in situations where existing transit labor units demand that they operate any new paratransit service, even in cases where it is only new jobs that are at stake. The possible results of this are: 1) service ends up operated by transit labor, which is more expensive than alternative courses of action; 2) the service is not implemented; or 3) a compromise which increases costs is reached; e.g., maintenance is performed by union labor.

Section 13(c) was not a problem in any of the cases studied here, although problems did develop in a number of other cases discussed in this report. Since this document is not directed towards exploring issues such as 13(c) in depth, no further discussion of the issue will take place here. Obviously, resolution of the "13(c) problem" is important to the further expansion of paratransit.

Problems with claims of competition with taxi companies, on the other hand, occurred in four of the sites: Ann Arbor, Santa Clara County, Orange

County (City of Orange), and Westport. In the first three cases, taxi companies brought suit based on local statutes. In both Ann Arbor and Orange, the courts ruled that paratransit service did not represent unfair competition to local taxi service (although this Orange decision represented a higher court ruling overturning a lower court decision). Prior to the reversal in Orange, the City's Dial-a-Bus had been terminated and replaced by fixed-route service; when the decision was overturned, Orange reinstituted demand-responsive service, but this time through a contract with the very taxi company which had initiated the suit. In Santa Clara, the court ruled that the project was indeed in violation of a "buy out" agreement in the transit district enabling legislation. The Santa Clara County suit was one of the major reasons for the termination of the demand-responsive component of the APT system.

The Westport case was based on a federal regulation - namely, the "3(e)" provision of the Urban Mass Transportation Act, which prohibits competition with private mass transportation carriers. The court ruled in this case that: 1) exclusive-ride taxi companies are not considered mass transportation providers; and 2) companies afforded the opportunity to bid in a competitive bidding situation do not have grounds for complaint under 3(e). In Westport, a service contract had been offered to both local taxi companies, but only one accepted the opportunity while the other elected to sue.

The implications of these cases is that one can expect opposition from taxi companies if they are not offered the opportunity to participate in a paratransit service (and, in some cases, even if they are). While in most cases to-date the taxi companies have been unsuccessful in their attempts to halt paratransit services, there is no guarantee that this will continue to be the case. This suggests that careful consideration must be given to utilizing taxi (and other private) companies to provide paratransit service. As noted earlier, this also usually results in lower operating costs.

The Santa Clara County case also provides dramatic evidence of two other constraints: political/community issues and institutional problems. The former barrier was manifested in two stages: (1) through the controversy over the type of public transportation to be implemented; and (2) through the subsequent protests of community groups representing "displaced riders". The

first stage was "resolved" through the system design, i.e., to implement an integrated system covering the entire county. Unfortunately, that resolution contributed to the second stage of opposition; this second barrier was eventually "overcome" by eliminating the demand-responsive portion of the system and expanding the fixed-route service.

A fundamental obstacle to implementation, of course, has always been lack of funding. This may involve a locality desiring transportation but unable to secure enough funding, or a locality unwilling to commit a local share of costs. Such fiscal constraints have been thrust into public view through the passage of measures limiting public spending, such as California's Proposition 13 and Massachusetts' Proposition 2½. The Orange County Transit District has felt the impact of the former, as plans for one proposed community system (Costa Mesa) were scrapped at the time of its passage.

The importance of adequate funding is demonstrated by the fact that those states having programs that have provided funds for paratransit operations - Michigan, Minnesota, and California - have seen the bulk of paratransit development to date. In Michigan and Minnesota, paratransit services have been initially funded entirely (or with a small local match) by the states on a year-long demonstration basis, after which time the localities are expected to assume a greater percentage of system costs. The use of demonstrations has worked well in Michigan, where virtually all of the DART sites have voted to increase their local funding commitment following the initial year. The lack of need for an initial (local) financial commitment for a new system will clearly make a locality more willing to implement that system.

The Michigan experience also points to the importance of demonstration projects in generating community support. The small scale of demonstration or pilot projects enables the operator to gain operational experience while ironing out the bugs in the system, and allows the community to become familiar with the service. The failure of the Santa Clara County APT system is evidence of the nature of problems which may result from "all at once" implementation of a large scale project.

Besides their importance in developing community support and improving the capability of the operators, initial demonstrations have served to diffuse information about the potentials of paratransit and have influenced other

areas to implement similar services. In Orange County, for instance, the success of an initial demonstration (La Habra) stimulated interest in other cities and convinced the Orange County Transit District to commit itself to institute service in other locations. In Michigan, the success of the Ann Arbor pilot project had a similar stimulating effect on the state's decision to develop the DART program. The federal government is, of course, sponsoring demonstration projects covering all aspects of paratransit; among the cases studied here, UMTA demonstration grants were used in Westport and Orange County.

Although demonstrations have proven to be invaluable in many instances, certain localities may balk at implementing a project on a demonstration basis. If there is uncertainty about funding assistance after the demonstration period, an otherwise interested grantee may decide against introducing the service, for fear of creating a dependence on the service by the patrons and then having to abruptly terminate it for lack of funding. Thus, a demonstration can be a very effective tool, but it must offer a reasonable option for continuation of the service once the demonstration phase is over.

The development of community support also depends on other factors. Barb and Cook (2) and Jones (14), among others, have written of the need for community support in advancing paratransit development. Barb and Cook explain that there are three "key prerequisites to local adoption of paratransit:" 1) the presence of a "local mandate to effect a technology 'pull' (i.e., the benefits of paratransit are recognized and sought out by the local community) rather than a technology 'push' (i.e., federal programs requiring paratransit program elements...);" 2) the presence of "an enthusiastic and effective 'patron', generally an individual or individuals willing to take the initiative and who have control over the necessary local resources to implement a program;" and 3) "the availability of staff with entrepreneurial skills and motivation to directly manage and operate the services."

Examination of the case studies reveals that the presence of a strongly motivated "lead" agency or individual can indeed be a crucial element in the successful development and operation of a paratransit service. The success of the original pilot dial-a-ride project in Ann Arbor, for instance, is largely

attributable to the efforts of several key individuals. Similarly, the heads of the Transit Districts in Orange County and Westport were extremely instrumental in implementing innovative integrated services in those locations.

The degree to which a community will accept and support a new service has been shown to be at least partially dependent on what residents perceive to be the local objectives It was found (from interviews with city and transportation offices in seven DART sites (3)), for instance, that in the Michigan DART program, the single major reason for local approval has been concern for the elderly. Although all DART systems serve the general public, and ridership is, on average, about one-third elderly, the elderly are commonly regarded as being the primary support group, benefit recipient, and rationale for the systems. Such support is, of course, often generated by the transportation disadvantaged groups themselves; they have traditionally worked hard to promote passage of millage elections, and judging from the results in many of the Michigan localities, have often been quite successful. Concern for the "transportation disadvantaged" in general (i.e., elderly, handicapped, poor, and youth) is often the major rationale for implementing and continuing community paratransit services in many other locations as well.

In order to promote acceptance and use of new transportation services, an effective marketing campaign is important. Westport and Merrill demonstrated the results possible from creative and comprehensive programs. One lesson learned from Santa Clara County, however, is that care must be taken not to create false expectations. The promotional campaign preceding APT was quite successful in making people aware of the upcoming service, but did an inadequate job of explaining how to use the system and what it could actually do; thus, people expected too much, and were unsure how to obtain service. This created considerable confusion, once service began, and contributed to its ultimate demise. Thus, marketing can be an extremely important tool, but it must be properly used.

Once service is operational, the most important factors impacting community support are service-related: how reliable is the service?; how easy is the system to use? Merrill, Westport, and Peterborough all enhanced their support by providing service that is very reliable. Peterborough made the transfer process relatively painless by closely coordinating schedules; Westport provided a range of services tailored to different needs, and kept

the system understandable through its marketing campaign. Low-priced prepaid fare options (including a special "family pass") added to the system's appeal. These experiences can be contrasted with those of Ann Arbor and Santa Clara County. Although Teltran benefited from considerable local support, the system was rather complicated, frequently requiring multiple transfers within an oft changing zone structure. The APT, meanwhile, generally demonstrated how not to promote community support: the quality of service was low, despite high ridership, and the system's information dissemination (i.e., telephone) capabilities were inadequate to handle the volume of inquiries on how to use the service.

Summary

In summary, general community paratransit service have proven to be viable transportation alternatives in certain applications. Such systems have been in operation in some communities (e.g., La Habra, Batavia) for seven or more years. While these systems do not carry a great many passengers, they obviously do satisfy a local transportation need.

High costs have been a problem in some community paratransit systems, notably Santa Clara County and Ann Arbor. However, in a number of other, typically smaller communities, cost has not been a major factor. Contracting with private operators, as evidenced by the case studies in Michigan (DART), Orange County, Peterborough, and Westport, can reduce the costs of paratransit operation. As evidenced by the Madison case, some private paratransit systems can be operated without any subsidy, albeit at a significantly higher fare than conventional transit.

To-date, the majority of general market paratransit systems have been implemented in smaller urban areas. There are a number of reasons for this, including: 1) less in the way of existing transit service in these areas, creating a greater need for service and, at the same time, less of a potential for "displaced riders" (where paratransit replaces transit service); 2) less in the way of institutional constraints imposed by traditional transit authorities and transit labor reluctant to see services which they fear will "compete" with fixed route. Lower wage rates in smaller communities help keep

down the costs of low productivity paratransit services. The spread of paratransit in smaller communities has been promulgated by statewide demonstration/assistance programs in states such as California, Michigan, and Minnesota.

The concept of spatial integration of paratransit and transit has been demonstrated to be feasible. If designed properly, as is apparently the case in Peterborough, this type of system may prove to be extremely cost- effective (as compared to fixed route only). However, the Ann Arbor experience, while generally positive, testifies to the way in which the requirement to transfer can serve as a constraint on demand.

The desirability of temporal integration is less clear based on the cases studied. In both Ann Arbor and Orange County, changing service type by time of day proved confusing. On the other hand, in a situation in which a new service was superimposed on an existing structure (e.g., Westport), temporal integration (i.e., varying fixed routes by time of day) appears to have been quite successful.

The cases studied indicate the variety of general community paratransit services, ranging from pure door-to-door dial-a-ride service in many of the sites to the scheduled point deviation service in Merrill, and the fixed route jitney on Mission Street However, the case studies provided no real indication of the impact of density on paratransit operations, or whether demand-responsive service is clearly more cost-effective than fixed route in lower density areas.

Finally, the experience to-date suggests that establishing community support is essential for the successful operation of a paratransit system. Elements in generating community support include: 1) planning services on a community, rather than regional level (involving members of the community in planning); 2) demonstrating that a paratransit service is desirable through a pilot project (which requires little in the way of local funding); and 3) operating a reliable, well-marketed, simple-to-use system. It has also been found that the presence of a strong "patron" - a lead agency or individual - can be a crucial element in the successful development and implementation of a general community paratransit service.

3 General Community Paratransit: State-of-the-Art

The case studies and other research efforts have revealed that general community paratransit evolved considerably during its "first decade." The range of options in use today is significantly broader than the range available in the early 1970's. This chapter reviews the evolution of the concepts and summarizes key current operational and organizational arrangements and roles within different urban settings.

Service Concepts

The concept of general community paratransit has evolved from the original conception of a large scale, publicly-operated dial-a-ride system, to recognition of a family of services, often small scale in size, which may be initiated and operated by a variety of groups.

As noted earlier, dial-a-ride was the focus of most of the early research into general community paratransit, although one of the first such systems was the route deviation system implemented in Mansfield, Ohio in 1969. It is now widely recognized that dial-a-ride is but one of a range of demand-responsive services; in the past few years, even community-based minibus fixed route systems have been labeled as paratransit. However, despite the development of new concepts, the majority of general community paratransit systems implemented over the past decade have been "many-to-many" dial-a-ride systems. Some of these systems have still not met the expectations of the original researchers, either in terms of scope of service or technical sophistication. However, it can be said that we are still on a "learning curve" in terms of developing and operating paratransit services; paratransit continues to "mature" as more and more systems are implemented.

The early paratransit researchers envisioned systems with hundreds of vehicles, controlled by computers. In fact, only a handful of systems have ever operated with as many as 25 vehicles. This can be traced in part to the fact that the ridership levels projected by M.I.T. and others have never materialized,* and in part to the fact that systems have been implemented in

* The early M.I.T. research, which predicted that systems could operate on a break-even basis with productivities of 10-20 passengers per vehicle hour envisioned demand densities of 100 or more trips per square mile per hour. In fact, few systems operate with densities of over 2 trips per square mile per hour. Since productivity is extremely sensitive to demand density, this largely accounts for the low productivities achieved to-date.

much smaller areas than was planned. Nonetheless, the small size of most general community paratransit systems tends to keep overall costs relatively low, even if cost per passenger is high.

Dial-a-ride has often been suggested as the best-suited service for low density areas not having well-defined travel corridors. In fact, this type of service is utilized in many of the cases presented here, including the Orange County and Michigan systems. However, despite its widespread application, the term dial-a-ride appears to conjure up negative images in the minds of many persons. This is probably a result of the much publicized "failures" in Haddonfield and Santa Clara (although the latter was not strictly a dial-a-ride service) and the reported high costs of many other systems. Indeed, experience suggests that the concept has several inherent disadvantages:

1. A door-to-door service has a limited achievable productivity level, as measured in passengers per vehicle hour. While productivities as high as 9 have been reported, most systems seldom surpass 5, as indicated in Table 1. This translates directly into high costs per passenger (and relative energy inefficiency).

2. Given the changing character of demand from hour to hour and day to day, there is an inherent unreliability in dial-a-ride operations, which results in significant uncertainty regarding wait and ride times. Although it has been demonstrated that automation can minimize the unreliability (16), even at higher levels of reliability, the uncertainty may be a deterrent to use.*

3. There is evidence that suggests that many persons do not like to "plan" for service (via a telephone call) and then have the associated uncertainty regarding pick-up time. Such persons may prefer walking to a busstop, where they "know" a bus will show up.

Despite these limitations, dial-a-ride service continues to be employed in many smaller communities where lower public sector wage rates or the use of the private sector keep costs down; however, some communities have begun to view dial-a-ride as better suited for transporting the elderly and handicapped than the general public.

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* However, little research has been done on the impacts of reliability on service use.

Of course, as noted above, dial-a-ride is but one form of demand-responsive transportation; other options have certain characteristics of fixed route service in addition to demand-responsive elements, and are therefore known as "hybrid" services. Hybrid options include route deviation, point deviation, checkpoint many-to-many, and cycled service, all of which have seen some, though limited, experimentation to date. Deviation services offer passengers a choice between accessing a vehicle along a route (or at a checkpoint) or being picked up (and/or dropped off) at their doors (typically for a premium fare). Checkpoint services limit stops to designated locations, operating otherwise in much the same manner as dial-a-ride services. Cycled service involves vehicles scheduled to arrive/leave a major activity center on a regular basis. There are also a variety of permutations of these options. The evidence to date, based on both empirical data and research results, suggests that these hybrid types of service are attractive to passengers, tend to reduce unreliability, and are able to achieve productivities higher than door-to-door services.

The demand-responsive service-type (other than dial-a-ride) most familiar in North America is the cycled service. The Ann Arbor Teltran system utilized cycled many-to-one service in fourteen demand-responsive zones. In this case, a fixed route transfer point served as the terminal in each zone. The majority of passengers did transfer to fixed route, although approximately 30% traveled entirely within a demand-responsive zone. The demand-responsive component was able to achieve productivities on the order of 7-8 passengers per vehicle hour. Similar services operating in Bay Ridges (Ontario) and Regina (Saskatchewan) have reported productivities as high as 10. Cycled services are particularly well suited for serving major activity centers, such as line-haul terminals, shopping centers, and employment centers. As the Ann Arbor experience suggests, however, such systems need not be restricted solely to serving the activity center.

Deviation systems, on the other hand, make more sense for serving relatively well-defined travel corridors. Such services have the potential for even higher productivities. For example, the point deviation system in Merrill has achieved productivities as high as 13. An earlier point deviation service located in the Model Cities neighborhood of Columbus (Ohio) carried

approximately 10 passengers/vehicle-hour. The productivity of a route deviation system in Winona (Minnesota) has been on the order of 10-12. In contrast, the productivity of door-to-door demand-responsive services most often falls into the 4-6 range.

While the above three deviation systems - plus the Mansfield route deviation system - represent the only documented experiences with deviation systems of any reasonable scale in this country, there have been even fewer examples of checkpoint services; a cycled checkpoint service currently exists in Natick (Massachusetts), and an earlier demonstration of checkpoint subscription (many-to-one) service was conducted in Rochester, N.Y. (to Kodak Park). However, there are several demonstrations currently going on in Europe*. Examples include: the French Confluent BUSPHONE system, implemented in 1976 in three small communities containing 45,000 persons about 12 miles northwest of Paris; the RUFBUS system, implemented in Friedrichshafen, Germany in 1977, with seven vehicles and 29 checkpoints; and the RETAX (or R-BUS) system, implemented in 1977 in the City of Wunstorf, Germany. In both German systems, passengers can travel from one checkpoint to any other. In each case, some of the checkpoints are equipped with "trip selection terminals;" passengers accessing the system at one of these checkpoints pay a partial advance fare and indicate, by pushing buttons on the terminal (the alternative is to telephone the control center from home or some other location), the desired destination and the number in the party. The information is automatically routed to a control center where a computer makes passenger assignment and vehicle routing decisions. Vehicles are routed only to checkpoints from which there has been a demand for service. These systems are described further in the section of the report dealing with the European experience.

Several studies have analyzed hybrid services within the context of the overall range of paratransit options. In a study for the U.S. DOT, Multisystems analyzed checkpoint services and found them to be potentially more cost-effective, as well as being able to provide higher quality service (i.e., reduced overall travel time) than comparable doorstep service. The study found that, because of their higher productivities, checkpoint services would typically require smaller vehicle fleets to carry given passenger loads

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* See the volume on PARATRANSIT IN EUROPE for a more in-depth discussion of these systems.

than would doorstep services, and consequently, would produce fewer vehicle miles (and vehicle hours) of service.

In another study which examined checkpoint services, John Montgomery (17) found checkpoint many-to-many systems superior to doorstep systems for demand densities in excess of 5 demands/sq. mi./hr. In lower density systems, particularly those with less than 2 passengers per square mile per hour (currently experienced by many U.S. demand-responsive systems), he found that the advantages of checkpoint service could not compensate for the walk time and the fact that wait time is at a checkpoint rather than at home. For a many-to-one system, however, he reported checkpoint service superior even at lower demand densities.

Finally, in another study for the U.S. DOT, Multisystems (3) determined that, at least in certain settings, less flexible demand-responsive services appear to have considerable potential. The results of the analysis in one hypothetical setting suggested that "one good location to demonstrate checkpoint many-to-one service would be a relatively dense (3500-5000 persons per square mile) inner suburban area with little in the way of existing transit service, and a number of dispersed activity centers." This particular analysis compared checkpoint with doorstep services in several zones and reported that a checkpoint system could be expected to produce lower costs and higher ridership than a doorstep service. In other settings (with densities on the order of 5000-6000 persons per square-mile), the study found route deviation service more cost-effective than either fixed route or dial-a-ride service.

Despite the relatively good experiences with these types of services, as well as the promising research, very few hybrid services have been implemented in this country.* One of the reasons for this could simply be a lack of sufficient dissemination of information on these services.** However, we suspect that the problem goes somewhat deeper. Hybrid services such as point

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* As of early 1981, however, several cities (including Glendale, Arizona; Minneapolis/St. Paul; and Fort Collins, Colorado) were considering implementing checkpoint service demonstrations.

** In an effort to remedy this situation, the U.S. DOT initiated a study of the potential of checkpoint service in late 1979. In addition, UMTA's Service Methods Demonstration Program - one of the major non-local catalysts for paratransit service - has been interested in sponsoring demonstrations of the checkpoint concept.

deviation and checkpoint many-to-many may be more complex to understand, implement, and use than pure demand-responsive or fixed route alternatives. It may appear easier for a locality to implement a "pure" demand-responsive service (which simply requires putting vehicles on the street and setting up a dispatch center) or a "pure" fixed route service (which simply involves establishing routes and running buses on the routes). Hybrid services, with features of both demand-responsive and fixed route service, require elements of both of these services to be understood and implemented.

While hybrid services may be more effective than fully flexible services in certain settings, fixed route services may represent the most effective option in many cases, even in low density areas. Some small communities, such as Westport, have chosen to implement combined demand-responsive/fixed route services, and many consider the entire system a form of paratransit. Such community-oriented systems differ from conventional mass transit in that they are typically initiated and developed by (and for) the community, rather than by a regional transit authority (although they may be funded in part by the transit authority). In addition, they generally utilize smaller vehicles, and the nature of the routes may be rather "flexible" (i.e., they may change by time of day, by season, or by changing demand patterns). Thus, these community systems exhibit certain characteristics generally attributed to paratransit modes, making a clearcut paratransit/transit distinction increasingly difficult (and, indeed, less important). Note, for example, that jitney services are essentially fixed route (although not fixed schedule), but are typically considered paratransit.

Organizational Options: The Role of the Private Sector

As discussed earlier, general community paratransit services have been developed, implemented, and operated within a variety of institutional frameworks. All three of these functions may be performed by the same agency or organization, or they may be carried out separately. The most common organizational options for these services are local government agencies, transit authorities, and private operators, although various "activity centers" and individual entrepreneurs have begun to enter the transportation arena as well.

Public bodies (i.e., transit operators and local government agencies) have been responsible for the introduction and operation of the bulk of paratransit

systems to-date.* However, the private sector (chiefly the taxi industry) is becoming increasingly involved - both from its own initiative, through the introduction of shared-ride service, and from the initiatives of the public sector, through service contracts. The participation of private operators has led to lower operating costs, and is therefore growing in popularity.

During the early years of its development, paratransit was viewed as another form of transit service to be operated by the public. The public sector did not even think of the taxi industry as a potential provider, since taxis were not generally viewed as a form of public transportation. Orginally, this was fine from the point of view of the taxi industry, as most taxi operators wanted to have nothing to do with the public sector. However, this situation began to change by 1973, when many taxi companies began recognizing that public paratransit could adversely impact their business. While the early response of the taxi industry was to try to stop paratransit systems from being implemented, the subsequent attitude was to try to operate paratransit services themselves. For some taxi companies, this reflected the desire to expand their market in an era of decreasing ridership; for others it merely reflected an attitude of "if you can't beat them, join them."

The public sector was somewhat reluctant to involve the taxi industry at first, but began to change this attitude when it was recognized that: 1) dial-a-ride was, in fact, nothing more than shared-ride taxi; 2) controls could be placed in contracts to ensure that pre-defined service standards were maintained; and 3) costs could be decreased via private sector operation. Hence, the majority of general community paratransit systems implemented in the U.S. over the past few years have involved the private sector. This has raised concerns on the part of the transit industry, however, as is addressed later in this chapter.

In addition to private operators, the private sector has become involved in the initiation and implementation of paratransit services through the actions of various types of "activity centers." Organizations which "create the need for travel" are important initiators of specific kinds of paratransit

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* Exclusive-ride taxi service is sometimes considered to be a form of paratransit, but is not treated as such in this study.

service, as is the case with employers (ridesharing) and social service agencies (transportation handicapped services). However, general community services have also been introduced by activity centers. The Laclede's Landing Shuttle is an example of such an activity center-sponsored project. Another type of sponsor is the shopping center. For example, for the past eight years, the developer of the Echelon Shopping Mall in Voorhees Township, New Jersey has operated a small transit service connecting the Mall with major housing concentrations in the Township. This system carries some 300 passengers daily. The Galleria Mall in Glendale, California was the site of a project operated by the Chrysler Corporation subsidiary, Vanpool Services Inc., in which vans used to transport employees were used to transport shoppers in dial-a-ride service during midday hours.* Furthermore, many developers/managers of apartment complexes (for both senior citizens and the general public) in areas not served by transit provide transportation for their clients/tenants. Examples include the Leisure World retirement community in Laguna Hills, California and the Landmark and Cherry Hill Apartment complexes in Cherry Hill, New Jersey.

Airports and schools are other organizations which may sponsor paratransit services. For example, at Boston's Logan International Airport, the Massachusetts Port Authority contracts for shuttle bus service connecting the airport terminals to a rapid transit service, and also sponsors a shared-ride taxi service, paying a substantial proportion of system control costs. In other sections of the Boston area, the University of Massachusetts and Harvard University sponsor shuttle services between the respective campuses to and from other locations.

While systems such as these are typically very small in scale, the examples mentioned here represent but the tip of the iceberg. Because the sponsors of such services are not tied in to the formal planning process, the majority of such systems are operated with no fanfare and little public awareness outside of the population served. As a result, few such systems are ever brought to the attention of transportation professionals or reported on in the literature. The point is that paratransit, even for the general

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* As of mid-1980, the vanpool element of this service was dropped, and the dial-a-ride service was expanded; service is provided (for the elderly only) anywhere within the city of Glendale or the immediate area between 8:30-4:45. The service is now funded by the City of Glendale.

community, is not initiated only within the traditional transportation environment of municipalities, transit authorities, and private operators, but can be initiated by any organization with a stake in improving transportation. (The role of the activity center is discussed in greater detail in Chapter 4.)

Urban Settings

As noted earlier, the majority of general community paratransit systems have been implemented in smaller cities under 100,000 (in most cases under 50,000) in population Systan (4) reported that 80% of all such systems they had identified had been implemented in small cities (with most of the remaining implemented in rural areas). The major reasons for this are as follows:

- Smaller cities tend to have little in the way of fixed route transit services
- There are a variety of difficulties in implementing general community paratransit in larger metropolitan areas, as is discussed below.
- Funding specifically targeted to paratransit has been made available in smaller communities.

The latter point is key, since the majority of (demand-responsive) general community paratransit systems have been implemented in the three states - Michigan, Minnesota, and California - having specific paratransit/community transit funding programs. The importance of such funding in spawning general community paratransit services cannot be over-emphasized. The Michigan DART program, for instance, has fostered the development of over 40 paratransit operations. Minnesota has a statewide paratransit demonstration program, which has also been responsible for the implementation of over 40 projects representing a broad range of paratransit service concepts. In California, where sales tax revenue can be used for paratransit operations, over 45 general community paratransit systems have been implemented. There are no specific federal funding programs for community paratransit; UMTA's Service and Methods Demonstration Program has funded over a dozen such demonstrations (and has been a major source of information dissemination), but this total is rather insignificant. In fact, until recently, with the passage of "Section 18" funding, cities under 50,000 received no federal transit operating assistance and depended solely upon state and local support.

General community paratransit systems in small cities tend to be quite similar to one another. Most are small in scope, with fewer than 10 vehicles. Most are door-to-door in nature, although some are fixed route or fixed schedule Most are geared towards the transit dependent - the elderly and handicapped in particular - even if they are available to the general public. Many such systems have been operated, under contract, by the private sector. (Most of the unsubsidized shared-ride taxi services are also probably operated in smaller cities, although there has been no attempt made to develop a comprehensive listing of where such services exist.) Finally, in most cases, general community paratransit is viewed as a "social" service, with fares kept extremely low. The majority of systems identified by Systan have fares in the range of 25¢ to 50¢, despite costs per passenger on the order of $2.00 - $3.00 (4). It is the relatively small size of these systems, combined with available state and/or federal subsidies which keep them affordable to many communities.

Relatively few general community paratransit systems have been implemented in metropolitan areas. There are a variety of reasons for this, including the following:

- Most metropolitan areas have fixed-route systems; implementing a paratransit system as an additional service represents a luxury transit authorities may be reluctant to implement. Redesigning service to include paratransit might require fixed-route "rationalization," which might not be politically expedient.

- Paratransit services provided by transit authorities face high wage rates and stringent work rules which generally make them too costly.

- Established transit authorities may resist innovative paratransit services due to organizational inertia and the potential effect on labor contract negotiations. Alternatively, labor may oppose such services if they are to be operated by other than the authority.

- It is politically difficult for transit authorities to implement paratransit in only some sections of a metropolitan area; on the other hand, large-scale implementation throughout a region may be economically infeasible.

- Past experience has not demonstrated that paratransit is truly successful as a feeder/local circulator service in metropolitan areas.

- Paratransit must "compete" with fixed route service for available UMTA Section 5 operating assistance.

However, the key factor, for whatever the reasons, has been the general ambivalence of transit authorities towards paratransit, although this may be changing. In many cases, suburban communities have been demanding improved service from regional authorities in return for the funding they contribute. Simultaneously, some transit authorities have begun to view paratransit in suburban communities as a mechanism for expanding their constituency in a more cost-effective manner than in extending transit service. Similary, some authorities have turned to paratransit as a means of meeting their obligations to serve the handicapped.

One example of this approach can be found in the Detroit area. The Southeastern Michigan Transportation Authority (SEMTA) provides paratransit service in thirteen districts, each comprised of several municipalities. These services, originally operated by contract providers, are now operated by SEMTA and form an overall network called the SEMTA Connector. Funding is made available, in part, through the State Small Bus Program (formerly DART).

In the Boston area, a "suburban demonstration" program was initiated in 1976 and ran through 1980. The Massachusetts Bay Transportation Authority (MBTA) shared the planning and cost of providing service with communities whose proposals were accepted. Intra-community systems were implemented in five communities.* These services are primarily fixed route, but include demand-responsive components; they serve both local circulation and feeder functions. Eighteen other communities applied for MBTA funding, but the funding allocated did not allow additional expenditure. Combined daily ridership on the five systems averaged 2,300 per day during 1980.

In the Chicago area, a political compromise led to the creation of a Regional Transit Authority which contracts with private carriers for intra-community service outside the city itself, where the (publicly-operated) Chicago Transit Authority provides service. Although the majority of suburban services are conventional fixed route operations, some paratransit systems have been implemented.

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* Despite the fact that these projects were considered to be rather successful (in terms of ridership and productivity), the MBTA terminated its support for the demonstration program at the end of 1980. This move was made necessary by budget cutbacks within the MBTA. Consequently, four of the towns assumed total responsibility for operating their systems, while the fifth terminated its service because of fiscal limitations imposed by a statewide tax limiting proposition.

Whether these examples of the transit authority acting to coordinate services operated by multiple operators represent the wave of the future is dependent upon a variety of factors. Uppermost in importance is funding: in an era of tightening resources, newer, lower productivity suburban services may be the first to be cut (although it is suburban areas which have seen the greatest growth in transit areas over the past few years). SEMTA has utilized a special funding program for its paratransit services; the lack of such funding has limited the program in Boston. On the other hand, in light of the current Administration's plan to reduce (and eventually eliminate) transit operating subsidies, the role of community-sponsored, privately-operated paratransit services as transit supplements could become quite important; this is addressed further in Chapter 4.

Another major issue is the attitudes of labor. In Boston, the transit union is seeking to have the suburban demonstration project operated by the authority itself, claiming that the award of contracts is in violation of its 13-C agreement. If the union prevails, it would set a precedent which could block similar programs elsewhere.

Thus, general community paratransit is a concept which has seen only limited adoption in larger cities, although there are a fair number of examples of such systems. What growth there has been in the past few years in metropolitan areas appears to be occurring in suburban locations. There has been little reported in the literature on growth of "public" paratransit in inner city areas. Jitneys remain illegal in almost all cities. There are some examples of inner-city paratransit services sponsored by activity centers or neighborhood groups (18); examples include the Laclede's Landing and Mission Hill projects noted earlier. However, very little is known about such systems, including the extent to which they exist around the country.

In summary, unlike the case of specialized market service (e.g., for the work trip and transportation handicapped), general community paratransit has not seen widespread implementation in metropolitan areas. Ambivalence of transit authorities, institutional and political constraints, and the lack of funding have all been factors which account for this. Whether there is potential and need for change in this situation is discussed in Chapter 4: FUTURE DIRECTIONS FOR GENERAL COMMUNITY PARATRANSIT.

4 Future Directions for General Community Paratransit

The previous two chapters have traced the history of general community paratransit over the past decade, presented key findings from past projects and reviewed the current status of paratransit service and organizational options. In this chapter, we explore the factors which may influence the future direction of general community paratransit, the roles it may play in the future, potential service forms and organizational options, and steps which may be needed to achieve further dissemination of the paratransit concepts.

Factors Which May Influence the Development of General Community Paratransit Services

Energy Availability and Cost

Among the factors which are most likely to have the greatest impact on travel patterns over the next few years are energy availability and cost. Issues related to the energy situation have been prominent over the past few years, and are likely to continue to be in the foreseeable future. The decontrol of domestic oil in 1981, combined with continued massive price increases by OPEC nations (and continued unrest in the Middle East), ensure that gasoline prices will continue to rise, with the increase in the next few years perhaps approaching the 100% rise experienced in 1978-1979. Such an increase seems likely despite the oil glut experienced in early 1981.

While the magnitude of the impact of gasoline price increases on automobile use is unclear, it is apparent that Americans are shifting to smaller cars, and driving somewhat less. Although there is no evidence to suggest there will be a significant decline in auto use - even if costs rise to the European levels of over $2.50/gallon - even a small shift in auto use can be significant in terms of the number of persons who use transit and paratransit modes. The longer term picture is even less clear, since increased automotive fuel economy and a growing consumer preference for smaller cars will tend to offset the impacts of fuel price increases. On the other hand, any long-term constraints on the availability of gasoline, either through rationing or the law of supply and demand, could have a more significant impact on the demand for public transit services.

The potential impact of the energy situtation on general community paratransit stems from the fact that severe energy price rises or shortages may create a demand for transit service from suburbanites currently dependent upon the automobile, yet not having access to conventional transit service. Where fiscal constraints permit, many such communities may elect to implement some form of paratransit as an alternative to extending transit service.

Reductions in Transit Subsidies

A second factor which may significantly impact the future development of general community paratransit is the reduction in (and eventual elimination of) federal transit operating subsidies proposed by the new Administration in 1981. In light of rapidly escalating operating deficits, predominantly due to spiralling fuel and labor costs*, the proposed cutback in federal aid will force most transit agencies to significantly streamline or revamp their operations. In light of the role public transportation plays in meeting various federal goals (e.g., ensuring mobility for the transportation handicapped, reducing energy consumption, and reducing air pollution), there will be a need for transit agencies and municipalities to reduce public transit expenditures while maintaining acceptable levels of service. Paratransit options - generally less expensive to operate than transit - can potentially play a role in meeting this need, both by replacing less productive transit routes and by supplementing transit during peak periods so as to reduce the inefficiencies caused by unbalanced peak to off-peak service ratios.

In both of these situations, transit authorities or municipalities might, for instance, contract with private operators to provide some form of paratransit service appropriate for local needs. The use of paratransit services enables the contracting body to reduce operating expenses - through the lower wage rates of the private sector and/or the use of part-time labor where appropriate, and through the use of smaller vehicles to meet lower demand levels. This may significantly lower overall transit operating costs, although the desired impact is by no means guaranteed; a change in service may also reduce ridership - perhaps to the point where any reduction

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* Since 1960, while consumer prices have increased by 235%, average transit wages have grown by over 400% (19) and retail gasoline prices have risen by nearly 600%.

in operating costs is offset by a greater reduction in revenue. For this reason, it is important that any replacement/supplementary service be properly designed (i.e., so as to retain and/or generate sufficient patronage).

In line with this last concern, paratransit options offer the advantage of being able to be tailored to specific demand patterns and user needs. For instance, as discussed earlier, community-based services can be operated as fixed route collectors/feeders interfacing with line haul or express transit routes during peak commuting periods; then, during the off-peak, these community services can be operated on a demand-responsive (or route/point deviation) basis so as to accommodate the needs of non-commuters (e.g., the elderly or non-workers making shopping trips). The level of service can be adjusted to meet the level of demand so as to avoid providing much more service than is necessary, as is often the case for transit during off-peak times. Furthermore, the individual communities (both suburban and central city) are more likely to take responsibility for funding such services than for contributing greater sums to the regional transit operation which may provide only minimal intra-community service. The development of a regional network of community-based services, linked by mass transit serving major corridors, would improve the efficiency of the overall system. The transit agency could continue to operate regional service and function, in effect, as a regional "broker." (The brokerage concept is discussed later in this section.)

Finally, while publicly-funded contract services will reduce overall expenditures, <u>privately-initiated and funded</u> services can also play increasingly important roles in providing alternatives/supplements to conventional mass transit. Many activity centers benefit from "public" transportation services, and are increasingly perceiving the advantages to be gained from sponsoring their own services. Similar to the case of employers instituting ridersharing programs for their employees, activity centers (e.g., shopping centers, residential developments) should see a clear advantage in ensuring convenient access to/from their facilities; where transit is cut back - or where activity centers are built in locations not served by transit - the merchants and developers may benefit from implementing their own services (the future role of the activity center is addressed later in this section).

Thus, the transit cost spiral and the planned cutback in federal operating subsidies will likely dictate a new approach to the provision of public transportation. In efforts to improve the efficiency of transit operations, paratransit options - especially those operated through the private sector - will likely see increasing application over the coming years.

Migratory and Development Patterns

Although it is difficult to predict what migratory and development patterns will occur over the coming decades, some recent trends, if continued, may have an impact on the development of general community paratransit services.

First, consider inter-regional trends. Since 1970, the dominant inter-regional settlement trend has been the so-called "sunbelt" shift, characterized by the migration of large numbers of people and businesses to the southern and western states. The most recent census data reveal that the 25 fastest growing counties in the U.S. (over the 1970-80 time period) were located in the South and the West. Various factors have combined to encourage the population shift to the South and West, including the lure of expanded economic/employment opportunities, generally lower housing costs taxes, and overall living costs, and the weather itself.

The sunbelt shift could have a significant impact on the development of public transportation service. Unlike the older and denser cities in the northeast and midwest, the "newer" cities of the sunbelt have developed in a less dense, sprawling manner, well-suited to the private automobile but not especially conducive to mass transit. Mobility within these areas is linked closely to the availability of the auto, and the need for alternative forms of transportation is increasing. The increasing price of fuel is starting to push many solo drivers to seek more economical forms of transportation. General community paratransit options may prove more viable in these communities than in older, more transit-oriented cities.

The most significant trend in terms of intra-regional settlement patterns over the past few decades has been the movement of people from high to low density areas (i.e., "suburbanization"). The longstanding suburbanization trend has, within the last decade, been joined by a shift to small towns and rural areas. Since 1970, the growth rate of non-metropolitan areas has been

considerably higher than that of metropolitan areas (except for certain metropolitan areas in the sunbelt). As of 1975, the national growth rates were 8% for non-metropolitan and 4.7% for metropolitan areas (20). A considerable amount of this growth has taken place in counties adjacent to metropolitan areas (and is thus perhaps more accurately called "exurbanization" than rural migration), but freestanding rural counties have also experienced significant gains. In fact, those counties having the lowest existing desities have seen the largest increases on a percentage basis. This clearly may have impacts on the potential for paratransit in rural areas (See RURAL PARATRANSIT volume), as well as in smaller cities.

The major impact of suburbanization on metropolitan areas over the past decade has been a continuation of "sprawl," as people and activities have moved out of the inner city to lower density suburban areas. This trend is occurring most noticeably in rapidly growing sunbelt cities such as Houston and Phoenix, where population growth reflects, in part, the annexation of surrounding communities, rather than increases in population density. This trend towards decreasing metropolitan densities appear to be continuing; however, new economic forces may be slowing down the rate of decrease. In the latter part of the 1970's, inflation led to soaring interest rates. The record prime lending rates (over 20% at the end of 1980) have reduced borrowing and have therefore considerably slowed down new housing starts. This fact, coupled with an increasingly tight mortgage market (and very high housing prices) is effectively slowing down the rate of low density suburban expansion. What is occurring instead is that suburban areas themselves are increasing in density. Much of the housing that is being built is of the attached townhouse variety, with the developers offering financing. The long term impact of these trends is impossible to predict, however. The prime rate will undoubtedly come down again (it is already below the maximum as of this writing), spurring new development, and conventional mortgage money may become more available. It is, therefore, somewhat premature to declare the major settlement patterns of the past two decades over.

Whereas the costs (i.e., travel and residential) associated with continued lower density living are taking increasingly larger chunks out of household budgets, the premium placed on such a lifestyle may prevail over economically-based inclinations to shift to more compact living and commuting arrangements. This viewpoint is well-stated by Melvin Webber (21):

> Recent inflation in gasoline and housing has generated speculation that automobiles might be replaced by mass transit and suburban houses by high-density central city apartments. There is no doubt that some persons at the margin will make these shifts. But the scale of sunk investment in present suburban buildings and public infrastructure and the high values placed on both automobility and low-density living make it implausible to expect that many will. More likely, families will modify budgets to allocate more money to transportation, so they can still commute from suburban homes while paying higher prices for gasoline. Moreover, the automobile-telephone-suburb system is by now such an integral aspect of contemporary American society that major reductions in any of the three components of that system would mean extreme disruptions in the social order. Even if we willed it so, we probably no longer have a choice other than continued reliance on autos, phones, and suburbs.

This line of reasoning suggests that relatively low density suburban living is likely to continue to dominate over high density central city living. Furthermore, one might expect that outmigration (suburbanization) will undoubtedly continue in most, if not all areas, although the rate of such movement might be slowed.

Impact of Alternative Development Scenarios on Paratransit

The continued low density dispersion of residents and densities has a number of implications for public transportation in general, and general community paratransit in particular. First of all, increased sprawl results in increasing dispersion of trip ends. Since employment and shopping centers, as well as residences, are typically decentralized, the result is relatively fewer trips with destinations in the central city. The rather random dispersion reduces the capabilities of line-haul transit to efficiently serve travel patterns, and thus creates additional opportunities for flexible paratransit services, which can better serve multiple origins and destinations.

Developing areas on the outskirts of urban areas also represent expanded opportunities for paratransit. Newly developing areas are unlikely to have been served by transit; thus it becomes easier to introduce paratransit service. (It is particularly in these areas that paratransit might serve as a "stepping stone" to conventional transit. This concept, originally hypothesized by Ward (8), suggests that the paratransit service "introduces" area residents to public transportation and builds up ridership to a point where regular fixed route service might become cost-effective and can be implemented.) The availability of paratransit in such areas would tend to support the prevailing development pattern. If paratransit can provide

flexibility similar to that of an automobile, then low density areas could continue to remain attractive, even in a situation of greatly increased fuel costs or limited fuel availability. Thus, the impact of paratransit on development patterns in this case could be a reinforcement of the trend towards sprawl.

It is, in fact, possible that real estate developers might in some way sponsor a form of paratransit service in order to make their developments more attractive. Thus far, this concept has been used in a number of retirement communities where the residents were expected to have only limited access to automobiles; an analogy can be drawn with the general public in the case of a severe energy shortfall or very high energy costs. One can also look back 70-90 years to the development of "streetcar suburbs," when developers built and operated electric railway lines in order to encourage people to move farther from the CBD (22).

The other product of (and contributor towards) the "society of sprawl" which could be severely impacted by reduced automobility is the shopping center. The number of shopping centers in this country has increased from approximately 1,000 in 1960 to over 19,000 today (23). Of these, almost 400 are large, regional centers of over 800,000 square feet of leasable area; virtually all of these are located at least 8 miles from the CBD of the nearest major city. It has been estimated that under 3% of the approximately 6.5 billion trips per year made to these large malls are made by transit (24). If transit were to increase its share of this market to just 10%, total (non-rail) transit ridership in the country would be increased by about 10%. Thus, we are dealing with an extremely large potential market.

Yet, most shopping centers are not designed to be served by transit. Despite the fact that Victor Gruen, the designer of several early shopping centers, included bus-only lanes and bus shelters in two of the earliest centers in the Detroit area, most shopping centers do not have such amenities. The pavement in many centers is not designed to support heavy buses. Often, turning radii are not sufficient for 40 foot transit coaches. Most malls have no adequate bus waiting areas or, at best, will have one in a mall with multiple entrances. Many malls will not let buses enter the property at all, requiring passengers to walk long distances through crowded,

sometimes dangerous parking lots. Finally, many shopping centers are not served at all by transit, while, in other cases, fixed route service cannot adequately serve the dispersed locations of mall users.

In some areas, paratransit service could potentially be a superior alternative to conventional transit in serving malls. Smaller vehicles solve many of the problems of maneuverability within the malls, and may prove less objectionable to mall operators. Demand-responsive services may be better suited to serving travel patterns. Indeed, in many of the early dial-a-ride demonstrations, including those in Rochester, Haddonfield, and La Habra, the shopping center was the dominant trip attractor.

In recent years, environmental concerns and community opposition have slowed the rate of shopping center development. Concerns over energy and accessibility are further impacting shopping center construction. Paratransit services could potentially address at least the accessibility issues. Thus, the availability of paratransit could be a factor which encourages new construction. Furthermore, paratransit could be a mechanism for maintaining accessibility to existing centers in the case of severe energy availability problems. To provide such mobility, it is conceivable that shopping center developers or store owners would themselves take on the responsibility for providing paratransit services, as mentioned earlier. Other activity centers in lower density areas, including medical centers, may also feel a need for improved access, and therefore implement or support paratransit service.

Thus, in areas which demonstrate continued sprawl, there may be additional opportunities for implementing paratransit service. In these cases, however, paratransit may reinforce the prevailing development trend, especially if flexible service is provided.

Although the predominant settlement trend over the past few decades has been a flow away from the central cities and toward suburban and exurban areas, a more recent trend has seen the beginnings of an increase in higher density living - both in higher density suburbs and in central cities. There is considerable disagreement over the extent to which "redensification" (and the accompanying urban "revitalization") is occurring; however, there can be no argument over the fact that there is at least renewed interest in central cities and older suburbs. As energy and economy-related problems continue to

mount, the convenience offered by central cities has begun to attract middle-income people from less dense areas, or in some cases, has influenced urban residents to stay, rather than heading for suburbia. The availability of relatively inexpensive housing (i.e., condominiums and older houses in deteriorated neighborhoods) is causing some persons to become "urban pioneers." Rehabilitation of older housing has been abetted by low-interest federal loans (such as Section 312 funds from the Department of Housing and Urban Development) in certain neighborhoods, or has been otherwise made affordable through city loans or "sweat equity." This overall process has resulted in a new word - "gentrification" - entering the vernacular.

Actually, gentrification is still relatively new and there is little data as to its extent. Researchers caution against proclaiming the immediate significance of the movement back to the cities. A working paper from the HUD Urban Policy staff (25) reports that revitalization has occurred in only a tiny fraction of any city's neighborhoods and has affected only a small proportion of their housing stock. (Since 1968, nearly 55,000 units or only 1/2 of 1 percent of the nearly 20 million units in cities have been affected by revitalization/ restoration efforts.) Furthermore, most households involved in revitalization (more than 70 percent) have not been suburbanites returning to central cities, but intra-city movers converting to owner status. Thus, based on current data, it is difficult to predict how significant the gentrification trend will be over the coming years.

Nevertheless, there is "reason for optimism" over the return to health of the ailing downtown, as well as of many central city neighborhoods. Although a great many cities still face severe fiscal problems,* there has been a recent boom in downtown investment. New office construction had come to a virtual standstill between 1973 and 1975; since then, there has been a steady increase in investment. In 1975, the contract value of new urban office buildings was $3.9 billion; this figure had climbed to $8.9 billion by 1978, and to over $10 billion during 1979.** In many cities, office expansion has

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* The HUD Urban Policy Staff reports from recent studies by the Treasury Department that "of the 48 largest cities in this country, 10 face high fiscal strain, and 28 others face moderate fiscal strain." (25)

** As reported by the F.W. Dodge Division of McGraw Hill Inc. (26)

been accompanied by a growth in various business support services, according to J. Thomas Black of the Urban Land Institute (27). Black further contends that the office construction boom provides a base on which cities can expand in residential and retail areas. Considerable retail and other non-office redevelopment has indeed occurred in a number of cities, marked by downtown malls and activity centers such as Philadelphia's Gallery, Indianapolis' Merchants Place, and Boston's Quincy Market.

Where higher density, inner-city development occurs, the role and potential of paratransit will be influenced by the need for improved access within urban neighborhoods. In this situation, paratransit can potentially augment the overall revitalization/economic development process, by improving access to local services and by providing a certain amount of local employment (i.e., through operation of the service).

Despite the fact that metropolitan transit systems are generally oriented toward the central city, they tend to focus on the CBD and major commercial centers, and operate only along major thoroughfares. The result is that, often, residential neighborhoods are served inadequately. The return to the city of a large group of persons who are willing and able to demand services could foster the development of neighborhood transportation service. Given the difficulty or high cost associated with parking and insurance in many dense inner city areas (parking charges of $60-100 per month are not uncommon in such cities as New York, Boston, and Chicago), many urban residents may be willing to do without an auto (or with only one household auto) if acceptable local transportation is available.

Alternatively, increased densities of inner city areas combined with higher automobile operating costs could lead to new arrangements for owning and operating automobiles, in which the vehicle is, in some way, shared. Vehicle-sharing may yield benefits in the following areas:

1. By making more intensive use of an automobile (and by sharing fixed costs), the cost to individuals of operating the automobile is reduced. Among other things, this permits lower-income individuals to have access to automobiles which would not otherwise be possible.

2. By eliminating the "sunk cost" represented by auto ownership (and replacing it with the true marginal cost of auto trip-making), mode choice decisions for some trips may be shifted to other modes, such as

transit. In other words, the auto is shifted from the unique status of a privately-owned vehicle to a mode more directly competitive with public transit. The result might be a greater use of transit for trips which are better served by transit.

3. By providing a choice in terms of vehicle selection, smaller, more fuel efficient automobiles may be selected for work travel, with the option of using larger vehicles for appropriate purposes (e.g., longer distance family travel or transporting bulky materials).

4. By reducing the total number of autos owned, parking requirements might by reduced.

That this type of arrangement may be feasible is evidenced by the fact that many Manhattanites do not own cars, but rather use taxis and transit for daily travel while renting cars for weekend trips. Approximately 40% of car rentals in New York City are by local residents as compared to 5% nationwide (1). The advantages of this arrangement have been summarized by Sylvia Porter (author of The Money Book): "If you live in a large city, don't commute by car and drive primarily on weekends, you'll almost surely save by renting." (28). (Possible vehicle-sharing arrangements are discussed later in this section.)

A more formal neighborhood service might involve local fixed route circulator-type service, demand-responsive service or possibly a brokerage-type operation. These can be initiated and provided through a variety of service delivery systems, involving neighborhood organizations, associations of business owners, municipal governments, private enterpreneurs/operators, human service agencies, or neighborhood cooperatives. The particular manner in which the service is operated will depend largely on how it is initiated and the particular function(s) it is intended to serve.

By insuring access to neighborhood businesses, services, and jobs, improved local transportation is potentially an important element in community development efforts. A recent research study by the National Center for Urban Ethnic Affairs (29) explored in some detail the potential role of transportation in economic development. This study found strong indications that small-scale neighborhood-based transportation services can assist local business groups and neighborhood organizations in attempts to "... counter-balance the outward pull of the private auto and suburban mall, and to stabilize the demand for services of the city neighborhood within the local

community and the CBD." If better access improves the market for local stores and thus increases their viability, it may serve as an inducement for additional investment in the community.

Furthermore, a neighborhood transportation service may, in itself, create jobs, although the number of such jobs is likely to be fairly limited. Local residents could be employed in managing and operating the transportation service. Such employment may even serve as the bottom rung of an "upward mobility ladder:" ll drivers, mechanics, dispatchers, and administrators may be able to develop expertise while working in the small scale neighborhood system which will, perhaps, enable them to move on to larger (e.g., conventional transit) systems, or to expand their roles within the local one. This is a role served by jitney services in many developing nations.

An intra-neighborhood service can also serve an important function in offering safe travel during the evening hours, when it might be unsafe to walk within many neighborhoods. Finally, by linking with transit stops/stations, the neighborhood service can insure areawide mobility for residents, and therefore reduce or even eliminate the need for a car for travel within the urban area.

Boston's Mission Link (initiated by the Mission Hill Planning Commission) is a privately-funded neighborhood circulator service. The service is provided by a private bus operator.

(photo: D. Fleishman)

Thus, in those urban areas which experience redensification and revitalization of the central city (and older suburbs), paratransit services may see significant growth in future years, as there is greater demand (and therefore expanded opportunities) for local access. Such services may play a role in encouraging continuing revitalization by helping to promote local economic development.

Still another possible model for future urban growth is the "satellite city" concept in which development occurs in a fairly compact manner in isolated clusters throughout the metropolitan region. This model implies a strong central city as well, since the satellite communities would likely be dependent to some extent on functions/services offered by a larger city. The satellites would be largely independent and self-contained, but would be linked to one another and to the central city by rapid transit (i.e., rail lines or busways) and freeways.

Although this growth scenario is occurring to some extent in the U.S., it is more prevalent in Europe - most notably in the new town/satellite community structures found in Finland (e.g., around Helsinki) and Sweden (e.g., around Stockholm). The Garden City concept - originally proposed for guiding London's future growth at the end of the nineteenth century (30) - represents the basic model for this development pattern: a series of self-contained communities surrounding a central city, buffered by strips of open space.

A number of "new towns" and "greenbelt communities" have been initiated in the U.S. roughly following this model,* but these have not proven successful enough (financially) to warrant widespread duplication; in fact, HUD has decided not to fund any more such projects. Two relatively successful new towns (from the point of view of attracting residents), are Reston, VA outside Washington, D.C.) and Columbia, MD (outside Baltimore), both of which were privately developed. However, both are essentially bedroom communities and have not developed into self-contained towns, as originally planned.

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* The American "new towns" include nine communities developed largely with private funding, and nine developed with federal funding (HUD, under the Urban Growth and New Community Development Act of 1970). In addition, there are five federally-sponsored "greenbelt towns." For an in-depth look at the new communities, see Shirley Weiss et al.(31)

What is probably more likely to occur in the future is smaller scale satellite "communities" forming around major activity center clusters. Examples of the beginning of this type of development include research parks such as North Carolina's Research Triangle Park, an aggregation of government and private research institutions located in the middle of the "triangle" formed by Raleigh, Durham, and Chapel Hill; clusters of suburban shopping centers as in Natick/Framingham, Massachusetts, with three large adjoining centers; and high density clustering of residential and commercial structures around rail transit stations, as seen in Toronto. The development of full-fledged communities around such activity centers will depend on a variety of factors, including the energy and economic trends discussed earlier, governmental actions and policies, and obviously, the decisions/actions of developers.

The role and potential of paratransit within this scenario will primarily reflect the need/demand for feeder service to the inter-community line haul routes, as well as the need for intra-community service. The formation of compact satellites could result from a serious scarcity of fuel; under these conditions, the demand for means of transportation other than the private auto should increase substantially over current levels. Opportunities for paratransit and community-based transit should thus increase accordingly.

The Reston Commuter Bus experience indicates the type of service that can be developed in a new community.* Since Reston is not a self-contained community, the emphasis has been on line haul service to the Washington CBD, although the line haul buses have provided their own feeder service. By providing access within a limited service area, an intra-community system may encourage development and growth within that area, thereby promoting the formation of self-contained satellites. The development of satellite communities will obviously be an incremental process, with transportation needs changing as the size and density of the town increase. As a flexible, easily modified set of services, paratransit can adapt to the changing

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* See the COMMUTER RIDESHARING volume for a description of the Reston service.

environment. Good local transportation should play a role in simultaneously attracting new residents and businesses.*

The local transportation system might be initiated through the private sector (i.e., by developers or associations of business owners/employers), by the local government, or perhaps by a regional transit authority. In the first case, the service could conceivably be taken over (all or in part) by the local government once it reached a certain ridership level and merited expansion.

It has been proposed in some circles that developers be required to implement "public" transportation in all new subdivisions or commercial developments, i.e., that transportation should be treated as a "utility."** One point to this is that public transportation services could be more efficiently provided if residential neighborhoods were designed with these services in mind, rather than attempting to "retrofit" them in areas designed solely for automobile access (e.g., with extensive cul-de-sacs, thereby hampering vehicular circulation).

In addition to defining the boundary of a satellite community, a paratransit service might be able to facilitate a more uniform density gradient within the community. This would result from an improvement in access throughout the area, thereby neutralizing, to a certain extent, the otherwise significant accessibility advantage offered by locating in the immediate proximity of a rail transit station or other line haul service. However, such an impact could be muted by zoning regulations (e.g.,

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* This has been demonstrated in Reston, for instance, where a survey of Commuter Bus riders revealed that the presence of the service was a major factor in influencing people's decisions to locate there (32). More than 43% of those completing the survey indicated that they would not have decided to move to Reston if the RCB had not been available; in addition, more than 48% of the respondents indicated that, although the RCB was not the deciding factor, it was very important in their decision to live in Reston. Furthermore, the RCB was used as a selling point by realtors: over 27% of the survey respondents learned about the bus service through realtors.

** For a more complete discussion of this concept, see Bob Komives (33). This idea was considered in Fort Collins, Colorado, but was ultimately rejected by the City Council.

restricting commercial uses to certain locations) and/or relative land values. The impact attributable to paratransit would be difficult to measure, in any case; nonetheless, in an energy-scarce situation, paratransit could centainly be a contributing factor.

In all likelihood, each of these development patterns will be reflected, to some extent, in all urban areas. Thus, if the arguments put forth here are correct, there may be an increased role for paratransit in all types of urban settings over the coming decades.

Technological Advances

Another factor which may affect the future directions of paratransit is technological advances. Such advances can be considered to fall under one of three basic categories: 1) non-paratransit-related transporttation; 2) non-transportation-related (e.g., telecommunications); and 3) paratransit-related (e.g., vehicles, dispatching/monitoring systems). These are discussed briefly below.

General transportation-related developments will have a mixed impact onb paratransit. The continued improvement in the fuel-efficiency of automobiles will tend to somewhat diminish the demand for public transportation in general, due to the resulting reduction in auto-operating costs. Meanwhile, the development of non-petroleum based fuels (and appropriate vehicles) would ultimately ease the push for energy conservation and would essentially enable the retention (or resumption) of the current dependency on the private auto. However, the introduction of such fuels may not be feasible for a very long time; by the time they are developed, th "transit habit" may be more ingrained in our travel behavior and the single-occupant auto may have lost its current lofty status. Thus, the development of new fuels may not affect paratransit within the forseeable future.

The impacts of major technology advances on transportation in other areas, such as telecommunications, may similarly be relatively minor in the near term. Although telecommunications innovations have abetted the shift of businesses to low density areas by improving the speed and ease of longer distance interaction, there is no real evidence that such innovations have

directly affected travel patterns. However, future developments (e.g., videophones) may reduce the need for travel, if they enable people to work at home for instance.

Finally, advancements in paratransit-related technology may have certain impacts on the future potential of paratransit. Improvements in vehicle design and dispatching/monitoring/communication systems may contribute to higher levels of service and productivity.

The broad spectrum of paratransit services employs three basic categories of vehicle types: sedans, vans/van conversions and small buses/converted motor homes. There are a plethora of manurfacturers of each, and each manufacturer offers several options. Whereas certain vehicles have established reliable reputations, other makes (especially in the small bus field) have been plagued by poor performance records. The problems in some cases stems from the fact that vehicles are used which are not designed specifically for public transportation (e.g., heavy stop-and-go driving). Improvements in durability would reduce maintenance costs and improve overall service performance by reducing "down-time."

Improvements in two other areas might also upgrade the attractiveness of paratransit service; energy efficiency and suitability for accomodating wheelchair-bound passengers. The former is obviously an aim shared by all vehicle manufacturers (since it is mandated by Congress); it is being accomplished primarily through use of ligher materials and redesign of engines (e.g., to use diesel or non-petroleum-based fuels). The latter represents a problem faced by all vehicles which may carry handicapped riders: existing sedans are simply not designed to permit wheelchair access, while larger vehicles have experienced problems with wheelchair lifts and rough rides. Further research and development should be focussed on minimizing these shortcomings.

UMTA has, thus far, undertaken two projects aimed at improving vehicles used in paratransit applications. The first of these projects (1975-76) produced two prototype sedan-type "paratransit vehciles." These vehicles - built by AMF, Inc. and Steam Power Systems - were designed for easy wheelchair access and were powered by Rankine steam engines. (The specifications were

developed by the N.Y. Taxi and Limousine Commission for the Museum of Modern Art's Taxi Project.) Both engines were later replaced with conventional gasoline engines and submitted for testing; evaluations resulted in the conclusion that the vehicles were far too expensive to produce for general use, and that a new vehicle should be designed based on a voncntional engine. UMTA currently has three companies (Minicars, McFarland Design, and South Coast Technology) under contract to design and build new prototypes. These vehicles will be essentially modified autos, carrying 4-6 passengers, which will be wheelchair accessible and will have low, flat floors.

The areas of most significant technology advancement in the delivery of paratransit services have been in the automation (computerization of dispatching, monitoring and communications functions. The impacts of such advancements have been addressed in a number of studies. One such study (Multisystems, 1979) analyzed the potential benefits and costs of such technologies. Potential benefits of digital (rather than voice) communications are reduced fleet size or hours of service, reduced frequency requirements, and reduced control room staffing requirements. Potential benefits of automated dispatching are reduced vehicle fleet size, reduced control room staffing requirements and improved reporting capability. Fully computerized systems have been implemented in Haddonfield (N.J.) and Rochester. In both cases, automation reduced passenger wait time and the variability wait and ride time. The Multisystems study found that both of these technologies could be cost-beneficial to demand-responsive services. Thus, future technological advances may make some forms of paratransit more cost-effective.

Another area of technological development is Automated Vehicle Monitoring (AVM). This system, which a vehicle's locational information is provided on a continuous basis, is presently receiving a thorough testing by UMTA, although in fixed route applications. Preliminary consideration suggests that an increase in productivity of up to 5% may be achievable in a many-to-many demand-responsive system, but further experimentation/analysis must be undertaken before this benefit can be cerified. Such a system is, of course, extremely expensive; thus, the future potential for use in paratransit services (unless possibly combined with other users such as police departments) may be quite limited).

Evolving Organizational and Service Options

One contribution of paratransit to the understanding of public transportation in general is a broadened perspective on options for the development and delivery of service. Unlike conventional transit, which is traditionally initiated and provided by a single actor - the transit authority - paratransit options can be developed and operated by a variety of actors, within a wide spectrum of institutional arrangements. In addition to the traditional service initiators - "third party" organizations (e.g., transit authorities and private operators) - transportation services can be developed by individuals and a range of organizations, including activity centers. In other words, transportation initiatives can come from travelers and organizations that create the need for travel; in the latter case the provision of transportation is an auxiliary rather than a primary function.

Furthermore, there may be more than one actor involved with a single paratransit service or set of services. Planning and initiation, service provision, and service coordination can all be the responsibility of different organizations. This subsection discusses the nature of possible future organization frameworks as well as several new service concepts which may be developed through these arrangements.

The Third Party

We begin our discussion with the traditional type of transit provider: the third party. This term is used since the provider directly represents neither the users of the service nor the activity which generates the demand for transportation.

Transit Authorities

As discussed in the previous sections of this chapter, general community paratransit was initially viewed as another form of service to be operated by the transit authority. However, the experience of the past decade suggests that, perhaps with the exception of smaller cities, transit authorities may be unwilling or unable to introduce general community paratransit services and moreover, may not be an appropriate provider of such services. Nevertheless, transit authorities have played a role in the initiation or funding of general community paratransit as well as in the direct provision of service. One of

the key evolving functions of the transit authority over the coming years is likely to be a role in facilitating coordination of a number of different community services within the overall transit service area. At least in major metropolitan areas, the future role of the transit authority is likely to be important.

This stems from the fact that, inasmuch as transit authorities operate and or regulate virtually all transit services in most larger cities, their attitudes towards paratransit will strongly influence the dispersion of the concept. If transit authorities remain hostile to paratransit, it is unlikely that general community paratransit will see much wider-spread implementation. On the other hand, if they accept the concept but insist on directly operating the service, it is likely that we will see more high cost failures.

There is evidence to suggest, however, that the trend will follow neither of these courses. Economic realities are having two effects: 1) transit authorities are seeking to expand their constituencies by either sponsoring new forms of service (e.g., ridesharing) or providing improved service to outlying areas; and 2) in many communities, service expansion is a thing of the past, and service cutbacks are the rule. In either case, spurred by the current Administration's tight fiscal policies, there may be new found willingness to contract with lower cost private operators in suburban areas (assuming labor problems can be worked out). Such developments should signify reduced transit authority ambivalence toward more innovative forms of service, greater local control over service in outer areas, and greater use of private operators. To the extent that more flexible forms of paratransit service make sense in certain areas, there may be greater implementation of such services.

Although there is evidence of a trend toward contracting out certain services - the Orange County, Chicago, and Boston experiences cited earlier are examples - it is too early to signal significantly greater flexibility on the part of many transit authorities with regards to paratransit and the use of private contractors. Nevertheless, the fact that such trends are appearing should be encouraging to those who favor an improved atmosphere for growth of paratransit service.

In situations such as those in Orange County and the Chicago area, the transit authority essentially serves as a type of "broker" of transportation

activities.* The authorities coordinate the initiation and operation of various contracted paratransit (and intra-community fixed route) services in suburban communities. The transit suthority provides funding (for initiation and portions of operating expenses) and technical assistance, and oversees the operation of the individual services. (As an extension of brokerage activities, an authority might also attempt to coordinate transportation services with local economic development plans; this has been a major goal of a comprehensive transportation improvement program being undertaken in Bridgeport, Connecticut by the Greater Bridegport Transit District.) As operating costs increase and federal transit funds are cut back over the coming years, the brokerage-type of arrangement may see growing application as transit authorities seek ways to reduce their expenses (e.g., by using lower cost operators and shifting operating responsibilities for some service to local governments).** Alternatively, the role of the transit authority regarding paratransit might be further diminished, with the functions of contracting and perhaps even funding local service left directly with local governments and other organizations interested in transportation.

Taxicab Companies

As described in Chapter 2, a trend over the past few years has been for general community paratransit services to be operated by the taxicab industry. Taxi companies offer a number of advantages over transit properties with regard to paratransit. First of all, their labor costs are generally considerably lower. Second, they do not have rigid labor work rules typically found in the transit industry, which make it difficult to implement new services. Third, they are geared to the provision of flexible, demand-responsive services and thus have less need for reorientation and re-education. Taxi operators have responded to the new opportunities and many

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* The brokerage concept has also been applied to other forms of paratransit (i.e., ridesharing and service for the transportation handicapped), and is discussed within those contexts in the other volumes of this study. On the simplest level, a transportation broker can be defined as one who matches travel demends with the most appropriate supplier. The exact role is rather more complex, but the intent is to make the most efficient use of existing resources while best serving transportation needs.

** The Northeast Illinois Regional Transit Authority (RTA), for instance, contracts with individual local governments, who then develop their own local services; as of the end of 1980, there were over 30 different intra-community services operating under the RTA's jurisdiction.

have begun to become more complete "paratransit companies," offering contract services, transportation handicapped services, package delivery services, limousine services, and other services to complement the traditional exclusive-ride taxi business.

Of course, there may be difficulties associated with taxi company paratransit operation as well. While taxi companies do have a demand-responsive orientation, it usually relates to exclusive-ride taxi operation. There have been difficulties, in some cases, associated with taxi companies adapting to the provision of shared-ride service, which is the key to paratransit operation. Furthermore, while taxi wage rates are relatively low right now, there are concerns that contracts to provide subsidized service may exert an upwards pressure on wages, which may eventually diminish any cost advantage. Finally, the typical goal of a taxi operator - profit maximization - may not be consistent with the public sector goals of maximizing service quality and reliability. Nevertheless, with the proper understanding and control, taxi companies may very well be the most appropriate paratransit provider.

In general, taxi companies have not been the initiators of paratransit service. That responsibility typically rests with a local government organization (or with a transit authority), which then contracts with the operator, subsidizing the service in some way (e.g., on a cost per passenger

Share-a-Cab provides shared-ride service from Boston's Logan airport to designated communities at fares equivalent to 50% of the regular taxi fares. (photo: D. Fleishman)

or hour basis). As suggested in the previous subsection, this form of operation is likely to grow in popularity over the next decade. In particular, in larger metropolitan areas which have seen less in the way of paratransit service, taxis could see greater use as feeder vehicles, as transit authorities cut back in outlying service and benefit from the Peterborough and Tidewater-type experiences.

Of course, taxi companies have also initiated general community paratransit service on their own (e.g., Madison's Badger Cab). Over the past few years, many operators within the taxi industry have cited shared-ride as the wave of the future - necessary because of the rapidly rising costs of taxi operations. Numerous communities throughout the country have relaxed prohibitions on shared-riding which had been in effect for years. (Indeed, the regulations which offer taxi operators a rebate on federal gasoline excise tax - placed in effect in 1979 - allow the rebate only in areas where shared-riding is permitted). Nevertheless, the taxi industry has been slow to introduce large scale shared-ride taxi systems.* There may be a variety of explanations for this. First, the taxi industry remains basically conservative, despite the changes in relation to working with the public sector demonstrated over the past decade. Second, despite the taxi industry's claim that it has always had the dispatch capability, shared-ride dispatching is much harder than exclusive-ride dispatching. Many so-called shared-ride systems (e.g, Hicksville, N Y.) operate shared-ride for "one-to-many" and "many-to-one" trips only. Third, some taxi companies may try to "have their cake and eat it too," offering shared-ride service but not cutting fares sufficiently to make it attractive to the public.** Fourth, most taxi

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* For example, since Seattle legalized shared-ride taxi service in 1979, one operator has expressed interest in shared-ride service, but has not, as of this writing, operated such service. In Portland, which also legalized shared-riding in 1979, one company has advertised shared-ride service, but, as of this writing, has not provided it.

** A proposed Boston (to operate in the Roxbury section of Boston) Shared-Ride Taxi/Jitney Demonstration--never implemented--represents a good example of the taxi industry attempting to protect itself from any potential loss to such an extent that little potential benefit is offered the public. As part of the rules governing the demonstration fare structure, the taxi industry insisted that each driver have the option of charging the regular exclusive ride fare if there is only one prospective passenger at a shared-ride stop. This means that if most drivers exercise this option, there is no incentive for a single prospective passenger to wait at a stop - he/she may just as well call for a cab and get door-to-door service, rather than taking a chance on going to a designated stop only to end up paying premium fare anyway.

companies do not have the marketing ability or resources to really promote such a new service. Finally, many taxi companies have opted for the safer course of contracting with a public agency to provide some form of paratransit service, rather than accepting the risk of starting such a service on their own.

Whether future taxi operating cost increases will be sufficient to overcome these barriers is unclear. In all likelihood, there will be some further growth in fully private shared-ride taxi service, without any government action other than further relaxation of restrictions. Any larger scale expansion will likely depend on further government initiatives, such as technical assistance in planning and marketing, as well as decisions to allow government-sponsored services to be offered at "market" rates rather than through a significant subsidy. Nevertheless, it is clear that the taxi industry will likely play a greater role in the overall provision of public transportation services.

Private Bus Operators

There are also potential opportunities for private bus operators in the provision of paratransit service. Private bus operations (many of which receive some form of subsidy for providing regular route service) still exist in many areas. Some of these operators have been entering the paratransit market as an extension of their contract work. For example, a local school bus company was recently selected by the Northeast Illinois RTA (through a competitive bid process) to provide paratransit service in Schaumburg, a Chicago suburb.* The role of such operations, which are typically less expensive than publicly operated systems, can only increase as communities and transit authorities seek ways to keep costs down.

Car Rental Companies

Another supplier of transportation which could potentially be involved in the provision of general community paratransit is the car rental company. These companies have not been traditionally thought of as public

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* It should be noted that school bus operators represent a major component of the national transportation system; according to the National School Transportation Association, there are approximately 10,000 private school bus operators, utilizing 156,000 buses, in this country.

transportation providers.* However, companies such as Hertz have recently entered the paratransit marketplace through vanpooling (see the volume on COMMUTER RIDESHARING). Car rental companies might also be potential providers of general community service, if they see potential for a profitable undertaking.

The car rental industry in the United States has seen tremendous growth in recent years. Recent figures indicate that, in 1979, $2 billion of vehicle rental and leasing business was conducted, and projections for 1985 approach $5 billion (34). The market has been expanding 10-20% each year, and has increased in revenue by 600% over the past ten years.

The form of paratransit most logically operated by car rental companies is a concept known as "short-term auto rental" (STAR). This system, alternatively called "multi-user vehicle system" or "public automobile system," is a form of public use of the auto noted earlier. It differs from traditional car rental in that vehicles are provided for very short trips and very short time periods. In addition, the service entails faster check-out/check-in procedures. In some (proposed and actual) applications, the vehicles are also constrained to rather small service areas. Because of these characteristics, and the fact that it is targeted toward the general community rather than persons at major activity centers such as airports, STAR requires a much more extensive network of rental/check-in terminals than does conventional car rental.** In early studies (35,36), the STAR concept was tied to small, non-gasoline-powered vehicles, but Kirby (1) later pointed out that STAR could be initiated using a conventional vehicle fleet. Car rental companies offer an existing infrastructure through which this arrangement could be provided; they already have a network of terminals, which could be used as a base for short-term rentals, and they possess the management/financial structures necessary to run such an operation. Furthermore, the changing nature of the car rental industry (e.g., entering vanpooling and establishing working relationships with retail outlets and auto dealers)

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* The Urban Institute study did, however, consider car rental a form of paratransit. In this study, we have adopted a somewhat more restricted definition of paratransit, and do not view traditional automobile rental as a paratransit mode.

** The STAR concept and examples are discussed in greater detail in the section on NEW SERVICE OPTIONS: PUBLIC USE OF THE AUTO.

suggests that at least some companies may have interest in introducing new options. (The modifications to the current rental infrastructure necessary for STAR arrangements are discussed under NEW SERVICE OPTIONS.)

Thus, there may be potential for variations on present car rental averagements in certain types of settings in the U.S. Changing development patterns, including the "back to the city" movement, coupled with spiralling auto operating costs and potentially reduced transit service may produce new directions for the car rental industry within the next couple of decades.

The Activity Center

As indicated in Chapter 3., initiatives for transportation provision are increasingly coming from activity centers, for whom transportation is an ancillary function. In light of current trends which are affecting travel and locational/development decisions, it may become increasingly necessary for activity centers to assume increasing degrees of responsibility for insuring access to their own activities.

The concept of transportation services being initiated and provided by activity centers makes sense when one considers the advantages of such an approach. Activity centers will develop service for a variety of reasons, depending on the nature of the activity involved, the availability of existing transportation options, and the pressures exerted by trends such as limited energy availability. However, the general rationale will be to facilitate use by current and potential patrons. As discussed earlier, for instance, a shopping center may be able to increase (or at least maintain) business by providing non-auto access; this may be especially important during periods of limited energy availability and high fuel prices. Housing developers have sponsored transportation services in cases where little public transit service was available. The Laclede's Landing service was a case in which businesses grouped together to sponsor transportation which they viewed would be helpful to their business.

These types of services benefit those persons traveling to or from the activity center by offering an alternative mode to the auto, and opportunities are extended to those without access to an auto; those wishing to cut down on auto use will not have to reduce travel to the particular activity center. The local community and, possibly, the regional transit authority may benefit from the private provision of transportation service in that such a service

may obviate the need for public provision of certain services. For example, if a developer implements a service, a municipality or transit authority can avoid extending transit into that developer's new subdivision.

Furthermore, the activity center approach offers certain advantages over the development of more conventional transportation modes. Service can be tailored more directly to particular user needs, since a single destination (or in some cases, origin and trip purpose) is generally involved and the temporal nature of demand can actually be influenced by the supply. An activity center service may also offer unique opportunities for temporal as well as market integration, as shown in the original Glendale Galleria Mall operation, with its peak hour vanpooling/off peak dial-a-ride service.

Thus, activity center-developed services can fill certain well-defined travel needs which may not be adequately met by public transportation. Such services will be initiated where the center management perceives direct benefits (e.g., shopping areas' increasing/expanding "business," reducing parking space needed, or even improving public relations). However, the benefits or needs must be sufficiently substantial to spur interest in providing transportation; among profit-making centers, the number of transportation services introduced thus far has been quite small. Activity centers are obviously not plugged into the traditional transportation planning process, and therefore may never even think of initiating such an operation. In addition, service development may be hampered by a lack of expertise and/or experience in planning and operating transportation services. Finally, the implementation of such services may be constrained by the legal/ regulatory environment; this will depend on the location, the nature of the service, and the existing transportation operations. Such technical and regulatory barriers need not be severe. The greatest constraint will likely be the first mentioned above - simply, a lack of motivation or initiative to provide transportation.

A significant increase in the introduction of activity center services may hinge on these basic factors: 1) worsening of the energy situation (i.e., more limited availability and very high fuel prices); 2) the introduction of governmental actions restricting energy availability (e.g., rationing); 3) significant cutbacks in transit service caused by federal subsidy reductions; and 4) the introduction of governmental controls/restrictions on development.

The last factor could take the form of requiring new developments (e.g., shopping malls, subdivisions, etc.) to provide some form of "public" transportation, as suggested earlier. An alternative strategy which would, hopefully, have similar impact, would be to restrict the amount of parking in new developments. These types of strategies could be mandated for energy conservation and environmental reasons, although they could simply result in discouraging new development. As yet, the impact of such actions can only be speculated; there is no evidence of such requirements in this country. Growth management concerns may eventually produce this type of action; however, over the shorter term, market forces (e.g., reductions in discretionary travel due to energy and economic doldrums) are likely to provide the greatest motivation to developers and activity center managements to initiate transportation services.

The Individual

Individuals can be potential providers of paratransit, acting on their own (i.e., as entrepreneurs), or in a cooperative venture. Carpoolers might be cited as examples of individuals organizing paratransit services oriented to the work trip; in this section we explore possible parallels within the general community sector.

Jitneys

The oldest form of paratransit - the jitney - is probably the best example of the role the individual might play in the provision of paratransit. As discussed in Chapter 2., few legal jitneys currently operate in the United States, although the jitney is one of the dominant modes of public transportation in many third world countries. However, the fact that illegal jitney operations thrive in a number of inner city areas, including neighborhoods in Chicago, Pittsburgh, and Newark,* point to the fact that jitneys can still serve certain travel needs in inner city areas in the U.S.

Jitneys depend on high levels of demand (the demand density for Atlantic City is approximately 350 per square mile per hour; for Chicago, it is over 400), and ideally need closely spaced trip generators. Evenly spaced short trips are desirable, as revenue is dependent largely on the rate of passenger

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* see Heramb *et al.* (11)

turnover. Densely developed and populated corridors are therefore necessary for successful operation; the population density along Pacific Ave. in Atlantic City is nearly 13,000 persons per square mile, while San Francisco's Mission St. has a density of 6,300. There are relatively few corridors in the U.S. with similiar densities; most such existing corriders constitute the primary transit routes in a city. Thus, there may be limited potential for jitneys, even if they are legalized on a widespread basis.* (In most Third World countries, jitneys may compete with a few bus routes, but typically operate over different, historically-based corridors.) However, there are undoubtedly unserved corridors of the necessary density, as evidenced by the illegal operations. Furthermore, a significant return to the city movement could create additional corridors which could support jitney operation.

The rising costs of vehicle operation could be both advantageous and disadvantageous to jitneys. As the costs of fuel, maintenance, and vehicles escalate, the jitney operator must correspondingly raise the fare in order to cover costs. Earnings of jitney drivers in Third World countries - often high relative to local wage rates - would not be acceptable in the U.S. It is conceivable that rising fares would further limit the number of corridors in which jitneys would be economically feasible.

On the other hand, rising costs are also hurting transit operators, and are likely to result in service cutbacks. It is conceivable that jitney service could be allowed along certain key transit corridors as a means of reducing peak transit vehicle requirements, thereby helping to reduce the cost of providing transit service while maintaining passenger service levels.** It is clear that there are significant institutional barriers to such developments, in the form of both transit management and labor objections, but economic realities may overcome such institutional problems. At a miminum, jitneys could potentially play this type of role in the event of a serious energy shortfall (assuming jitney operators would be allocated sufficient fuel). The demand under such circumstances may be sufficient to support unsubsidized operation, although, conceivably, jitneys could be subsidized,

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* Over the past couple of years, jitneys have been legalized in San Diego, Indianapolis, and Dade County, Florida.

** Strong arguments for this type of approach are presented by Richard Oram (37).

perhaps in the form of reduced prices for gasoline provided by the public sector. The use of jitneys in an emergency was demonstrated in Chicago during a December 1979 transit strike, where taxis were authorized to operate along some city bus routes. In a longer term emergency, the legalization of jitney service could be extended to other than licensed taxicab operators.

Under any circumstances in which jitneys are legalized, there may be difficulties in encouraging the number of entrepreneurs neccessary to ensure a high frequency service. This may be a particular problem in poor inner city areas, where potential operators may have difficulty aquiring vehicles and insurance. Ironically, it is precisely in such areas that jitneys serve an important function in creating jobs. One possible approach to overcoming this problem is currently being demonstrated by the World Bank in Nairobi, Kenya. The Bank is providing low interest loans to jitney, or ("matatu") drivers to allow them to purchase vehicles which meet certain specifications. This has the dual result of improving the quality of the overall public transportation vehicle fleet while simultaneously expanding the number of operators. A similar approach could conceivably be followed in this country by some government agencies, or perhaps even inner city banks.

Transportation Cooperatives

Another organizational structure in which the individual plays the key role is the cooperative, a concept which has become increasingly important in the production and/or delivery of goods and services of all types. Cooperatives involve the grouping together of individuals in a joint venture, typically aimed at reducing the cost or increasing the quality/responsiveness of some good or service. (Note that the majority of jitney services and many taxi operations in the world involve some form of cooperative or association to which owners/drivers belong.)

Transportation cooperatives have been implemented predominantly in rural areas to date (two exceptions are the Columbia (MD) Commuter Bus and the Reston Commuter Bus - see the COMMUTER RIDESHARING volume). In most of these cases the cooperative was seen as a useful structure for organizational purposes, rather than a true cooperative venture. Similarly, the major short-term rental programs in Europe were organized as cooperatives, although they were not initiated by neighborhood residents grouping together. The

Laclede's Landing/Hotel Shuttle described earlier represents an example of an urban cooperative (serving an entertainment district), but again this was not initiated by neighborhood residents. However, there may be potential for such neighborhood-based cooperative services.*

The primary potential for a cooperative arrangement in the urban environment probably lies in inner city neighborhoods. A neighborhood-based transportation service can potentially improve local and regional access for residents, improve local safety, help promote economic development, and provide a certain amount of local employment. A cooperative might be an appropriate structure for serving these functions, while simultaneously promoting community pride.

Cooperative arrangements might also hold some promise in suburban neighborhoods, although the demand/need may be greater within the central city, due to lower auto ownership rates, denser development, and greater problems with safety. There also may exist greater degrees of neighborhood "cohesion" and "cooperative spirit" in older, denser areas, better facilitating the formation of cooperatives. In any event, there may be greater opportunities for cooperatives in the future, as increasing numbers of people seek alternatives to the auto, and the costs of providing public transportation service rise steadily.

The cooperative approach has long been applied to a number of activities, including food purchasing and housing arrangements. Cooperatives may function either through: (1) a purchase of professional services; (2) provision of the service by the membership using entirely in-kind services; or (3) some combination of purchased and in-kind services, with professional management directing in-kind labor.

Cooperative management offers certain advantages over other forms of provision of transportation services. Services can be provided at lower costs than are possible through other options (i.e., contracting for service with an existing operator), through the utilization of "marginal" labor and/or equipment. In other words, retired persons or homemakers with extra time can serve as drivers or call-takers. Similarly, underutilized vehicles (e.g.,

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* The neighborhood transportation cooperative concept is assessed in greater depth in a separate report (38) prepared as part of this study.

second cars, social service vehicles, etc.) can be pooled or deployed to provide local service. Furthermore, by being planned and implemented (and possibly operated) at the neighborhood level, a service can be quite responsive to changes in the service environment and variations in local demand. Formation of a cooperative might therefore be an appropriate solution to the intra-neighborhood transportation needs of a central city neighborhood having a low auto ownership level (and/or limited parking space) and inadequate service by other modes of transportation.*

Neighborhood cooperatives may begin to develop as interest in central city neighborhoods continues to grow, persons with various technical/management skills move to these areas and cooperative activity in other areas (e.g., housing, energy provision) increases. However, the lack of seed funding and technical support are likely to hamper the initiation of transportation cooperatives, even where a local need is fully recognized. Federal demonstrations are thus important in testing the concept and providing "models" for neighborhoods to employ in developing their own services. Seed funds will help to get projects off the ground (i.e., through professional planning assistance and, perhaps, purchase of vehicles); these could come from combinations of federal and private sources. Day to day operations on the other hand, would have to be covered through private contributions, membership fees, and volunteer efforts.

There are a number of forms which a neighborhood cooperative might take. At one level, it might involve the initiation of a formal service, either fixed route or demand-responsive in nature, operated either by a contractor or by the members themselves (or some combination thereof). On a simpler level, involving almost nothing in the way of capital expenditure, a cooperative might simply provide a formalized "friends and neighbors" type carpooling program (for trips other than just the work trip). This type of system is akin to the "volunteer driver systems" which exist in rural areas, and are discussed in the volume on RURAL PARATRANSIT. A central coordinator, or broker, would attempt to match persons needing rides, through both a "sign-up"

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* As suggested earlier, other types of neighborhood services may also see growing interest. Services such as Boston's Mission Link (initiated by the Mission Hill Planning Commission) may see more widespread implementation if the future brings the expected transit cutbacks. Of course, lack of funding will also hamper the development of such services.

board (such as is used in many colleges) and through telephone calls. The broker function could probably be easily funded by membership dues; a more complicating factor may be need to, in some way, reimburse drivers (and charge passengers) for trips.

One particular form of cooperative is one in which members share the ownership of a common set of automobiles. Sharing of automobiles can potentially extend beyond the family unit to neighbors, friends, relatives and even fellow tenants or owners within residential complexes. This type of system reduces the fixed costs of auto ownership, thereby reducing dependence on the auto and the importance of the sunk cost in mode-choice decisions. Sharing automobiles could also make current auto-less persons more mobile, and reduce auto storage capacity requirements. (The auto-sharing cooperative is another example of a public use of the auto, and is discussed further below, under NEW SERVICE OPTIONS.)

New Service Options: Public Use of the Auto

With the exception of carpooling, most of the forms of paratransit demonstrated to date approach the transit edge of the spectrum of services constituting the concept It should be kept in mind, however, that paratransit can also include services that approach the other end of the spectrum - the private auto.

Regardless of future energy/economic trends, the automobile will undoubtedly continue to be the preferred mode of travel for a majority of Americans. Use of the auto, however, can be made considerably more efficient, through a variety of shared use arrangements. These options, which can be broken into "trip-sharing" and "vehicle-sharing" arrangements, can be considered together under the mantle "public use of the auto." Some of the individual concepts, such as carpooling, are in widespread use in this country, while others have been tried only in Europe. In light of shifting attitudes toward auto ownership and residential location, there may be a potential market for several of the latter arrangements in the U.S.

Trip-sharing options, such as carpooling and volunteer driver arrangements, have been extensively used for many years, and will undoubtedly continue to expand: carpooling because of its role in reducing the cost of the commuting trip; volunteer driver arrangements because of their usefulness

in helping to provide mobility to the elderly and poor, especially in rural areas. A third trip-sharing option - organized hitchhiking - has been introduced in several U.S. locations, but has met with little success to date, in large part due to safety concerns and reliability problems resulting from limited registration of drivers and riders. (These concepts are addressed in the volumes on COMMUTER RIDESHARING and RURAL PARATRANSIT.)

The alternatives to trip-sharing arrangements are those in which the vehicle itself (i.e., ownership or operation) is shared. Two basic options are "short-term auto rental" (STAR) and "auto cooperatives." These options can potentially result in more efficient use of transportation modes; if the pricing structure is established so that users see the true cost of an auto trip, rather than the out-of-pocket cost currently perceived, then more trips may be diverted to transit (where such an option exists).

Short-term Auto Rental

The concept of short term auto rental is a variation on conventional auto rental, involving faster check-out/check-in procedures and a greater distribution of rental/check-in locations; the vehicles may be rented for very short periods of time (e.g., for a single intra-city trip of a few miles), and rental charges are based on length of use.

The STAR concept has been analyzed in a number of studies, dating back to the late 1960's with UMTA-sponsored research efforts by Stanford Research Institute (35) and the University of Pennsylvania (36) Thus far, however, there have been only two documented experiences with the STAR concept, both of which have taken place in Europe (and are described more fully in the chapter dealing with the European experience). Transport Individual Publique (TIP) was established in 1971 as a cooperative transportation system by Procotip, S.A. in Montpellier, France (a city of 200,000). Although the system was initiated with some government support, there was no ongoing public subsidy. Up to 300 members joined the cooperative by presenting a driver's license and paying a monthly fee ($10 initially). The system started with 16 vehicles and 17 stations, later adding 14 vehicles and 10 stations. It operated using conventional gasoline-powered sedan vehicles, which were available to members on an as-needed, as-available, basis from the designated parking areas at stations. Vehicle repairs, service, fuel and insurance were provided by TIP,

and paid for in user charges on a mileage basis. Special TIP tokens were purchased for use in the vehicle's specially designed meters. The system did not break-even and was discontinued in 1973.

The second major demonstration of the STAR concept is currently in operation in Amsterdam. WITKARS is operated by a cooperative (Cooperatieve Vereniging Witkar U.A.) and serves a 10 square kilometer area in the central city area. The cooperative has 3400 members, about half of whom live in the inner city. Members (paying a $10 annual membership fee and a $10 key fee) may use any WITKAR vehicle on an as-needed and as-available basis. The cooperative provides all repairs, servicing, and insurance.

Service was initiated in 1973, with one station and four small electric vehicles. Today it operates with three stations (with three more under construction) and 20 vehicles. Expansion plans call for 15 or more stations and 105 vehicles in the future.

The WITKAR vehicles were custom designed to be small, easy to operate, and low-polluting. The vehicles are about 7 feet tall, 6 feet long and 4.5 feet wide, and are constructed of polyester and fiberglass on a steel frame and are electrically powered. They can reach speeds of 22 mph and can travel up to seven miles on a single charge. The stations accomodate ten WITKARS in three normal automobile parking spaces. The land was donated by the City government, and the cost of constructing a station (in 1974) was $16,000. System control was automated in 1980.

The most recent assessment of the STAR concept in the U.S. was completed in 1977 by Alan M. Voorhees and Cambridge Systematics, Inc. (39). This study concluded that, although the limited success with STAR to date is not necessarily indicative of inherent weaknesses in the concept, it is unlikely that STAR is a viable and promising mode for intra-CBD service. The Voorhees/CSI study offers a number of reasons for this, including inherent service unreliability, low system utilization, large vehicle fleet and terminal requirement, and potentially high system cost.

There are, however, some basic modifications to system design that may make such systems feasible in the future. First of all, the car rental industry may be a more efficient provider of this type of service than the operators in Europe. The advantage of utilizing the auto rental industry

relates to economies of scale. While it is doubtful that the same vehicles can be used for both full-day and short-term rental during weekday hours, the rental companies have an existing infrastructure, including terminals, maintenance facilities, bulk purchasing and sales mechanisms, and management/financial capabilities which could be directly applied to STAR service. They also have the management expertise which was lacking in the Montpellier demonstration. These factors could be significant in minimizing the costs of the service.

Whereas a STAR system tied into the current auto rental system might offer the above advantages over the earlier attempts, significant additions/changes would be required to integrate a STAR system into the auto rental system as it exists today. These might include:

1) faster check in/check out - A STAR system would involve a greater number of check-ins/check-outs per vehicle. Despite the fact that such processes have been streamlined at auto rental locations, STAR would require quicker procedures. An automated system for regular STAR users should not be difficult to establish, given existing computer software and hardware, and might also benefit regular auto rental users.

2) availability of convenient locations - More auto rental locations would be needed to accomodate STAR travellers conveniently. Furthermore, these locations would have to be distributed more evenly throughout the urban or metropolitan area. (This is discussed further below.)

3) intercompany agreements - To operate as an urban system, it would be most advantageous (and perhaps the only feasible solution) for the various auto rental companies to develop reciprocal agreements so that, for example, vehicles rented from a Hertz location might be returned to an Econocar office. This would constitute a major change in the industry. A model for such cooperation is the use of railroad cars from different railroads, and, to a lesser extent, the honoring of airline tickets by different carriers.

A key question regarding the potential for a STAR system based on the existing auto rental infrastructure is terminal density (and distribution). Currently, airport and downtown locations predominate, with rather sparse distribution in other areas. In Boston, for example, excluding East Boston (Logan Airport), there are 42 rental car locations in an area of about 42 square miles, or an average density of one per square mile. It should be stressed that this is average density, since locations are typically unevenly distributed (e.g., many of the Boston locations are to be found at bus and rail terminals and hotels).

Were the existing 42 locations to be evenly distributed, average distance between terminals would be 1 mile, implying average walk distances to terminals (assuming uniform residential density and a rectangular, fully-connected grid street pattern) of one-half mile. The number of rental locations would have to be quadrupled to reach a more reasonable average walk distances of 1/4 mile (a typical transit accessibility criterion). Perhaps gas stations and auto dealers (some of which already serve as rental locations) could be used as terminal locations. This is already happening to some extent in the auto rental industry. For example, over half of the Chrysler, Plymouth, and Dodge dealers have taken advantage of a Chrysler Corporation program to introduce car rentals to dealerships. Chrysler's "DRAC" (dealer rent-a-car) program enables its dealers to offer rentals at the dealership and other approved locations in their communities. DRAC vehicles can be leased from Chrysler, thus avoiding the major capital investment in a fleet. DRAC vehicles are leased for a period of 4 to 12 months, after which time the dealer purchases the vehicles as a source of used cars and trucks. The dealers' initial interest in the program was to obtain used cars; however, it has become a significant portion of the business, and, by exposing the public to Chrysler products has served as a significant marketing strategy. Similarly, Budget Rent-a-Car has established a tie-in with Sears, Roebuck and Company which allows Sears credit card holders to charge Budget rentals at 600 participating stores. Budget has also established rental car desks at more than 200 Lincoln-Mercury dealerships over the past five years. Finally, Thrifty Rent-a-Car and other companies routinely use service stations as their primary terminals.

One service feature already familiar to the auto rental industry which may make the service more attractive is the provision of a number of different types of vehicles for the public to choose from. A person might be able to rent a low cost 2-seater for a trip to work or shopping, and a (higher cost) full-size car for a weekend family trip. Of course, peaking problems will minimize the extent to which real choices will be possible. Nevertheless, the flexibility provided by this type of arrangement might serve as an additional inducement to the auto owner who has available only one type of car.

Finally, another operating policy which is already standard for the auto rental industry might improve the attractiveness of STAR service. The STAR

concept has typically been based on the assumption that passengers would simply walk up to terminals, much as they might to taxi stands. However, there is nothing that precludes the possibility of reserving a car in advance, much as one would a taxi, or a rental car for that matter. In fact, it has become increasingly difficult in most areas to rent a car, or obtain a taxi, without advance reservation. The advantage of advance reservation for STAR is that it would tend to reduce the unreliability problem identified by Voorhees/CSI. Of course, to be consistent with the concept of short-term rental, advance notice of two hours or less, rather than 24-hours, should be required. As is the case for paid-driver paratransit service, regular reservations might be accepted for work trips. Ultimately, one could conceive of a situation in which the reservation process serves as a mechanism for matching riders interested in sharing vehicles (resulting in reduced VMT and savings to the users).

The question remains as to whether a sufficient demand can be generated for a STAR service. A number of factors may change the potential market for this service. First of all, previous studies have focussed on a small CBD as the appropriate site for this type of service. In fact, other settings may be more appropriate. Transit, taxi service, and walking are all typical reasonable alternatives for short CBD trips. This type of competition may limit the demand for STAR service.

An alternative would be a larger area - still relatively dense, but containing a number of dispersed activity centers, not all of which can be adequately served by transit. In this case, STAR would be expected to serve as a complement to transit, rather than a competitor. This fits in with the notion of STAR being an agent to change mode choice decisions. The availability of STAR is intended to impact auto ownership; once an auto is not available for a trip, and a user is faced with either the true cost of auto travel (via STAR) or transit, transit may be selected for those trips which are adequately served (and STAR chosen for the other trips).

Moving away from the CBD to an area with more diverse activity centers may reduce peaking problems, although that will depend on the characteristics of the area. It must also be recognized, of course, that larger areas will mean much more in the way of terminal requirements, although the Voorhees/CSI suggestion of over 100 terminals per square mile to match the level of service

of the automobile is probably unnecessary (since there is no necessity to make STAR identical to the automobile).

A number of current trends will potentially impact the potential of the STAR concept in the future. First of all, the fixed costs of automobile ownership, including depreciation, financing, insurance, licensing, and fees have been rising dramatically. According to data from Hertz, the effective fixed cost per mile for operating an intermediate-sized car 10,000 miles per year for 10 years increased from 11.5¢ in 1977 to 13.3¢ in 1978, an increase of over 15%. Costs have risen even more sharply since. The point could soon be reached where many families will begin to question the desirability of purchasing an automobile, particularly a second or third car which may be infrequently used.

While one might question whether people will really be willing to do without automobiles of their own, there is some evidence to suggest that Americans are becoming more willing to part with the ownership aspect of automobile operation. The leasing of automobiles by private individuals has soared in recent years. Leasing occurs despite the fact that it is typically more expensive than outright ownership. This appears to be largely a matter of convenience; with leasing, the operator has less to worry about vis a vis maintenance and insurance. In addition, the driver is able to obtain a new car every year or two. These benefits would be even greater in a STAR-type-concept.

At least in the near term, the most promising candidate sites for the STAR concept are probably those cities with high density core areas (i.e., 12,000 persons per square mile or higher); this includes such cities as New York, Chicago, Boston, San Francisco, Washington, D.C., Philadelphia, and Baltimore. Other sites which may be appropriate, especially as auto prices rise, include relatively dense, suburban-dominated areas, such as Los Angeles and other Southern California counties, and New York's Nassau County.

Thus, the fact that short-term auto rental has not yet been attempted in this country need not imply that there is no potential for the concept in the future. Evolving development pattern and economic realities could create a demand for this type of service. If such a demand is created, the auto rental industry is the likely provider.

As an interesting aside, an entire reorientation of urban structure based on the STAR concept has been proposed by a researcher at the Lund Institute of Technology in Sweden (40). This application has been termed RIDE, or "Rental Car Systems in Demo-Structures." It involves rental car systems designed to serve "neighborhood" units and is part of a larger urban settlement/lifestyle redesign approach he has called "demobilism." Under this concept, urban areas would be divided into "demes." In the center of each deme, local travel terminals would be constructed which serve car rental, public transit, taxi, pedestrian and bicycle traffic. Residences would be located conveniently to the terminals and residents would no longer need to own a vehicle; they instead have the freedom to choose the travel mode most appropriate to the circumstances of a particular trip. The aim is to achieve a positive feedback effect: public transit use is increased as a result of this urban structure, which induces consequent improvements to transit frequency and service quality, thereby reinforcing a mode shift to transit.

Auto-Sharing Cooperatives

The auto-sharing cooperative is an approach which integrates aspects of STAR into the neighborhood cooperative framework. Following the basic model of the time-shared vacation home, the concept entails groups of persons having joint ownership of one or more automobile. This reduces the fixed costs related to auto ownership, thereby giving access to an auto to persons who would otherwise be unable to afford it, while also possibly diminishing the total reliance on the auto of others.

Auto-sharing cooperatives have not developed in the U.S. to any noticeable (or at least documented) extent,* but there have been several documented experiments in Europe. The most notable examples are Sweden's "Bilpoolen" and England's "Green Cars."

Bilpoolen was a demonstration which operated for 3 years in Lund, Sweden (40). A neighborhood automobile cooperative consisting of 150 members (20 of whom were car owners) was formed in the Kloster Falad section of Lund. When cars were not being used by their owners, they were offered on an advance

* There are, however, a number of auto repair cooperatives, including ones in Ann Arbor, Michigan and Watertown, Massachusetts.

notice, rental basis to cooperative members at rates 30-40% cheaper than commercial rental-cars. Car owners got substantial returns from the rental of their autos and the administrative (broker) costs were covered through the user charges. The cooperative operated on a non-profit basis, and was reportedly very successful - so successful, in fact, that the project grew beyond the capacity of the non-profit broker administration, and therefore ceased operation. The pilot project does, however, demonstrate the potential of the concept.

In Britain, Green Car schemes are reportedly operating in 20 different locations. These projects were originated at the Open University in Milton Keynes, and all are being monitored by a university team. The Green Car program established a set of explicit car-sharing guidelines and a costing technique which shifts costs into variable costs as much as possible. The aim is to allow users to perceive actual costs of automobile travel on an average rather than marginal basis, which therefore tends to make other modes of travel more attractive. Important findings from the Green Car projects are that advance reservation should be used, and that is is best not to rely on shared-cars for work trips.

It is evident that, in many ways, existing shared-auto cooperatives resemble the short-term auto rental (STAR) concept. The key difference is that the STAR system may be publicly or privately owned; shared-auto cooperatives involve cooperative ownership, and are not necessarily geared only to short trips. However, auto-sharing cooperatives may be more easily implemented than short-term auto rental, and can achieve virtually the same ends. Cooperatives avoid the need to establish an entire infrastructure, involving a terminal network, marketing program, redistribution procedures, etc. Further, they do not require financial returns, and need little, if any, in the way of government or private sector initiative. They also do not require that users give up complete claim to automobile ownership. As with STAR (though to a lesser degree), cooperatives reduce the user cost of auto ownership, reduce parking requirements, and set up a situation (depending upon the cost structure established) in which sunk auto costs do not play as important a role in mode choice decision.

At the present time, automobile transportation is too much of a basic "requirement" for most Americans for time-shared cooperatives to be

extensively viable. However, for city residents having reasonable transit service and only occasionally needing an automobile, it may be a reasonable alternative. The increasing movement back to the cities could generate interest in automobile cooperatives. Automobile ownership in the city is often costly and inconvenient, and many inner city residents find their automobiles under-utilized; meanwhile, the costs they are forced to pay may be even higher than those outside of the city, due to higher insurance and parking costs.

There is a need of course, for some organization to manage and administer the vehicle sharing. Among independent homeowners or apartment dwellers, this could be a deterrent to implementation. Perhaps the most likely initiators of such systems might be found among condominium and housing cooperative organizations. These existing organizations, which already represent a set of common interests, could conceivably foster the development of auto cooperatives among their members. For example, large apartment complexes in inner urban areas might lease vehicles which could be stored in the building garage for occasional use by tenants. Agreements might even be developed with rental agencies for supplementary vehicles in the event of demand peaks, which may very well occur during off-peak periods for rental agencies. The cost of such supplementary vehicles could be included in the cooperative membership fee. This might help to resolve the problem of vehicle availability.

On a slightly larger scale, but still one in which members have common interests, neighborhood groups might attempt to organize auto sharing cooperatives. The shared-auto system could potentially be managed by the same broker responsible for arranging shared-rides; indeed, shared-riding could be an integrated component of an automobile cooperative, perhaps with "carpoolers" gaining preference over single drivers in the use of the vehicle.

Some additional study of the concept is obviously required. What are the implications of peaking on vehicle requirements and the desirability of the option? Under what organizational arrangements would peaking be minimized? What cost sharing mechanisms are both equitable and lead to the desired objectives? How can insurance costs be minimized? What maintenance arrangements are most effective? Once these questions are answered, through both study and demonstration, the government will be in a position to promote the concept through information dissemination, in much the same manner that

carpooling is promoted. At that time, other desirable federal, state, or local initiatives could be identified as well.

Future Roles in Promulgating Paratransit

The development of paratransit is likely to occur in the future in response to changing market needs, regardless of formal actions taken on the part of governmental or other organizations. However, if paratransit is ever to achieve its full potential, ther are a variety of actions that should be taken by governmental agencies at different levels. Futhermore, there is also a need for a more formal recognition of the functions paratransit can serve. The roles of different groups in promulgating paratransit are addressed below.

The Role of the Federal Government

In the future, the federal government (particularly U.S. DOT) can play an expanded role in the promulgation of paratransit services, both as a means of pursuing national goals (e.g., energy conservation, improving mobility, reducing traffic congestion, etc.) and as a way of reducing public transportation spending levels. The federal government's major area of influence is the elimination of barriers to implementation and the introduction of incentives (including funding).

The list of actions which might comprise the former category is shorter, but probably harder to implement than those in the latter category. There are actually few barriers to paratransit which originate at the federal level. The labor issue - 13(c) - is the only one of any significant nature. Although the manner in which 13(c) can be resolved is difficult to assess, suffice it to say that the 13(c) barrier should be eliminated if paratransit is to be able to achieve its full potential Other regulatory barriers to paratransit - including laws prohibiting shared-ride taxi and jitney - exist on the state or local level. The federal government has no control over these laws; however, federal policy* and recommendations can influence many localities

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* For instance, the long-awaited Paratransit Policy Statement (issued in late 1982) could significantly aid in the promotion of paratransit. It could do much to "legitimize" paratransit options as viable forms of public transportation, and could broaden the current range of initiators and providers.

to change their regulations. Such changes would come very quickly if transit funding were tied to increased local regulatory flexibility with respect to the provision of paratransit.

Another barrier to community paratransit in some areas has been the ambivalence of transit authorities. Again, short of strings attached to funding, the federal government has little power over local transit authorities. Once again, however, federal policy calling for consideration of privately-operated paratransit service by transit authorities should have some impact, especially within a situation of severaly limited federal funding.

On the side of incentives, a variety of activities are in order. First of all, continued demonstration and dissemination of information are important, as they provide local areas with important information on the applicability of paratransit concepts. Concepts noted here worthy of further demonstration include checkpoint paratransit, automobile and neighborhood cooperatives, and the use of jitneys to provide peak-hour transit supplements.

The primary incentive which can be offered, of course, is funding. Short of funding designated specifically for paratransit - which is probably inappropriate since localities should be free to design the most cost-effective overall transit service - there are a variety of steps which the government can take. Among them are:

1) Expand funding available for demonstration of untested concepts.

2) Integrate developers, activities centers, or other groups interested in transportation into the planning process, and allow them to compete with traditional transit operators for funding.

3) Provide low interest loans to neighborhood groups, including cooperatives and entrepreneurs interested in initiating service.

Finally, the federal government could encourage metropolitan areas to initiate policies likely to spur the development of paratransit, including placing greater restriction on developers (e.g., an upper limit on parking spaces) and granting local (as opposed to regional) control over local transportation alternatives. Of course, the proposed reduction in transit operating funding may well do more for encouraging greater flexibility at the metropolitan and local levels than any formal policy recommendations. Severely limited availability of federal funds will force localities to seek greater efficiencies in the provision of public transportation, as well as alternative providers.

In conclusion, the federal government can play a significant role in promulgating the development of paratransit over the coming years - through its own direct efforts and through efforts to encourage participation on the part of the private sector and state and local governments.

The Role of the States

State governments have demonstrated that the key to diffusion of paratransit concepts is programs targetted specifically at paratransit development. State funding programs for paratransit in Michigan, Minnesota, and California have resulted in the implementation of the majority of formal general community paratransit systems introduced in the U.S. to date. State demonstrations, which often come with (or, at least, are perceived to have) fewer "strings attached" (e.g., fewer data collection requirements) have, at times, been accepted more readily than have federal demonstrations by many communities. If a state believes that expanded paratransit activities are desirable, a demonstration funding program, accompanied by the promise of ongoing state support at some level is clearly the most effective strategy for initiating a group of new services.

The Role of Local Governments

As suggested earlier, local governments have a fair amount of leverage with which to encourage the dispersion of paratransit concepts. For instance, the elimination of local restrictions on shared-ride taxi and jitney service could stimulate the development of paratransit by local operators. In addition, changes in zoning laws so as to restrict parking space development should encourage alternative forms of privately-sponsored transportation service. Finally, new regulations could require developers to introduce "public trasportation" of some sort in new developments, along with roads and utilities.

Local government bodies also play a key role in the actual initiation of paratransit service, as community governing bodies have been the most prevalent initiators of general community paratransit (i.e., using state or federal funds). This trend is likely to continue, particularly if regional transit authorities are reoriented so as to allow greater local autonomy over service. An increase in local control, combined with a decrease in federal

transit funding, will undoubtedly increase the level of funding required from local governments. Such financial pressures are likely to further induce local government bodies to seek an expanded role for the private sector in sponsoring and operating local transportation services.

The Role of the Paratransit "Broker"

Governmental policies and practices to encourage paratransit will certainly help to expedite the diffusion of the concepts, but may not succeed entirely without a local base of support. Furthermore, governmental efforts may not be sufficient to ensure that paratransit services are introduced in the most cost-effective way. For example, one of the strengths of paratransit - the fact that it can be initiated and operated by many different organizations - is also one of its weaknessess. A multitude of operators can lead to service duplicaion and/or inefficient use of resources, as well as a syndrome in which each group feels the need to "reinvent the wheel." For paratransit to be most effective, there must be some mechanism for ensuring service coordination.

The coordination of services and the dissemination of paratransit concepts are both projected results of an approach to transportation management which has been called "transportation brokerage." On the simplest level,as suggested earlier, transportation brokerage is the act of "matching travel demands with the most appropriate supplier." Obviously, the exact role is somewhat more complex, but the intent is to make most efficient use of existing resources while best serving transportation needs.

The brokerage concept was pioneered at the University of Tennessee in the mid-1970's. An UMTA-sponsored demonstration, managed by University staff, was involved in a comprehensive range of services; however, because of limited resources, the project focussed primarily on commuter ridesharing. In fact, the most widesepread use of the brokerage approach to date can be found in the ridesharing agencies being established in major urban areas throughout the country, although several transportation handicapped brokerage operations have also developed. Ridesharing agencies basically try to "match" individuals into carpools, vanpools, buspools, and, often, transit as well. Ridesharing agencies typically work with and support employers interested in ridesharing; by serving as a central information and technical support center, a

ridesharing broker obviates an employer's need to "reinvent the wheel." (The role of the ridesharing agency is discussed in the volume on COMMUTER RIDESHARING.) No truly comprehensive brokerage program has yet been implemented in this country; however, there have been a multitude of operations which have utilized the brokerage philosophy and have illustrated the possibilities of such an approach.

In the context of general community paratransit, various brokerage roles are possible. For example, as noted earlier, some transit authorities, such as the OCTD and SEMTA, have performed a brokerage function by contracting out local community services to private operators.* A broker could also assume a broader role of supporting developers or local communities in planning service and contracting with existing operators (the Northeast Illinois RTA has done the latter). In addition, a broker could seek out communities not well-served by public transportation services, and try to arrange for service - either through the public or private sectors. A broker could maintain relevant information on all possible transportation funding sources, and help "match" available funding programs with groups or services in need of funds. In general, a broker should keep track of all "public" transportation activity within a region and attempt to avoid unnecessary duplication.

Essentially, the role of broker, in working with a multitude of operators to address specific transportation needs, is the antithesis of the role of the transit authority, which provides a single service to meet mass needs As such, brokerage is inherently a paratransit concept. The existence of a brokerage organization in an area would effectively serve to "legitimize" paratransit, by focussing on individual, rather than mass market needs. AS such, a broker may serve as an "ombudsman" for paratransit, providing the unified constituency that paratransit has heretofore lacked.

The questions of <u>who</u> acts as broker, <u>how</u> a brokerage is initiated, and <u>how</u> a brokerage is funded are obviously important. The transit authority may represent a logical location for more comprehensive brokerage activities, in that it obviously has a strong base of knowledge of local transportation needs and options, as well as control over a portion of existing service. However, a transit authority obviously has an inherent bias towards transit, and, as such, does not represent the impartial view envisioned for the concept;

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* As noted earlier, SEMTA subsequently took over these community services itself.

furthermore, growing funding problems may force transit authorities to devote all of their resources to operating mass transit services. Alternatively, ridesharing agencies could conceivably expand into more "general market" brokerage activities, but there too funding constraints may limit their ability to do so.

A federally-sponsored demonstration to determine the effectiveness of different forms of general community brokerage is probably necessary to help ascertain whether additional public funding should be made available for brokerage-type arrangements, if private funding can be tapped, and how a brokerage should best be implemented.

Summary: Future Potential of General Community Paratransit

Paratransit designed for the general community has taken, and will continue to take, a variety of organizational and operational forms. These services may be initiated and/or operated by transit agencies, municipal governments, community organizations, private operators, business owners/developers, or individuals. General community services have fulfilled various roles in pursuing national and local transportation goals (e.g., energy conservation, reducing congestion, improving mobility), and offer the potential for playing expanded roles over the years ahead The current Administation's plan to phase out operating subsidies for transit should, for instance, present new opportunities and demand for alternatives. This will mean increased activity at the community/neighborhood level, as well as a greater degree of participation on the part of the private sector.

As the cost of providing public transportation has increased along with the demand for new services, transit authorities have recently become involved in the provision of paratransit services. Several authorities have, for instance, provided funds and/or technical assistance to individual suburban communities so that these communities could implement and operate their own local circulator/feeder services. Since these services are generally contracted out to private operators, the unit operating costs are typically considerably lower than the unit costs of the regular transit services. This has significant implications for the future, as one can envision a scenario in which the transit agency directly operates line-haul routes within major travel corridors, and the remainder of the service in the region is provided by private operators, under contract to the transit agency. Thus, the number

of paratransit systems in suburban communities can be expected to grow at least somewhat, and the role of private operators will expand considerably in providing these and other services.

Finally, in an effort to minimize operating costs, those services that are implemented as local circulators/feeders are likely to be variations on fixed route/fixed schedule service (e.g., "hybrid" services such as route or point deviation), rather than the completely demand-responsive "dial-a-ride"-type services which have been demonstrated in a number of locations over the past decade. The latter service option has been shown to be considerably more expensive to operate than less flexible options; therefore, demand-responsive arrangements are likely to be reserved primarily for services targeted to the tranportation handicapped.

In conclusion, as the demand for alternatives to the private auto increases (due primarily to high fuel costs) and federal assistance for transit decreases, there may well be increased opportunities for general community paratransit services - replacing certain transit routes and interfacing with those serving major travel corridors. Many of these services will be initiated and operated through the private sector - involving both traditional transportation providers and activity centers which create the need for travel. Finally, in addition to more "conventional" paratransit services, the future may bring greater opportunities for the introduction of new concepts such as neighborhood transportation cooperatives and various "public use of the auto" arrangements, thereby expanding the role of the individual in developing and operating transportation services.

Glossary

brokerage:

The concept of "brokerage" involves a central party/agency which attempts to match travel demands with the most apprpriate available mode and promotes the most efficient provision of these modes. In the general community service area, brokerage can take various forms, including a transit authority sponsoring or contracting out local community services to private (or community-based public) operators.

checkpoint service:

Checkpoint service is a variation on dial-a-ride, in which pickup and dropoff locations are limited to specific designated stops.

cycled service:

Cycled service is a zonal demand-responsive service in which the vehicles are scheduled to arrive/leaved a major activity center on a regular basis; in between the scheduled stops, passengers are picked up at their doors. The activity center serves as a transfer point for travel between zones.

demand-responsive transportation:

This is any type of public transportation involving flexibly scheduled service, generally between origins and destinations specified by person requesting service. Specific types of demand-responsive service include dial-a-ride, cycled service, and deviation services.

dial-a-ride:

This is the best known type of demand-responsive service. It involves advance request doorstep pickup, with dropoff either at the desired destination or at a designated checkpoint. Dial-a-ride service is generally publicly-operated or sponsored. There are three basic types of dial-a-ride: "many-to-one," in which transportation is provided from multiple origins to a single destination; "many-to-few," in which transportation is provided from multiple origins to a few designated destinations (e.g., major activity centers); and "many-to-many," in which transportation is provided between any two points within the service area.

hybrid service:

Hybrid options are those types of paratransit service exhibiting characteristics of both demand-responsive and fixed route transit service; hybrid options include route deviation, point deviation, checkpoint and cycled services.

general community paratransit:

This is a general term referring to the entire range of paratransit services which attempt to serve a broad cross-section of travel needs (i.e., not targeted specifically at the work trip or the needs of the transportation handicapped).

jitney:

The jitney is an unscheduled fixed route (or route deviation) service, operating on short, but variable headways. The jitney vehicle, holding six to eighteen passengers, is owned and operated by a self-employed individual.

point deviation:

A point deviation system is one in which vehicles stop at specific locations on a regular schedule, but do not have to follow a set route between those stops. Passengers may request being picked up or dropped off at any location (e.g., at their homes) within a certain distance from the general "routes." The actual route is determined, on a run by run basis, by the locations of the individual requests as well as the scheduled stops.

route deviation:

A route deviation system is one in which vehicles proceed along a fixed route, making scheduled stops along the way; however, the vehicles are allowed to deviate from the route on demand to pickup or dropoff passengers. The vehicle returns to the original route at the same point at which it left.

section 3(e):

This is a provision of the UMT Act of 1964 which prohibits UMTA funding from being used to create competition with private mass transportation carriers.

section 13(c):

This is a provision of the UMT Act of 1964 which requires that the position of existing workers "not be diminished" through projects initiated with UMTA funds.

shared-ride auto transit (SRAT):

This option typically involves a formalized "hail-a-ride" (or "legalized hitchhiking") service, in which (licensed) cars follow fixed route corridors on which (licensed) riders are able to hail them.

shared ride taxi:

Shared ride taxi is a type of demand-responsive service in which taxis are legally permitted to carry two or more passengers having different origins and destinations.

short term auto rental (STAR):

STAR is a variation on conventional auto rental, involving faster check-out/check-in procedures and a greater distribution of rental/check-in locations; the vehicles can be rented for very short periods of time and rental charges can be based on length of use and/or distance.

spatial integration:

This is an arrangement in which flexible paratransit service is used to provide feeder/circulation service in certain portions of a metropolitan area in conjunction with fixed route transit service operating along high density corridors.

temporal integration:

This is an arrangement in which: 1) the same resources are used to provide different services (e.g., vehicles being used in fixed route and demand-responsive service) at different times of day; or 2) different resources are used to provide the same type of service at different times of day (e.g., taxis replacing transit at night).

transportation cooperative:

A transportation cooperative is an organization which operates a transportation service, the users of which are members of the organization and are involved (either directly or through representation) in the management of the service.

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Persons Contacted for Case Study Information

- Merrill-Go-round: Harry Banaszak (Merrill-Go-Round)
- Michigan DART Program: Kip Grimes (Michigan DART)
- Westport: Gordon Aoyogi, Martha Hauhuth (WTD)
- Santa Clara APT: (from literature)
- Ann Arbor Teltran: Steven Fern (AATA)
- Orange County Community Transit Services: Steve Walsh, Ed Munsey (OCTD)
- Peterborough Trans-Cab: John Stephenson (Trans-Cab)
- Badger Cab: Kathy Hicks (formerly City of Madison), Harold Bergdorf (formerly Badger Cab Co.)
- Mission St. Jitneys: Anthony Bruzzone (MUNI)
- Laclede's Landing/Hotel Shuttle: Robert Wesling (Lenox Hotel)

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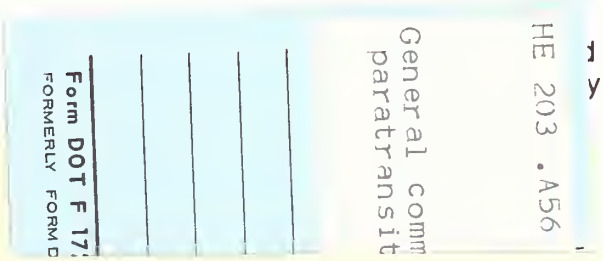

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