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TRANSPORTATION FOR OLDER RURAL AMERICANS

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The major objectives of the Older Americans Act of 1965 are to "maintain maximum independence and dignity in a home environment." A principal barrier to achieving these objectives is the lack of personal mobility for older Americans. Simply the ability to get out and around improves the quality of life in old age. In an effort to meet national needs of older Americans, over 1500 proposals have been tried. Some met with success while others faded after the expiration of funding. For rural areas the Senate Subcommittee on Rural Development found no sound basis for confident conclusions about the financial viability of rural transportation [3].

The increasing cost of owning and operating a private car along with the reduction in rural transit services and continued out-migration of younger Americans all contribute to the rural transit problem. Older people may not be able to depend on children to transport them. Lower income families and older Americans may not be able to own or operate the private car which is the only transportation in many rural areas. Finally rural bus and taxi services continue to drop out or at best hold their own.

The purpose of this paper is to provide a framework for transportation planning in rural areas with particular emphasis on the elderly.

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The first section considers the problem of demand estimation. The second discusses an analysis of transit costs. The third relates types of services and area served to the cost and demand analysis. The fourth addresses the critical question of how the transit systems can be financed. Finally, transit programs in rural Minnesota are considered.

Demand

For planning rural transportation systems, demand or ridership estimates are an important consideration. One needs to know who will use the services, at what price and how often. The demand will vary depending on the type and frequency of service provided. Demand analysis can be ex poste and involve counting the number of people using a transit system or it can be ex ante and involve a survey to determine who might use a system if it is installed.

Demand is often confused with need. Demand for transportation may be defined as the various quantities consumers are willing to purchase at alternative prices, other things being equal. The quantity purchased is affected by a number of circumstances, the more important being the price of the good or service, tastes and preferences, income, the number of consumers and the prices of related goods or services. The quantity taken typically varies inversely with the price charged. The definition refers to an entire schedule or demand curve with a negative slope.

In contrast, need is not easily defined. It is essentially a subjective concept which refers to a requirement of something essential or desirable that is lacking. A teenager "needs" a car or a senior citizen's

club "needs" a bus for transportation to a concert. One cannot develop a schedule of needs or assign a numerical value to these needs which will be acceptable to everyone.

Even though "demand" is a more workable concept then "need" it may not provide an adequate framework for transportation analysis. If consumers have insufficient funds to purchase transportation at any price level, there is zero demand except at zero price. The idea that tastes and preferences and related goods and services influence demand implies that the consumer has a choice. However, choice of transport is severely limited in many rural areas. Thus, due to the income constraint and the paucity of substitutes, the question of subsidized transportation should be considered. As will be discussed later, the declining unit cost nature of transportation services also suggests use of subsidies.

One possible approach to estimating potential ridership is referred to in the literature as latent demand [1]. It provides an estimate of the new trips that would be made if a specific population received increased transport services. It involves estimating the demand for new transportation under the assumption of no substitution.

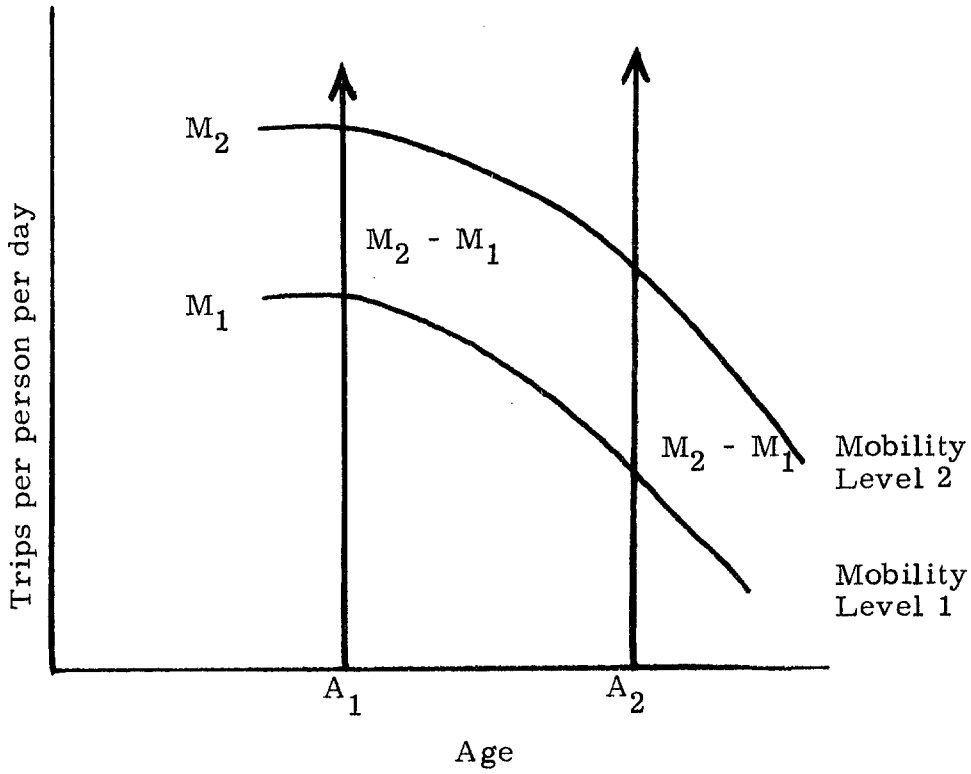
Two closely related procedures have been used to estimate latent demand. One is called "gap analysis" and compares trip rates among individuals [1]. The maximum latent demand is the difference in trips made by individuals who have an automobile and individuals who do not. These two groups are compared within strata, such as similar ages and incomes. The analysis hinges on locating two populations which are similar except for the availability of automobiles.

An example of this type of analysis is shown in figure 1. Mobility Level 1 relates to individuals with no private transportation and Mobility Level 2 relates to individuals with one automobile. Latent demand for a person age A_1 is $M_2 - M_1$. The difference between M_2 and M_1 is an estimate of the number of new trips a person will make if an automobile were available. Mobility levels are measured in trips per person per day for all people at a given income. However, if the transportation to be provided by the public is a bus or a van, the gap should be measured for these specific vehicles. The demand for the use of an automobile may be quite different from that of a bus.

The second approach is almost the same as gap analysis. It involves obtaining the transportation "required" for a target population by subtracting the average number of trips made by a target population from the number of trips made by a "normal" population. Normal travel behavior and the target population's travel are estimated with surveys. The National Personal Transportation Survey conducted by the U.S. Department of Transportation is the most frequently used data for normal travel. Populations usually are grouped by place of residence, age, sex, income, size of household, dependence on others for transportation, ownership of automobiles and availability of public transportation. Trips are categorized by purpose, cost, destination and frequency.

Both the "gap" and "requirements" approaches rely on surveys to estimate travel response to additional transportation. Yet studies show that survey data do not predict actual use very well [3]. Problems arise in surveys from seasonal variation (or other irregularities) in

Figure 1. Trip Rates by Age



ridership, multi-purpose trips, memory loss and the representativeness of the population surveyed. The whole question of unrevealed preference is always present in survey responses.

Current transportation demand analyses tend to be dual-choice models which compare a public transit mode with the automobile. In some situations models are needed that have more than two choices; relevant choices may include car pooling, taxis, automobiles, along with various modes of public transit. However, in many rural areas, due to the scattered population, the automobile may be the only existing mode to compare with proposed public transit and a dual choice model may suffice.

It is also important to consider such factors as reliability, safety, comfort and convenience when estimating demand for transit, particularly for the elderly and the handicapped. Thus, when we analyze the costs of alternative vehicles, we must consider how the demand for the services of the vehicle is influenced by its characteristics such as ease of access, flexibility and safety. The time and convenience involved in the use of the system will also have a significant impact on quantity demanded. In fact, time cost involved in using the system can be considered as part of the price of the transit system.

Both time series and cross section demand models have been tried which include time cost as one of the variables. "Time series models explain travel by mode or all modes for a geographical region; cross section models, ... generally involve city-pair data. The latter models are variations of gravity models, generally with little or no economic content. Often they simply attempt to explain total travel between city pairs in terms of variables with no obvious meaning and no policy implications" [7]. An example of such a term is the product of the two cities' populations divided by the square of the distance.

The main weakness of the demand estimates for single modes is the failure to distinguish between cross and direct elasticities. Lave shows in models which include more than one mode that the cross elasticity component is much more important than the direct elasticity component. Thus, failure to include competing modes is a significant drawback [7].

As indicated earlier the cross sectional models might work better in rural areas than in cities because of the limited alternative modes.

Even if choice could be limited to two modes in most rural areas the demand may have to be estimated by purpose. Watson found that the purpose of the journey requires a different hypothesis regarding the choice of models. The time-cost trade-off hypothesis was satisfactory for commuters while the social-recreational traveler required a different hypothesis. Commuters were primarily interested in dollar costs and relative trip times (i. e. a 10-minute wait for a 10-minute trip is a long wait but a 10-minute wait for an hour trip is not). The social-recreational traveler, in contrast, was concerned about mode convenience features and speed [8].

Where little or no demand information exists, a cross section demand model might be used which is based on a number of independent variables such as: D = f (explicit price, implicit price or time and convenience, age, personal income per capita, population density, employment) with separate demand functions for transportation to obtain food, capital goods, health services, recreation, etc. The big drawback is finding the necessary data to estimate the model. One would need to find newly introduced systems in rural areas with similar purposes and modes. However, with the growing number of public transportation programs under federal and state support information and data are becoming increasingly available.

Finally in rural areas where new transit systems are being introduced, a pilot project to test the demand may be a good approach. A pilot system operated with a rented school bus and/or volunteer drivers should create a demand which can be used to plan the system based on actual use. With this approach the community may not be burdened

with inappropriate capital equipment purchased on the basis of a survey of what people said they would do.

Program Costs

Cost analysis is the second major part of planning transportation systems. If the demand schedule is known, the problem then is to find the least cost methods of providing the relevant service levels.

Most systems will have costs which are fixed no matter how much they are used, while other costs will vary either by the miles traveled or the number of people transported. Fixed costs include administrative overhead, annual wages, insurance, taxes, fees and depreciation.[1/] The costs which vary by mileage driven include maintenance, tire replacement, oil and gasoline. Under a fixed route system, i.e. following a set route and schedule, miles traveled are increased only as additional runs are made on the same route. Unless the system is being used close to full capacity an extra passenger would have little or no effect on costs. In contrast, with a demand responsive system such as a taxi the mileage and costs generally increase with the number of passengers carried, since more passengers generally mean more trips. For demand responsive systems administrative cost may also be influenced by numbers of passengers calling in for rides.

This highlights one of the problems associated with planning and charging fares for fixed route public transit systems. Unless the system is operating at or near full capacity the marginal costs (added cost) of

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1/ Wages would be a variable cost if the driver is paid by the miles driven such as volunteer drivers.

another passenger is near zero. We are dealing with a decreasing average cost service and it may not make any economic sense to try to cover the full cost of operation with user fees. In fact attempts to cover the full cost of operation by fares may well eliminate most or even all potential riders. For example, when we are evaluating the possibility of public operation of a small private rural bus system the marginal cost of an additional rider and the rider's willingness to pay should be considered. If the demand curve is D_2, marginal cost pricing requires a fare of OP_1 and a public subsidy of P_1P_2 (figure 2).[2/]

With demand D_2 the transit system could charge fares P_5 and cover total costs but the ridership would drop from Q_0 to Q_1. In contrast if the demand were D_1 total cost could not be covered at any level of ridership since AC > D at all levels. Still society could justify operating the system if the total consumer surplus P_3 BC is greater than P_3P_4FB (the cost not covered by fares). In other words the triangle ECP_4 must be larger then triangle EFB which it is in figure 2. The fare based on marginal cost pricing would be OP_3 and the subsidy would be P_3P_4.

Two costs seem to loom large in the design of a rural transpor-

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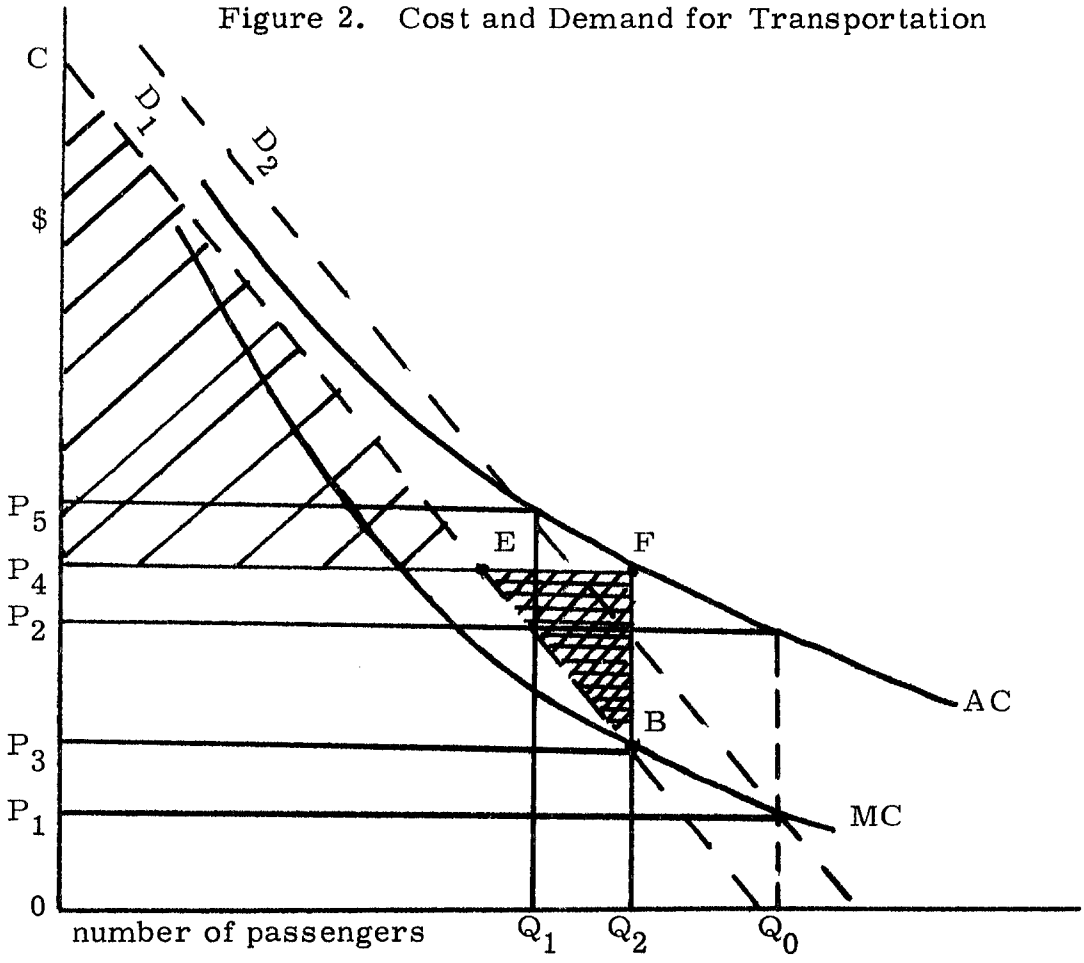
[2/] One method of financing such a system, suggested by Glenn Nelson, might be to charge all users of the transportation system a membership fee sufficient to cover fixed costs. Anyone can become a member regardless of income but the government pays part or all of the membership fee for low income people based on a sliding scale. User charges or fares are then based solely on marginal costs. These fares may also be subsidized for low income people. This system would be of potential benefit to everyone but its financing would be consistent with marginal cost principles. The membership fee could be a tax on residents of a geographic area so that all residents would be eligible to ride.

Figure 2. Cost and Demand for Transportation



tation system: driver and administrative costs. For example, they account for 83 percent of the cost of a two 11-passenger van system which under 1974-75 prices has a total cost of approximately $50,000 annually [5]. Forty-seven percent of the cost of the system is for administration while 36 percent is for the paid drivers. The depreciation on the vans account for only 6 percent of the costs while gasoline is about 6.5 percent of the cost.

Because of high driver costs, new transit systems particularly for older Americans have relied heavily on volunteer drivers. The high administrative costs are a result of the dispersed population and the resulting small size of rural transit systems. For example, the same administrative staff might be able to run four vans as well as two vans.

With four vans, instead of two, administrative costs drop to only 31 percent of the total costs while driver costs jump to 47 percent of the total costs.

A change in the cost of fuel does not have a major impact on its proportion of program cost. If fuel costs rose from 54¢ to 75¢ per gallon, annual costs go up by about $1,200 for each van and fuel costs would account for 8.6 percent of the total cost of a 2-van transit system.

The least cost modes will differ depending on the number of passengers. With an average of three passengers per car, the auto with volunteer driver is the least cost alternative. Once the system starts transporting 10 and 11 passengers per day, the 11-passenger van is the least cost mode. After ridership goes beyond the capacity of vans, the school bus becomes the lowest cost alternative. The cost per passenger in a half full 44-passenger school bus is just a little over 3¢ per seat-mile occupied as compared to 5¢ for volunteer drivers carrying three passengers and 4.5¢ for a full 11-passenger van.

If the convenience factor is introduced, the school bus may not be as attractive as the van or the automobile. But when transporting 30 or more people on one route the 44-passenger school bus with costs of 1.5¢ to 2¢ per mile is hard to beat from a cost standpoint.

Type of Service and Area Served

The type of service and area to be served should be decided in conjunction with demand and cost estimates since they will affect both cost and demand. First is the service to be fixed route, or is it to be demand-responsive? The system might also be a combination of these

services with volunteer drivers picking up riders and taking them to fixed pick-up points on a route traveled by a bus or van. Second, will the service be provided for anyone who wants a ride or will it be only for older Americans who need health services or want to take part in a nutrition program? If transportation is to be provided for work, then it must be every day at regular times except weekends. In contrast, transport for health services will be needed much less frequently.

The area or community to be serviced is another important consideration. Should the system serve a small city, the county or even several counties? Total costs both in dollars and travel time will go up as the area served is increased. However, over a certain range of equipment and distance the cost per passenger will drop as the area served is expanded and ridership increased. Community and financial support both play a role in defining the area to be served. For example, arguments over how much of the cost should be subsidized by the city and how much by the county has caused the county to withdraw from providing possible transportation services in several areas of rural Minnesota. The rural transportation services tend to follow administrative boundaries although certain parts of a county may not participate because they already have adequate transportation or they have a bias against public services.

If the system is to be designed to meet the needs of people who have difficulty going from their house to the vehicle, it will be necessary to buy special equipment and possibly provide escort service. These factors add to the cost of any vehicle although for a bus the cost will be spread over many more passengers than for smaller vehicles.

Financing Rural Transportation

One of the critical questions facing rural transit systems is financing. Currently a number of state and federal programs exist to help finance rural transit. The major source of funding for the systems in rural Minnesota comes from Title III of the Older Americans Act and from Minnesota Transit AID programs. The former provides federal funds of 75 percent the first year, 60 percent the second year and 50 percent the third year. The remaining funding must come from state or local sources. After three years the program is no longer eligible for Title III. The program also does not allow any fares, although donations are accepted and account for something less than 10 percent of the operating budget. In some cases because the service is free, it has become known as a poor peoples' program. This reduces ridership in some conservative rural areas. In these cases ridership will actually increase by charging a fare. The demand curve will be positively sloping over a certain price range, possibly up to as high as 50¢ per trip.

Once the third year funding runs out, the Title III funded program has four options. First, the service can close down because of inadequate funding. Second, the program may be able to operate with county support and fares collected from all riders able to pay. Third, the system could be expanded to all rural Americans needing transportation in the area. This might increase the ridership enough to make it self-supporting. However, because of declining average costs, as shown above, charging fares high enough to cover full operating costs may not be the best from society's point of view. A final option is to obtain assistance from other

state or federal transportation programs such as the Minnesota Transit AID programs which aid existing transit systems and help start new systems outside the Twin Cities. The Minnesota Transit AID programs do not restrict ridership and allow fares to be charged. A system that does not restrict ridership and can charge fares has a much better chance to become viable in rural areas with widely dispersed populations.

Non-metropolitan Transportation in Minnesota

The transportation system in Minnesota is oriented toward the Twin Cities (Minneapolis and St. Paul). There is very little public transportation outside of the Twin Cities especially running north and south. Therefore, it is very difficult without a private car to go from one small city or town to another in outstate Minnesota. Even within most non-metropolitan cities taxi or bus service is limited or non-existent.

In response to this apparent lack of transit services in non-metropolitan Minnesota a number of public transit systems have been established recently. In Dakota County a system of vans, small buses and volunteer drivers provide people with transportation for medical services, shopping, social activities, work and nutrition programs. A much smaller program operating in Chisago County provides bus trips only for older Americans to the nutrition program. A tri-county system was started in central Minnesota in 1976. It uses vans to meet the transport needs for medical services, shopping, social activities and nutrition programs. All three transit programs have been started with funds from Title III of the Older Americans Act. Only the Dakota

County program is old enough to have had to make the transition from Title III to other funding sources. Because of its location near the Twin Cities it was able to obtain about 40 percent of its funding in 1977 from the Twin Cities Metropolitan Transit Authority.

In many cases it was a key individual or a small group of individuals which were the ones who initiate these programs. These same individuals are usually the ones who have to keep them going.

Some of the problems in estimating demand and planning for rural transit can be highlighted by the tri-county program. The use of the system varied considerably by month and purpose (see Table 1). The first two months ridership was low because the program was just starting. However, even in the last six months the ridership varied by over 100 percent for most purposes (medical services, social activities and nutrition programs). The aggregate demand did not vary as much since the individual demands followed different patterns. Still planning for a transit demand which varies by as much as 258 passengers per month or 47 percent requires some costly extra capacity or long waiting periods for passengers.

Conclusion

Two of the more important considerations in the design and operation of a rural transit program are community participation and flexibility. The citizens who will be using the system must be involved in planning and evaluating the transit program. If local tax dollars will be used to support the program, the entire community should be aware of the costs and benefits. The program itself must be flexible enough

Table 1. Ridership for Tri-Cap Senior Citizen Program - Central Minnesota, 1976

Month	Reasons for Trip				Totals
	Medical	Shopping	Social	Nutrition	
		------- numbers ------			
January	24	149	11	27	211
February	25	223	11	99	358
March	28	425	59	69	581
April	39	424	21	78	562
May	29	225	22	255	531
June	40	240	38	198	516
July	27	242	34	203	506
August	41	194	52	225	512
September	84	219	92	108	503
October	53	246	129	197	625
November	55	364	41	213	673
December	34	255	28	98	415

to adapt to changes in demand for services. It may start out in a small way under Title III funding but will have to adjust to a changing funding situation every year.

Some experimentation can be done in identifying demand for various transport services (health, nutrition, social, shopping and commuting) and adjustments made as demands are identified and/or attitudes change towards public transportation. One way of beginning small with a relatively certain ridership is to provide transit services to regular clients of social services agencies through contracts with these agencies.

Finally, the community and those operating the system should agree at the beginning how performance should be measured. Should performance be based just on the numbers of riders? One likely measure might be to have the system self-sufficient after 3 to 5 years. However, this may well be unattainable as well as socially undesirable.

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