

panel discussion

## DEMAND-RESPONSIVE TRANSPORTATION FOR THE ELDERLY AND HANDICAPPED

Albert J. Sobey, Booz-Allen Applied Research, moderator

The need to aid the handicapped, the aged, and other people who are patrons of our systems proved to be of more interest to those attending the conference than the organizers had anticipated. Panelists were first asked to describe the activities in which they are involved and then to respond to prepared questions.

### PANELISTS

John Kent, RRC International  
Herbert Bauer, General Motors Research Laboratories  
Jeanne Fitzgerald, Visiting Nurse Association of Detroit  
Jim Mateyka, Booz-Allen Applied Research  
Wayman D. Palmer, Toledo Department of Community Development

### ACTIVITIES OF PANELISTS

**KENT:** RRC has been the project consultant for the Valley Transit District in Connecticut to design and implement a transit program in an area where virtually none existed before. The project is funded by the Urban Mass Transportation Administration, the state of Connecticut, and 4 municipalities that joined together to form the Valley Transit District. The project's objectives are

1. To enable riders to select from 3 kinds of transit services depending on their particular needs and their location within the community;
2. To provide transit services by allowing vehicles to shift from one service mode to another based on rider demand and thereby to make a maximum use of the facilities;
3. To develop a fare structure that allows for equitable charges to the rider based on the actual cost of providing the transit service;
4. To evaluate and develop the necessary modifications to transit vehicles to make them more accessible to the elderly and the handicapped; and
5. To develop the methods and techniques necessary to encourage the use of public transportation services by health and social service agencies.

Although this project is expected to serve the transportation needs of the general public, it was initiated for the elderly and handicapped because the communities felt they were in the greatest need of transportation services. The response has been overwhelming, and the transit district is planning to double the size of its fleet. Fare collection is now done by the use of credit cards.

The Valley Region is in the center of a triangle formed by Waterbury, New Haven, and Bridgeport, Connecticut. The 56-square-mile area has a population of 116,000, with densities of about 3,000 population per square mile. The density decreases toward the outskirts of the region.

There are 3 levels of transit service: a scheduled shuttle that runs along the north-south spine of the area; a rental bus that is used by groups and agencies, particularly by health and social agencies, for group ridership; and demand-responsive service.

The scheduled service has the lowest fares: 10 to 25 cents, based on distance. The route has 2 portions that run through the low-income areas and the business districts. There is no transfer, but a passenger pays a second time in effect if he or she moves from one area to the other. The rental bus is used for any purpose by various groups. The demand-responsive bus system operates much the way most of the others do except that credit cards, or B cards, are used when passengers get on and off. This gives us very substantial data on the operation of the system for management purposes. The Twin Coach TC 25 gasoline-engine vehicles were selected because of their durability and because they can move up and down hills fairly easily. We still need a better vehicle developed for this kind of service.

We modified the vehicles substantially to provide better access. The entrance has been widened considerably. When the doors open, handrails and an additional step are brought out. This has enabled us to put 7-in. risers on the vehicle, which has pleased the elderly and handicapped. Those that are ambulatory can move in and out comfortably. We have put a rail on the sides of the platform, and passengers have indicated that they feel quite secure on it as it moves them rapidly up and into the vehicle.

We put in wider seats with headrests and package racks at the side and end. The aisleway is wider than normal. Three seats can fold up when we need to accommodate the handicapped, but then are available for use by the general public.

On the shuttle service the general public pays a cash fare. However, handicapped people who use the demand-responsive system and group riders are issued credit cards. Passengers insert the cards when they get on and off. In addition, the driver pushes zone buttons as he moves from one zone to the next. This information is taped on board the vehicle and then transferred each evening to the computer. The cost of the ride is split among the individuals on board the vehicle and is directly related to the distance. We are also able to implement other fare policies, such as shared fare. In this case the passenger, in addition to inserting his credit card in the slot, pushes a fare share button. We then bill the agency monthly for its share and the individual for his.

BAUER: I am a research psychologist by training, and I am also an engineering psychologist. That automatically divides my interest in the area of handicapped and elderly into 2 categories: (a) the soft area, that is, their attitudes, perceptions, and needs and the extent to which those needs are met; and (b) the human factors engineering or the equipment design associated with the transit system so that the design is appropriate to the needs of the elderly and the handicapped.

FITZGERALD: I am not an engineer and never heard of the term "demand-responsive transportation" until a month before the conference when I became involved with the Ford Motor Company transportation research department. I am a nurse, and my viewpoints and approach are completely different from the design system approach.

I look at the aged and the handicapped from the perspective of what I have seen their needs to be. For 5 or 6 years I was involved in delivery of personal help and support services. I am now working with the Visiting Nurse Association of Detroit to develop a program to add new services. One of our targets is the Michigan Medicare system. Michigan has about 30,000 people in nursing homes. At least 40 percent of them are "basic care" patients, which means they do not need skilled nursing care but have been relegated to institutional care for the remainder of their lives because services are not available in the community to meet some of their basic needs. It is amazing how important transportation services could be in keeping those individuals out of institutions. We have developed a set of services, including housekeeping and nursing visits, handyman calls, and referrals to the new Title VII nutrition projects, which are being developed.

The importance of transportation in developing Title VII projects is also interesting. Any community center that provides meals must also provide transportation. An arbitrary decision has been made that no more than 10 percent of the meals that are prepared at any center can be home delivered (the intent is to get older persons out of

their homes and back into the community).

**MATEYKA:** I am the engineer in charge of safety and human factors engineering on the Transbus Program, which is a \$25 million design competition to develop a standard 40-foot transit bus by the late 1970s. There are 26.5 million elderly and handicapped people in the United States according to the 1970 census. Of these, 13,390 are handicapped, and more than 20 million are over 65 years of age. There is some overlap in the distribution; about half of the handicapped are over 65. The wide range of impairments—visual, hearing, and mobility—leads to some difficulties when one is designing a vehicle to meet the needs of everyone who is not institutionalized. According to the U.S. Department of Transportation, 56 percent of the elderly and handicapped are in urban areas. Seventy percent of these, or 10.4 million people, do not drive automobiles, and this is the target population for any transit system or service. Of these 10.4 million people, 60 percent have transit available within 2 blocks of their residences. The remaining 4.2 million do not and would be candidates for demand-responsive service.

**PALMER:** In Toledo, we have been involved in the development of a demand-responsive system as a subsystem of the regional transit authority and also of another subsystem to support recreational programs for physically and emotionally handicapped people. As component portions of our model cities program were designed, transportation problems were readily identified. Not unlike the companies in many other communities, our private bus company at that point was near its demise: Service was down, scheduling was poor, and equipment was inadequate. We had many citizens who were handicapped either physically or emotionally and almost all were handicapped economically. Our system was designed, therefore, as much to meet sociological needs as to meet economical needs. We started our dial-a-bus system through a neighborhood-based corporation during a period in which the city was in a transition from a privately operated public transportation company to a regional transit authority. Later that system became a part of the regional transit authority and is now operating 2 kinds of service: (a) fixed-route service within the model neighborhood area for which a 10-cent fare is charged to those who are not classified as handicapped or elderly or who are not on some form of public assistance and (b) a demand-response service that operates on a 4-hour scheduling basis after calls are received. When a substantial recreational program was developed for senior citizens and for the physically and emotionally handicapped, a special transportation need was created that the regional transit authority could not serve. However, through the cooperation of local industry, we secured 4 specially equipped vehicles to serve these recreational needs. Two are equipped with a side-lift apparatus for taking those on and off who are not ambulatory. Special safety features are built into the buses for protection of the handicapped.

## VEHICLE DESIGN

**QUESTION:** What are the needs of the elderly and handicapped with regard to vehicle design?

**BAUER:** The most obvious barrier to travel by the handicapped and the elderly is economics. Even if transit is available within 2 blocks of one's residence, it might as well not be if one cannot afford to use it.

There is also the psychological barrier to travel by the handicapped and the elderly. They have a great fear of being assaulted and not being able to ward off an attack; they have a concern about being in crowds and not being able to maintain their positions within a crowd; and they have a fear of getting lost on the transit system. Many of us who are neither elderly nor handicapped would also have difficulty getting around on a strange transit system. Even schedules and maps do not always help. I used to have a sort of hobby that when I was in a new town, I would try going from point A to point B by bus. I have since given it up. I had the advantage that if I really got lost I could always take a taxicab. But the elderly, the handicapped, and the economically deprived are not able to do that. So, they worry about getting lost on the system, and

they are not eager to ask strangers or bus drivers for help or advice. There are not many communities where a person can ask a bus driver a series of questions. The driver may be running late or in a hurry or tired or at the end of the run, and he or she is impatient with anyone asking all kinds of questions that may sound dumb but are important to the rider.

There are many physical barriers associated with vehicle design. Just an added step reduces what is perhaps one of the biggest barriers to the aged and the handicapped, and that is the distance from the ground to that first step on the bus. We have spent many hours with engineers discussing this problem. To reduce that distance to the point where it is easily negotiated is difficult. General Motors Corporation has developed a rapid transit experimental vehicle that has been called a "kneeling" bus. That is, by the use of hydraulics, the front of the bus is lowered and then raised up again to reduce the height of the first step. There are also problems with signs, handholds, and grab rails.

We have recognized and listed all of these problems, but I see very little being done toward solutions.

MATEYKA: I would like to use the Transbus Program as a reference point to discuss what can be done and what should be done in the design of a new vehicle. Much of the Transbus technology is applicable to small demand-responsive buses. I will start by describing the old buses. The lighting level is low, and one can barely see what the vehicle looks like. It is usually dirty because it is not designed for easy cleaning. The seat backs are low; seating is cramped. A number of the grab rails are in the wrong place; they are made of stainless steel and present some safety hazard. The windows are relatively small—too low for a tall standee. The steps are steep, with 10-in. risers inside the vehicle and a 14-in. step to the ground (that far exceeds the 7-in. steps in homes). The step well is poorly lighted, and the curb area is not lighted at all from the bus.

On one version of the new Transbus, the lighting level is vastly increased, and the seat backs are much higher. The grab rail is soft, pliable plastic and is above the shoulder of the seated passenger. The seats are slanted back so that one can pass down the aisle, using handholds from seat back to seat back. The ambulatory handicapped or elderly person must have this kind of support inside of the vehicle. The seats are cantilevered from the wall, and no legs are underneath so that the floor area is completely free. The windows are large, and the smallest seated passenger and the largest standing passenger can easily see outside. An audio system is built in for use in announcing the next stop. There is a single 7-in. step within the vehicle; the distance from the bus to the curb is less than 7 in. The floor surfacing is either carpeting or a skid-free rubber material.

Within the Transbus Program, there is a special contest to design a vehicle to accommodate the elderly and handicapped, taking into account getting an individual in a wheelchair on and off the bus. Three companies have entered the competition.

The AM General bus requires an interfacing platform on the street and would be used in a large urban area. It integrates with an overall system that provides more information and amenities to the passenger because the problem cannot necessarily be solved by vehicle design alone. There are a number of physical barriers at the stop. The bus can be lowered from 20 to 17 in. to align with the platform height. As the bus comes to a stop, a level platform slides out through the open doors, and entering or exiting the bus is as simple as going through a doorway—and the doorway is 40 in. wide, providing plenty of clearance. Hand rails are built into the inside of the door.

The General Motors bus rolls up to the curb, lowers to about 17 in., using its kneeling feature. There is a single large platform, and normal-service people would step up to the large platform and then step up one 7 in. step into the bus. Because the bus is so low, this large platform can be lowered and raised quite easily with a very simple mechanism. A number of retaining devices are built in the lift mechanism itself so that there is no problem with sliding or rolling off.

The Rohr Industries bus has an even lower floor height; this 40-ft bus is only 13 in. off the ground. The ramp projects out from the bus only 3 ft and is used where there are curbs. To meet the architectural barrier standard for proper ramp angle, that

ramp would have to be 20 ft long on an existing transit coach with a 34-in. floor.

**QUESTION:** How do you prevent an elderly or handicapped person from being turned over if he or she is in a wheelchair, stepped on, or crowded in, particularly during the rush-hour period? Is the bus being designed so that there are special locations on the bus for the handicapped?

**MATEYKA:** In a crowded situation, how do you make sure that the elderly or handicapped individual has a safe ride? The system must have the capability to deploy a ramp or something from the vehicle. And, all of the systems deploy outward. If there is limited visibility in twilight or in the early morning hours, the vehicle must have floodlights to illuminate the area around the stop. Both the ramp and the intensity from the light will tend to move people back from the curb to allow the handicapped person to enter. Beyond that, the problems are operational. Inside the bus, the individual comes up through the central area behind the fare box. The seats directly behind the inward-facing seats either fold up or are removed in that standee area. Some hold-down devices are required.

**BAUER:** To equip all of the 58,000 urban transit buses to remove barriers to wheelchairs in getting on and off, the Urban Mass Transportation Administration has estimated that it would cost about \$5,000 per bus or \$250 million.

**QUESTION:** We have 2 choices: One is to adapt the present service to use by the handicapped and the other is to provide separate service or accommodations. What effect will providing service to the handicapped on the normal operations have with regard to delays and trip time?

**FITZGERALD:** This raises the question of where the driver's responsibility ends. Does he go to the door of the bus to help a person on? Does he go into the house? Does he go up the stairs? Does he go into the apartment? What are the extra kinds of services that some of these people need? Is this a responsibility of the transportation system, or must there be some kind of support service? There is then the problem of delay time. If the driver must provide support services, does this cut down on the number of people that he can carry? What about those who are already waiting in the vehicle? I cannot answer these questions, but I am glad to know that I am not the only one who has asked them.

**KENT:** One of the criteria of demand-responsive transportation is to guarantee pickup and delivery times. You cannot readily do this if you mix normal ambulatory persons with severely handicapped, quasi-ambulatory, wheelchair patients. Perhaps we need a demand-responsive service that is specifically designed for handicapped persons and another service that has a more flexible schedule for others.

**QUESTION:** The Transbus design is supposed to reflect the next generation of commuter buses. There are provisions in the Transbus to accommodate the nonambulatory handicapped. The question is, Can the transit industry accommodate wheelchairs on regularly scheduled commuter services and still maintain a schedule?

**KENT:** We certainly cannot now satisfactorily accommodate handicapped people in normal fixed-route service. We are making progress, but we have a long way to go.

**MATEYKA:** For regular service on an arterial route, about 7 or 8 percent of the time, the bus is at a stop. On a 40-minute route, 3 minutes of time is spent at the stop. If 10 individuals in wheelchairs boarded at the stops, the bus would run 10 or 15 percent slower than it normally would.

## SERVICE

**QUESTION:** What specific services can demand-responsive transportation provide?

**FITZGERALD:** In addition to transporting the elderly and the handicapped for medical purposes, for social and welfare services, and for recreational activities, demand-responsive transportation can aid in their socialization. We are increasingly concentrating housing for the elderly in transit-functional areas, and there is a need for

socialization outside of that elderly housing. Demand-responsive systems can help meet that need.

KENT: We are using demand-responsive transportation to take services to people: public health nurses, homemakers, and homemaker aides. We also handle blood plasma batch delivery and similar medical services.

FITZGERALD: Demand-responsive transportation is a completely different thing for the engineer, for me, and for those who are handicapped or aged. There is, of course, a common denominator: the vehicle. But, the being transported itself is the important thing for an older or a handicapped person who perhaps is socially isolated. A social system develops in the act of being transported, and it becomes more than a ride. And the driver becomes more than just a bus driver. He or she is someone for that individual to relate to. You can see the social system develop in the way the passengers on a vehicle form a subcommunity or a subsocial system.

There are also different levels of needs for this kind of transportation for older and disabled people. There are different kinds of dependencies. In Ann Arbor, about 11 percent of the riders are 65 and over. They do not need anything more special than a normal dial-a-ride system. Yet for others, there are different levels of need. Those who have sensory impairment or vision and hearing problems may not be able to take trips by themselves all the time. They may not be sure where they are going, and, once there, may be afraid of getting off. A project in Cleveland uses transportation aides, someone who travels with the aged or handicapped individuals and helps bridge the gap between their homes and communities that they are not too familiar with.

PALMER: There are other kinds of special needs; one deals with the variability of schedules for fixed-route variations. One of the problems we have encountered is the flexibility that is built into routing. We may have a service point that is 2 blocks off of the predetermined route. The user of the service cannot negotiate that 2-block area, and the system does not allow for detours so that there can be door-to-door delivery.

QUESTION: Why then is the federal government spending \$25 million on hardware before it spends a couple of million to determine whether there is a demand for this service and whether that money would be better spent for a special service in large metropolitan areas where 3 or 4 vehicles could serve the whole metropolitan area?

MATEYKA: The basic design of the Transbus, which we should have done a long time ago, replaces the 1958 new-look design, which everybody recognized was not going to attract anybody back to transit. The primary concept in designing the vehicle was to incorporate features that would make the bus safer, more comfortable, and more attractive. The design also meets the needs of the elderly and the handicapped, particularly the ambulatory elderly and handicapped; the vehicle is a great deal more comfortable and easier for everybody to use. Features such as wider doors and lower steps, which are fundamental to any bus configuration with or without the handicap lift, are the kinds of things that will cut time on routes by as much as 5 and 10 percent, and that is money in the bank. The other aspect of designing for the handicapped is a significant safety benefit that can be translated into dollars. Tripping on stairways and other types of things now account for about 15 or 20 percent of the total claims bill, and these will be reduced significantly. As a result of the design for the handicapped, there are features that should speed the transit service and make it safer and, therefore, less costly.

QUESTION: In the Connecticut project, which is in an area that has 80,000 people, one of the 6 vehicles has equipment on it to allow wheelchairs and severely handicapped people to get on easily. There is space on that vehicle for 3 wheelchairs, but to date, the service has not been extensively used. Why has it not been used? Is it because people need a lot of encouragement to use it, or are they afraid to use it?

KENT: The 3 tie-down positions are increasingly used. We can tie down more in the center of the vehicle if necessary, but we have not had to do so. One of the major problems is that many people in wheelchairs cannot get out of their houses or into other buildings because of steps.

**QUESTION:** There are many architectural barriers and walls for people in wheelchairs. Nobody in a wheelchair can get anywhere near the city hall in my hometown because of the steps. Sports auditoriums, theatres, certain shopping centers, and restaurants have barriers. It is nice to get people out of their houses and into buses, but will many people be interested if they have nowhere to go other than to ride around town?

**BAUER:** Transportation does not function independently of the rest of the activities in the community. The elderly and handicapped should not necessarily have to use transit at all if they do not desire to do so. They should be able to get onto the sidewalk in a wheelchair and go to the stores to shop or to other community facilities. That they cannot is certainly one of the shortcomings that we have nationwide.

**QUESTION:** Does the transit authority or some other agency make the medical assessment of who should use the regular transit service and who requires special service?

**KENT:** In Connecticut, we rely on the health and social service agencies that normally interface with the elderly, handicapped, or low-income groups. Those agencies know most about the individual through relationships that have already been developed.