panel discussion

GROWING DEMAND-RESPONSIVE SYSTEMS IN THE UNITED STATES AND CANADA

W. R. McDougall, Kates, Peat, Marwick and Company, moderator

Several demand-responsive systems that commenced operation 2 or 3 years ago have been considered so successful that they are now undergoing significant expansions; in some cases, they are becoming communitywide systems. These systems and the names of the panelists who discussed them are given below. Panelists were asked to respond to prepared questions as well as those from members of the audience. The questions were not technology oriented in that they did not deal with planning techniques, routing, dispatching systems, and equipment. The intent was to discover how the community views demand-responsive transit service, where systems have been successful, and why they have been successful, not necessarily according to the technicians but according to the people who use the system.

METROPOLITAN TORONTO DIAL-A-BUS

Hugh Clelland, Ontario Ministry of Transportation and Communications, Toronto

The Government of Ontario has the distinction of having launched the oldest operating demand-responsive system in North America. Through its GO Transit operation, Ontario commenced a commuter rail feeder system in the suburban community of Bay Ridges in 1970. That operation has continued to thrive and grow; ridership has steadily climbed every year. Recently operating responsibility was transferred from GO Transit to the municipality of Pickering.

Based on the success of the service in Bay Ridges, other Ontario communities have launched demand-responsive systems, notably Stratford, Kingston, Bramalea, and Ottawa. By far the largest and most ambitious is the system now being implemented by the Toronto Transit Commission and GO Transit in North York. This system will feed line-haul transit and provide internal circulation within a service area containing residents.

Item	Initial System (Bay Ridges)	Expanded System (North York)
Service date	June 1970	October 1973, first phase February 1974, final phase
Population served	13,700	200,000 (total off peak)
Number of vehicles	4	27 (20 off peak)
Average weekday ridership	640 (winter 1972)	5,000 to 6,000 projected
Fare	30 cents	40 cents
Type of service	Commuter rail feeder; many-to-many intra-neighborhood, off peak	Subway and route bus feeder, peak; suburban shopping and many-to-many intraneighborhood, off peak

ANN ARBOR TELETRAN

Michael J. Berla, Ann Arbor Transportation Authority

The basis for expanding the Ann Arbor system is success of the dial-a-ride pilot project. Two significant findings were recorded:

1. Transit trip-making in the target neighborhood doubled over previous regular route bus service; and
2. More than half of the dial-a-ride patrons previously used private cars to make the same trip.

The citizens of Ann Arbor voted a 2½-mill property tax in April 1973 to expand the dial-a-ride service from one neighborhood to a citywide Teltran system. The Teltran system is being implemented in phases and will be fully operational in 1974.

Item	Initial System	Expanded System
Service date	September 1971	Summer 1974
Population served	6,500 initial 17,000 final	100,000 (entire community)
Number of vehicles	3	40 dial-a-ride 30 express coaches 5 wheelchair buses
Average weekday ridership	200 initial 375 final	5,000 to 6,000 projected
Fare (adult cash)	60 cents	25 cents
Type of service	Many-to-few neighborhood to downtown and hospitals	Many-to-many citywide

ROCHESTER-GENESEE REGIONAL TRANSIT AUTHORITY DIAL-A-BUS

James E. Reading, Regional Transit Service, Rochester

The Rochester-Genesee Regional Transit Authority has been a leader in advancing the demand-responsive transportation concept. Its first project was a citywide system for Batavia (population 18,000). Based on the ridership response and efficient operation in Batavia, the authority implemented service in part of the Rochester metropolitan area. The new Rochester system employs radio teleprinter communication, which was first successfully demonstrated in Batavia. The present operation in Rochester is considered to be the first step in what will eventually be a much larger system.

Item	Initial System (Batavia)	Expanded System (Greece and northwest Rochester)
Service date	October 1971	August 1973
Population served	18,000	30,000
Number of vehicles	5	7
Average weekday ridership	450 (winter 1972)	230 during 4th week; still growing
Fare (adult cash)	60 cents	$1.00 base fare with discount fare for children and regular subscription service
Type of service	Many-to-many; citywide in small community including home to work and home to school	Home to work and home to school service; feeder for regular route bus; many-to-many; midday service

REGINA TELEBUS

Wallace G. Atkinson, N. D. Lea and Associates, Ltd.

The Regina Telebus project is the most ambitious and successful in North America if ridership is used as a basis for comparison. The original test area is a high-income neighborhood in south Regina, which had failed to attract significant ridership on regular-route buses. Telebus was overwhelmingly successful, doubling transit ridership from the area and simultaneously reducing the operating deficit. Regina Transit has subsequently been expanding the service on a regular basis, adding area and vehicles. Eventually, all outlying neighborhoods in Regina will have Telebus service.

Item	Initial System	Present System	Ultimate System
Service date	September 1971	April 1973	1976
Population	18,000	32,000 peak; 63,000 night	80,000 peak; 120,000 off peak and night
Number of vehicles	7	11	35
Average weekday ridership	1,200	2,000	5,000 projected
Fare	35 cents	35 cents	40 cents
Type of service	Intraneighborhood many-to-many, line transit feeder		

REASONS FOR EXPANSION

QUESTION: What specific findings from your test or pilot system led to the decision to expand? By what criteria has your system been judged successful? Is the community as a whole involved?

BERLA: The two most important, specific findings from the Ann Arbor pilot dial-a-ride project were (a) transit ridership approximately doubled in the area where the project was first operated (a relatively high-income, high-automobile-ownership area) and (b) approximately 50 percent of the trips were diverted from automobiles. In the absence of dial-a-ride, 18 percent would have driven their automobiles and another 32 percent would have been driven as passengers. Our situation required 2 major decisions: one by the Ann Arbor Transportation Authority to propose that the system be expanded and the second by the public to vote at a general election where the millage was on the ballot in the form of a permanent charter amendment. The crudest measure of community involvement is that 61 percent of those who voted in the Ann Arbor general election on April 2, 1973, voted in favor of a charter amendment that had the effect of raising local taxes by 17 percent for public transportation.

CLELLAND: Our decision to expand was based on the successful operating experience in Bay Ridges and the ability to service a population of approximately 14,000. The overwhelming success of our provincially sponsored commuter rail network in the Toronto area, changing transportation demands, and public acceptance of innovations in the transit field led to a provincially sponsored transit funding policy. This was introduced approximately 2 years ago, and since that time the subsidizing of municipal operating deficits made the acceptance of dial-a-bus as an innovative transit system much more attractive to local governments. The operating deficit is subsidized to the extent of 50 percent.

READING: The Batavia system started 2 years ago this month. A 3-bus, dial-a-bus system replaced a 2-bus, fixed-route system. The fixed-route system had a 25-cent fare; the dial-a-bus system had a basic adult fare of 60 cents. There was almost an immediate 30 percent increase in riding. Besides the dial-a-bus system, we also own and operate a school bus system. Both have home-to-work and home-to-school and return subscription service. There is no subsidy whatsoever. The community is totally involved. The retailing community, the senior citizens, the very young, the young without automobiles, all ages without automobiles have made it accepted by the

community of 18,000 people in a 5½-square-mile area.

ATKINSON: In Regina, we found that dial-a-bus works and can be operated by the existing transit staff. It doubled transit usage in the low-density area where it was first installed. We found that it could be used as a community planning tool, not unlike the streetcar operations in earlier days, but most important we found that public reaction to the personalized service was enthusiastic. A better level of service can be provided for the same dollar investment and, in some cases, there were marginal savings in the subsidy required. Approximately 40 percent of the city population has access to service in the evening hours, a smaller percentage in the off-peak day hours, and a smaller percentage in the peak. The Regina strategy has been to provide different levels of service in different hours of the day and expand the system slowly.

IMPROVEMENTS BASED ON EXPERIENCE

QUESTION: In what specific areas did you learn from your mistakes in the test system? What corrective actions have been taken?

ATKINSON: We made 2 big mistakes in Regina. One was in locating stations for transferring to the fixed-route system in residential area. We received unpleasant reactions from the community. If dial-a-bus is used as a feeder system, the transfer stations should be located in a corner park or in areas where residents are not disturbed because, even if they get better service, they like the better service in front of somebody else's home. The other was with regard to information service. You just cannot underestimate the amount of telephone answering service and the amount of information that you have to give to the public. We also did not keep political decision-makers sufficiently informed of what we were doing.

READING: I do not think any mistakes were made in Batavia. We did learn that there is no vehicle being produced today that can be applied to this kind of service. Many other operators have encountered the same difficulty. Also, we found that we could improve on the digital communication system used in Batavia for dispatching vehicles. About 3 years ago, we attempted to get federal demonstration funds for a program here in Rochester; that attempt failed and delayed our start about 2 years.

CLELLAND: I agree with the comments about the vehicle. In Ontario, we have researched the industry trying to find what we would call a dial-a-bus vehicle. We have finally developed a prototype. The Bay Ridges system serves a commuter rail station; passenger pickups to the station are dispatcher-controlled, but the number of passengers from the station is an unknown. The 11-passenger Ford Econoline van had insufficient capacity to handle the return trips; we should have had a van that seated 15 to 20 passengers. We also recognized that we could have made the driver's life easier by eliminating the selling of tickets and making change. In the Toronto Metro project, we are advocating exact cash fare. For a small community of 14,000 people we had a 2-week driver-dispatcher training program, but feel 1 week would have been enough. As the dispatching system becomes more sophisticated, the time for that training naturally has to increase.

BERLA: With regard to locating transfer points, I noticed that one of the transfer points in the Ann Arbor system is going to be located across the street from the house of the former mayor, who was instrumental in helping to bring about a favorable public climate for the system. He is going to be put in an interesting situation when the buses begin stopping in front of his house: Is he for it or against it when the crunch comes? On the question of size of feeder vehicles, it seems to me that there is a trade-off between productivity and level of service. Larger vehicles, obviously, have better potential productivity but also longer tour times. With 10-passenger vehicles, we have already a number of complaints from people who are dropped off last. We made no major mistakes or problems in the pilot system, but one thing we learned was that dial-a-ride ought to be integrated into a total system; for it to work as an add-on is difficult. The public gets confused about the service and whether service is related to where they live. A sufficient share of the initial budget should be devoted to marketing, by which I mean transmitting information to potential users. I am amazed

at the number of times an individual who is not "into" transit needs the same message in a number of different ways before he or she understands the options that are available.

ALTERNATIVES CONSIDERED AND ROLE OF SYSTEM SELECTED

QUESTION: What alternatives to demand-responsive service were considered for your expanded system? How does the demand-responsive service fit into the overall public transport system in your community? What role does it fill? What other systems are used in conjunction with it?

BERLA: We looked at 2 alternatives to a demand-responsive system: One of them was a capital-intensive PRT system, and the other an expanded line-haul system. We discarded the PRT system because we do not think that we have enough density and enough corridors. We do think there is a role for PRT in certain specified corridors in the city, however, and we are hopeful of getting some support from the state to plan such a project. We would like to move ahead on that but not as a whole system. In terms of the options of either expanding the line-haul system or going to a demand-responsive system, our judgment was that in a city like Ann Arbor, which is a relatively affluent community with a high automobile ownership rate per household, a significant number of people will not be pried out of their cars by anything except a very highly personalized service. So, putting money into a line-haul system would not generate the demand and the ridership.

The Teltran system will be an integrated demand-responsive system, the major features of which will be door-to-door neighborhood feeder service, coordinated transfer to express buses operating principally on radial lines, and a subscription service that we hope will cover many of the work trips and school trips. The system will change very drastically over time basically in the size and number of zones. The largest number of zones will be at peak hours. The system will adapt by time of day, by day of week, and probably by month of year. At certain times of the day it will be a many-to-many, single-zone, dial-a-ride system; at other times a single-transfer, dial-a-ride to dial-a-ride system; and at peak times a coordinated-transfer dial-a-ride or feeder-bus to express-bus system.

CLELLAND: In Kingston, Stratford, Bramalea, Bay Ridges, and Ottawa, the dial-a-bus role is primarily as a feeder service. The new service just initiated in Ottawa has some trunk-line feeder service also. In Toronto, dial-a-bus will provide feeder service to the fixed-route bus and subway systems. As far as the alternatives to dial-a-bus, I believe that all of the systems which have been implemented resulted from transit studies. We considered fixed-route and demand-responsive systems and selected the higher level of service, recognizing the higher cost associated with it.

READING: The dial-a-bus system in Rochester is a part of the regular transit system which is called the Regional Transit Service (RTS), but at the present time is a sort of an add-on system. We hope that eventually it will become a totally integrated part of the system. Other systems that are used in conjunction with dial-a-bus are subscription service and a feeder service to the regular route service. We looked at other alternatives because of our experience in Batavia.

ATKINSON: The Regina Telebus system is now fully integrated with the existing transit service. It is a local service, about 11 percent many-to-many, about 35 percent many-to-few, and about 45 percent transferring to downtown. At several points it also feeds fixed-route services. We tried fixed-route services and found that the deficit in low-density areas varied from $1 to $2 per passenger. Telebus reduced the deficit to about 40 cents per passenger.

USE OF RESEARCH

QUESTION: A great deal of federal and nonfederal money has been invested in research and development of demand-responsive transportation, and a considerable amount of

money can be spent on transportation studies that precede implementation of new transportation systems. What was the role of previous research and development in designing the individual systems that you are responsible for? How extensive a study was conducted before the system was implemented?

BERLA: We did not do a great deal of studying before we implemented our pilot system; but that was a demonstration system, and frankly I think that is the most valuable kind of research to do, that is, do research on a small-scale system in place. A great deal of design work was done by our consultants before that system was implemented, and a great deal more design work has been done and is being done on the Teltran system. I am skeptical about the utility of spending large amounts of resources on paper studies. Demand-responsive transportation has proved itself to be feasible, and characteristics, costs, levels of service, and so forth are by now quite well-known. My preference in this sort of thing is to do it.

CLELLAND: In the Bay Ridges experiment, we did not do a study; the decision was made to implement the service. Some in-house evaluation was done of area size, density, zone size, and vehicle requirements; but within approximately 3 months from the time we received the approval to proceed from the conceptual plan, service was implemented. Since then, all systems that have materialized in Ontario have resulted from transit needs studies. And this, we feel, has given each municipality an opportunity to review the options of transit services in their particular areas, to choose the type of service they would like, and to evaluate the cost involved for the various alternatives.

McDOUGALL: From the point of view of one who does studies for demand-responsive systems, typically the study is not a feasibility study but a preliminary design study. The preliminary design study is, in most cases, a low-budget study in which an estimate is made of costs, expected revenues, vehicle requirements, personnel requirements, and so on. Based on that study, a decision is made. If the system is to be implemented, that requires more detailed design, hiring people, tendering for vehicles, and so on.

READING: It helps to have knowledgeable consultants, and we were fortunate in Batavia and in Rochester to have retained M.I.T. researchers to do our preimplementation study and market research work.

ATKINSON: The initial research that was done served mainly to give us courage to go ahead in the job. We drew heavily from the problems of the Ontario experiments, and we took courage from the Mansfield, Ohio, project, which had to be the smallest demand-responsive system in the world, but it showed that it could be done. We had a minimal feasibility study done, and after getting experience with the system we identified some deficiencies. The big deficiencies are management controls. We monitored these systems fairly well, but we have not been able to translate the monitoring information into a control system loop so that management can look at it each week and see that the system is actually dynamic. Expanding these systems is easy, but contracting them in off-peak hours or in summer is difficult.

M.I.T. researchers have done a tremendous amount of work on potential computer programs for large cities, and we have some small manual systems and some systems that provide computer assistance with the paper work. But, at the moment, there is nothing in between, and there is a real need for more research on how one gets from the small manual system to the large "unmanual" system. There is a shortage of research on land-based communications. The Bell system researchers have not become involved in these kinds of programs to determine whether their equipment might have application to this service; we suspect that they probably have some that does. In addition, research is needed on high-speed paper-handling systems. So there are some very good areas of research, and I would suggest that consultants to the newer systems might be of more help in undertaking this research than in trying to design a detailed system, which is going to be changed by the staff as soon as it is operating anyway. The most acceptable arrangement for the latter is for the consultants to work with the existing staff; in that way the consultants learn from the system and the staff is trained so that when the consultant leaves the system does not collapse.

FUNDING, FARES, AND COSTS

QUESTION: What are the operating and capital funding sources for your system? What is the fare? Is there any research money being used to implement or evaluate your system? What has been the financial performance of the demand-responsive service in relation to the performance of the rest of the system?

ATKINSON: The initial experiment in Regina was funded partly by the city and the province and partly by the federal government for planning, engineering, monitoring design, and so on. The city provided all operating funds and capital equipment. Now that the experimental portion is over, the system is financed entirely by the city. The city expects to get some assistance from the province, but the province (Saskatchewan) has not yet established a cost-sharing policy. The fixed-route system in Regina is subsidized by approximately 10 cents per passenger. For 8 million annual passengers, the subsidy amounts to about $800,000. The Telebus system is subsidized by approximately 40 cents per passenger.

READING: The dial-a-bus system in Rochester is not subsidized except by the regular Regional Transit Service bus rider, but that is not really true because the regular bus company is losing money itself. The system started by the use of retained earnings for capital purposes or by the use of equipment leased for a monthly charge. Both systems are losing money at the present time, but patronage is increasing on the dial-a-bus system and decreasing on the regular bus system. When the 2 systems are integrated, we hope we can reverse the trend to a degree, but we have informed the authority that some form of operating assistance is absolutely necessary to the continuation of the RTS operation.

CLELLAND: The provincial government of Ontario has 3 forms of transit subsidy. The first one applies to municipal transit needs studies for which the province pays 75 percent and the municipality pays 25 percent of the cost. We have been promoting these studies primarily to try to improve the operating deficits and naturally the system design and level of service. This work has been carried out mainly by consultants in short time periods that normally range between 6 weeks and 2 months. We also cover operating deficits, and funds can be allocated in 2 ways. We will cover 50 percent of the operating deficit, not to exceed amounts derived by the following formulas: $1/capita for the first 10,000 and $3/capita for the remainder plus 5 cents/revenue passenger, up to a maximum of 50 percent of the operating deficit. We cover the cost of capital equipment to the extent of 75 percent or a maximum based on an annual formula of $2/capita for the first 150,000 and $3/capita for the remainder. The fares of the 5 operating dial-a-bus services in Ontario range from 30 cents in Bay Ridges to 50 cents in Ottawa. However, Ottawa offers a 5-cent discount rate during off-peak periods and a 20 percent discount if the patron prebooks for 5 consecutive days (those patrons are also allowed unlimited rides on the system during that week). Toronto Metro will have an exact-fare system and similar incentives for prebooking. The provincial government offers monitoring services to these municipalities to obtain ongoing statistical information regarding passengers carried. We expect to expand this information to include detailed information on operating costs.

BERLA: The basic cash fare in Ann Arbor is 25 cents for a one-way trip, including such transfers as are required. A personal, unlimited service pass is $10/month, and a special kind of a pass that we call a family pass is $15/month. Any number of occupants in the same household can use the family pass to make the same trip from the same origin to the same destination together. A 50 percent discount on any of those fares is given to senior citizens and to persons who are in low-income families. The system has required approximately a 50 percent subsidy that came from the general revenues of the city until June 1973. We estimate that the system will require approximately an 80 to 85 percent subsidy, of which 75 percent or about $1½ million out of a total $2 million budget for the first year of full operation will come from the new local earmarked millage tax. Seven to 10 percent will come from state funding under a new state half-cent gasoline tax, which is available for urban transportation in Michigan, and the remainder will come from fares. The dial-a-ride experiment indicated that on a per-trip basis, dial-a-ride trips cost approximately twice as much

as line-haul trips. However, I believe that the bottom-line relation between fare revenues and total cost is becoming a less important performance criterion; at least we have found that to be true in Ann Arbor. I think citizens have become much more sophisticated about asking what costs really mean. They are ready to move away from questions about how much subsidy is required to keep a system running to questions about social, environmental, and land use costs, and how they fit into the picture. That is why these kinds of questions may be a bit limited for systems where expansion is contemplated.

QUESTION: Will the expanded fares have a negative effect on ridership? If not, why not? If so, how can that be overcome and ridership increased?

READING: We have no way of measuring the impact because we started with a $1 fare, graded down for subscription service and for multiple riding. As I mentioned earlier, the second person in a family or the second person in a group can ride for 25 cents. However, the fare was set at $1 because nobody has ever ascertained how much a person will pay for demand-responsive transportation. We felt that it would be better to lower the fare if we had to than to raise it. We anticipate the probability of lowering the fare sometime in the future.

CLELLAND: In Bay Ridges, we set the original fare at 25 cents and gave a discount to those who purchased tickets. We wanted as many riders as we could possibly get, and we certainly did not want to deter them because of fare structure. After a year of operation we increased the fare to 30 cents. We predicted a 3 percent decrease in ridership, but that never materialized. As a matter of fact, the same rate of increase has been maintained during the past 18 months.

BERLA: I can give you just a couple of observations on fare elasticity based on a comparison of similar numbers of operating days in September 1972 and in September 1973. The dial-a-ride fare in September 1973 was 25 cents, down 58 percent from the 60 cents it was in September 1972. Ridership was up about 48 percent for 16 comparable operating days. Revenue was down by a little less than 20 percent. On the line-haul system, the fare was reduced 28 percent from 35 to 25 cents. Ridership was up about 23 percent, and average daily revenue was up about 15 percent.

McDOUGALL: The basic principle here is that people are certainly, within quite a reasonable spread, willing to pay for the service provided. We thought, for example, in Bramalea, which is essentially a working-class community, that a 35-cent fare might be a little steep and people might be scared away. That did not turn out to be the case at all, and people are paying 35 cents to ride from a point just off a corner of the main regional shopping center into the shopping center, just about 2,000 feet away.

BERLA: We probably would have preferred to set our fare higher than we did. Frankly, we made a political judgment that the chances of the millage issue passing would be favorably affected by establishing a low fare. We were able to say that, with this millage that we are asking from the city at large, people would be able to use the system for approximately, say, $200 per year on a family basis or $60 per year on an individual basis. I would feel more comfortable had we set fares somewhat higher, because I think we would have greater ability to respond to demand levels that may turn out to be considerably higher than we predicted.

SYSTEM OPERATION

QUESTION: One of the striking characteristics of a demand-responsive system is that a vehicle will have a few passengers on board midway in a trip and will receive a message to pick up somebody else. How frequently does this happen? What is the average number of deviations per vehicle trip?

ATKINSON: In the morning rush hours, it is impossible to deviate a vehicle that has already left for its tour because that would simply put everybody off schedule from their expected pickup time. In off-peak hours, generally on a 30-minute vehicle

tour, no deviations are made 10 or 15 minutes after the tour starts.

READING: For our morning subscription service, we do not deviate, but for the afternoon service we do deviate to pick up and drop off passengers in the regular route of the vehicle tour. At other times, we only deviate a vehicle for additional pickups or drop-offs when they are enroute to current origins and destinations and do not require the vehicle to backtrack or go off the route.

ATKINSON: I should explain that we are talking about a tour pattern, not a route. The patterns for subscriber service, of course, are almost the same each day unless there has been a last minute change. Different drivers may also follow a slightly different pickup order. Patterns in off-peak periods can be quite random.

READING: A difference that needs to be understood between the systems in Regina and Rochester is that in Regina they have regular tours that meet scheduled buses.

QUESTION: How does one define the trade-off between a large area or a small area, between waiting time, between run times, between fares, and so on?

ATKINSON: We tend to try to maximize productivity within the preselected constraints of what the vehicle tour time is. You could set up service standards, but, first, you have to find out what the goals of the community are. You then establish levels of service, A, B, or C, and calculate the per capita cost. We did this for one project. Based on the modal split, $6/capita provided level A, $30/capita provided level B, and $150/capita provided an almost automobile-free situation. The community then decides what it can afford, and the manager must work within those constraints and operate as effective a system as possible within the preselected service level.

BERLA: People in Ann Arbor do not like to wait more than 15 minutes. If you tell people the waiting times are 25 minutes, they will say, "No thank you, we'll find another way." People in Ann Arbor do not like to be on a bus more than about 35 minutes. If you give a level of service that calls for people to ride longer than 45 minutes, they will use their cars. We use these guidelines in determining the size of our service sectors, vehicle tour times, and dispatching principles.

REGULATIONS

QUESTION: What government and regulatory approvals were required to implement your system?

CLELLAND: In Ontario, there were 2 different areas: the demonstration projects—Bay Ridges and the Toronto Metro project—and municipal projects. In Toronto, the approval of the local government was obtained. Because the Toronto Transit Commission was asked to be the operator, the approval came through relatively easily. In Bay Ridges, only local municipal approval was required. This also applied in the 4 municipally operated systems.

McDOUGALL: The capital subsidies, the study subsidies, and so on that the provincial government provides to municipalities required a change in what was originally called the Highway Improvement Act and is now called the Public Transportation and Highway Improvement Act. The essential change in that act was to provide for provincial government subsidy to municipalities.

READING: The town of Greece, the city of Rochester, and the county of Monroe had to be informed of our plans for dial-a-bus. The legislation that created the transit authority did not give to it any authority. It had the authority to carry out its functions, but not if a town or municipality or any kind of local government opposed it. Therefore, it had to get the approval of the town of Greece, the city of Rochester, and the county of Monroe before implementing the dial-a-bus system. In Batavia, the authority bought a private company and continued the operation but with a change in service.

ATKINSON: Local approvals are required for carriers; and, of course, the license for the radio system in Regina is issued by the federal government.

DIVERTED AND NEW TRIP-MAKERS

QUESTION: Who are the patrons of demand-responsive service? Has it diverted passengers from other forms of public transit and private cars, or has it induced new trip-making? Does your system include any specific disincentives to private automobile use?

BERLA: Most of our riders are female. We also have many school children, principally because of the local characteristics of the pilot project. Most of the trip diversion was from automobiles, either passengers or drivers. Two 1972 surveys showed about 11 percent diversion from the regular line-haul bus system and 12 percent diversion from cabs. In 1971, the cab companies initiated a suit to enjoin the city from operating the system. That suit was dismissed, and the dismissal was upheld on appeal. When we began major expansion, I expected that the local taxi operators would strongly oppose it. Such was not the case, and I understand that in general the taxi industry thinks that if anything dial-a-ride has generated trips for them. People will use a bus to go to a shopping point, but feel they need a cab to go home.

CLELLAND: In Bay Ridges, we were somewhat disappointed with the statistical data we obtained in trying to indicate or recognize the diverted trips from taxis. The only positive result of diverted trips was that 2 small operators went out of business; we know there were trips diverted. There was little comparison with regular buses because, of course, no buses had previously operated in the system except a 2-month experiment tried several years before. For the Toronto Metro project, we will conduct presurvey analysis of present ridership. (I should explain that the Toronto Metro will supplement existing fixed-route services.) We want to get some idea of how many trips are diverted from fixed routes to demand-responsive service. The market area we are trying to reach is the sections approximately 1,000 feet beyond the major arterials where the fixed-route buses operate. The fixed-route service runs on a good system of $1\frac{1}{2}$-mile major arterial streets. We are trying to reach the pockets of poor service areas in between. We are trying to get some cooperation from the taxi industry to monitor its fares for 2 months to see how we affect the industry. With regard to incentives, we have tried to relate fare structure to the perceived cost of the automobile trip. The average trip from the Metro area is about 14 miles, and we have attempted to relate the fare structure to this. The fares are 40 cents both peak and off-peak. There will be no integration with the present Toronto Transit Commission subway service, which has a fare of 25 cents. However, the combined fares compare favorably with the cost of operating an automobile over that distance.

READING: In Batavia, there has been no indication that it has diverted or in any way hurt the taxicab company. Some car pools have been eliminated that took children to school and people to and from work. In Rochester, we have had no calls or complaints or demands on the part of the taxicab companies that we should get out of the business. As a matter of fact, the wife of a taxicab driver indicated that she was going to use the service, and the owner of the largest taxicab company in the service area has subscribed for his children to take dial-a-bus to and from school. There has been little effect on ridership on the regular route; some people are using dial-a-bus to get to and from the regular routes, which take them on into downtown Rochester. Although we have the highest dial-a-bus fare in the United States ($1 each direction), with subscription service, additional people within a family group can ride from one point for 25 cents each. With regular service, additional people in a group can ride for an additional quarter, up to a maximum of 4, so that 5 people can travel for $2. Then it starts all over again, resulting in a fare of 40 cents, which is the basic adult fare on our regular service.

ATKINSON: In Regina, approximately 51 percent of the riders were using the fixed-route system that was already in the area, 11 percent were driving their cars, 13 percent were chauffered passengers—children being driven to school and noncar owners being driven about, 9 percent were traveling by taxi, 10 percent were walking, and 6 percent were unable to make any particular trips before the Telebus service began. The city of Regina both licenses the taxi system and operates the transit system so that there is some control, and there was some good dialogue with the taxi companies,

which after all provide public transportation. The point is that, if automobile ownership is reduced, all forms of public transportation benefit, both taxi and transit. The incentive to use the system in Regina is simply low fares and good service.

QUESTION: In a study of the feasibility of a system, how are estimates made of the potential ridership?

McDOUGALL: There is no fool-proof way; the best method is the rule-of-thumb method based on a comparison of the social, economic, and development characteristics of the city or municipality in question with those of other municipalities that have had demand-responsive systems operating for a period of time. We did this recently in Bramalea, which is northwest of metropolitan Toronto and has about 30,000 people, a small industrial base, and a regional shopping center. We estimated that the 6-bus system we designed would carry 1,000 passengers per day by the end of the year. In fact, it carried 1,500 passengers per day at the end of 3 weeks. So that does not say too much for our ability to estimate patronage. Several attempts have been made to take attitude surveys and try to estimate some levels of the potential impact. The problem is that people are asked whether they will use a service with which they have had no experience.

ROOS: One of the real problems is that many of these systems have a market share by mode of, say, 1 to 5 percent. If estimates are off by 1 percent, the size of the system may be off by a factor of 2. This is really a critical problem for small-scale systems. We do have a reasonably good handle on what might be called the "initial site selection," that is, what portion of a large area has the best characteristics for demand-responsive service. I think there is little to gain by trying to obtain really accurate ridership figures; but, on the other hand, spending time on determining what areas you should go into and what areas you should not go into is well worthwhile.

DISPATCHING

QUESTION: Are you planning to employ automated dispatching or digital communications in your expanded system? If so, how?

ATKINSON: In Regina, we quickly got into trouble because of the high demand for service and the high percentage of subscription riders—as many as 45 percent of the inbound morning riders. Three clerks were required to handle the records. A computer program was then written to handle the subscriber file, and we discovered that it could be used as a dispatching aid. At the moment, the computer file is updated overnight, and the orders are printed for the drivers the following morning. There is no reason, of course, why the computer file could not be updated hourly or half hourly; and, because the pickups are sequenced in order of pickup, it is possible to insert into the subscriber list the demand calls and thus have a computer-assisted dispatching system. We learned that the human computer was very efficient in decision-making and the mechanical computer was most useful to handle the high volume of paper work and to eliminate some of the drudgery. I think the computer costs are a fraction of what the manual labor costs would be to handle a very high subscriber file. For the expanded system, teleprinters are being examined as are the experiences in the United States, but there are no immediate plans to implement any further aids until about 1975, mainly because of a lack of financing.

READING: The Batavia system uses a manual system throughout. We experimented with a digital communications operation, but found it to be too expensive and not really necessary for a system of that size. But that experiment helped in the development of the Rochester system. The operators are trained keypunch operators and are equipped with headsets so that both hands are free. The information goes immediately into keypunch cards, which then go to the dispatcher, who makes mental decisions as to which vehicle will make the pickup and in what order pickups will be made. The cards go into a card reader and the information is digitally transmitted to the vehicles and printed out, giving the driver the location of the people to be picked up, where they are to be dropped off, the order of the pickups and drop-offs, and the fare to be

charged. When the system is expanded, we expect to use the computer for dispatching.

CLELLAND: In our Toronto Metro project, we will require some computer assistance in our dispatching office because we will be serving a population of approximately 70,000 people during the rush hour. There will be 27 in-service vehicles during that period of time. This is a 3-year demonstration project, which is funded 100 percent by the provincial government. During these 3 years, our intention is to test out dispatching techniques, primarily in the transmission of data from the computer-assist programs. The computer system will edit, store, and sort reservation requests into trip order and produce dispatch listings of pickup requests sorted by street and street number. It will also help to prevent overloading a vehicle and provide a means by which vehicle loading levels may be monitored and the upper limits for loading changed. The system operates on a time-shared mode in the ministry's IBM 360/65 computer through telephone connected terminals in the dispatch office. A second IBM 370/158 computer will provide a dual computer configuration that is necessary for a reliable computer dispatching system. The justification for a computer-based system arises not from any substantial cost savings but from the greater achievement in dealing with increasingly complex problems that attend larger demand-responsive operations and that make manual dispatching increasingly complicated and difficult. We do not plan to install digital or transmitting teleprinter facilities on vehicles until after we become operational.

BERLA: Our present system is manually dispatched by a voice communications link. As we move toward a full citywide system we will have digital links with some sort of computer printout or other numeric display on the vehicle.

MANAGEMENT, STAFF, AND OPERATORS

QUESTION: How have you organized your staff hiring and training program? Have special qualifications been set? What type of special management capability is required?

BERLA: Immediately after our local vote for an expanded system, the Ann Arbor Transportation Authority determined that we had to have an executive director who would have full responsibility for the operation of the system including staffing and training. The authority is in the process of moving away from detailed interference in operating decisions. We are doing that partly on our own motivation, and partly with a good deal of guidance on how to disentangle gracefully from our executive director. He is willing to point out to us decision-making areas that are rightfully his rather than ours. That has been a great help, and I think it will continue to be.

READING: The director of advertising and public relations of the Regional Transit Service (RTS) was transferred to the Rochester-Genesee Regional Transit Authority, where he was given full responsibility for the marketing effort of the dial-a-bus system. Robert Aex, the person most responsible for the development of the Batavia dial-a-bus system, is the executive director of the authority. RTS is responsible for the actual operation of the system. The chief dispatcher came up through our scheduling department to radio dispatch. He is a young man, bright and intelligent, who has the ability and capability of going on to even bigger things. He is doing an excellent job. His assistant and the chief telephone operator also came from our scheduling department. A third person in the control center was hired from the outside and trained in the cardpunch machine and telephone headset operation. All of these people received exactly the same initial training as the bus operators receive. We have 365 regular bus operators who pick the job of dial-a-bus. These highly professional, trained bus drivers periodically pick the work they want on the basis of their seniority with the company. And 12 dial-a-bus runs were gone by the time the twenty-sixth driver in seniority had picked; obviously, it is regarded as highly desirable work. Because they are professional operators, drivers do not need any intensive training, except in the geographics of the area such as where the dead-end streets are and how to find the addresses. They have actually redone a map, which is the best map available anywhere of this particular area.

ATKINSON: Gerry McAdoo is the general manager of the Regina system, and he says that the transit manager must be optimistic and enthusiastic. There is no way that optimism and enthusiasm can be transmitted to the staff if they are lacking in the leadership. It is easy to get a government grant and to write a training program, make 10,000 copies, and distribute them to every system in Canada and the United States. But such a program is sterile. What is needed is to have people who are involved in all aspects of the system planning and feeding back to the management their day-to-day problems. The best way to do this is to sit down with them for a couple of hours and just listen. I think that is the most successful way to bring staff along. Start out with a nucleus and through optimistic and enthusiastic management and supervisory teams you eventually have enough people trained to run a large system.

QUESTION: How do you propose to make a manager account for the decision he has made?

BERLA: I think it comes down to setting management objectives between the authority and the management and then testing whether they have been met. One measurement is how well the system is maintaining its budget; another is how well the schedule is maintained in terms of staging. If there are some efforts to develop ridership growth targets, then surveillance should be maintained on those. There are also the areas of public relations and staff relations—what the public image of the system is and how the manager is interacting with the employees.

QUESTION: That describes a process of evaluating the person or persons in charge of the project. The question is, How do you hold a person accountable in a project corporation in which he or she has no personal investment in the system other than career or professional status?

BERLA: That is the ultimate sanction, and all authorities are going to have to use it. Our director's job is on the line, and that is understood by all parties; it was, in fact, a major subject of all preselection interviews.

READING: No transit manager or system would last very long if the public did not like the service that was being provided. The management contract system, of course, builds in incentive bonuses for efficient operation. But, because of the focus of attention on transit today, the transit manager is being looked at through a microscope in many cities.

QUESTION: Have any systems experienced problems with labor restrictions?

ATKINSON: Some of the Canadian systems have actually been able to get sort of a "moratorium" on bending some of the rules and regulations that are agreed to with the unions. The city of Ottawa has the most notable arrangement: a 12-month moratorium on having to negotiate in detail each little change in the regulations. In Regina, the union adopted a "wait-and-see" position for a year. It prefers, of course, to have fairly decent shifts, but is willing to go along with 2 and 3 splits. If the union helps out in this way by not being suspicious of what might happen in the future, the system will go much better.

READING: In Rochester, we have had few problems with the union. We agreed at the outset that all provisions in the contract would prevail in our dealing. We have had no difficulty working out splits because they fall within the provisions of our labor agreement. We did ask the union (and it cooperated fully) to allow those operators who initially picked the dial-a-bus operation to stay on it through 2 picks so that at the end of 3 or 4 months we would not have a new group of operators and disruption to the service. There is no indication on the part of the drivers that they want to relinquish the dial-a-bus pick. They like it and enjoy the opportunities that it has given them.

CLELLAND: In Toronto, the unions have agreed that drivers will bid on a 12-month assignment for the demonstration project. Of course we were concerned about training fixed-route drivers for demand-responsive service. As for the split-shift arrangement, we are unique in the sense that we serve a population of 70,000 during rush hours and approximately 140,000 during nonrush hours. There are 27 service vehicles

during the rush and 20 during the nonrush, so we have minimized split-shift adjustments because of peak demands.

BERLA: Union-imposed constraints have not been a major problem in Ann Arbor, and I do not anticipate that they will be. As a matter of fact, the union was well ahead of management on one issue, that of providing for employees who want to work part time rather than full time. Because ours is a university town, the union felt that a substantial number of people might want to work less than a 40-hour week and wanted to be sure that that flexibility was preserved.

PACKAGE DELIVERY

QUESTION: What has been done to supplement income, say, from package delivery?

READING: In Batavia we have had package delivery service from the time the demand-responsive service started, but it has not grown the way we expected it to. Our business is basically with drug stores, delivering prescriptions from drug stores to homes, and is also with hospitals, delivering hospital supplies and, particularly, blood plasma. We deliver some mail, but had hoped to deliver more from the post office to the firms in the city. We do a considerable business delivering important papers and data tabulations among branches and main offices of banks. Revenue from package delivery is about 10 to 15 percent of the total system revenue, and it could be significantly more.