A mixture of different transportation services and providers are required to serve the varied markets and needs in an urban area. Innovative services such as ride sharing and demand-responsive transportation provide new opportunities to serve markets that are currently not served by more traditional services. Communities such as Westport, Connecticut, have demonstrated that these services can be combined in a complementary fashion, so that the different services reinforce, rather than compete with, one another. By offering a range of services provided by different suppliers, a unique system has been created that has had a significant impact on the community. Westport shows what can be achieved by a single community, and the lessons of this and other communities with the family-of-services concept must be diffused on a much broader basis. To achieve this, changes are required on a local and federal level. These changes require an increased awareness of available options and approaches, incentives to adapt these options and approaches where appropriate, and new institutional arrangements to accommodate the changes. An increased emphasis on service implementation and coordination is required, and different relations between planning and operations are appropriate.

Every urban area has a unique mixture of activities, development patterns, local objectives, population densities, markets, and travel desires. To satisfy these varied characteristics and needs, a family of different transportation services is appropriate. No single service or provider can satisfy all the needs. Instead, a mixture of different services and service providers must be interfaced properly to produce an overall transportation system.

This paper discusses the family-of-services concept with particular emphasis on innovative urban transportation services. Three primary areas are addressed. The first is the evolution of specific innovative concepts into more general families of related services. The development of car pooling into a mixture of ride-sharing services is used to demonstrate this evolution. The second is how innovative service concepts can be interfaced with more traditional approaches to result in a coordinated system of different services. The case study of Westport, Connecticut, is used to illustrate this family-of-services approach. Third, a number of issues are raised that should be resolved to ensure that the family-of-services approach can be more easily implemented.

The discussion will be restricted to urban transportation innovations that are not dependent on fixed-guideway technology. Thus, automated guideways, personal rapid transit, and dual mode will not be directly considered although many of the issues raised are equally applicable to these services.

DIFFERENTIATION OF SERVICE CONCEPTS

Although most urban areas have many different transportation services, only recently have we reflected the family-of-services approach in the planning, implementation, and decision-making processes. A first step occurred during the 1960s when highway and transit options, which previously were independently considered, became more closely related. Next, the range of conventional transit alternatives was broadened from the narrow perspective of two modes, bus and rail, to the recognition that each consists of a family of different services. For example, bus systems vary with respect to the size and capacity of the vehicle (minibus, regular, articulated, and double-deck) and the nature of the service provided (local, express, priority lane, or exclusive lane), and rail service can be subdivided into light- and heavy-rail systems.

Traditionally, we have differentiated services by using supply characteristics such as vehicle technology, capacity, or speed. More recently, services have been differentiated on the basis of market segmentation. This is most evident for the specialized services developed to satisfy specific markets, such as ride-sharing options for the peak-hour commuter (car pooling, van pooling, and bus pooling), school bus and airport limousine services, and specialized services for the elderly and handicapped.

A family of service providers exists in most urban areas to operate the various services. These include public and private transit companies, nonprofit agencies, individual entrepreneurs, and companies that are not primarily in the transportation business but provide
transportation services in an incidental manner (e.g., many companies operate bus or ride-sharing services for their own employees).

Thus, the family-of-services concept is much more complex than transit versus highway or automobile versus bus versus rail. It reflects the rich mixture of services, markets, and providers present in an urban area and the need to select and properly interface these components in an appropriate overall system.

In addition to the many existing service alternatives, new innovative services should also be considered as parts of the family of services. What are the implications of these new concepts? First, the available options and the spectrum of choice are expanded. Second, the process of choosing and interfacing appropriate services is complicated. Obviously, the more choices one has, the more difficult it is to select among them. A further complication is the lack of experience with these new concepts and the uncertainties inherent in experimenting with something new. Third, and probably more critical, is that the implementation process can be quite complex.

Here, again, uncertainty is a factor. However, the major difficulty in the implementation of a new concept may cause changes in other institutions, and the process of institutional change can be quite complex.

**EVOLUTION OF INNOVATIVE CONCEPTS**

An innovative concept is often introduced in a specific (and sometimes narrow) context. As the concept develops, initial preconceptions change, and specific contexts evolve into more general approaches. Unfortunately, many new concepts become stereotyped at an embryonic stage, often in an inaccurate manner that does not reflect the changes in the concept as it evolves. We must guard against this, recognizing that most new concepts have numerous different configurations and variations.

The evolution of car pooling into a family of ride-sharing services illustrates how a specific new concept can evolve into a mix of services that are conceptually similar yet provide different service characteristics. Ride-sharing options (van pooling and bus pooling, as well as car pooling) are peak-hour subscription-type services in which each day the same people are picked up at their homes and brought to a common destination (generally an employment center). With respect to differences among the various ride-sharing services, van pools and bus pools with larger capacity vehicles are most useful for reasonably long commuter trips [e.g., 16 km (10 miles) or longer], whereas car pooling is more practical for shorter trips. Most bus pools use a paid professional driver, while car-pool and van-pool services use a nonprofessional driver who generally contributes in-kind services. As a result, the cost of bus-pool service is considerably higher than that of car-pool or van-pool services and generally requires a subsidy. A car-pool driver typically uses his or her or a passenger’s vehicle, whereas a van-pool or bus-pool driver uses a vehicle provided by some organization. Thus, van-pooling and bus-pool service require some organizational involvement in their operations, whereas car pooling can rely on a much looser organizational structure.

There are many variations on a single ride-sharing concept, such as van pooling. The van-pooling concept first initiated at the 3M Corporation has now been replicated at over 100 other organizations. Obviously, there are limits to the number of companies that have a sufficiently large number of employees to support their own van-pool program or the motivation to initiate such a program. Therefore, to expand the applicability of the concept, multiemployer van-pool programs are being organized to serve several organizations in close proximity. The involvement of several different organizations broadens the market, but also complicates the implementation of the program. Whereas a company is often willing to perform certain functions (such as insurance protection and vehicle maintenance) for its own employees, it is reluctant to become involved with employees of other companies. Thus, some other organization must assume the coordinating role. For example, a multiemployer van-pooling project that has just begun in the Twin City area is being coordinated by the Metropolitan Transit Commission and will actively involve private enterprise in purchasing and leasing the vehicles. In the Knoxville, Tennessee, ride-sharing program, the city is the coordinating agency, while the vans are owned by the individuals providing service. The Tidewater Transit Commission will own all the vans in its van-pooling project. In the Baltimore VANGO van-pooling program, a private nonprofit corporation is the lead agency that acquires the vans. Different institutional arrangements have been developed to facilitate the deployment of a similar service concept.

All van-pooling programs to date have been structured on a break-even basis (an argument can be made that, in some cases, a company has provided various indirect subsidies to initiate and operate the program). However, many variants are possible—e.g., a profit-making operation, where the profits would serve as an incentive to private industry or as a cross subsidy for a public agency. Van pools could also be operated at a deficit, particularly if the deficit were less than those of other alternatives.

The various ride-sharing concepts are complementary, each serving different market needs. Organizations such as the 3M Corporation and the Tennessee Valley Authority use a mixture of car-pooling, van-pooling, and bus-pooling services, rather than relying on any single one. Many state and regional government agencies have initiated programs that reflect the family of ride-sharing services (the programs in California and Massachusetts are good examples of statewide ride-sharing programs). The original dial-a-ride concept has developed into a family of demand-responsive services. Numerous different service designs have been used in the more than 100 demand-responsive systems that have been implemented in North America. Some of these systems are totally flexible, whereas others might be considered hybrid systems, combining both fixed and flexible characteristics. Different operating frameworks have been used, including public transit companies, taxi companies, and private nonprofit organizations.

As in the case of ride-sharing, demand-responsive services have been implemented on both regional and statewide bases. The most interesting statewide program is in Michigan where 41 new demand-responsive systems in small urban areas have been implemented in the past 3.5 years. The state will pay for the service the first year, but the locality must decide at the end of that year whether it wishes to continue the service and, if so, assume financial responsibility for approximately two-thirds of its cost (the state pays the remainder). Thus far, of the 32 communities making that decision, only 2 have decided to terminate service, whereas 30 have elected to continue. In 19 communities, the decision was put to the voters who passed the millage in 17 cases.

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At the same time that these communities were approving transit funding, some communities were defeating mileage for other public services such as schools and libraries by sizable margins. The conventional wisdom that public transportation in small urban areas is not a priority need has certainly been refuted in Michigan.

There are numerous examples of successful ride-sharing and demand-responsive services in many different settings, but many failures can also be cited. These failures have generally been caused by several factors. Initial perceptions of key issues and approaches are often incorrect. For example, many areawide carpooling programs that initially emphasized computer matching have been unsuccessful. The realization that the key initial contact is the employer (rather than the individual) and that the basic issue is marketing (not computer matching) results in more successful follow-on programs.

A second reason for failure is that a concept is misapplied or implemented in an inappropriate setting or manner. It is sometimes suggested that the inherent flexibility of demand-responsive services allowed them to be adjusted during implementation. Finally, we must acknowledge that many tests of new concepts are failures because the concept does not perform as anticipated. A high failure rate should be anticipated when anything new is attempted, but unfortunately, our political processes are not very compatible with failures in the public sector.

Ride-sharing and demand-responsive services represent two innovative areas where reasonable implementation experience has been gained. Several other innovative areas exist where little or no implementation has yet taken place. Examples include short-term automobile-rental schemes, transportation cooperatives for housing developments or neighborhoods, and organized hitchhiking schemes involving licensing regular drivers to pick up and charge passengers. Each of these schemes, and others, could play a potential role in the family of services, but far more must be learned before that role can be understood.

FAMILY-OF-SERVICES IMPLEMENTATION

A good way to illustrate how the family-of-services concept can be implemented is through examples. Many examples exist where various innovative concepts have been combined with more conventional approaches. Areawide programs combining fixed-route and demand-responsive services are under way or being initiated in Ann Arbor, Michigan; Orange County, California; Minneapolis and St. Paul; Detroit; Cleveland; and Chicago.

Some transportation authorities are now playing an active role in ride-sharing, in addition to operating mass-transit, service. Knoxville, Tennessee, has established a new city agency to serve as a transportation broker and coordinator for bus, ride-sharing, and demand-responsive services and specialized transportation needs. Rather than exploring a number of these examples in some detail, one specific example will be presented in considerably greater detail. Westport, Connecticut is an excellent example of how a family of services can be developed and have a significant community impact.

Westport (population 28 000) was considered a community where public transportation would never succeed. It is extremely affluent (median family income $24 000), has low-density development [500 persons/km² (1300 persons/mile²)], and high automobile ownership (2.2 automobiles/household). Three years ago, the newly created Westport Transit District introduced a pulsing fixed-route hail service where all routes converge at the town center approximately twice an hour (Figure 1). The seven routes are carefully laid out to serve major activity centers and provide coverage within 0.4 km (0.25 mile) of a route to 85 percent of the residents. During the peak hours, the routes are modified to serve the commuter railroad station [Westport is 80 km (50 miles) from New York City] (Figure 2). The system carries approximately 1800 regular riders and 500 commuters daily, and during the summer months, ridership increases significantly, sometimes exceeding 4000 riders/d. This ridership is significantly greater than ridership in other comparable areas. The cost per passenger for the service has varied between 50 and 60 cents, a remarkably small amount for any urban area, particularly a small city.

The impact of the service on the community has been significant:

1. Twenty-six percent of the commuters have already reduced their automobile ownership, and an additional 24 percent plan to not replace an automobile (households with multiple automobile ownership).
2. The town real estate association, which initially opposed the system and claimed that it would destroy the community, presented the transit director with its first person-of-the-year award, stating that the transit service had done more to increase real estate values in the community than any other factor.
3. A poll of persons moving into the community indicated that the transit service was one of the three primary factors causing them to choose Westport.
4. More than 50 percent of the regular riders are 12- to 15-year-old children, and 50 percent of their trips represent travel that they were unable to make before the service was initiated. The transit service has provided a new mobility for young people, an often forgotten transportation-deprived group. Perhaps these young people will acquire a positive attitude toward public transportation that they will retain as adults.
5. A survey conducted 2 years after initiation of the service indicated that 40 percent of the population had ridden the bus during the previous year, 20 percent the previous week, and 10 percent the previous day.
6. As a direct result of the services, the town has canceled plans to build an additional 300 parking spaces that would have cost approximately $1 million.
7. The introduction of the service has resulted in a significant increase in the use of community services such as the libraries and summer schools.

There are many reasons for the Westport success, but three are of primary importance:

1. Service design: The service was carefully de-
signed to serve the travel needs of the community, with particular emphasis on two specific markets (commuters and young people), and to minimize peaking problems.

2. Pricing policy: An annual pass allowing unlimited use of the system was offered at extremely low cost (during the first year, the charge was $25/year for husband and wife and $7/year for each child (a 50¢/trip service is also available, but most passengers use the annual pass)). More than 7000 persons (25 percent of the population) bought passes the first year, and once a person had a pass, the impetus to use it was present. Thus Westport was able to prefinance a large portion of the cost of a widely used service, rather than to use the traditional approach of obtaining most funding from taxes to support a service that is frequently used by only a relatively small number of people.

3. Marketing approach: During the first year, more than 7 percent of the annual budget was spent on marketing. The service was attractive, efficient, and reliable; it used eight Mercedes Benz minibuses. Great care was taken to interact with the community and make the service easy to understand and use.

Westport has successfully created a transit awareness in the community that is generally lacking in most urban areas. That degree of transit awareness is of critical size, allowing the city to build on an existing foundation. The overall objective of the transit district is to provide a range of complimentary transportation services that will further decrease reliance on the automobile and improve the quality of life in the community. Accordingly, a series of new services has been introduced as part of an Urban Mass Transportation Administration Service and Methods Demonstration Project. The first of these is a Maxytaxy shared-ride service to complement the existing Minnybus service. The initial plan was to form a new transportation cooperative and allow both taxi operators in the community to participate. One taxi operator declined to participate, so the new service was awarded by competitive bid. The same taxi operator who opposed the cooperative refused to bid and filed suit in Federal District Court. In an important decision, the judge ruled in favor of the Westport Transit District, which allowed the service to begin (the case has been appealed). The Westport Transit District pays the taxi operator on a cost-plus-fixed-fee basis with an incentive fee based on passengers carried, productivity, and safety performance.

Although the service has not been operating long, preliminary results are quite encouraging:

1. The ridership on the shared-ride service increased from 400 passengers/week at the beginning to more than 2500 passengers/week 9 months later.
2. The service is recovering 60 percent of its costs, with the recovery percentage increasing with increasing ridership. The goal of a near break-even operation appears feasible if ridership increases continue at the same weekly rate of increase.
3. Ridership on the regular Minnybus service increased in comparison with the previous year, with the increase appearing to be related to the Maxytaxy service.
4. Only 10 percent of the users of the shared-ride taxi service previously used the exclusive-ride taxi service. Thus, a new market has been developed, rather than an existing market being diverted.
5. There has been a 30 percent ridership decrease in exclusive-ride taxi service for the company supplying the shared-ride service. However, the operator's gross revenues and profitability for the exclusive-ride service

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Figure 1. Off-peak service.
have both increased; he now concentrates on using his exclusive-ride service for the more profitable long-haul service with the shared-ride service absorbing the less profitable short-haul trips.

Although the results are preliminary, they indicate several important conclusions:

1. Different services attract different markets. The shared-ride fare ($1 to $3/trip) is significantly more expensive than the Minnybus fare ($0.50/trip or less for passengers using passes), but less expensive than the exclusive-ride taxi service.

2. The new service provides additional alternatives to the automobile, which increases the attractiveness and ridership of existing services.

3. The private provider benefits by having a more profitable overall operation. It was originally anticipated that the exclusive-ride service would be less profitable, but that the combination of the two would be more profitable. The increased profitability of exclusive-ride service is a surprise.

New services continue to be introduced. Several of the Maxytaxi vans are equipped with a wheelchair lift, so that areawide service to the physically handicapped is now available. A package-delivery service was recently begun as part of the Maxytaxi service. Small retail establishments that previously owned their own vehicles and used part-time drivers are now contracting with the Maxytaxi service to provide a similar service at lower costs.

The taxi company is also providing supplemental fixed-route service during the peak hours. The transit district is therefore able to avoid the peaking problems characteristic of most transit operations.

These car-pool and van-pool ride-sharing programs are being initiated in cooperation with the Connecticut Department of Transportation. The Westport Transit District is serving as an information coordinator and broker for all urban transportation needs. A computer system has been introduced to allow management to better evaluate performance and assist in a limited way with the operation of the services.

WESTPORT IMPLICATIONS

The Westport story is an impressive one, showing how a family of services can have a significant impact on a community. This city has successfully combined all
modes of travel from heavy rail at one extreme to taxi service at the other.

Success was not easy to achieve. The basic groundwork for initiation of the Westport Transit District started in 1968. It took 6 years before service was started, but the careful work that went into developing the various services has paid off.

Why has Westport succeeded, and can that success be replicated in other urban settings? Certainly the service design, pricing policy, marketing, and service-delivery approaches are essential components of the success. However, there are other more fundamental characteristics that include the following:

1. Leadership: The success is directly related to hard work, dedication, and the skill of Richard Bradley, executive director of the Westport Transit District. Bradley came to the transit district from a social service agency in the community. This past experience provided him with the necessary understanding of the community, its markets, and its needs. The lack of any past involvement in urban transportation allowed him to explore alternative approaches without preconceived biases. He attended professional meetings and talked with leading authorities to capitalize on new concepts and approaches.

2. Institutional setting: Because there was no community transit service before the formation of the transit district, Bradley was able to create a new entity without being constrained by existing institutions already providing service. The Westport system is on a small enough scale so that it can be reasonably managed. The employees feel that they are part of an exciting activity. As new activities and services are developed, each is provided with a separate organizational unit.

Consider these components of success in relation to other urban areas. There is an infusion of new leadership in urban transportation, as demonstrated by the number of young people heading major transportation authorities and transit operating companies, taxi companies, and ride-sharing programs. However, a much more extensive program in education and training will be required to ensure that top and middle managers can make maximum use of new concepts and approaches.

Institutional constraints in urban areas do, however, present formidable problems. Whereas we have recognized the concept of a family of services, we have not recognized the relation of those services to a family of providers. Many of the new concepts are not consistent with the traditional missions of existing institutions and do not fit neatly into existing organizational roles.

1. Car pooling is most closely associated with highway agencies whose traditional activities have been construction-oriented, but the objective of car pooling is to increase automobile occupancy and reduce the need for new construction.

2. Metropolitan planning agencies have traditionally been concerned with long-range activities and the use of transportation to influence urban development. The new concepts largely reflect, rather than influence, development patterns, and traditional planning techniques are not applicable to their basic design questions. Issues of coordination and implementation become more central than traditional planning approaches.

3. Transportation authorities and transit operating companies preoccupied by escalating operating deficits are primarily concerned with providing adequate funding to support existing services and reluctant to allocate time or resources to different services.

4. The new services are not capital intensive and use existing equipment. Therefore, there is no major incentive for private industry to exert major interest.

The traditional advocates, both public and private, are not present to foster innovation and change. Given this situation, it is therefore not surprising that most of the major successes have been initiated by nontraditional groups. Ride-sharing programs have been initiated by radio stations, citizen's groups, and chambers of commerce, but not often by professional transportation agencies.

Why not allow this process to continue? There are several reasons. First, most of the programs initiated by nontraditional groups have been narrowly focused toward specific approaches. The group is often interested in promoting that specific technique, rather than in obtaining maximum benefit from interfacing the specific service with the family of other services. Second, whereas the initiating group serves the critical role of introducing the service, it is generally not well equipped to deal with the complex issues of service coordination. It is not surprising that the responsibility for second-generation ride-sharing programs, dealing with a variety of ride-sharing concepts and their relations with more conventional approaches, has shifted toward organizations having the capability to provide coordination and integration.

One must not confuse coordination and operation. The vitality, incentives, entrepreneurial initiatives, and private-sector involvement characteristic of the initial independent efforts can and must be preserved. A coordinating organization has much to provide, but it must be careful not to overstep its role.

The introduction of new service concepts has forced us to reexamine and rethink basic assumptions about organizational roles and responsibilities. These are not easy questions, but they are very important ones.

In most urban areas, there is no readily identifiable lead agency to provide overall direction and coordinate service delivery. Our funding programs, planning requirements, and institutional roles largely reflect a single provider of conventional services. A broadened perspective of multiple-service providers and the introduction of new service concepts raise new issues of resource allocation, regulatory reform, labor protection, and service delivery alternatives.

Issues of scale and impact are important. Many of the new concepts can play (and in some cases have already played) a major role. As such, they must be treated seriously and not simply remain on the periphery of the issues. Again, it must be emphasized that the issue is not simply introducing a new specific concept. Rather, it is a far broader concern—that of introducing a different process and conceptual framework for the planning and provision of urban transportation services.

FEDERAL ROLE

The federal government has a central role in these areas because of its function in providing funding and establishing guidelines and requirements. The U.S. Department of Transportation is to be commended for its recognition of the changes that have occurred as shown in its concern for transportation system management, short-range incremental planning involvement of the private provider, and consideration of a broader range of options. However, firm policies have not yet been issued. It has been more than a year since the draft policy statement on paratransit was released. Until that policy statement is finalized, urban areas will be reluctant to reflect the intent of the new policies. Second, existing funding pro-
programs and policies do not provide the necessary incentives or penalties to encourage change. Neither carrots nor sticks are present. It is unrealistic to expect most urban areas to allocate scarce resources for new service concepts. The use of Urban Mass Transportation Administration section 5 funds is a case in point. Although the program was intended to support both capital and operating costs, most funds have been expended for operating costs. New service concepts cannot compete in such an arena.

What, therefore, should be done? Several approaches seem appropriate. First is the issue of awareness. The federal government has stated that the determination of the appropriate service mixture is a local decision. That philosophy is sound and argues against any mandated program for a particular service concept. However, the federal government must ensure that local decision makers without professional transportation background are aware of the possible options and the implications of those options. How is awareness increased? More than better information dissemination is required. Existing planning procedures and requirements should be modified to better reflect changing needs and approaches. Less emphasis should be placed on traditional planning issues, and more emphasis should be directed toward operational planning, regulatory reform, resource allocation, implementation issues, institutional roles, service delivery, and service coordination. In how many urban areas are policy makers even aware of the inventory of existing service options and providers available to them? Very, very few.

Social Service Transportation

Joseph S. Revis, Institute of Public Administration

The nature and scope of social service transportation systems are summarized, and the benefits and limitations of coordination among such services are explored. The potential for improvements in coordination and a series of considerations for future improvements are identified. The increased interest in coordinating social service transportation is explained by the increasing funding constraints of the late 1960s and the 1970s as projects became more concerned about using their resources as effectively as possible. The nature of coordination is examined and the findings of a national survey of state agencies on aging are presented. The barriers to coordination are identified and classified into two broad categories: statutory and legal and administrative, institutional, and perceptual. The statutory and legal barriers include eligibility and user restrictions and franchise and labor problems; the administrative, institutional, and perceptual barriers include regulatory and administrative constraints, accountability requirements, insufficient information on transportation services, preferential treatment of clients, discontinuity of funding, and public transit. The benefits of coordination include (a) reduced overlap and duplication, (b) increased service capacity, (c) improved vehicle productivity, and (d) cost reductions in purchases. Directions for improved coordination—in the areas of policy, planning, operations, and research—in the future among transportation services provided by social service agencies are identified.

The provision of transportation services to their clients by social service agencies has long been an integral part of their programs. Recently, these agencies have become more concerned and involved with the issue of coordinating their transportation services because of the number of projects providing such services (due to the inadequacy of public transportation and the lack of private transportation among certain social groups),

2. The scarcity of funds for social service programs in the 1960s and 1970s, and
3. The concomitant recognition of the importance of coordination in the face of the need for and scarcity of funds.

This paper reviews the background of social-service transportation projects; describes the nature of coordination and the barriers and limitations to coordination efforts; and presents an overview of some of the solutions and possibilities for improving transportation coordination among social service agencies and between social service agencies and public transportation (1, 2).

PROJECT GROWTH AND FUNDING

Project Growth

The Institute of Public Administration's (IPA's) state-of-the-art report on the transportation problems of the elderly, which was based on a survey of projects throughout the country, estimated that in 1974 there were between 1000 and 1500 projects providing transportation services to the elderly and other disadvantaged groups (1, pp. 71 ff). Most of these projects were of comparatively recent