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Technology Transfer in Paratransit: Five Case Studies

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The evolution and adaptation of paratransit from the perspective of technology transfer are examined. Three key factors in successful technology transfer and local adoption are the presence of necessary prerequisites (local paratransit-program mandates, a service patron, and entrepreneurial staff skills), the resolution of barriers (recognized as including local transportation planners, government agency staff, and federal programs and policies), and the transferability of the situation (unique local program or community characteristics that militate against the successful duplication of case study experiences). Five case studies are used to represent the major paratransit modes and mandates and substantial operating experience: the Seattle-King County Commuter Pool; the Knoxville Commuter Pool; Colonial Paratransit and Taxi Company of Bethel Park, Pennsylvania; Dial-a-Bat of Brockton, Massachusetts; and the Choanoke Area Development Association, Inc., of Murfreesboro, North Carolina. All five programs have evolved toward successful examples of technology adaptation and are characterized by broadly conceived mandates and multiple service activities. The case studies underscore the significance of the noted local prerequisites, particularly the role of the patron.

The principal objective of this paper is to examine the evolution and adaptation of five leading paratransit programs from the perspective of technology transfer. Examination of paratransit from this perspective provides new insights into the success and failure of local programs.

Successful local technology transfer and adaptation have occurred when the technology has been accepted in all its ramifications and has secured a stable role in the broader institutional milieu. For paratransit, this means operational transportation services that (a) serve a significant purpose that was previously not well served by other modes of transportation or institutions and (b) are accepted and supported by stable institutional structures.

Our interest in paratransit from the perspective of technology transfer arose from an Urban Mass Transportation Administration (UMTA) university research and training grant for the development of curriculum materials to support paratransit instruction in colleges and universities. A major element of these materials was five case studies of mature local paratransit

organizations that had successfully implemented paratransit services. All facets of service development were investigated so that they could be related to instructional concepts being developed. They thus represent prototypes of successful local technology transfer and adaptation in the paratransit field.

CONCEPTS OF TECHNOLOGY TRANSFER

Technology transfer commonly includes two dimensions. The first is technology transfer in the sense of the evolution of a technology from conceptualization to broad practical application. In this process, a technology is perceived as "transferring" from one stage of development to another, and its overall evolution—generally described in terms of the number of units in operation (e.g., the number of carpools formed)—is presented by the familiar cumulative growth-decay, or S-shaped, curve (1).

In all cases, the model suggests an initial slow-growth phase; a rapid-growth, or adolescent, period; and a slow-growth, mature phase that leads to a no-growth point of equilibrium. The fundamental assertion of the model is that there are recognizable and predictable phases in the life of a technology that culminate at a point of eventual saturation or cessation of use. At that point the technology is generally succeeded by a technology that has greater utility or potential.

The second dimension of technology transfer is concerned with the interinstitutional diffusion of a technology and the process of its institutional adaptation. In this dimension of technology transfer, it is commonly held that there are three sets of factors that affect the local adoption of a new technology such as paratransit: the existence of key prerequisites for local adoption, the effective resolution of barriers to adoption, and transferability factors (unique local situations) that

may preclude duplication or adaptation of a successful program elsewhere.

Prerequisites

Three key prerequisites to local adoption of paratransit surfaced during the case study investigations. The first is the presence of a local mandate or interest to effect a technology "pull" as opposed to a technology "push" (a push would be federal programs that require paratransit elements, often as a prerequisite to overall program funding). The presence of a viable local mandate is seen as fundamental to a soundly conceived and broadly implemented paratransit service.

The second prerequisite is an enthusiastic and effective patron, generally an individual or individuals who are willing to take the initiative and who have control over the necessary local resources to implement a program. It should not be forgotten that the patron is assuming some risk in seeking the adoption of any innovative concept.

The third prerequisite is the staff that has the entrepreneurial skills and motivation to directly manage and operate the services. This type of staff is more commonly found in the small-business sector than in local transportation planning departments.

Barriers

Paratransit, like any innovation, must overcome a number of barriers. In a sense, the absence of one or more of the prerequisites mentioned above represents a significant barrier; in fact, it is difficult at times to conceptually separate prerequisites and barriers. The discussion of barriers to paratransit has centered around institutional, regulatory, insurance, and labor issues. Barriers such as those described below have received little attention:

1. Traditionally trained transportation planners are coming to be recognized as barriers to paratransit development. For example, Gakenheimer and Meyer (2) note conflicts between long-range planners and the transportation system management (TSM) perspective of short-range operational planning. Paratransit service planning and implementation are a principal issue in this disaffection among planners. Rather than a grand, long-term process of facility conceptualization that is aloof from the general public, paratransit planning involves "nitty-gritty", short-term service planning, implementation, and management in intimate contact with the public—a messy business! Paratransit development is not what transportation planning was advertised to be, and it is not the transportation planning that our facilities-oriented transportation training programs emphasize.

2. In typical fashion, the crosscurrent of federal funding programs is undercutting existing mechanisms for the provision of paratransit service, principally the private taxi industry. Current government programs inherently lack cost consciousness and a mandate for cost-competitive provision of service. At the same time, year-to-year ad hoc federal support of paratransit undercuts program resources (much of the year is spent fighting for next year's budget), program status, and serious integration of paratransit programs in long-term regional transportation plans.

3. Government bureaucrats have an aversion to dealing with the private sector, and vice versa. This is particularly evident among the planners and managers of social service agencies, who are chary about contracting for client transportation services with profit-

making taxi or bus companies. Underlying this there appears to be a fundamental mutual distaste in both sectors for the perspective from which the other sector operates.

Transferability

Transferability refers to the specific characteristics of a case study situation that can affect the degree to which the situation can be duplicated elsewhere and the generality of the observations that can be made about it. What works in one city may not work in another and for reasons that cannot be explained by prerequisites and barriers alone.

FIVE CASE STUDIES

The five case studies used in this research are the Seattle-King County Commuter Pool; the Knoxville Commuter Pool; the Colonial Paratransit and Taxi Company of Bethel Park, Pennsylvania; Dial-a-Bat of Brockton, Massachusetts; and Choanoke Area Development Association, Inc. (CADA), of Murfreesboro, North Carolina. The characteristics of the five case studies are summarized in Table 1. They were originally selected to represent the major market applications (commuter work trips, service to the elderly and the handicapped, rural service, and social service agency coordination), the major paratransit modes, and—as prominent and mature organizations—the likely evolution of the scope of programs and services over time. It was found that none of the programs can be simply characterized as just a carpool matching service or a provider of specialized services. All are multifaceted, and this, it is asserted, is partly responsible for their vitality and survival.

Seattle-King County Commuter Pool

Significance

The significance of the Seattle-King County Commuter Pool program is that it is a broadly conceived, multimodal paratransit development program primarily undertaken within the context of TSM.

Chronology

The Seattle-King County Commuter Pool was organized in 1974 as a regional carpool program sponsored by the U.S. Department of Transportation. The broad public interest in carpool matching that was anticipated did not materialize, however, and early in 1975 the commuter pool initiated a broader, multimodal paratransit program focused on the commuting needs of employees at major employment centers in the Seattle area. The approach was based on a comprehensive survey of employees to determine, in detail, their daily commuting arrangements and their personal interest in mass transit and paratransit alternatives (3).

The survey program was initially conceived to include the direct planning and implementation of a variety of paratransit services for individual employment centers. In practice, however, the Seattle program encountered the regulatory and insurance barriers common to most paratransit programs, and these problems had to be resolved first. When this paper was written, most of the principal barriers had been overcome and prototype buspool and vanpool programs had been implemented. By 1978, the commuter pool estimated that, through their carpool, vanpool, and buspool programs, peak-hour traffic had been reduced by 3733 automobiles

Table 1. Characteristics of five case studies.

Case Study Characteristic	Seattle	Knoxville	Colonial Taxi	Dial-a-Bat	CADA
Location					
Large urban area	X		X		
Medium-sized urban area		X		X	
Rural					X
Market					
Commuter work trips	X	X	X		X*
Elderly and handicapped			X	X	X
Social service agency clients		Some	X	X	X
Operational service					
Carpool matching	X	X			
Vanpooling	Some	X	X		X*
Express bus	X				X
Taxi			X	Some	
Subscription van or bus			X	X	X
Dial-a-ride			X	X	X*
Other functions					
Resolution of operational barriers	X	X		X	X
Development of incentives	X			X	X
Service consulting	X	X	X	X	X
Public-awareness programs	X	X			
Institutional base					
Add-on to existing government agency	X			X	X
Independently conceived	X	X			
Private enterprise			X		

*Planned service expansion for late 1978.

and there were attendant reductions in air pollution and energy consumption (4).

More significantly, the Seattle program now encompasses a still broader range of developmental activities, including the development of preferential parking and other ride-sharing incentives, survey and consulting services to aid local employers who are implementing paratransit and parking management programs, general publicity about issues of regional transportation congestion and alternative solutions, and, most recently, promotion of flexible work hours among employers to reduce peak-hour commuting demand.

Prerequisites

Three prerequisites have both made possible the success of the Seattle program and greatly affected its evolution. The first prerequisite has been a strong local mandate for the alleviation of peak-hour congestion where the alternatives of further freeway development and expanded bus service were not available. Federal mandates for abatement of air pollution and conservation of energy precipitated the program, but TSM—getting more use out of existing facilities—has been the primary sustaining local interest in the program.

The second prerequisite has been the effective patronage of the Seattle traffic engineer, who initiated the Seattle commuter pool and provides an administrative base for it within his department. This patronage has worked to encourage the TSM-oriented approach to paratransit; the commuter pool has not gotten involved in coordinating or providing services to social service agencies or the elderly and the handicapped.

The third prerequisite has been the availability of a program-development staff that has entrepreneurial and, to some extent, service-management inclinations and skills. The principal staff members have backgrounds in planning and personnel and are not formally trained in transportation.

Barriers

There have been several significant barriers to the Seattle program. In the early development of the commuter pool, local transportation professionals were competing for the federal support that was expected for the program while simultaneously resisting ac-

ceptance of the TSM short-range planning perspective. This competition has since been resolved; the TSM activities of the program have become accepted, and the Seattle-King County Commuter Pool is now reasonably secure as a special-purpose regional agency.

Now that the Seattle program is relatively mature, its future hinges on the prospective turnover in key staff, the prospects that it will adopt still broader development mandates (particularly in the area of social services), and its long-term institutional affiliation or incorporation.

Knoxville Commuter Pool

Significance

The significance of the Knoxville Commuter Pool program lies in its broad-scale implementation of a third-party commuter vanpool program and its subsequent development of the transportation brokerage concept.

Chronology

The Knoxville Commuter Pool was organized in 1975 under the supervision of the Transportation Center of the University of Tennessee as the operating element of a \$1 million demonstration grant from UMTA for the demonstration of third-party vanpool brokering as a means of fostering commuter ride sharing as an adjunct to existing bus commuter service. In 1977, the Knoxville Commuter Pool was transferred as one program into the newly created Knoxville Department of Public Transportation Services, which was intended to be the comprehensive public transportation management arm of the city government. Basing the Knoxville Commuter Pool in the city government proved politically infeasible, and in 1978 the program was returned to the university and was recast as a regional ride-sharing program, principally under Federal Energy Administration sponsorship.

The principal thrust of Knoxville Commuter Pool activities has been vanpooling. By the end of 1977, 51 vans had been purchased and put into operation. The agency has now had considerable experience in vanpool promotion and management and in overcoming barriers, notably in the area of vanpool insurance. In late 1977, the commuter pool began divesting itself of the vans by

selling them to driver-operators and turned its attention to multimodal transportation service consulting and brokering. The agency has started to investigate services for social service agencies and is currently developing an interactive, micro-computer-based ride-information system to provide support for handling inquiries about the transit schedule, inquiries about buspooling, vanpooling, and carpooling, and referral services for social service agency transportation.

Prerequisites

The federal demonstration grant was the primary impetus for the Knoxville Commuter Pool, but there was strong local interest in the alleviation of downtown congestion and improved public transit service. These mandates, however, did not become the preserve of the commuter pool, for the Knoxville Transit Authority vigorously developed express bus services and the Tennessee Valley Authority independently developed extensive express bus and vanpool services for employees at its headquarters building in downtown Knoxville and elsewhere in Tennessee (5).

Frank Davis of the University of Tennessee is the initiator and patron of the Knoxville Commuter Pool through the university's Transportation Center. The Knoxville Commuter Pool has been under the management of John Beeson, a former businessman and an effective entrepreneur for vanpooling.

Barriers

It is an irony that the Knoxville Commuter Pool, which has gained national recognition for dealing successfully with barriers to paratransit, should itself be confronted with potentially significant political barriers to its continued existence. In 1977 and 1978, a major preoccupation of the agency staff was establishing a role for the agency in the local governmental structure. Final institutionalization of the Knoxville Commuter Pool is unresolved.

Colonial Paratransit and Taxi Company

Significance

The Colonial Paratransit and Taxi Company of Bethel Park, Pennsylvania—an aggressive, multiservice, private paratransit organization—illustrates the potential services that can be cost-competitively provided by for-profit taxi companies. Colonial Taxi also underscores the continuing turf conflict between the private and public sectors.

Chronology

Colonial Taxi is a family-owned small business that, through aggressive, discerning management, has developed over the past 25 years from an exclusive-ride taxi company into a multiservice provider of paratransit. The company principally serves the south side and southern suburbs of Pittsburgh. In the mid-1950s, the company began providing contract services to private charities and school districts, principally to transport handicapped children. At about the same time, the company began offering shared-ride commuter services that feed suburban transit routes.

Today, Colonial Taxi has more than 170 vehicles, including 100 Checker passenger sedans and sixty-five 12-passenger vans (many equipped with wheelchair lifts). Income is derived from a variety of service programs; only 21 percent comes from traditional exclusive-ride

taxi service. The distribution of income from the various services provided is given below:

Service	Percentage of Income
Demand-responsive shared-ride taxi	9
Subscription van and bus service to social service agencies and local communities	27
Agency-sponsored and private van service for the handicapped	28
Taxi service for the elderly	11
School busing	5
Exclusive-ride taxi	21

Colonial Taxi grossed about \$1 900 000 in 1977.

Prerequisites

The key prerequisite of Colonial Taxi's success has been the qualifications and personality of its president, William Knaus, who was recognized as "1978 Operator of the Year" by the International Taxicab Association (6). Knaus is an aggressive entrepreneur who has a good instinct for national trends in the paratransit field, knows local transportation institutions, and possesses the necessary management skills to operate a small-scale service enterprise. These traits, unfortunately, are not always found in the taxi industry today.

Barriers

Two types of barriers have plagued Colonial Taxi as it has expanded its services; both have arisen from government programs and regulatory policies. In recent years, the organization has been involved in lawsuits as it has attempted to defend its service market from government encroachment.

The first type of barrier has been government regulation and policy on the way Colonial Taxi does business. Restrictive regulatory provisions for paratransit were developed by the state of Pennsylvania in response to the services being initiated by Colonial Taxi and other taxi organizations in the state. A more significant threat, however, has come from federal programs. This includes federally funded efforts by the regional planning agency to coordinate and control local social service agency transportation through a transportation brokerage similar to the one in Knoxville. This, in effect, would challenge the de facto transportation brokerage that Knaus and the Pittsburgh taxi companies have created and the working relations Colonial Taxi has established with public agencies over the years.

A second threat comes from federal capital grant programs, notably Section 16b2 of the Urban Mass Transportation Act of 1964 (as amended), for the purchase of van-type vehicles by nonprofit social service agencies. Social service agencies entering the transportation market compete with Colonial Taxi, often to unfair advantage, in that total capital and operating expenses or economic liabilities are not necessarily computed in the operating costs of these federally assisted agencies.

Dial-a-Bat

Significance

Brockton Area Transit (BAT) of Brockton, Massachusetts, was one of the first public transit properties in the United States to tackle the problem of coordinating the transportation services of local social service

agencies. Dial-a-Bat, the paratransit element of Brockton Area Transit, is a demand-responsive service for agency clients and the elderly and the handicapped.

Chronology

Dial-a-Bat was developed without federal demonstration or other specific funding, through the initiative of the administrator of Brockton Area Transit, Michael Padnos. Operations began in February 1977 after a year of planning and negotiation with local social service agencies. By early 1978, Dial-a-Bat was transporting more than 10 000 patrons/month, 90 percent of whom were clients of about 20 local social service agencies. At that time, Dial-a-Bat had eight 12-passenger vans and two minibuses equipped with wheelchair lifts.

During the first 13 months of operation, approximately 83 percent of Dial-a-Bat patronage was subscription service and 17 percent was demand-responsive dial-a-ride (reservations must be made one day in advance). Dial-a-Bat has subcontracted a small percentage of its dial-a-ride trips, generally those originating in outlying residential areas, to a local taxi company. Since approximately 90 percent of the subscription patronage—and 75 percent of the total patronage—is children, there is a significant decline in activity in the summer.

The cost of the combined Dial-a-Bat operation in fiscal year 1977 was \$1.57/passenger, and 45 percent of this was recovered from fares and agency charges. The deficit represents less than 10 percent of the total BAT operating deficit. Costs include administrative and operating costs but not vehicle capital costs. The subscription service in the first 13 months of operation recorded a mean productivity of 12.50 passengers/vehicle-h; the dial-a-ride service averaged 2.21 passengers/vehicle-h but was increasing consistently over time and exceeded 3.00 passengers/vehicle-h by early 1978. Social service agencies are charged \$7.00/vehicle-h for subscription service and \$2.50/vehicle-h for each one-way dial-a-ride trip by clients. Elderly and handicapped patrons are charged \$1.00/dial-a-ride trip and \$0.50/subscription trip.

Prerequisites

A strong local mandate for improved public transit service was established through the efforts of the mayor of Brockton and was facilitated in 1973 by Massachusetts legislation that included provision for state assumption of half the operating deficit of local transit that was not assumed by the federal government. BAT was established in 1974. Since taking over the previous bus patronage on the greatly expanded fixed-route service, it has increased fivefold to 10 000 patrons/day in 1978.

BAT administrator Padnos was the patron for Dial-a-Bat; he conceived the idea and hired a Harvard government major to plan and implement the service. An experienced supervisor employed by one of the local taxi companies was hired as the "manager of mobility" (MOM) to operate the service, interface with social service agencies, and deal directly with the general public.

Barriers

One barrier that had to be overcome was acceptance of Dial-a-Bat by local agencies. Negotiations with the agencies were described as involved but cordial. A significant prerequisite in agency acceptance was the early participation of a major private, nonprofit social service agency that was already providing transporta-

tion—Self-Help, Inc. BAT entered into a contract with Self-Help in which BAT replaced aging Self-Help vehicles and Self-Help, in name, manages and operates Dial-a-Bat. This gave Dial-a-Bat a strong social service identity and initially enabled the service to use nonunion drivers (as employees of Self-Help) at lower wages. BAT absorbed the start-up expenses and provided the vehicle insurance under the same policy as the fixed-route transit buses.

Federal funding programs have been both a boon and a bane for Dial-a-Bat. Padnos noted that none of the current federal statutes related to social service transportation require that agencies take affirmative action to ensure coordination. Consequently, not all agencies in Brockton make use of Dial-a-Bat. Agencies also find that working within Title 19 (Medicaid) and Title 20 guidelines of the Social Security Act presents many problems, some of which are unresolved.

It should also be noted that in February 1978 Padnos was successful in hammering out a Section 13c supplemental labor agreement that placed no restrictions on the use of nonunion drivers in current or expanded Dial-a-Bat services.

Choanoke Area Development Association

Significance

The Choanoke Area Development Association operates one of the premier rural paratransit systems in the United States and has long been engaged in the coordination of social service agency transportation. It represents both the problems and the potential of public transportation in rural areas.

Chronology

The Choanoke Area Development Association (CADA), a private, nonprofit corporate entity headquartered in Murfreesboro, North Carolina, has operated rural paratransit services for the clients of local social service agencies since 1966. Having started with one leased station wagon, the CADA transportation service has expanded to a fleet of 15 vans and minibuses. In mid-1978 it provided subscription service to more than 7000 patrons/month. In late 1978 CADA embarked on an expansion of service that involved the development of scheduled rural bus routes supplemented by demand-responsive feeder vans.

CADA serves a four-county region that had a total 1970 population of 121 950; 40 percent of the households have incomes below federal poverty guidelines. CADA subscription bus services developed in response to local social service agency needs and the availability of federal funds. The recently expanded services have enabled CADA to achieve the broader objectives of providing public transit for all citizens in the region and generally increasing rural mobility and access to jobs in local towns. In mid-1978 the subscription services were operated at a total cost (including capital expenses) of about \$1.00/vehicle-km (\$0.60/vehicle mile) and an average productivity of 3.60 passengers/vehicle-h. Charges to social service agencies cover about 70 percent of the costs.

Prerequisites

CADA, as a major social service agency, established an internal mandate and was in the transportation business before the advent of substantial federal funding for social service transportation in the 1970s. CADA

has been careful not to overextend itself in transportation; all vehicles have been purchased outright rather than leased, and all costs associated with delivering transportation have been accounted for in practice. Federal demonstration funds for transportation have been used twice for system expansion. A 1972 grant from the Office of Economic Opportunity enabled CADA to centralize operations and formally pursue contracts with local social service agencies. Demonstration funds provided under section 147 of the Federal-Aid Highway Act of 1973 were used in 1978 to develop fixed-route public transit services.

The executive director of CADA, James T. Barnett, has taken a personal interest in the transportation service and is its patron. A former businessman, Barnett has developed an experienced operating and maintenance staff that provides what is probably one of the most cost-effective rural transportation services in the United States.

Barriers

CADA is well-established in the Choanoke region. The transportation service is one of three principal divisions in the organization. The experienced staff should ensure continuity of service in the event of Barnett's departure. In 1973 and 1977, changes in North Carolina Public Utility Commission regulations concerning the operation of public transit systems enabled CADA to become a public transit operator legally able, in 1978, to charge fares and establish routes. There were few other barriers to service implementation. Insurance costs have been minimized by allowing the insurance provider to approve new drivers.

CADA is, however, quite dependent on federal funds for achieving its goals. The demonstration grants have been used as opportunities to meet previously established goals. Unfortunately, CADA has not always been successful in gaining access to available federal funds. In 1976 Barnett gave up attempts to obtain funding under Title 20 of the Social Security Act because the paperwork requirements were too burdensome for cost-effective operation of transportation service for Title 20 clients.

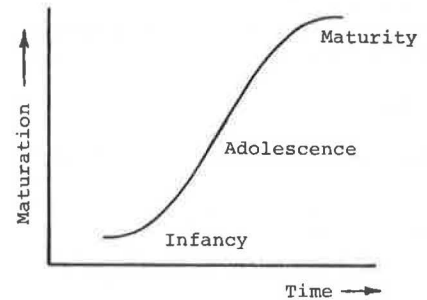
SUMMARY OF RESULTS

Examination of the case studies reported in this paper suggests the following summary observations on technology transfer and on broader implications for public transportation.

The three growth phases of technology—infancy, adolescence, and maturity—are related to local institutionalization of paratransit in general. Figure 1 shows a graphical representation of the three growth phases of technology: infancy, adolescence, and maturity. In relation to the local institutionalization of paratransit, these three phases of growth can be characterized as follows:

Phase	Characteristic
Infancy	Single-mode orientation, generally prompted by federal program or requirement Cursory or limited planning
Adolescence	Rationalization and broadening of mandate Innovative development of new markets and services
Maturity	Complete development of multidimensional service Emphasis on refining service and minimizing cost Secure local mandate and integration into local institutional structures Mechanisms for regenerating staff and adapting to changing conditions

Figure 1. Evolution of paratransit programs.



In paratransit the initial stages of development are characterized by limited modal development—e.g., carpool matching services—generally in response to a federal mandate or funding opportunity and accompanied by, at best, cursory planning. Many paratransit programs, particularly those that limit themselves to a single federal program, will probably evolve no further.

All five of the case studies reported here have advanced to the adolescent or expansion stage, and some are approaching maturity. Successful technology transfer occurs in the mature phase, when programs have secure mandates, a broad range of operational services, and mechanisms for staff training and adaptation to changing markets and opportunities. Table 1 gives some aspects of this development for each case study.

With regard to prerequisites, strong local mandates exist in all five case studies although they generally do not correspond to such federal mandates as energy conservation, abatement of air pollution, and equity of access to transportation. More relevant local concerns are easing traffic congestion and saving money.

Patrons were easy to identify in all case studies except the Knoxville Commuter Pool. In Knoxville, the paratransit program suffers from being a university-based technology push (i.e., a sizeable federal vanpool demonstration) rather than a locally initiated technology pull. An effective local patron or patron institution is a key factor, if not the key factor, in successful institutionalization.

Finally, entrepreneurial skills were evident in all case studies except, perhaps, Seattle, where operational services were least developed. Colonial Taxi is exceptionally well managed, but CADA demonstrates that management skills are not the exclusive preserve of the private sector.

The existence of barriers underscores the need for patrons. In all five case studies, there were many barriers to implementation of service that could only be resolved or circumvented by the vigorous effort of agency staff.

There is some evidence that transportation planning professionals have been barriers to paratransit technology transfer. But, more significantly, they have not been a factor or presence in these case studies. Virtually all of the principal staff people involved in the agencies studied had non-transportation-planning backgrounds.

Without federal funding programs, none of these case studies would have existed; if they did exist, their role would have been greatly diminished. However, some federal programs (e.g., energy conservation) appear to represent little long-term local impetus for local para-

transit development, and others, particularly in human services (e.g., the Social Security Act), have presented difficulties for agencies. Federal policies may unintentionally threaten services that are already provided by the private sector, such as Colonial Taxi.

Colonial Taxi is a successful example of a situation in which government agencies are working with the taxi industry and the taxi owner is the patron in technology transfer. All of the case studies involved in coordinating social service agency transportation have been successful, but in all of these cases effort and education were required to overcome initial reluctance by the agencies.

No compelling evidence was found in any of the case studies of unique circumstances that would preclude technology transfer. Key factors in transfer are the previously identified prerequisites and barriers. It should be emphasized, however, that all of the programs studied are to a great extent the personal accomplishments of individuals; effective transfer of local paratransit technology is not yet at the "cookie-cutter" stage.

It can be concluded that the evolution of paratransit fits the typical characteristics of the technology transfer model. As a new transportation technology, paratransit has experienced innovative leadership (typically from persons outside of the traditional professional community), the implementation of new concepts, and a growth-decay curve of staff development and interest. In most locales, the public transportation community is just in the process of getting used to these innovations.

Finally, there is evidence in these case studies that the successful paratransit organizations are those that are broadly conceived and operated. The paratransit concept has been criticized by some for implying a broad focus in transportation that is not relevant in

practice. However, at least two of these case studies—Colonial Taxi and CADA—have evolved into organizations that encompass virtually the entire spectrum of paratransit service planning.

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Estimating the Costs of a Subscription Van Service

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The development and results of a model that examines in detail the costs associated with supplying subscription van service in a small urban community are discussed. The service is assumed to consist of a number of vehicles that travel fixed routes for an extended period of time. Start-up costs, equipment replacement, system growth, and other variables are incorporated in the analysis. The effects of depreciation, taxes, purchasing and leasing of equipment, and other parameters are monitored. Possible savings to participating commuters under service cost-recovery criteria are also investigated. The procedure developed was implemented by a series of interactive computer routines coded in APL and simulated in a hypothetical demand situation for the Fredericton, New Brunswick, area, and a sensitivity analysis of the major variables and assumptions was performed. The analysis indicated that the model produced reasonable estimates of the results of introducing subscription van service in the Fredericton area. The development of the model is described, and a representative module is provided to show the level of detail undertaken in the analysis. Results of the simulation runs are presented, and variables in the sensitivity analysis that were found to have major impacts on the economic viability of subscription van service are discussed.

Many innovative transportation schemes have been suggested to alleviate existing urban commuting and parking problems. Most of these programs, however, tend to be long-term solutions for a very current problem. The technology required for some proposed solutions is not yet available. Other proposals have associated implementation costs that are prohibitive under current economic conditions. These problems of application are especially prominent in smaller urban areas such as those typical of the Atlantic Region of Canada and many areas of the United States.

Increasing the efficiency of existing transportation facilities is one way of alleviating many of the current transportation problems in these urban centers. Although this may be only an interim solution, such increases in efficiency can be realized in any urban center, regardless of size, and show almost immediate results.