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The Disadvantaged,  
the Elderly, and  
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# Demand for Special Transit Systems to Serve the Rural Elderly

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Regional planning agencies have become increasingly aware of the transportation needs of the rural elderly. A promising solution to some of these problems has been the development of a rural special service transit system that gives elderly persons who lack means of transportation access to crucial social services. A preliminary, important step in planning such systems is estimating demands; unfortunately little demand information is available to aid in making such decisions as selection of vehicles, routing, and scheduling. This paper examines the demand for transportation services for the elderly and presents techniques for approximating travel demands. Methods based on attitudinal surveys, comparative trip rates, and participation frequencies illustrate that the best estimates currently possible are based on average travel behavior. Further, such methods only approximate the many factors affecting demand. Data monitoring to formulate an economic demand model, which would account for the significant variations of behavior, is suggested by this study as a relevant future research activity.

Significant portions of the elderly population living in rural areas have difficulty obtaining transportation to receive medical care, social services, groceries, and supplies. Some analysts believe that providing special transportation services may be a key element in improving the quality of life of the rural elderly. These transportation services would supplement private travel modes and would also be coordinated with existing public transportation.

Guidelines are needed to help local planning agencies devise optimal special transit systems. To make decisions on routing, scheduling, and selection of vehicles requires a forecast of passenger demand. Unfortunately, demand forecasting of rural transportation planning has often been glossed over by planners of special transit services. Demand is often confused with concepts of need and latent demand. Often demand is expected to materialize independent of the quality of the transit services provided.

This paper presents methods for estimating existing and potential demands for rural transit alternatives and distinguishes among the factors that influence the levels

of demand. The characteristics of travel to rural social services in Virginia counties are used to illustrate some of these demand relationships. In addition, a number of demand estimation techniques, methodologies, and approaches are compared. Accurate travel demand estimates should be of special interest to social service agencies, regional planning bodies, and other organizations considering the development of special transit systems to serve the elderly.

## BASIC CONCEPTS AND DEFINITIONS

The demand for transportation to a social service agency is a derived demand in that, primarily, the social service activity is demanded by the user and not the transportation to the agency. Transit travel demands are, therefore, contingent on the character and quality of the social services provided at the agency or destination activity. However, the ability of a rural special transit system to attract passengers also depends on the character and quality of the transportation services that it provides. Indeed, both factors are crucial to the evaluation of demand.

An economist might view the demand estimation process in terms of a traditional demand curve relating the quantity of trips purchased to the price of the trip for social services. However, an elderly individual would probably view the price paid for a service trip in more than just monetary terms. The price of the trip might rightfully be termed the impedance cost of a trip for social service. Impedance values are determined by such factors as waiting times at home and in the agency, discomfort levels on the vehicle, lack of privacy, necessity for making an advance reservation, and possible re-scheduling of pickup times.

In economic terms, the decision to provide a rural transit service for the elderly is clearly related to the potential volume of social service trips that would be generated by a transit system and its costs. This volume is an indicator of willingness to pay the monetary and nonmonetary impedance costs of the trip. Demand volume is difficult to forecast accurately because of the many influencing agency, transportation, and population characteristics of a particular rural environment.

Most planning agencies concerned with developing a transportation system are not interested in individual users' demand characteristics, but rather in the aggregate demands of all users within a specific geographic area. Aggregate demand curves reflect the travel behavior of many elderly persons often from quite different socioeconomic backgrounds. In formulating a demand equation, one should include variables to serve as descriptors of the client population. Thus, three primary components basic to the determination of the aggregate demand of the elderly for rural social service delivery systems are characteristics of

1. The elderly client population,
2. The available transportation systems, and
3. The activity system including environmental and agency characteristics.

Two related concepts, demand and need, are crucial to the evaluation and implementation of a rural transportation system for the elderly. Demand has been defined as an indication of willingness to pay impedance costs; therefore, any particular demand volume is related to characteristics (social service and transit service) that determine it. Demand is not to be confused with a need to travel; need is a fixed quantity of travel that the users or planners deem necessary to maintain minimum standards of living. Need is a subjective estimate and is not based on economic considerations of willingness to pay. Need may be assessed to exist whether or not one can afford to travel.

#### CURRENT DEMAND ESTIMATION APPROACHES AND TECHNIQUES

A number of estimation techniques have been incorporated into the demand forecasting processes for existing rural transportation systems. These approaches are reviewed for their usefulness in future rural transportation system design.

A common approach to demand estimation is door-to-door attitude surveys. The reason for such surveys is generally not to generate a workable demand model but to provide evidence for justifying the selection of vehicles, routes, and schedules for the initial service. There are two serious flaws with this method of demand projection. The first flaw is that multipurpose journeys are often not measured properly by the questionnaire. Generally, respondents are asked to indicate how many trips they would make on the service, if it existed, for each trip purpose. In doing so, they often neglect to consider multipurpose trips and provide an overestimate of the actual number of person trips. Second, and of critical importance, the demand forecast indicated by these questionnaires is not verified by actual travel behavior. In a survey of prospective travel frequencies in Oneonta, New York, public response indicated that a demand-activated bus service would generate 33 700 trips/week when an actual service in a nearby small town, Batavia, New York, only generated 1500 trips/week (1). Clearly, public opinion surveys cannot accurately predict vehicle trip demand. Indeed, one of the serious problems facing rural transportation systems in many parts of the country has been an oversupply of vehicles (2). Faulty or overzealous demand estimates are assumed to have contributed to this oversupply. Demand forecasts should consider the existing levels of demand for similar transportation services in similar localities.

#### DEMAND ESTIMATES BASED ON TRIP GENERATION RATES

Usually an initial estimate of demand considers the total number of transit trips per person made during a year by residents of a comparable area. This rate of transit use varies with income level, age distribution, population density, and other such factors. In general, most transit systems operating in rural areas seem to carry less than 1 annual trip (one-way)/resident.

Burkhardt and Miller suggest that service to groups with special needs would result in much higher rates of travel demand (3). For example, in Pennsylvania senior citizens average as many as 10 to 15 one-way transit trips/year. Nonelderly, low-income riders also demonstrate high rates of travel. Data from Pennsylvania, New York, and Minnesota all indicate that use of public transportation is greater in small towns than in rural country.

One method for estimating travel demand is to use rates of trip-making observed in other localities where life-styles are similar. This method assumes that elderly persons demonstrate a comparable trip-making behavior, independent of geographic variations, transportation service, or any agency differences. For example, a consultant's study for the state of Georgia investigating the development of rural transportation to serve elderly and handicapped states (4), "Since Georgia borders Tennessee and socio-economic and demographic characteristics of the two states are similar, it was agreed that the travel demand of the target group would be approximately the same." A target group of elderly and handicapped was then divided into four categories (above poverty, below poverty, rural, and urban) to validate the group differences in trip making as indicated by the Tennessee survey.

Rates of trip making may be measured on a daily, weekly, monthly, or yearly basis. These rates are usually calculated by referring to the total population (trips per person) or by referring to a target population (trips per elderly resident). Occasionally the rates are reported as a trip density for a study area (daily trips per person per square kilometer). The following are trip rates of some rural transit programs.

Annual Trips per Person	Location
5.00 to 10.00	Batavia, New York, dial-a-ride (1)
3.00 to 4.00	Small urban areas in Pennsylvania (3), high estimate
2.00 to 3.00	Rural areas in Pennsylvania (3), high estimate
1.00 to 2.00	Mid Delta, Arkansas (12)
0.50 to 1.00	Raleigh County, West Virginia (12)
	Small urban areas in Pennsylvania (3), low estimate
0.25 to 0.50	Venango Action Corporation, Pennsylvania (12)
	Rural areas in Pennsylvania (3), low estimate
0.00 to 0.25	Kingsport, Tennessee (12)
	Potter County, Pennsylvania (11,13)
	McKean County, Pennsylvania (11,13)

Some of these programs include special service to the elderly; others have a broader ridership base. The rates were calculated in terms of annual transit trips (one-way) per person. Most systems service less than 1 annual transit trip/resident. Many systems do not even produce this level of ridership. In a Pennsylvania study (3), a range of rates between 0.3 and 2.4 annual trips/person was used to develop a forecast of statewide potential rural transit demand. This expansive range (where the highest estimate is eight times the lowest) may prove to be of little use to a planner trying to decide on a realistic demand level for a particular county or planning district.

This comparative modeling technique can be used to estimate the total demand for travel in an area, by summing the products of group population times trip-making rate for all groups in the area. Trip rates for particular target groups (elderly or subgroups of elderly) may be used to refine estimates by disaggregating the population into more homogeneous subgroups. In mathematical terms a simple trip rate model is stated as

$$D = \sum_{i=1}^n d_i P_i = \sum_{i=1}^n (\alpha_i A_i) P_i \quad (1)$$

where

- $D$  = total demand (annual transit trips),  
 $d_i$  = anticipated transit demand for target group (annual trips per person),  
 $P_i$  = population of target group,  
 $\alpha_i$  = appropriate dimensionless design parameter,  
 $A_i$  = annual transit trips per person for target group in a comparable area, and  
 $n$  = number of target groups.

A planner should assume that all  $\alpha_i$ 's = 1.0 unless the comparable region does not seem to be truly equivalent in trip-making potential to the region from which the rate was derived. This is perhaps the least refined but most popular technique for demand estimation.

#### DEMAND ESTIMATES BASED ON PARTICIPATION RATES

A second technique used to approximate demand is to identify the activity participation rate of potential users such as the rural elderly. While similar to the trip models, this approach often attempts to identify travel behavior with regard to specific trip purposes by particular subgroups of elderly. With this technique, at least an indirect attempt to identify relationships between agency attractiveness and travel demand is undertaken. However, these methods are also insensitive to the quality of the transportation provided and therefore represent simple approximations.

Identifying participation rate requires the collection of participation percentages and participation frequencies. Participation percentages refer to data that indicate the fraction of elderly who would be expected to use a special transit system. Participation frequencies refer to the number of trips per week, month, or year that would be made for each purpose. Unfortunately, a review of studies on elderly travel characteristics has not provided a completely uniform and comprehensive data base from which accurate demand forecasts of this sort can be made. Thus, a set of assumptions is necessary.

If particular rates and frequencies are forecast, or even roughly estimated, then a simple multiplication yields the travel demand for each trip purpose in terms of the total number of trips desired.

$$T_p = (\text{POP})(R_p)(F_p) \quad (2)$$

where

- $T_p$  = number of trips for purpose (p);  
 $\text{POP}$  = elderly population in region;  
 $R_p$  = participation percentage of elderly for purpose (p) ( $0 < R < 1.0$ ); and  
 $F_p$  = frequency of travel for purpose (p).

Research efforts and resulting data (5, 6, 7) describe to some degree the travel frequency of different groups of elderly. Data collected by Carp (8) give travel mode and frequencies for various trip purposes for the urban elderly. However, data on participation percentages by transit bus ( $R_p$ ) are scant. Attempts at approximating  $R_p$  generally involve separating the elderly into groups according to life-styles and thus eliminating those persons who are not likely to be expected to participate. For example, Carp's data indicate that about one-third of the elderly travelers are vehicle drivers, about one-third are vehicle passengers, and the remainder are users of other modes such as bus, walking, or taxi. In rural areas the percentage of drivers appears to be much higher and to be related to income levels and the environment of the elderly. A reasonable approximation is to assume that few, if any, of the drivers will participate in the transit service. Further, a small percentage of the vehicle riders would be expected to switch modes, particularly if they were paying for existing rides. Those riding with a relative or friend are unlikely to switch initially. The fraction of elderly who would initially participate primarily include some who previously walked, used a taxi, or rode as a passenger with others.

An application of a participation rate calculation of demand is illustrated in Table 1 for Montgomery County, Virginia. At the current stage of development, the method requires both empirical data on travel behavior and the judgment of the analyst. The advantage of this approach for deriving a demand estimate is that it readily enables the planner to measure demand projections against three observed average measures from current transit operations for the rural elderly.

1. Riders of many special transit systems use services approximately once a week (9). This observation is clearly not a defined goal or standard, but rather an observed fact from typical operations.

2. At most, 3 percent of the total elderly population of an area might be expected to initially become system users during the initial year or two of operation (9).

3. Annual trip-making rates for the area's total population should be consistent with comparative travel data such as those given above for rural transit systems (less than 1 annual trip/person).

Any estimate that violates one of these observed indicators of demand levels should be fully justified by particular variances in local conditions relative to those of

Table 1. Estimate of transit travel demand of elderly persons in Montgomery County, Virginia.

Mode (1)	Elderly in County		SS Survey Destinations per Month (4)	Likely Transit Destinations per Month (5)	Likely to Switch		Total Transit Destinations per Month (8)	Total Estimated Transit Trips per Month (9)
	Number (2)	Percent (3)			Percent (6)	Number (7)		
Drive	935	31	12	—	—	—	—	—
Ride	1538	51	4	4	3	46	184	331
Other	60	2	2	4	5	3	12	22
Do not go	482	16	0	—	—	—	—	—
Total	3015	100	18	8	8	49	196	353

the system previously predicted. Otherwise, a refined estimate, consistent with these observations, is required.

To derive the demand estimate given in Table 1, the elderly are divided into four travel groups according to modes of travel that are related to their life-styles (active, moderately active, locally active, and inactive). The purpose is to obtain typical rates of trip making for elderly who drive, are driven, walk, and use taxis or other means. The percentages of elderly in each travel mode (life-style) category were calculated from a Social Security (SS) survey of the elderly in Montgomery County, Virginia, by adding a "do not go" group of 16 percent to the modal breakdown for walkers, riders, and drivers. These percentages may differ from county to county, but are typical of rural areas having moderate income levels. The SS survey data are as follows:

Trip Purpose	Trips per Month	Do Not or Seldom Go (%)
Shop	1.4	22
Visit	6.0	37
Attend church	1.6	49
Obtain medical care	1.3	28

Two assumptions are inherent to this procedure. Those elderly who drive and those who do not go are considered to be unlikely candidates to switch to a new special transit system during its initial years of operation. Those who do not go are considered to include those who have physical mobility limitations. On the average, about 15.5 percent of the elderly are unable to perform any work (10). This percentage compares with the finding that 16 percent of the Montgomery sample was totally inactive and did not visit, shop, or go to church. These incomplete data suggest that, for purposes of a preliminary demand estimate, this fraction of elderly drivers and elderly unable to travel may be eliminated as potential riders. Although some of these types of elderly might be attracted if there were a concentrated outreach program, their contribution is minimal in approximating initial system demands.

Current destinations per month (Table 1, column 4) were obtained from the SS survey and include travel for grocery shopping, visiting, church, and medical care. Estimates of the number of monthly destinations by users of currently operating and comparable special transit systems are given in column 5. These systems currently service shopping, medical, and social service trips such as food stamp eligibility checks, nutrition, and senior center activities. On the basis of monthly destinations for social-recreational travel presented by Carp (8) and the SS survey data above for shopping and medical travel, we estimated that 4 destinations/month (1/week) are typical. This rate agrees with those of currently operating systems in Rhode Island and Delaware (9).

We assumed that, primarily, automobile riders and those using taxis, walking, or using other modes might switch during the first year of operation and that the walkers and taxi users who switch might increase their frequency of trip making. Although few data are available to support this contention, two lines of reasoning seem feasible: (a) We may assume that those switching will not, initially, alter their travel frequency for these trip purposes; and (b) we might estimate an overall frequency of about 1 trip/week (4 destinations/month) that seems to be typical of other systems in operation.

We then evaluated the participation percentages of each modal travel group that would be likely to switch to the transit service. Unfortunately, the modal-split equations and graphs commonly used in urban transpor-

tation evaluation have not been developed for rural areas. Such curves would relate the percentage of transit users to variables describing the quality of transportation service.

In the absence of better information, estimates based on the observed ridership of similar systems were used. We assumed that 3 percent of the elderly automobile riders and 5 percent of the elderly who travel by walking and other modes might initially switch to the special transit system (Table 1, column 6). The number switching (column 7) is obtained by multiplying data in columns 6 and 2. Total transit destinations per month (column 8) were obtained by multiplying data in columns 7 and 5. To convert from destinations per month to trips per month, we also assumed that each destination represented 1.8 one-way trips (e.g., some journeys include more than one destination). Hence, column 9 was determined as 1.8 times the data in column 8 or an estimated 353 transit trips/month.

The estimate of 353 trips/month is equivalent to 4236 trips/year or 1.40 annual trips/elderly resident. Another view of the estimate is to consider the monthly frequency of trip making by those riders who would use the system. Each rider would make about 7.2 trips (one-way)/month or nearly 1 round trip/week. Based on this example of 3015 elderly in Montgomery County, 49 riders are expected to be initially attracted. This represents about 1.6 percent of the elderly population. All of these indicators are representative of current data from other systems. The elderly trip rate (1.4 annual trips/elderly) is approximately equivalent to 0.14 annual trip/person, based on the fact that about 10 percent of the population is 65 or more years old. This annual rate per person is consistent with existing operations in many rural areas for which data are given above.

#### ACHIEVING A COMPREHENSIVE DEMAND ESTIMATION PROCEDURE

As previously stated, the demand for rural transportation delivery systems must finally be evaluated in terms of those factors that directly influence demand levels. Demand volumes are a function of the levels of service provided by existing transportation modes, the levels of service provided at the service agencies, and the socioeconomic status of the elderly population. Demand models can be formulated and validated once a comprehensive data base of these characteristics has been collected. These models would indicate the sensitivity of demand volumes to changes in the system parameters. Before describing the formulation of such models, we should outline the types of factors that might significantly influence demand. Local personnel may suggest that particular relationships be emphasized in the systems design process.

Two sets of systems factors are reviewed. The first group, TRANSEL, refers to the transportation level-of-service variables that might influence demand. The second group, ACTSEL, refers to the level-of-service variables that describe agency (activity) operation.

The TRANSEL factors listed below are not meant to be an exhaustive list of all the variables that possibly influence transportation demand but a representative sample of the variables that are most crucial.

Factors	Variables
Convenience	Pickup and delivery proximity
	Multipurpose destination capability
	Frequency of service
	Reservation time requirements
	Compatibility with agency schedule

Factors	Variables
Comfort	Seating comfort Special provision for elderly and handicapped Overall trip length Average wait at stops
Privacy	Traveler mix Information requirements User status and self-image
Fare	
Dependability	
Safety	
System coverage	Number of users served Area served System reachability Scope of services Demand satisfaction level

An individual elderly person of a particular socioeconomic background is assumed to choose a mode of travel based primarily on the first six level-of-service factors, particularly one mode (e.g., automobile riding) over the alternative (social services bus). Each of these factors, or the lack of them, contributes to the transportation impedance or cost of the trip. Obviously, certain groups of elderly tend to be quite sensitive to these variables. For example, those elderly who live with relatives and do not own an automobile have at least two travel mode choices. They may wait for a ride with relatives, or they may use the special service bus. In such cases, the bus quite possibly could provide a superior level of service as indicated by the list of variables. At the other end of the spectrum are those elderly who drive and are quite active (perhaps 50 percent of the rural elderly). These elderly would find that the special service bus cannot match their private vehicle on most of the level-of-service factors. Hence, their decision, although based on the factors of relative comfort, convenience, privacy, cost, safety, and dependability, is viewed as hardly a choice at all, and they are unlikely to switch.

The last level-of-service factor, system coverage, may not influence individual mode-choice decisions, but is useful to transit planners. System coverage usually correlates highly with demand volumes (e.g., area served is usually related to demand levels). However, many of the system coverage variables are related to the comfort, convenience, privacy, cost, and dependability factors that directly influence individual travel choice.

Some of the less obvious TRANSEL variables are related to the convenience factor. Pickup proximity appears to be especially important to the elderly, and door-to-door service is advised. Multipurpose capability refers to the ability of a journey to serve more than one purpose. This convenience factor depends on both transportation and agency scheduling. Frequency of service refers to the number of times per week that the trip could be scheduled. One day per week service offers the potential traveler little flexibility of choice and may detract from demand. However, a potential exists for a regular service pattern to develop in which elderly persons would expect transportation on a particular day. Important economies can be achieved if agencies are effective in accommodating their case loads to this service. Reservation requirements, if necessary long in advance of trips, also tend to detract from potential demand. Providing transportation service that is compatible with agency schedules is necessary to avoid long wait periods.

Primary among the comfort variables are the necessary special provisions such as seats, steps, and lifts to serve an elderly and handicapped clientele. Also of importance to a comfortable ride are the amount of in-

vehicle travel time and the number and length of in-vehicle stops.

Privacy has been noticed especially in some rural Virginia and Carolina counties to reflect the degree of vehicle utilization. Elderly have been observed to be adverse to social class mixing and to cultural, racial, or even healthy-and-handicapped mixing on buses. These observations are based on limited data, but should be investigated in detail in particular localities when a transit service is designed.

Weights of levels of importance have not been attached to the various transportation level-of-service factors. The relative importance of each can only be assessed from the actual observed behavior of the elderly who use a system and are influenced by these factors. Hence, these data must be collected, when feasible, from a large number of operating systems that vary considerably as to service provided. Not all factors influence travel demand; in fact, not all factors are totally independent from other variables. Therefore, those variables used to estimate demand can be considerably fewer than those listed above.

Simultaneously with the mode-choice decision, the decision concerning whether to make the trip (travel frequency) is reached. This decision depends on the quality of transportation modes and also on the levels of service provided at the agencies or other destination activities. The following is a list of agency level-of-service factors that must inevitably influence demand for the services and, therefore, the derived demand for transportation to the services. Variables are related to user convenience, comfort, cost, and privacy.

Factors	Variables
Convenience	Operating hours Prior appointment requirements Compatibility with transportation Compatibility with other activities Service rate capability, staffing Wait time for service Outreach
Comfort	Accommodations for elderly and handicapped Waiting room facilities
Privacy	Social distance among user groups Information requirements User status and self-image
Cost of service	

One other important factor that influences the demand for agency services and, thus, agency transportation is not given in either the TRANSEL or ACTSEL factor list. This factor is the outreach of the agency as influenced by personal contact, advertising, and communications media. Agencies with significant outreach programs tend to change the perceptions of the ACTSEL and TRANSEL variables to the individual elderly. The perceived value of the level-of-service factors influences travel behavior, not actual values. Often the outreach tends to generate new customers by initiating a perception of TRANSEL and ACTSEL where no prior knowledge existed.

#### ECONOMIC DEMAND MODEL FORMULATION

A rigorous demand model formulation would incorporate most of the previously mentioned level-of-service factors into a mathematical expression. Such an expression should be the focus of continued research and data monitoring for rural transportation systems. Mathematical forms for a demand model are briefly described to encourage planners and agency personnel to be cognizant of the requirements of producing a valid, working demand model.



In this case, a demand model is generated as opposed to a demand forecast. The advantage of the model is that it can be used to forecast demand under a variety of socioeconomic circumstances. Demand models may be sensitive to changes in social or economic policy and, therefore, be used as tools in future rural development plans used in policy research.

We have stated that demand for rural transportation services to social agencies is functionally related to the characteristics of the elderly population, the level of service provided by transportation systems, and the level of service provided at the agency.

$$D_{IJK} = f(\bar{E}, \bar{T}, \bar{A}) \quad (3)$$

where

D = demand,  
 $\bar{E}$  = set of population characteristics (age, sex, income, or health),  
 $\bar{T}$  = set of transportation systems characteristics for available modes,  
 $\bar{A}$  = set of destination activity system characteristics,  
 I = origin,  
 J = destination, and  
 K = mode.

If necessary, demands may be further stratified by trip purpose (p) and the time of day (t).

To generate a demand model, observed values of demand ( $D_{IJK}$ ) and existing characteristics as described by  $\bar{A}$ ,  $\bar{E}$ , and  $\bar{T}$  variables are used as input. The model parameters are then calculated by empirical techniques such as standard regression estimating procedures. Resulting models may then be subjected to a rigorous statistical validation based on correlation coefficients, significance tests, and associated evaluation indicators.

This description of demand model formulation has been quite theoretical and perhaps of little present value to agencies. Yet, if meaningful demand models are to be constructed, agencies must be cognizant of the data requirements necessary to model construction. In addition, a thorough description of demand interactions is necessary to the design of eventual rural service delivery systems for the elderly.

## SUMMARY

This analysis of the transportation demand for social services illustrates two important facts: (a) Existing demand estimation techniques do not fully incorporate all system effects and are, therefore, likely to provide only mildly acceptable results; and (b) a coordinated effort to collect the data necessary to develop an economic demand model would be beneficial to further systems development. A reliable model of this nature does not currently exist.

This lack poses a serious problem to those planners faced with the task of developing initial special transit programs for the rural elderly. We recommend that, in the absence of data, a trip rate consistent with those given in this paper and tempered by local judgment be used for an approximation of demand. If relevant data are available, an analysis of participation frequencies, also tempered by local judgment, will give a first approximation to demand volumes.

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# Latent Travel Demands of the Handicapped and Elderly

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In every urban area there are large numbers of elderly and handicapped persons whose mobility needs are not being met by existing transportation systems. Consequently, this part of the population is being denied, in varying degrees, access to essential services and active participation in urban life. In this paper an hierarchical approach is proposed for measuring latent demand and is applied to interview data from a sample of elderly and handicapped persons. Three types of demand are measured: total demand for activity participation, latent demand for activity participation, and latent demand for transportation. The effects of handicap status and socioeconomic variables on these demands are analyzed, and the importance of various activities to a respondent's life-style is examined. A profile of the respondents and their existing travel habits is also presented.

In every major urban area there are many citizens with permanent and temporary mobility limitations for whom travel is severely restricted because of existing transportation system design and operation. Consequently, this part of the urban population is being denied, in varying degrees, access to essential services and active participation in urban life. In effect the handicapped, because of inadequacies of transportation service, are being denied "individual opportunity for variety, range of choice, and personal advancement" (9, p. 8).

Congressional attention to transportation problems of the handicapped and elderly has increased in recent years, producing specific legislative requirements and guidelines in planning and design processes (10, 15, 16, 17). Planning for the elderly can be done with census data and transportation survey data (12), and some special studies on travel of the elderly have been conducted (5, 6, 7). Far fewer data have been collected on travel of the handicapped, and only a few studies have been done (1, 2, 4, 11, 14, 18).

Research is sparse on the concept of latent demand for transportation by the population at large and even more so for the handicapped and elderly. In pioneering work on latent demand done at Carnegie-Mellon University

(4), the concept of latent demand considered the demand for attributes of the transportation system as well as total trip making. Further, the concept was linked to knowledge of the transportation system and to activity desires. Burkhardt and Eby developed the concept of need as a determinant of latent demand in a study of rural populations (3). They used, as did Yukubousky and Politano, gap analysis in which travel of a subject group is compared to travel of a group that has higher mobility and that is taken as a norm (20).

The concept of latent demand implies the measurement of a difference between some norm of travel behavior and existing travel. This norm implies an alternative set of conditions to the conditions under which existing travel is measured. These alternative conditions include an increased opportunity for travel through improvements in the physical design, layout, operation, and information service of travel options. The Carnegie-Mellon concept would add activity participation desires. On a broader scale changes in the demographic and socioeconomic characteristics of the city should also be considered.

Burkhardt and Eby analyzed several techniques for estimating or measuring latent demand. Their first technique was the collective opinion of a panel of experts; this technique, however, was arbitrary and often ignored information from the subjects. The second technique was the use of a particular group as a norm. The suggestion that everyone wants to and should travel as much as everyone else is intractable. However, if the subject group and the norm group are similar in all respects except for one criterion causing the demand differences, then the technique has potential merit. The third technique was the use of the subjects' perceptions of what they would like to have. This technique usually gives expression to desires for transportation services quite new and different from existing options. However, what the group actually does is quite different from what the group says it would do.

Most urban areas have established models for estimating travel behavior under alternative sets of conditions. The urban travel models are applied predominantly at the zone level for mid- and long-range system planning. Although certain system attributes are included, they are

not the ones relevant to the handicapped and the elderly. Market segmentation is sometimes applied, but rarely are specific groups of the travel disadvantaged singled out. Further, the trip generation models for most urban areas are not sensitive to the transportation system. Thus, although the handicapped and the elderly make up 13 percent of the population (18), their needs are not explicitly accounted for even when the most prevalent techniques for travel forecasting are used.

#### HIERARCHICAL APPROACH TO LATENT DEMAND

The demand for transportation services assumes a demand for activity participation. The latent demand for transportation services must also assume a latent demand for activity participation or a demand for better transportation. The demand for transportation is multidimensional and relates to all system attributes—comfort, convenience, frequency, speed, and information—however these might be defined.

A simplified conceptual model of latent demand is presented in Figure 1. To participate in an activity, a person must know about the activity, be able to participate (physically, financially, and otherwise), and desire to participate. The latent demand for the activity is the difference between existing participation rates and those rates that might come about under some known or unknown alternative circumstances. For example, if a person were to earn more money, he or she might go to the theater more often.

Latent demand for transportation exists whenever there is a latent demand for activity participation. Latent demand related to nontransportation factors is an implied latent demand. Latent demand related directly to the transportation system may be termed a "direct" latent demand and may exist whether or not there is a latent demand for the activity.

#### ORGANIZATION OF SURVEY

With the aid of several organizations, a pilot home interview survey was conducted in a portion of Chicago's north side. The study area was a 3-km (1.8-mile) wide strip extending about 12 km (7.2 miles) north from downtown Chicago along Lake Michigan and containing over 500 000 residents. The area is spotted with concentrations of ethnic groups, and about half the employed persons have blue collar jobs. Compared to the rest of the residents in Chicago, relatively few residents own their homes. Multifamily dwelling units predominate. The predominantly grid street pattern has a clearly defined arterial network. Bus service exists on all arterials, and two rapid transit lines also serve the community.

Of the 168 interviews obtained, 86 came from the Senior Citizens Project (SCP) operated by the Chicago Housing Authority at North Clark and Irving Park streets, close to the center of the study area. Because the emphasis of the pilot survey was to determine characteristics of the target population, rather than to assess parameters of the population accurately, the survey was not designed to be either totally random or representative.

The survey included physically handicapped persons and persons of age 65 or over. Blind or mentally ill persons were excluded. The socioeconomic characteristics were influenced by the SCP residency requirements that tenants had to be over 65 or over 55 if they had a physical disability. In addition, there was an income ceiling. Characteristics of the respondents are as follows:

Characteristic	Respondents (%)	Characteristic	Respondents (%)
Age 65 or over	63	Cannot drive at all	78
Disability reported	85	Use transit	67
Women	67	Retired	67
Apartment dwellers	85	High school graduate	38

As part of the interview, a typical travel survey was conducted to analyze existing travel patterns of the respondents. The survey recorded all trips for 2 d by all modes no matter how short. Of the 375 trips reported, 44 percent were made by walking, the most used mode, and 33 percent were made by bus, the next most used mode. Over half of the nonhome destinations were for social and recreational purposes. Shopping accounted for 18 percent of all the nonhome trips. Excluding travel to home, 50 percent of the trips were shorter than 1 km (0.6 mile); these trips were almost all made by walking. Longer trips were almost all made by bus.

Since most regional travel surveys pay scant attention to short trips and walking trips, data are not always available for comparison with the handicapped and elderly data. The handicapped and elderly survey trip rates are compared with 1956 data from the Chicago Area Transportation Study (CATS) in Table 1 (8, p. 22). Since employment of the survey sample is low and since the CATS data omit walking trips, the most valid comparison is for nonwork, nonwalk trips. The handicapped and elderly survey rate of 0.286 person trip/d (excluding trips to home) is well below one-half the rate for the overall population. Although the handicapped and elderly do manage to reach many additional activity sites by walking, they still do not have the same range of opportunities as able-bodied people do.

The respondents were grouped according to their physical capabilities (13). Three groups were analyzed: B1, those who can perform most travel functions; B2, those who can perform most travel functions but cannot enter and maintain stability in a moving bus; and B3, those who have severe mobility limitations. In Figure 2, the nonwork trip rates of the three groups are compared with corresponding 1956 CATS data. As expected, groups B3 and B2 travel significantly less than group B1. Group B1 appears to make more trips than the regional average because the CATS data exclude walking trips.

In terms of latent demand, group B1 seems to be the norm for travel behavior, but statistical tests demonstrated that there were no significant socioeconomic differences among the groups (13). They differ only by their physical capabilities. One would, therefore, be making two erroneous assumptions in selecting group B1 as the norm: Group B1 has no latent demand, and groups B2 and B3 desire to, and are able to, participate in the same kinds of activities with the same frequency as group B1.

The questionnaire includes a series of questions to test the latent demand concepts discussed earlier in the paper (Figure 3). The responses are summarized in Table 2. The items are ranked according to the total demand for participation in the activity (TDA), i.e., the number of persons who already participate in the activity plus those who would like to. The activities near the top of the list are basic physical and social needs. These trips are made regularly and therefore rank above the social and recreation activities. However, those activities showing the greatest expression of latent demand (LDA) are social or recreational, i.e., going to a movie or visiting friends. The basic needs, such as visiting the doctor, are fulfilled as required and have less latent demand.

The survey reveals that 145 respondents (86 percent) have a latent demand for at least one activity. Of these,

Figure 1. Conceptual model of latent demand of an individual.

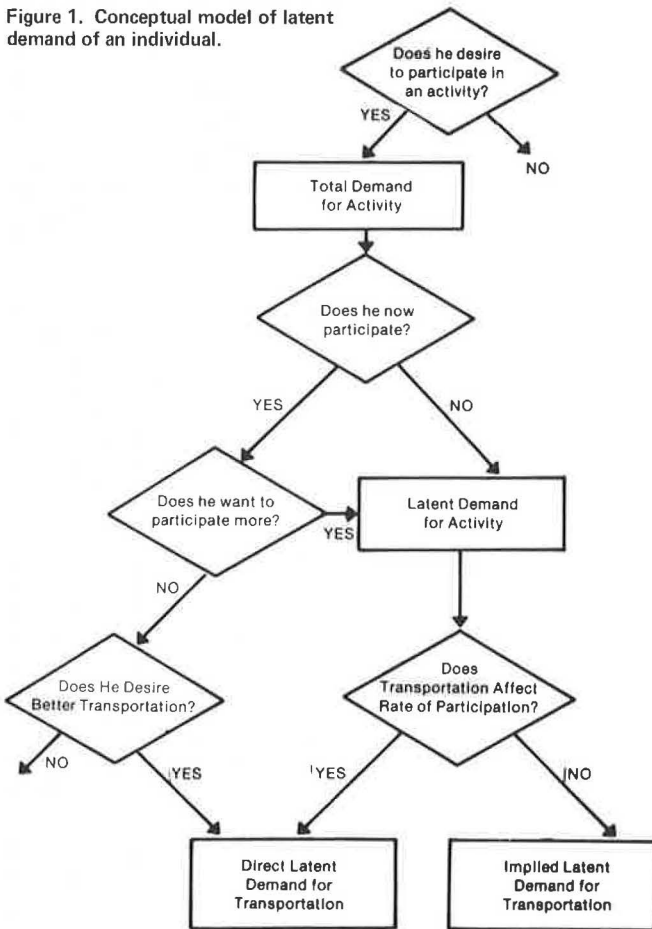


Table 1. Travel of the handicapped and nonhandicapped.

Purpose	Person Trips per Person per Day <sup>a</sup>		
	Includes Walking	Excludes Walking	CATS Population, Excludes Walking
Shopping	0.110	0.039	0.106
Social and recreation <sup>c</sup>	0.304	0.143	0.285
Other nonworking <sup>d</sup>	0.134	0.104	0.301
Total nonworking	0.548	0.286	0.692
Working	0.056	0.042	0.393
All purposes	0.604	0.328	1.085

<sup>a</sup> Excludes trips to home.

<sup>b</sup> 168 persons sampled, summer, 1971.

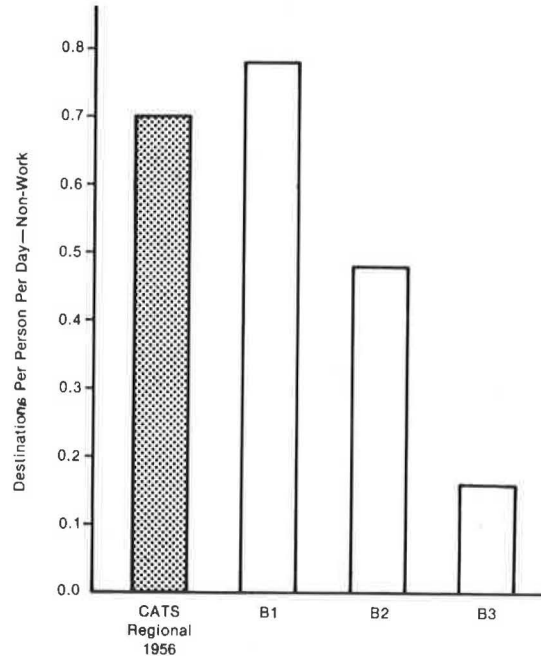
<sup>c</sup> Includes eating meals.

<sup>d</sup> Consists of personal business, school, and serve passenger.

122 indicate that transportation is a factor. Transportation improvements might therefore benefit 73 percent of the respondents or 84 percent of those with LDA. Table 2 gives the latent demand for transportation (LDT) for each purpose.

Figure 4 shows the relationship between total demand and latent demand. Three distinct clusters of activities are formed. (School trips provide too low a demand for meaningful evaluation.) The labels identifying the three clusters are an attempt to describe how much the respondents must travel for each purpose. There is a high demand for those activities in the "satisfied" cluster. The respondents make these trips when necessary regardless of cost. Except for a few persons traveling to regular rehabilitation clinics, travel to these activities is infrequent. The cluster labeled "essential" contains five activities that demand frequent trip making for sus-

Figure 2. Comparison of nonwork trip data from survey and from Chicago Area Transportation Study.



tenance purposes. Although eating out is generally regarded as a social activity, it represents an essential function for many of the respondents who cannot prepare their own meals on a regular basis. The respondents rate their social and spiritual needs as important as their purely physical needs. The "discretionary" cluster is made up of 10 items including all 7 of the recreational activities. This cluster has almost as high an absolute latent demand as the essential cluster, but because the overall demand level is much lower the level of unsatisfied demand is much higher.

SYNTHESIS OF TRAVEL NEEDS

The approach to latent demand typified by Figure 1 leads to consideration of two hierarchical probabilities:

1. If an individual now desires to participate in an activity, what is the probability that he or she desires to participate more often?
2. Given that an individual has expressed a latent demand to participate in an activity, what is the probability that transportation affects his latent demand?

Probability 1 also includes those individuals who do not participate but would like to; and the probability of demand is in essence  $TDA/N$ , where TDA is the number of persons desiring to participate in the activity and N is the number of responses to the item. The probability of latent demand is  $LDA/TDA$ . Finally, the probability for transportation is  $LDT/LDA$ , where LDT is the number of persons who responded that transportation affects their rate of participation.

Table 3 gives activities and their probabilities grouped in clusters previously developed. The differences in the clusters can be seen by the following typical probabilities:

Activity	TDA/N	LDA/TDA	LDT/LDA
Essential cluster	80	43	74
Discretionary cluster	43	77	74
Satisfied cluster	67	14	60
Work	42	83	28

Figure 3. Questionnaire for determining individual latent demand.

I am now going to read a list of purposes for making a trip. For each purpose indicate the response category on the card which best represents how often you make that trip in relation to how often you would like to.

PURPOSE	Do not make trip for this purpose but would like to	Make trip ¼ as often as I wish to	Make trip ½ as often as I wish to	Make trip ¾ as often as I wish to	Make trip as often as I wish to	Do not make such a trip & do not wish to	Q's 61-80,	Q's 41-60	Q's 61-80
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
41. Shop for groceries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
42. Go to a movie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
43. Go to a museum or art gallery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
44. Go to the library	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
45. Go to the zoo	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
46. Go to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
47. Shop for clothes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
48. Go to a Cubs ball game	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
49. Go to school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
50. Go to the beach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
51. Visit city or government offices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
52. Visit friends or relatives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
53. Go out to eat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
54. Shop in the Loop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
55. Go to the doctor or dentist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
56. Go to the bank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
57. Go to barber or hairdresser	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
58. Go to a public meeting, hearing, lecture or speech	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
59. Go to church, temple, or synagogue	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

Table 2. Latent demand analysis.

Rank of Latent Demand	Activity	Number of Responses	Wish to Participate in Activity		Wish to Participate More Often		Transportation Affects Participation	
			Number	Percent	Number	Percent	Number	Percent
1	Visit friends or relatives	167	150	90	64	38	51	31
2	Go to doctor or dentist	167	143	86	6	4	4	2
3	Shop for groceries	167	136	81	59	35	43	26
4	Shop for clothes	167	133	80	54	32	23	17
5	Go out to eat	167	127	76	71	42	45	27
6	Go to church, temple, or synagogue	166	116	70	54	33	43	26
7	Go to barber or hairdresser	167	112	67	25	15	15	9
8	Go to bank	166	96	57	13	8	2	1
9	Go to movie	167	86	51	66	40	37	22
10	Shop in the Loop	167	85	51	43	26	31	19
11	Go to zoo	166	77	46	59	36	46	28
12	Go to museum or art gallery	167	73	44	62	37	45	27
13	Go to public meeting, hearing, lecture, or speech	167	71	43	46	28	34	20
14	Go to work	167	70	42	58	35	16	10
15	Go to Cubs ballgame	168	65	40	53	32	30	18
16	Visit city or government offices	167	51	31	40	24	34	20
17	Go to library	168	51	30	39	23	30	18
18	Go to beach	167	42	25	35	21	24	14
19	Go to school	167	17	10	15	9	10	6

These statistics confirm the comments made earlier concerning the nature of the clusters. The hierarchical latent demand for transportation is uniform across the clusters, but is significantly lower for the work purpose. Apparently, the latent demand for work is due to physical and motivational factors rather than to travel barriers and requires a more in-depth analysis.

The demands can be qualified in terms of participation rates and travel rates. If a single activity is considered and  $t'$  represents the ideal frequency of participation in

the activity, the rate of participation of those who participate, and do so as often as they desire, becomes an appropriate surrogate. And if  $t_i$  represents the actual frequency for individual  $i$  and  $n$  becomes the total number of persons expressing demand for participation, the total demand for participation in a given time period is then

$$TDA = nt' \tag{1}$$

Figure 4. Latent demand versus total demand for activity participation.

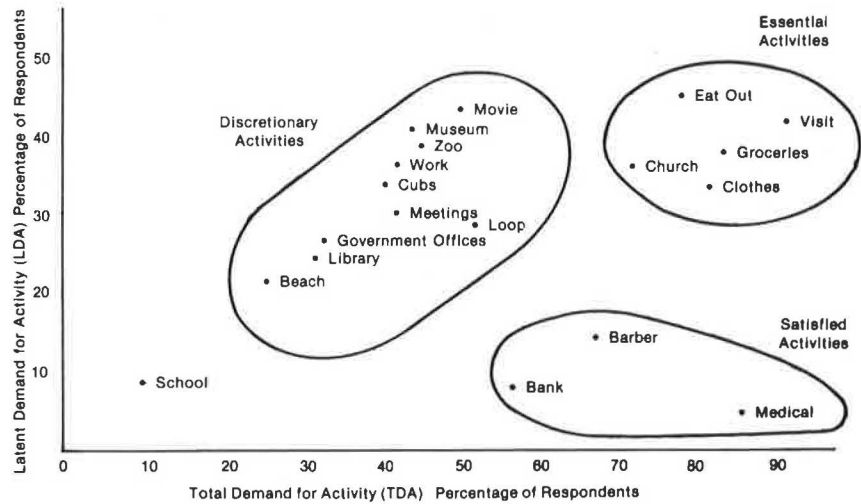


Table 3. Aggregate hierarchical probabilities for latent demand.

Activity	Probability of Demand	Latent Hierarchical Probabilities	
		Participation	Transportation
<b>Essential cluster</b>			
Visit friends or relatives	90	43	82
Shop for groceries	81	43	74
Shop for clothes	80	44	52
Go out to eat	76	56	63
Go to church, temple, or synagogue	70	47	81
<b>Discretionary cluster</b>			
Go to movie	51	77	57
Shop in Loop	51	51	72
Go to zoo	46	77	79
Go to museum or art gallery	44	85	74
Go to public meeting, hearing, lecture, or speech	43	65	74
Go to Cubs ballgame	40	82	59
Visit city or government offices	31	78	85
Go to library	30	76	79
Go to beach	25	83	69
<b>Satisfied cluster</b>			
Visit doctor or dentist	86	4	80*
Go to barber or hairdresser	67	22	60
Go to bank	57	14	18*
<b>Other</b>			
Go to work	42	83	28
Go to school	10	88	67*

\* Small samples.

TDA represents a rate of participation, but the measure  $\overline{TDA}$  represents a number of persons. The latent demand for participation by individual  $i$  can be expressed as

$$(\underline{LDA})_i = t' - t_i \quad (2)$$

The latent demand for participation by the entire sample is then

$$\underline{LDA} = \sum_i (\underline{LDA})_i = \sum_i (t' - t_i) \quad (3)$$

The expression for  $\underline{LDA}$  represents a total latent demand due to all factors, not just transportation. To determine what portion of this latent demand is affected by transportation barriers requires incorporating the hierarchical probability that transportation affects latent demand for participation given that there is latent demand for participation, i.e.,

$$p(\underline{LDT}/\underline{LDA})_i \quad (4)$$

The individual latent demand that can be affected by transportation improvements is then

$$(\underline{LDT})_i = (t' - t_i) \cdot p(\underline{LDT}/\underline{LDA})_i \quad (5)$$

The sample aggregate LDT is then

$$\underline{LDT} = \sum_i (t' - t_i) \cdot p(\underline{LDT}/\underline{LDA})_i \quad (6)$$

Equation 6 again represents a maximum, i.e., the maximum amount of latent demand that might be satisfied by improving transportation services. There are a large number of obstacles to be overcome by the handicapped, and the possibility of their overcoming these obstacles soon is doubtful. For example, a free air-conditioned, chauffeur-driven minivan with a hydraulic lift might satisfy most members of the target population, but society may be unwilling or unable to make such a vehicle available.

Some numbers are now applied to the above equations. One purpose has been selected at random from the essential and discretionary activity clusters: go to church and go to the zoo. If  $t'$  represents desired participation levels and equation 1 and the data in Table 3 are used, the total demands for participation ( $\overline{TDA}$ ) for the two activities are  $116t'$  and  $77t'$ .

From Equation 3 the latent demand for participation ( $\underline{LDA}$ ) can be computed with some simplifying assumptions. In the conceptual latent demand model, those persons desiring to participate in an activity were classified as follows:

1. Participate as much as desired,
2. Currently participate but would like to participate more often, and
3. Do not participate but wish to do so.

In the questionnaires, those in classification 2 responded most that they made trips half as often as they wished to, and almost equal but much smaller numbers responded that they made trips one-fourth and three-fourths as often. The rates of participation might then be  $t'$ ,  $t'/2$ , and 0. The numbers of responses in each of the three classifications of the church variable are 62 respondents in classification 1, 32 respondents in classification 2, and 22 respondents in classification 3. Applying equation 3 gives an  $\underline{LDA}$  of  $38t'$ . Thus, 33 percent of the demand to go to church is latent. Using the same method for the zoo variable gives an  $\underline{LDA}$  of  $55.5t'$ , a

representation of 72 percent of the total demand. These two variables again typify the activity clusters from which they were drawn.

Next, Equation 5 is applied to determine how much of the latent demand might, at the maximum, be due to transportation. None of the 62 persons responding that they participate as often as desired was assumed to have a latent demand for transportation. Of the 32 persons who participate half as often as desired, 26 said transportation is a factor and 1 did not respond. Hence, for the 32,  $p(\text{LDT}/\text{LDA})_1 = 26/31 = 0.839$ . Of the 22 persons who do not participate, 17 said transportation is a factor. Hence,  $p(\text{LDT}/\text{LDA})_2 = 17/22 = 0.773$ . Applying Equation 6 gives an  $\text{LDT}$  of 30.4t' for church and 43.71t' for the zoo. For each of these activities,  $\text{LDT}$  is 80 and 79 percent respectively of the  $\text{LDA}$ .

Several further extensions of the above method are possible. First, to dimension the demands separately for each handicapped group is possible. In this manner, an appropriate norm can be identified for each subgroup. Second, the concept of latent demand probabilities can be extended to finer levels. That is, a probability can be developed for the impact of each subgroup to particular improvement strategies. Thus, the  $\text{LDT}$  measured above is a maximum, representative of an occurrence under which 100 percent of the persons with an  $\text{LDT}$  respond up to the level of the norm. Finally, this study can be developed further by incorporating appropriate values for t' from a travel survey. Commensurate definitions of trip purpose would then be required.

#### SUMMARY

This analysis has been performed to demonstrate an alternative approach to the measurement of the increased travel potential of handicapped and elderly persons. The method has a basic premise that the key to accurate assessment of need is to disaggregate the population according to professed desires for activity participation and then to determine the potential for increased travel by subgroups. The study has concentrated on the number of persons who desire to travel more and on how much more they might travel. These are important measures of benefit. Parallel measures can also be developed to isolate individuals who would be helped in their travel problems if more travel opportunities were available and existing travel were easier. Certainly a variety of improvements are called for since most of the respondents do not drive and one-third cannot use transit.

#### ACKNOWLEDGMENTS

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# Travel Patterns and Mobility Needs of the Physically Handicapped

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This paper, which is based on a research project (1), discusses some relevant findings that may help decision makers and planners solve transportation problems of handicapped persons. The results of the Polytechnic study show that there is no single improvement on any single transportation mode that will provide a panacea for the transportation problems of the physically handicapped. Also, improvement needs appear to be perceived differently by each category of handicapped persons and vary by trip purpose.

## SAMPLE DESCRIPTION

The sample for this study consisted of 121 orthopedically handicapped adults living in the borough of Queens, New York. The respondents were mainly white, middle-class, middle-aged, long-term residents of Queens. Most were apartment dwellers although few had to climb stairs to gain access to their dwellings. The sample comprised individuals characterized by long-term physical disability usually caused by illness. Their condition was generally stable and their health tended to be good. Almost all used some type of walking aid. Most were high school graduates and many had completed one or more years of college. Almost half were employed at the time of the study and were residing with other adults. Half of the sample owned automobiles that usually were equipped for handicapped persons. Most of the sample (77 percent) lived within 224 m (800 ft) of a bus line.

## MOBILITY PATTERNS

Case study interviews provided data and self-assessed mobility information in terms of trip rate, trip purpose, and mode use. The results of these analyses are reported for the total sample and for types of functional disability.

Functional disability relates to a capability for self-locomotion. Functional disability may be divided into three classes depending on whether the handicapped (a) can climb stairs with relative ease, (b) can climb stairs with extreme difficulty, or (c) are confined to a wheelchair. These classifications of handicap were developed to analyze travel habits and mobility patterns and to assess differentials in mobility related to functional disability.

The average number of one-way trips per day (including walking trips) made by the handicapped was estimated on the basis of self-reported mobility. The trip-making rate varied from 2.74 to 1.43, and the trip rate decreased as the severity of handicap increased.

The reasons for trip making differ by type of handicap (Table 1). The proportion of trips to work taken by persons with less severe handicaps is substantially higher than the proportion of trips taken by persons with more severe handicaps. This latter group tends to make a higher proportion of medical-related trips and significantly more recreational and personal business trips. The other trip purposes are made with similar degrees of intensity by all handicap groups considered here.

These observations could be interpreted as constituting a measure of relative importance of the individual trip purposes for each handicap group. However, care should be exercised in interpreting these results. For example, to conclude that the work trip is less important to those more severely handicapped would be a mistake, for the lack of accessible transportation prevents many of the more severely handicapped from obtaining jobs.

Another objective of this research was to examine the use of transportation modes relative to trip purpose (Table 2).

The relationships between mode use and trip purpose give measures of modal choices and may indicate the importance placed on these modes by their users for each trip purpose. Modal choices, however, are not only a function of individual preferences but are also conditioned by socioeconomic and environmental constraints and the characteristics of the transportation modes and network configuration. The constraints of interest in this research are those related to the degree of functional impairment of the handicapped. The data given in Table 3



**Table 1. Trip purposes of handicapped persons by degree of handicap.**

Purpose	Able to Walk		
	No Hardship Climbing Stairs (%)	Hardship Climbing Stairs (%)	Regular Wheelchair User (%)
Shopping or personal business in neighborhood (grocery, haircut, bill-paying, bank)	22.5	29.6	24.2
Shopping or personal business out of neighborhood (department store)	9.1	10.5	10.9
Doctor	2.0	4.2	4.8
Dentist	1.1	2.1	1.1
Hospital	1.7	1.5	3.6
Official business (Social Security, welfare, Veterans Administration)	0.9	4.1	1.4
Work	35.6	19.3	18.2
Visiting relatives and friends	12.9	9.7	11.6
Attending religious services	3.9	4.8	3.1
Recreation (movies, clubs)	9.1	11.6	17.0
School	1.2	2.5	4.2

**Table 2. Trip purposes and modes used by handicapped persons.**

Purpose	Public Bus (%)	Subway or Railroad (%)	Taxi <sup>a</sup> (%)	Car Service <sup>b</sup> (%)	Special Service for Handicapped <sup>b</sup> (%)	Private Vehicle (%)	Walk or Wheelchair (%)
Shopping and personal business in neighborhood (grocery, haircut, bill-paying, bank)	5.0	0.3	2.2	1.6	0.1	60.8	30.0
Shopping and personal business out of neighborhood (department store)	5.6	2.4	3.1	8.0	0.3	76.6	4.0
Doctor	0.7	1.0	3.8	11.5	19.9	56.5	6.6
Dentist	1.6	1.9	3.2	4.1	12.5	65.0	11.7
Hospital	2.5	1.0	6.4	21.7	37.7	30.8	—
Official business (Social Security, welfare, Veterans Administration)	3.6	6.2	2.9	2.0	4.0	80.6	0.6
Work	12.9	5.6	2.0	6.0	7.3	63.9	2.2
Visiting relatives and friends	2.1	3.8	3.1	6.8	0.2	65.0	20.0
Attending religious services	3.0	—	—	2.2	2.2	66.5	26.1
Recreation (movies, clubs)	2.5	1.4	1.3	5.8	12.8	60.3	16.0
School	5.1	5.1	—	—	69.4	15.2	5.1
All purposes	6.1	2.8	2.3	5.4	6.8	62.6	13.8

<sup>a</sup>Hailed.      <sup>b</sup>Phoned for.

**Table 3. Modes used by handicapped persons by degree of handicap.**

Mode	Able to Walk		
	No Hardship Climbing Stairs (%)	Hardship Climbing Stairs (%)	Regular Wheelchair User (%)
Public bus	10.1	0.7	0.0
Subway or railroad	4.4	0.6	0.0
Taxi (hailed)	3.0	1.0	1.2
Car service (phoned for)	5.1	7.9	4.1
Special service for handicapped (phoned for)	5.4	4.0	12.8
Private vehicle	63.0	67.0	57.7
Walk or wheelchair	9.0	18.3	24.2

Table 4. Modes best meeting needs of handicapped persons by degree of handicap.

Purpose	Mode	Able to Walk		
		No Hardship Climbing Stairs (%)	Hardship Climbing Stairs (%)	Regular Wheelchair User (%)
Shopping and personal business in neighborhood	Private vehicle	60.3	64.7	36.8
	Walk or wheelchair	20.7	11.8	15.8
	Public bus	10.3	11.8	26.3
	Car or special service	3.4	11.8	10.5
Shopping and personal business out of neighborhood	Private vehicle	55.4	66.7	30.8
	Public bus	17.9	11.1	30.8
	Public bus or subway	10.7	11.1	12.8
	Car or special service	8.9	5.6	17.9
Doctor	Private vehicle	64.3	61.1	38.2
	Car or special service	7.1	11.1	26.5
	Public bus	8.9	11.1	14.7
Dentist	Private vehicle	58.5	58.8	48.6
	Car or special service	7.5	11.8	28.6
	Public bus	13.2	5.9	11.4
Hospital	Private vehicle	51.0	56.3	32.4
	Car or special service	8.2	6.3	37.8
	Car service	14.3	12.5	5.4
	Public bus	14.3	0.0	10.8
Official business	Private vehicle	48.9	66.7	41.9
	Public bus	14.9	0.0	16.1
	Car or special service	6.4	6.7	19.4
Work	Private vehicle	51.0	81.8	46.2
	Public bus	20.4	9.1	15.4
	Bus or subway	18.4	0.0	14.2
Visiting relatives and friends	Private vehicle	66.1	64.7	42.5
	Public bus or subway	12.5	11.8	17.5
	Car or special service	3.6	5.9	17.5
	Public bus	10.7	5.9	7.5
	Car service	1.8	5.9	12.5
Attending religious services	Private vehicle	56.5	60.0	47.1
	Public bus	21.7	6.7	11.8
	Car or special service	6.5	13.3	17.6
	Car service	2.2	13.3	8.8
Recreation	Private vehicle	47.4	52.9	41.0
	Public bus or subway	21.1	11.8	12.8
	Car or special service	12.3	5.9	23.1
	Public bus	10.5	5.9	7.7
School	Private vehicle	79.2	90.9	45.5
	Public bus	8.3	0.0	22.7
	Car or special service	8.3	0.0	9.1

show the extent to which current mode use depends on severity of handicap.

#### MODAL PREFERENCES FOR TRANSPORTATION IMPROVEMENTS

In Table 4 the percentage of handicapped who selected the modes that would best meet their needs for specific purposes, if improvements were made, are given as a function of disability. The private vehicle is most preferred for all purposes almost regardless of disability. However, a trend indicates that the greater the disability is the less attractive the private vehicle is regardless of purpose.

Despite the degree of disability many of the severely handicapped seem to prefer integrated modes of transportation, especially the public bus, or the public bus in combination with the subway. Indeed, there is a tendency for these modes to be preferred as the severity of the disability increases. However, there is also a tendency for many of the more severely handicapped to prefer the more segregated modes, such as the car and special services. The tendency for greater preference of both the segregated and integrated modes with increasing severity of disability is associated with a diminishing desire to use a private vehicle as the handicap becomes more extreme.

#### CONCLUSIONS

This paper examines some aspects of the transportation problems of the physically handicapped and gives some insights into the interrelationship of trip making, trip purpose, mode use, and desires for transportation improvements. The results of this study indicate that the transportation needs of the physically handicapped are rather heterogeneous and, therefore, no single transportation mode is likely to meet their travel needs.

#### ACKNOWLEDGMENTS

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# Travel Behavior and Mobility Patterns of Low-Income Residents of Syracuse, New York

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There has been extensive redistribution of people, goods, services, and land uses in the twentieth century. These changes can be directly related to more and improved transportation. More highways and automobiles have given increased choices to those who own or have the use of automobiles. It is sometimes assumed that improved public transportation gives increased choices to those who do not have the use of automobiles.

Some researchers maintain that the question of choice is not significant in analyzing mass transit systems as related to the poor who do not have automobiles. Their arguments are supported by data on low latent demand for travel among the poor, the low priority attached to mobility by the poor, and empirical evidence showing that the daily travel of the poor is much less than the travel of those who have higher incomes.

This research was designed to study the way in which a low-income population receiving subsidies through the Department of Social Services Aid to Families With Dependent Children (AFDC) traveled. Their perceptions of trip modal choice and their satisfaction with the travel mode used were included in a travel diary.

The questions addressed were those of the actual behavior exhibited in the travel patterns and modal choice of this low-income population. Is there a low demand for travel? Is mobility given low priority by the poor? Do the poor restrict their travel to certain days, hours, and geographic sites?

## RESEARCH DESIGN AND METHODOLOGY

A sample of 50 persons was chosen from the original population (1, Vol. 1) of 437 recipients of AFDC. Each person was asked to participate in a further, in-depth study of his or her travel habits and preferences.

There were seven phases in the project: (a) selecting the subsample, (b) developing and pretesting the travel

diary and travel diary questionnaire, (c) training the participants, (d) completing the travel diary, (e) administering the questionnaire, (f) analyzing the data, and (g) discussing with agency and community representatives to coordinate the findings with those reported on the larger sample.

To ensure that the sample would be geographically representative of the total AFDC population the respondents were randomly selected from each of the four city divisions (1, Vol. 2). The number of respondents from each division was proportional to the ratio of the AFDC population to the total population of the division. If a replacement was needed, an alternate respondent was randomly chosen either from the same census tract or from a contiguous census tract within the same city division.

The travel diary had a structured format that was designed to elicit detailed information about travel habits over a specific period of time. Following the training of the respondents in the proper use of the travel diary format, each respondent was requested to account for three different travel outings or trips. The respondents then carried out each outing on a different day during the course of a week. Participants arbitrarily chose the trips on which they would report, and all trips began and ended at his or her home. A travel outing is comprised of a series of stops or destinations that can be viewed as the various legs or segments of a journey. After an outing, the respondent described each trip segment, including the trip home, by completing the travel diary. For example, a respondent completing three outings, each comprised of three stops, accounted for nine trip segments in all.

After the respondent completed the three travel outings, a trained interviewer administered a short supplementary questionnaire. This instrument was designed to (a) obtain information regarding the respondents' use of and attitudes toward the mass transit system in Syracuse, (b) learn how the respondents receive information about the transit system (e.g., information about schedules, routes, and special services), and (c) gather information about the respondents' access to and use of an automobile. The information collected from this questionnaire also served as a check for the data generated by the questionnaire used in the earlier study (1, Vol. 1).

Both the travel diary and the travel diary questionnaire were pretested by two students who were receiving welfare and attending an adult basic learning center.

## DATA BASE

Fifty respondents completed and reported on three travel outings, or trips, each that were taken between May 24 and July 28, 1974. Therefore, there was a total of 150 outings with the origin and destination being the home. Each outing represented a number of legs or trip segments, the origins and destinations of which could be anywhere within Syracuse or Onondaga County. In the presentation of data that follows, each trip segment is treated as a complete trip.

The subsample was selected so that no respondent owned a car, but in all other respects they were representative of the general AFDC study population. The group consisted of predominately nonworking females (48 out of 50) between the ages of 18 and 74 and varied in race, educational level, and income. All had a minimum education of at least grade five.

## MAJOR FINDINGS

The following is a summary of the major findings that are related to four general areas: (a) time of travel, (b) distribution of trip destinations, (c) trip purpose, and (d) respondents' attitudes concerning a variety of travel modes.

### Time of Travel

The majority of the travel outings occurred between 10 a.m. and 5 p.m. with the peak travel time between 10 a.m. and 2 p.m. The peak is the same when the data are disaggregated by mode of travel. There were differences, however, in the after-5 p.m. data: Few individuals borrowed automobiles after that time; walking and bus riding declined markedly; and, finally, there was no decrease in travel as an automobile passenger. In fact, travel as an automobile passenger became the principal and almost only mode used during the evening and nighttime hours.

### Distribution of Trip Destination

In general, the trip destinations were concentrated in the central business district (CBD), in outlying areas where services are concentrated, and in areas where a large number of medical services are found.

There were modal differences in the distribution of activities. Travel by walking showed a well-dispersed geographical distribution, although there were two areas of concentration, the CBD and the Westvale shopping center area, which is easily accessible by walking for a large number of residents on the west side of the city.

Destinations reached by bus were concentrated in the CBD and in areas where a large number of medical services are found.

Destinations reached by automobile were geographically dispersed, and the range of travel was much wider than that found with any other mode. However, there were areas of concentration—the CBD and areas contiguous to it, and the shopping areas outside the city.

### Trip Purpose

The majority of the outings were single-purpose trips, and most could be classified as shopping or social-recreational or both. Less than one-tenth were work-

related trips. The automobile was the most frequently used mode, the bus was the second, and walking was third. Most of the trips in the last category were short.

The following differences were found when we cross-tabulated modes of travel and trip purposes. The principal means of travel for visiting or going to places of entertainment was the automobile. When grocery shopping, respondents either walked, for shorter trips, or went by automobile. When shopping for goods other than groceries, respondents used a variety of modes, depending on the destination: the bus for travel to the CBD, walking within the CBD or for short distances, and the automobile to shopping areas outside the city. When going to work, most respondents used the bus or the automobile, and when traveling to medical services, respondents used the bus most often.

### Respondents' Attitudes

Most of the respondents reported that the mode they had used during the specific outing was the usual way that they traveled to that destination, and most viewed it as a satisfactory method of travel in that situation. The chief exceptions to this were the taxi users, who reported that this was not their usual mode of traveling to the particular place they had traveled to. Less than one-third of all respondents felt that bus travel was convenient, and the rest were undecided.

Most of the respondents found the bus to be inconvenient when traveling to places of entertainment and when grocery shopping, but convenient when shopping for goods other than groceries or when going to work.

In general, the study population felt that they were at a disadvantage because they did not own automobiles. They did not have freedom of travel, and, because of a heavy reliance on the bus service, they were restricted due to the inflexibility of the existing system of bus routes and schedules.

## CONCLUSIONS AND IMPLICATIONS

The travel of this low-income group is primarily a function of where and when buses travel. The results of this dependence on mass transit have been discussed in numerous studies. These discussions center on the social, economic, geographical, and political impact of mass transit on mobility. The ability to secure and hold employment, the accessibility to the social-recreational activities that may enhance well-being, and the possibilities for cross-income and cross-cultural communication are all affected by the mobility of individuals and classes of society.

Numerous studies have also demonstrated in supply versus demand versus latent demand analysis that the neglect of mass transit has resulted in extensive social costs. When these social costs are juxtaposed with the costs for providing increased and better transportation services, the social costs have been chosen.

The immediate possibilities for improved mass transit for the low-income group and, therefore, the potential for increased mobility of these people are in the areas of

1. Better transit information systems that include scheduling, routing, and information dissemination improvements,
2. Extension of subscription-type bus services to low-income areas through programs directed toward increased employment by low-income residents of social and cultural, shopping, and other activities, and
3. Educational programs directed toward the study of taxing structures to support public transportation, in-

cluding an investigation of mass transit as a public good.

The long-run possibilities are in the areas of

1. Study of the relationship between mass transit dependence and various income, social, and psychological problems,
2. Study of travel behavior on a large scale, and
3. Planning in the framework of the relation between the locations of people and those of goods, services, and essential facilities. This could be operated through the planning and monitoring of programs such as those under the Community Development Act of 1974.

It can be concluded, therefore, that mass transportation is a very important entity to a majority of low-income individuals, either as a primary or a secondary mode of travel. The transit system, however, is inflexible, and those who are mass transit dependent remain relatively immobile in a society where increased mobility is essential to individual and collective well-being. The question is, Do we have the resources, patience, and knowledge to improve the mass transit system so that all may benefit by it?

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# Life-Styles and Transportation Needs of the Elderly in the Future

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Several common views of the transportation requirements of elderly Americans are reviewed, and conclusions are reached regarding the older population of the next two decades. While the elderly of today are relatively dependent on public transportation, live at higher densities, have lower incomes, and travel relatively little compared with other groups, there are indications that the elderly of the future may not be similar. Planners wrongly assume that a decline in mobility occurs with aging because of the aging process itself. Rather, people bring certain long-established life-styles into their old age. The mobility patterns of today's elderly reflect life-styles that were developed decades ago, when mobility was limited for all citizens, regardless of age. By contrast, the elderly of the next 20 years will include many suburbanites, many drivers, and many who travel a great deal. Planning and forecasting methods for the future transportation needs of the elderly should not be based on the transportation patterns and needs of those who are currently elderly, but should focus more on those who are now in their thirties and forties and will become the elderly of the future.

Transportation planning policy at all levels now emphasizes meeting the special needs and requirements of the elderly. Section 16 of the Urban Mass Transportation Act of 1964, as amended in 1970, embodies "the national policy that elderly and handicapped persons have the same right as other persons to utilize mass transportation facilities and services." Employing federal, state, and local funds, many transit operators are attempting to remove architectural and physical barriers to travel by older Americans. In many areas, demand-actuated service and services using specially designed vehicles are being introduced. Reduced fare programs are now standard. Since the elderly, who now constitute about 10 percent of the total population, are relatively deprived of mobility through lack of access to automobiles, such programs are an important advance in efforts to provide services in an equitable manner. These efforts should certainly be maintained and expanded during the coming decades, since these recent programs are still of limited scope in comparison with actual needs.

Because there has been a national commitment to the provision of mobility to the elderly, and because a significant start has been made at overcoming current barriers, this is an appropriate time to look forward in order to estimate the travel needs and patterns of the elderly in coming decades. It is especially important to look forward because many transportation programs and projects have long lead times and long service lives. By the time many transit systems that are now being planned are in service, most of the elderly of today will be dead. It should not be assumed that the elderly population of the future will have needs similar to those of the elderly population of today. If future generations of the elderly will have styles of living and travel patterns that are significantly different from those of the current generation, such differences should be identified now and incorporated into planning goals.

There is evidence that the living patterns and transportation requirements of the elderly are shifting, and that in the next two decades they may be significantly different from the patterns observed in the early 1970s. Today's transportation plans for the elderly are based on an image of high-density living by a fairly homogeneous group of persons, relatively few of whom are drivers, in central city locations. The elderly of the 1990s will, by contrast, probably be more heterogeneous and more affluent, will include more drivers, and will be dispersed in a variety of living environments of which an increasing proportion will be at lower densities. Such trends are already observable, and will probably be accentuated in the near future. The purpose of this paper is to speculate on potential future patterns of living and travel among the elderly, and to draw from these anticipated patterns some conclusions about the transportation planning processes needed to anticipate and accommodate future needs.

## ANTICIPATED DEMOGRAPHIC AND SOCIAL CHANGES AMONG THE ELDERLY

It is estimated that in 1975 there were 8.9 million men and 12.8 million women aged 65 and older in the United States. If present trends in age-specific mortality rates

continue through the year 2000, there will be approximately 10.2 million men and 16.3 million women in this age group by then. While this is an increase of approximately 22 percent over the current elderly population, it is a much less dramatic increase in the proportion of the total United States population that will be elderly, from the present figure of approximately 10 percent to a value of between 11 and 12 percent (9). The 1970 census showed that approximately three-quarters of all Americans aged 65 and older resided in urban areas, and it is probable that the recent tendency toward concentration of the elderly in metropolitan areas will continue, although the elderly now appear to be decentralizing within metropolitan areas.

With the number of elderly increasing by over one-fifth, and with this occurring principally in urban areas, it would seem that increased volumes of service of the types being offered today might be adequate to meet the needs of the elderly of 20 years hence. However, several social trends already well under way may cause the life patterns of older Americans in the 1990s to be rather different from the patterns observed today.

#### Improved Health

There is a tendency to associate old age with reduced capacities for movement and with increased disabilities of various types. While physical and psychological changes do accompany the aging process, more than 80 percent of the elderly have no health-related limitations on mobility, and of the remaining 20 percent, many are quite mobile, although with some difficulty (14). The increasing survival of persons into old age, the major factor that will bring about the increased number of elderly during the next decades, might imply either increased or decreased proportions of the elderly who are handicapped, disabled, or otherwise immobile. If increases in the age span are the result of survival of illnesses that were previously fatal, there will be more disabled persons, but if increases in life span are the result of generally improved health among the elderly, there will be relatively larger numbers of healthy elderly among the older population in the year 2000. Because the relations between morbidity, mortality, and life expectancy are complex, it is difficult to be certain about the health status of the future elderly. What seems to be happening, however, is the emergence of two major subpopulations that have been termed the young-old and the old-old (8). At retirement, at present in the vicinity of age 65 but possibly at earlier ages in future years, persons may be expected to have relatively few disabilities that are mobility-limiting and that impact life-styles or travel patterns. As the aging process continues, however, young-old persons will become old-old. Those surviving to age 80 and beyond may well be expected to have health conditions limiting their physical mobility and living patterns. Significant increases can be expected, however, in the numbers of young-old persons capable of relatively vigorous activity patterns with relatively few constraints on their mobility.

#### Independent Living Arrangements

Increasing numbers of young-old persons can only increase the trend established in recent years toward an elderly population not dependent on relatives (especially children) or institutions, but living in separate households. Today, even among persons over age 75, 80 percent of all women and 90 percent of all men are living independently (alone or with a spouse) (9). Women tend to outlive men, and the 1970 census showed that 72.4 percent of all men aged 65 and over are married, while

only 36.5 percent of women in the same age group are married. Among those who are not married there are many more elderly women living alone than men, since 52.2 percent of women over age 65 are widowed, while only 17.1 percent of men in this age group are widowed (15). In combination, these statistics show that the majority of elderly persons live in small and independent households, and that this trend will probably continue unless housing costs force older persons to double up or to move in with younger relatives. Neugarten anticipates an increasing number of old-old persons who themselves have children among the young-old. This may give rise to larger intergenerational family units of the elderly, but still within the basic trend of the elderly living in independent settings (9).

#### Improved Economic Welfare

Understanding of the economic situation of the elderly has improved a great deal in recent years. It is now realized that while the money income of the elderly is typically low, this alone is an inadequate indicator of the economic welfare of this population group. In addition to pensions and social security, elderly persons frequently have accumulated economic assets that are as important in determining their living patterns as are flows of dollar income into their households. For example, it is estimated that 80 percent of the elderly households in the United States live in owner-occupied dwelling units (12). These housing units, more frequently owned free and clear by their occupants than is the case for other age groups, are one of the most important economic resources of the elderly. Similarly, savings and investments are important sources of economic security. If both current income and accumulated assets are considered, as Havighurst (6) has noted,

It can be predicted with relative assurance that dire poverty among the elderly will be practically eliminated before the year 2000. The major step has already been taken in this direction, in principle, by the federal government provision for Supplementary Security Income (SSI), which replaces the varied state Old Age Assistance programs of the recent past. Payments from federal funds for SSI will probably increase, to compensate for increased cost of living.

#### Improved Educational Levels

Today, of every 100 persons aged 65 and over, 8 men and 8 women have had less than 5 years of schooling and are classified as functionally illiterate. The 1970 census showed that more than half of those over age 65 had an educational background that included only elementary school, but that more than half of those under age 65 had educations that at least included high school. Clearly, there have been major advances in the public education system during the life span of today's elderly, and those who approach old age at the year 2000 will generally be educated to a degree far beyond that of the present elderly population (14).

In combination, the foregoing social and demographic trends among the elderly imply a future population of much greater diversity and freedom than that of today's elderly population. Improved health and economic welfare, better education, and relatively independent living arrangements will characterize the future elderly. These conclusions should not be surprising, because the population under discussion is the group of persons now in their forties and early fifties. It is reasonable to conclude that the social characteristics and life-styles of these people will be brought with them into their retirement and old age, and that the best clues as to the living patterns of tomorrow's elderly may be found not among today's elderly but among currently younger

population groups. In spite of this obvious truth, we find generalizations in the literature and in the minds of transportation planners that imply that the elderly will always be relatively poor, immobile, and dependent. A static view of the elderly is being projected into the future when their transportation needs are considered, and the transportation solutions that are being designed will not necessarily be useful.

#### CONSEQUENCES OF SOCIAL AND DEMOGRAPHIC CHANGES AMONG THE ELDERLY

Although the elderly of today are probably a more heterogeneous group than our planning methods and policies would imply, it would appear that the elderly of the future will be even more diverse. The consequences of improved health, economic independence, and education will be to permit and encourage a variety of life-styles among the future elderly that will, in simple terms, be drawn from more diverse experiences in younger life and from greater freedom of choice in retirement. Some elderly will be found in dense urban environments, while others will choose free-standing retirement communities, and still others will continue to inhabit the suburbs that they helped to create and populate during the middle part of the twentieth century. Just as different communities among younger age groups are based on life-style variables of culture, ethnicity, and socioeconomic class, so will these variables play an increasingly important role in the creation of the life-styles of the elderly population of the future.

One important aspect of the probable proliferation of life-styles among the elderly is of special relevance to transportation planners. It is probable that an increasing proportion of the elderly population will be residing at lower densities than are currently associated with the aged. Transportation planners tend to portray the elderly as concentrated in central-city locations, close to public services and dependent on public transportation. In actuality, a trend away from this pattern is already evident. The table below shows that, among elderly whites in the United States, the proportion dwelling in rural areas declined from 35 to 27 percent between 1950 and 1970, and the proportion dwelling in the central cities increased by only 1 percent (from 32 to 33) of the total.

Area	Percent of Elderly Population			
	White		Nonwhite	
	1950	1970	1950	1970
Rural	35	27	43	24
Central city	32	33	34	51
Urban fringe	13	22	5	10
Other urban	20	18	18	15

The proportion living in the urban fringe, however, increased from 13 to 22 percent, a major shift indeed. Thus the largest increase occurred outside the central cities, in locations of relatively low density. Among the nonwhite elderly, there was a somewhat different pattern. The table above shows that for this group, which is presumably more constrained by income and education and by residential segregation, the largest shift was from rural to central-city areas, where more than half of elderly nonwhites now live. However, the proportion of nonwhite elderly living in the urban fringe has also doubled (from 5 to 10 percent) in 20 years (5).

There is reason to believe that such trends will continue. Since the majority of the elderly occupy dwellings that they own, the present elderly are found in high-density communities largely because they have grown

old in those communities where they have long been residents. While increased income and education and better health may permit many of the elderly of the future greater freedom to relocate than is presently the case, many will choose to remain in the suburban homes that they acquired in the 1950s and 1960s. Such individuals will be a major component of the total elderly population by the turn of the century. Recently, many states have instituted policies of granting property tax relief to elderly persons who occupy homes that they own. Such programs will, if continued, provide an added incentive for suburban family heads to remain in their homes when children leave and retirement approaches. Butler and Lewis (2) have written that "there are relatively few suburban elderly but it is projected that 20 years from now the suburbs may be predominantly elderly." Gelwicks (3) was rather pessimistic about this prospect when he wrote that "tomorrow's elderly will be left in declining suburbs; will suffer from too low a density to maintain social interaction and widely dispersed vital services without public transportation."

The 1970 census data for Los Angeles County show that many of the elderly are already residing at rather low densities. Approximately half of the elderly reside at densities lower than 3.5 persons/1000 m<sup>2</sup>, and 30 percent at densities below 2.5 persons/1000 m<sup>2</sup>. Thus, while it is true that half of the elderly population of Los Angeles is residing on the most densely populated 5 percent of the land, it is also true that the other half of the elderly are scattered at much lower densities on 95 percent of the land (15). Public transportation services are being significantly improved in areas of dense concentrations of the elderly, but these improvements do not reach the large proportion of people residing at lower densities. The consequences of these trends for transportation planning will be discussed later, after a closer examination of trends in travel patterns and requirements among the elderly.

#### ANTICIPATED CHANGES IN MOBILITY AND TRIP MAKING AMONG THE ELDERLY

When comparing the elderly to younger age groups, the most impressive statistics in this era of the automobile must be those that relate to automobile ownership and drivership. These data show quite conclusively that the elderly are currently much less mobile than are younger age cohorts. There is reason to believe, however, that these data are being interpreted improperly with respect to the implications that they hold for future generations of the elderly.

The table below shows national data on automobile ownership by age of the head of the household.

Age of Household Head (years)	Percent of Households Owning	
	No Car	At Least One Car
Under 25	19.3	80.7
25 to 34	12.0	88.0
35 to 44	11.6	88.4
45 to 54	13.6	86.4
55 to 64	19.7	80.3
65 and over	44.9	55.1

This shows that the proportion of households without automobiles is dramatically higher for those with household heads over age 65 than for other age groups. Nearly 45 percent of the households headed by those aged 65 and older owned no automobiles, while only about 20 percent of the immediately younger cohort (those aged 55 to 64) and 10 percent of households headed by those in their



thirties and forties had none. Similarly, data on the possession of drivers' licenses indicate large disparities between the elderly and younger age cohorts. Olsen (10) has reported that in Florida only 58 percent of those aged 65 to 75 and 30 percent of those over age 75 are licensed to drive, in comparison with 83 percent of those in age groups 25 through 64. Similar patterns are found in the city of Los Angeles, where only 65 percent of those aged 65 through 70, 51 percent of those aged 70 through 74, and 30 percent of those over 75 possess drivers' licenses, in comparison with more than 90 percent of the population in age groups 35 through 45 (4). In response to these findings, Olsen (10) and other authors have described a serious loss of mobility for the elderly that implies that the process of aging is itself causally related to reduced mobility. The implication of this view is that elderly persons of today and elderly persons of the future are or will be mobility dependent as a direct outgrowth of the process of aging. We believe that this view is incorrect. Having earlier stated that the locations and residential density patterns of the elderly are more probably a function of life-styles that are brought into old age than they are of aging itself, it is similarly true that travel patterns and mobility variables are also more probably explained by variations in life-style than by generalizations about the impact of aging on mobility. The conclusion of this reasoning is that it is not possible to predict future transportation requirements of the elderly without developing a deeper understanding of the possible life-style variations among the elderly of the future.

In spite of the fact that automobile ownership is significantly lower among the elderly than among other groups, it is unreasonable to conclude that age itself is the cause of this difference. The following shows how car ownership varies with income for all age groups in the United States.

Household Income (\$)	Percent of Households Owning	
	No Car	At Least One Car
Under 3000	57.5	42.5
3000 to 4999	30.8	69.2
5000 to 7499	13.6	86.4
7500 to 9999	8.4	91.6
10 000 to 14 999	4.1	95.9
15 000 and over	3.8	96.2

Low-income groups are characterized by much lower automobile ownership than upper-income groups. Nearly 60 percent of all households with 1970 incomes below \$3000/year and 30 percent of households with incomes between \$3000 and \$5000/year did not own automobiles, while only 4 percent of households with incomes in excess of \$15 000/year did not. Since the elderly are still disproportionately among the lower income groups, it may be that elderly persons are less likely to possess automobiles only if they have limited incomes and that lack of financial resources rather than aging itself is the cause of low automobile ownership among the elderly. This interpretation is upheld by the data below, drawn from studies in the New York area by Markovitz (7), who found that, among the elderly in this region, automobile availability varied significantly with income.

Household Income (\$)	Percent of Elderly Households With Zero Auto Availability
Under 3000	83.7
3000 to 5999	58.2
6000 to 9999	29.6
10 000 and over	20.6

While more than 80 percent of elderly households with incomes below \$3000/year did not possess automobiles, only 20 percent of elderly households with incomes over \$10 000/year had no automobiles available to them. Thus, if income is considered, it appears that the elderly are similar to other age groups in terms of automobile ownership. If age itself does not cause mobility dependence, the conclusions reached earlier about increases in income among the elderly during the next generation imply that the future elderly will possess automobiles at much higher rates than is the case today.

In the same way that the apparent relationship between age and automobile ownership may actually be the result of an underlying relationship between financial status and automobile ownership, the apparent relationship between age and the possession of a driver's license may also be independent of the aging process. While it is true that the elderly are much less likely to possess licenses than are younger persons, it is probable that many of today's elderly never possessed drivers' licenses and that the disparity in licensed drivers among the various age groups is not due to a decline in driving with age. Many of the elderly of the 1970s were teenagers during and immediately after World War I. In 1920, it was much less common for young people to learn to drive than it is today. It was especially unlikely that young women would learn to drive during those years. It is not surprising, therefore, that, in Los Angeles, among men over age 65 some 74 percent are licensed drivers but among women in the same age group only 39 percent are drivers. Among the very old, the disparity between the sexes is even greater. While 53 percent of the men aged 75 and older have drivers' licenses, only 18 percent of the women in this age group do (4). Although data are not available, it is probable that among the nondrivers in these age groups many never were drivers, and that the statistics reflect a living pattern of earlier years rather than a decline of driving with old age. This argument is also supported by an examination of the ratio of males to females holding drivers' licenses. In California, only 4 women possess drivers' licenses for every 10 men having them in the age group over 80. Among those in their seventies, there are 6 women licensed to drive for every 10 men; among those in their sixties the ratio is 7 to 10; and among those in their fifties there are 8 women drivers for every 10 men holding licenses. The trend is approaching unity very rapidly, and among the elderly of the future the present pattern of few women drivers will no longer hold. The reason, of course, is the changing social patterns that impacted role expectations for the two sexes during the past several decades. Projections into the future based on current patterns of sex differences among the elderly would probably lead to gross errors.

The dependence of life-styles among the elderly on social patterns established in earlier years may be widely misunderstood by transportation planners, who frequently describe this disparity in driving by stating that the elderly "no longer possess drivers' licenses." The assumption revealed by such wording, that a decline in driving takes place with aging, is not usually supported by time-series information in large part because such time-series data are not available. It is likely, however, that most of the elderly who do not drive are merely reflecting the life-styles of earlier decades. Since later generations of men and women were much more likely to become drivers, the elderly of the future are more likely to be drivers than are the elderly of today.

Related to lower automobile ownership and lower rates of possession of drivers' licenses among the elderly is the common finding that the elderly make fewer trips than do those of younger ages. Data from the Los Angeles

Regional Transportation Study showed, for example, that on days for which they were requested to keep trip logs 37 percent of the elderly respondents made no trips at all, while only 21 percent of the nonelderly respondents had not traveled (4). It is reasonable to conclude, however, that this decline in trip making is not necessarily dependent on aging. In addition, if the life-styles of the elderly include less reliance on automobile driving and a greater likelihood of residence in older central-city locations, some important definitional concepts may cause us to underestimate trip making by the elderly. In many urban transportation studies trips are defined in terms of vehicle movements and do not include pedestrian movements. However, elderly persons living in dense, inner-city communities may be able to shop, visit friends, and obtain many essential services by walking rather than riding, and many retirement communities are specifically designed around the concept of minimizing the need for vehicular traffic. Presumably, surveys of such communities would show relatively little vehicular travel. Thus, it would seem erroneous to conclude that low rates of travel imply unmet travel needs, but this is precisely what transportation planners have consistently done. It would be doubly incorrect to assume that low rates of vehicular travel imply unmet needs, especially in denser communities where walking can satisfy a large proportion of a person's needs, yet transportation planners consistently cite vehicular trip frequencies in discussing the transportation needs of the elderly.

#### IMPORTANCE OF LIFE-STYLE IN UNDERSTANDING THE TRANSPORTATION NEEDS OF THE ELDERLY

Many elderly persons of today live in older central-city communities that are characterized by low automobile ownership, low rates of vehicular travel, relatively good public transportation service, high densities of residents and services, and low incomes. While many elderly persons live under conditions that are far different from these, it is also true that such concentrations exist.

It is probable, however, that transportation planners have misinterpreted these findings. They reason that people become poorer as they age, and that their residential choices are narrowed as they become unable to drive. The transit-dependent elderly are seen as people who are forced to live in high-density neighborhoods of older structures, where they can rely on public transit to make the trips that they must make without the automobiles that they can no longer afford or that, because of their age, they are no longer able to drive. Such a concept leads to the conclusion that the elderly become transit-dependent as they age. If this is true, the elderly of the future may also be expected to become dependent as they age.

An alternate explanation can be offered, however, to account for the same observations. If the elderly of today grew up in an era of walking and public transit, they will have developed life-styles that are not automobile-dependent. If they do not drive, it may be because many of them never drove. If home ownership is an important correlate of location of the elderly, it may be argued that the elderly grew older with their inner-city communities, rather than moving to those communities in their later years. If they are residing in areas of dense transit service, this may be because transit service was established in these areas before the era of the automobile, and may help to explain why many of them never learned to drive. Thus, such

elderly persons may be characterized by an entire life-style that differs from the life-style of younger Americans. If this explanation is correct, it would be reasonable to say that the elderly did not become transit-dependent as they aged; it would be more correct to say that they never became automobile-dependent when they were younger. Their transit dependence does not represent a need that must be provided for but a life-style that must be understood in its entirety.

If the life-style explanation is acceptable as an alternative to the common view of transportation planners and if the elderly of today did not necessarily become more transit-dependent as they aged, there are important implications of this concept for considering the transportation needs of the future elderly.

The first implication for transportation planners of this alternative view is that standard methods of forecasting residential patterns and demand for transportation services among the elderly should be revised. We often establish relationships between locations or trip patterns and age and assume that the relationship that characterizes today's age-graded population will also characterize the population of 1990 or 2000. An alternative approach, in which relationships between today's elderly and their characteristics as a younger population, and similar relationships between today's middle-aged population and the future elderly, should be explored. If shifts in mobility are intergenerational and not a function of the biological process of aging, time-series analysis of each population group is more appropriate as a planning tool than is cross-sectional analysis of today's population. Unfortunately, most regional transportation studies have engaged almost solely in cross-sectional studies, and the conduct of time-series analysis of travel as a cohort ages will require original and special data collection efforts. Until such time-series studies are conducted, however, it will be impossible to fully understand the impact of aging on residential location and mobility.

The concept of life-style has been introduced as being a potentially powerful explanatory tool when considering residential location and travel among the elderly (11), but research is needed to provide further elaboration and definition of this concept. We know that some elderly persons remain in central-city locations in close proximity to services and public transit, while others choose to spend their later years in low-density retirement communities where automobile ownership is quite high. Differences in income, educational levels, and living patterns prior to retirement are probably systematically associated with such choices. Efforts are required to clarify these relationships.

The concept of life-style may also be promising for the redefinition of transportation planning methods in areas that go beyond consideration of the elderly. For years, economists have described the demand for travel as a derived demand, meaning that persons do not travel as an end in itself but because travel is one of the essential costs of taking advantage of the opportunities provided by the modern metropolis. The implication of this basic definition is that people who do not travel do not wish to engage in certain activities, or that their desire to do so is frustrated by physical or economic limitations. The concept of life-style might provide us with an alternate explanation of travel that is more appropriate to current needs. A particular life-style may be viewed as giving rise to locational preferences, activity patterns, and travel demands in combination with one another. Travel, rather than being derived from activities, is determined jointly with activity patterns. Thus, if elderly persons are observed not to travel very much, the conclusion may not be that the cost of mobility

is so high as to deprive them of desired activities. Rather, the life-style model might allow the conclusion that these persons have, in their earlier years, adopted living patterns in which activities are geographically circumscribed. Their travel is minimal, but a full range of satisfying activities is possible. Research aimed at clearer definitions of life-style and at the modeling of relationships between life-style and travel might establish an analytical tool of equal relevance to any age group. If society is entering a period of limited growth and limited resource availability, the modeling of various life-styles and their associated travel requirements and demands might provide a more useful planning framework than the standard methods that model travel as a simple derivative of projected economic and social activities.

While the concept of life-style can provide an entirely new dimension in the analysis of travel requirements of the elderly, it must also be recognized that this concept will be insufficient to fully explain the locational patterns and travel demands of all of the elderly of the future. While we believe that the life-styles that are brought into old age will be the principal determinants of living patterns and travel in retirement, we cannot ignore the fact that some people will become incapacitated, weak, or fearful as they age, and that these people are likely to change their life-styles as a result of aging. In this regard, it is once again useful to invoke Neugarten's distinction between the young-old and the old-old. The young-old can be assumed to be those whose travel requirements and locational choices can be best explained in terms of the life-style patterns established in younger life. The old-old, on the other hand, are those for whom the process of aging has made the attainment of desired life-styles no longer possible.

Transportation planners have tended to describe the elderly as a homogeneous group of transit-dependent central-city dwellers, but the young-old of the next two decades will probably be found in a wide variety of living environments at low and high densities and relying to varying extents on the automobile for transportation. Although increased freedom of choice will characterize the young-old in the years to come, this freedom of choice will itself make the transition to old-old status more difficult for those who experience it. The old-old will be much more dependent on others than the young-old for the provision of mobility or for the delivery of services. Yet, because of choices exercised during the early retirement years, the old-old will also be found at a variety of densities and in communities of widely varying characteristics. Thus, because the young-old of the future will exercise a much wider range of choices regarding living arrangements and travel patterns, the old-old of the future may become more dependent on public transportation, while being dispersed in communities in which such services can be provided only at very high cost. Whether we provide those services in low-density suburban locations, or require that the old-old be relocated to central facilities where such services can be effectively delivered, the consequences for the old-old of the future will be significant.

It is possible to anticipate the future life-styles of the young-old, and to estimate the numbers, locations, and mobility needs of the old-old of the year 2000 and beyond. It is possible, of course, because these population groups are already alive, and their life-style patterns are already established. The methods and approaches employed to date for the estimation of travel requirements of the elderly are inadequate, however, for the accomplishment of these tasks. We must today begin to build techniques that recognize the importance of life-style variables as well as the importance of

physical aging, if we are to meet the challenge of providing adequately for the mobility of the future elderly.

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# Analysis of a Taxi-Operated Transportation Service for the Handicapped

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This paper analyzes the demand for and cost of a taxi-operated special transportation service for the handicapped. Gross hourly cost is found to be \$6.74 for regular taxi service and \$8.62 for lift-equipped vans. About 1.5 percent of the population would need the special service. One-fifth of the handicapped need the special vans. Demand for this service would take years to develop. After approximately 5 years, demands of 1.4 trips/week/eligible person could be expected. The net cost of such a service for a standard metropolitan statistical area of 3 million people would be approximately \$11 million/year. The net cost of service is very sensitive to the fares charged, to limitations on trip purposes served, and to the advance notice requirement.

The need for special transportation services for the handicapped and elderly has become a critical problem. This problem has been recognized by the U.S. Department of Transportation, which has issued draft regulations requiring transit authorities to develop programs to meet the needs of the handicapped and elderly. Improvements in physical design and service will enable public transit to transport the elderly and handicapped; however, about 1.5 percent of the population will always have great difficulty in using the public transit system and will require special door-to-door transportation.

Taxi companies are logical providers of door-to-door transportation services for the handicapped. Currently about one-third of the trips taken by severely disabled individuals are by taxi. Contracts with taxi companies for special services would use existing drivers, dispatchers, and vehicles although some service and vehicle modifications would be required.

This paper develops a taxi-operated special mobility service for a hypothetical metropolitan area of 3 million people. The service closely parallels a service provided to the disabled in Gothenburg, Sweden. Operating costs for regular taxis and special lift-equipped vans are given. Demand for the service is developed by trip purpose. Metropolitan costs are analyzed in terms of trip purposes allowed, fare and other revenue policies, and advance notice requirements.

## TAXI OPERATING COSTS

Taxi operating costs vary with geographic location and type of operation. The 1970 cost per vehicle for 27 taxi companies, excluding New York City, was approximately \$11 000; however, the cost per vehicle for 50 taxi companies in New York City was about \$26 000 (8). Table 1 gives a breakdown of the cost per vehicle for a medium-sized taxi company in Dade County, Florida, in 1973. Operating costs are updated to 1975 by using an inflation rate of 12 percent for 1 year and 7 percent for the second year. Providing for 6 percent profit and 20 percent driver tip gives a total cost per taxi of about \$32 000.

Regular taxis would not be appropriate vehicles for transporting severely disabled individuals. Many persons who travel in wheelchairs, for example, should not be removed from their wheelchairs. The ideal vehicle for the more severely disabled would be a lift-equipped van with a converted roof to ensure proper headroom. Such a vehicle is more expensive to own and operate than a regular taxi. Table 1 gives a 1975 cost estimate for operation of a special vehicle by a taxi company. Assuming a purchase price of \$10 000 and a life of 3 years, yearly depreciation would be about \$3300. Drivers of special vehicles would have to assist persons from their doors and into and out of the vehicle. A premium rate of 10 percent above the regular driver earnings is assumed for driving the special vehicles. A Pennsylvania study of rural transportation gives a ratio of 1.56 for the cost of maintenance, fuel, and insurance of a van over that of a car (7). Table 1 reflects this increase. The total yearly operating cost of a special lift-equipped van is thus estimated to be \$40 000. Assuming that vehicles operate 90 h/week, or 4680 h/year, regular taxis cost \$6.74/h and special vans cost \$8.62/h.

## TRAVEL DEMANDS FOR THE SEVERELY DISABLED

Demand for transportation services by the severely disabled is based on the number of such persons, their origins and destinations, their trip purposes, trip lengths, and likely diversion from existing modes.

According to estimates from previous studies, between

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1 and 3 percent of handicapped persons cannot use existing transit services (1, 2, 4, 6). Experience in Gothenburg indicates that, when a special mobility service is offered to the severely disabled, a period of several years is required for potential users to learn about the service and to be registered for it. Data in Table 2 show that the number of registered users of the Gothenburg system increased from 0.5 percent in the first year to about 2.8 percent after 6 years and the upward trend is likely to continue. The growth pattern is almost linear. For this analysis we assumed that the total market for a specialized service is 1.5 percent of the population and that 5 years will be needed to reach that 1.5 percent market.

In addition to determining the number of severely disabled persons, determining the number of persons who can be transported in an ordinary automobile versus the number who require special vehicles with ramps or lifts is necessary. Various data sources indicate that between 15 and 23 percent require special vehicles (1, 4). We assumed that 20 percent of those who cannot use existing transit modes require special vehicles.

Although several data sources give trip purposes, trip rates, and present mode choice of handicapped individuals, none of these sources gives a complete picture of the most severely disabled individual. However, from these sources we can establish a range for trip demands that would be generated by a comprehensive special transportation service. Table 3 gives data on trip mode and purpose from Abt Associates and the Ontario Ministry of Transportation and Communications (1, 4).

Teixeria (4, 5) used the Abt data to predict a range for trip demands for a special door-to-door transportation service. Derivations of expected trips per week based on different assumptions for rates of diversion to a specialized transportation service are as follows:

Mode	Assumption 1	Assumption 2
Automobile		
Driver	0.0	0.0
Passenger	0.587	0.235
Taxi	0.432	0.27
Special taxi	0.077	0.038
Transit	0.187	0.094
Walk	0.155	0.0
Total	1.438	0.637

An implicit assumption here is that fares for the special service would be set low, in the range of public transit fares. The higher rate of 1.438 trips/eligible person/week compares favorably with Gothenburg rates after 5 years of service. For the purpose of this analysis we assumed that the first-year trip rate is 0.6 trip/week and the fifth-year trip rate is 1.4 trips/week.

Another factor to be considered in analyzing travel demand of the severely disabled is average trip length for a specialized service. The handicapped population is interspersed throughout the general population so that concentrations of handicapped persons are few. The spatial distribution of the handicapped trip demand may be different from the demand of the general population because the number of destinations is more limited, which implies longer trip lengths; however, the handicapped person is hesitant to travel to unfamiliar surroundings outside his or her neighborhood, which implies shorter trip lengths.

The Federal Highway Administration published data on trip lengths for taxi trips in the U.S. standard metropolitan statistical areas (SMSAs) in 1970 (8). Average taxi trip lengths were 9.1 km (5.7 miles) for work, 6.4 km (4.0 miles) for medical purposes, 5.1 km (3.2 miles) for shopping, 7.8 km (4.9 miles) for leisure, and 2.6 km

(1.6 miles) for education. Because of the lack of data on trip lengths for handicapped persons, we assumed that trip lengths for a special transportation service would be the same as trip lengths for taxi riders.

#### ALTERNATIVES FOR TAXI-OPERATED SPECIAL MOBILITY SYSTEM

Many alternatives are available to help in determining the special transportation services to be offered and their costs. The alternatives discussed in this paper are for a hypothetical SMSA of 3 million people. Four assumptions were made concerning the proposed taxi operated services.

1. A public coordination office oversees the specialized services. The coordination office negotiates contracts with private taxi companies, arranges for certification of handicapped persons by social service agencies, arranges for reimbursements to the program from social service agencies, and helps refer clients to the appropriate taxi companies that could offer the transportation service. (The coordination office of the Gothenburg Transit Authority operates its own special vehicles and lets contracts for taxi rides whenever a taxi ride is appropriate.) The coordination office receives calls and schedules the special vehicles for the taxi companies. The overhead cost is 5 percent, which is based on the overhead cost for the Gothenburg system of 5 percent of the total cost of taxi contracts and special vehicle operation.

2. The taxi companies supply the special vehicles. Federal funding is a future possibility, but for now the taxi companies purchase the vehicles.

3. Driver training is required for drivers of special lift vehicles. The SMSA pays for this training at the rate of \$250/driver. If the service requires 1.5 drivers/vehicle, the training adds \$0.08/h to the cost of a special vehicle.

4. Demand levels are derived by assuming total market saturation of 1.5 percent and trip rates of 1.4 trips/person/week. Actual first-year demand will only be about one-tenth of the demand derived. These demand levels were derived from the assumption that fares are set low, similar to public transit fares.

Table 4 gives an analysis of a special service for the SMSA assuming that (a) 1.5 percent of the population is eligible and 20 percent of this population requires special vehicles, (b) all trips are eligible, (c) service is available 90 h/week, (d) 90 h/week is sufficient service so that a level of demand of 1.4 trips/week/eligible person can be expected, and (e) vehicle use is 2 trips/h (the same as in Gothenburg and slightly lower than average U.S. taxi use).

The number of trips in Table 6 was developed by using the Toronto study data. Paid trip lengths are assumed to be the same as for regular taxi passengers. The total number of vehicle hours per year is derived from total trips based on 2 trips/h. Average total distance per trip is derived by assuming a vehicle speed of 19 km/h (12 mph), which is the national average for taxis (8). Total trip distance is derived by assuming a constant ratio of total distance to paid distance.

The annual gross cost of such a service is given below.

Cost Item	Number	Cost (\$)
Taxis	280	8 832 096
Special vans	70	2 823 912
Driver training	105	26 250
Overhead	—	582 800
Total		12 265 058

**Table 1. Operating costs per vehicle for taxis and special vans.**

Expense	Taxis		Special Vans, 1975 (\$)
	1973 (\$)	1975 (\$)	
Depreciation	1 000	1 200	3 300
Drivers	11 148	13 378	14 716
Maintenance	1 650	1 980	10 597
Vehicle operation	2 786	3 343	
Insurance	1 500	1 800	
General and administrative	2 585	3 102	
Subtotal	20 669	24 803	31 715
Profit (6%)		1 488	1 903
Subtotal		26 291	33 618
Driver tip (20%)		5 258	6 724
Total		31 549	40 342

**Table 2. Use of Gothenburg special transportation system.**

Year	Registered Users		Rides Provided	Rides per Registered User per Week
	Number	Percent of Population		
1969	2 246	0.5	—	—
1970	3 265	0.7	—	—
1971	4 758	1.1	—	—
1972	6 728	1.5	—	—
1973	8 800	1.9	629 199	1.37
1974	10 500	2.3	935 000	1.71
1975	12 651	2.8	1 172 000	1.78

**Table 3. Trips of handicapped by mode and purpose.**

Mode or Purpose	Abt Associates		Toronto Survey			
	Trips per Person <sup>b</sup>	Percent of Trips	Cannot Use Transit <sup>a</sup> (%)		Can Use Transit (%)	
			Need Special Vehicle	Can be Driven	With Difficulty	With No Difficulty
Mode						
Walk	3.1	—	—	—	—	—
Automobile						
Driver	2.3	30	6	8	23	26
Passenger	2.35	31	20	37	27	11
Taxi	1.08	14	35	30	16	2
Special taxi	0.077	1	31	1	—	—
Transit	1.87	24	8	24	34	61
Total	10.777					
Purpose						
Work	0.14	25	24		—	—
Shop	0.10	18	20		—	—
Medical	0.09	16	11		—	—
Home	0.51	—	—		—	—
Change mode	0.03	—	—		—	—
Other	0.23	41	45		—	—
Leisure	—	—	26		—	—
Education	—	—	19		—	—
Total	1.13					

<sup>a</sup>Rates are per week for mode and per day for purpose.

<sup>b</sup>Trips by purpose are return trips only.

**Table 4. Analysis of special mobility service for an SMSA of 3 million persons.**

Purpose	Trips (#)	Taxi Trips per Year	Special Trips per Year	Paid Trip Length (km)	Avg. Total Distance per Trip (km)	Trips per Hour	Taxi Hours per Year <sup>a</sup>	Special Hours per Year <sup>a</sup>
Work	24	628 992	157 248	9.2	13.80	1.4	450 000	110 000
Shop	20	524 160	131 040	5.1	7.65	2.5	210 000	50 000
Medical	11	288 288	72 072	6.4	9.60	2.0	140 000	40 000
Leisure	26	681 408	170 352	7.9	11.85	1.63	420 000	100 000
Education	19	497 952	124 488	2.6	3.90	5.0	100 000	20 000
Total	100	2 620 800	655 200	6.4 <sup>b</sup>	9.6	2.0 <sup>c</sup>	1 310 400	327 600

Note: 1 km = 0.6 mile.

<sup>a</sup>Hours by purpose = trips by purpose ÷ trips/h. Numbers do not sum to total because of rounding.

<sup>b</sup>Weighted average.

<sup>c</sup>Speed = km/trip. The average utilization of 2 is the harmonic mean.

The average cost per trip would be \$3.74.

From these data the effect of limiting eligible trips to trips for particular purposes can be easily computed. Table 5 shows the effect of limiting trips for work, medical purposes, and education. As shown below, the effect of eliminating leisure and shopping trips nearly halves the cost of the special service.

Expense	Number	Cost (\$)
Taxis	147	4 650 600
Special vans	36	1 465 400
Driver training	54	13 500
Overhead	—	305 800
Total		6 435 300

A second parameter to consider is the fare for the service. In this analysis, the assumption thus far has been that fares are set low. Fares on the Gothenburg system are \$0.30 for leisure trips and nothing for work, school, and medical trips.

Little information has been gathered on fare elasticities for handicapped persons. Further, little information has been gathered on the effect of fare variations on taxi or transit ridership. The method used in this analysis to predict changes in ridership assumes a varying fare elasticity between -0.3 in the range of transit fares and -1.354 (8) in the range of taxi fares.

The first assumption in this analysis is that the taxi and transit riding populations respond similarly to comparable prices. The second assumption is that the elas-

ticities for transit and taxi riders can be used to describe the response of the handicapped user of a special transportation service. The second assumption probably underestimates elasticities for the handicapped, so that ridership loss by an increase in fare is underestimated and revenue gain is overestimated.

Table 6 gives elasticities assumed for different fare levels for special service and the resulting ridership, revenues, and costs. A base fare of \$0.25 is assumed for the system described in Tables 4 and 5. Fare increments are small so that the negative change in ridership predicted does not equal or exceed a 100 percent loss. Table 6 indicates that a change in fare from \$0.25 to \$1.00 yields a ridership loss of 46 percent and a revenue gain of 114 percent. Net cost of service goes from approximately \$11 million to \$5 million. As stated previously Table 6 probably underestimates ridership decline and overestimates revenue gain for the handicapped population.

Another parameter needing to be examined is the amount of advance notice required for handicapped persons who want special service. The special service described in Table 4 is based on the Gothenburg system, in which most trips are arranged the afternoon of the day before. However, return trips from hospitals, doctors, and dentists are arranged on very short notice and must be fit into the prearranged schedule. The majority of trips in Gothenburg are "standing" orders, that is, regularly scheduled trips to schools, work, and nursing homes.

Table 5. Analysis of special service for work, education, and medical trips.

Purpose	Taxi Trips per Year	Special Trips per Year	Taxi Hours per Year	Special Hours per Year
Work	628 992	157 248	450 000	110 000
Education	497 952	124 488	100 000	20 000
Medical	288 288	72 072	140 000	40 000
Total	1 415 232	353 808	690 000	170 000

Table 6. Elasticities, ridership, revenue, and costs of special service.

Fare (\$)	Elasticity	Riders	Gross Cost at \$3.74/Ride (\$)	Revenue (\$)	Net Cost of Service (\$)
0.45	-0.3	—	—	—	—
2.50	-1.354	—	—	—	—
0.25	-0.20	3 276 000	12 265 058	819 000	11 446 058
0.50	-0.33	2 620 800	9 801 792	1 310 400	8 491 392
1.00	-0.58	1 755 936	6 567 200	1 755 936	4 811 264
2.00	-1.10	737 493	2 758 223	1 474 986	1 283 237
3.00	—	331 871	1 241 197	995 613	245 584

Note: Relationship between fare and elasticity is linear.

Table 7. Impact of parameters on special service.

Parameter	Change From Base System	Gross Cost of Service (\$)	Revenues (\$)	Net Cost of Service (\$)	Change in Net Cost (\$)
Base special service system	—	12 265 058	819 000	11 446 058	—
Trip purpose	Eliminate shopping and leisure trips	6 435 300	442 260	5 993 040	-47
Advance notice	Increase advance notice from 1 to 3 d	7 972 282	532 350	7 439 932	-35
Fares	Increase fare from \$0.25 to \$1.00	6 567 200	1 755 936	4 811 264	-57
Third-party payment	Assume three-fourths of medical trips are covered	12 265 058	1 762 242	10 502 816	-8

The large number of standing orders probably allows the Gothenburg system to schedule vehicles in a very efficient manner. Thus, if the advance notice requirement is increased from 1 day, there would probably be little improvement in Gothenburg's productivity of 2.05 passenger trips/vehicle/h. However, an increase in the advance notice time requirement would cut down on demand. For example, a handicapped person would probably not have a problem with a 2-d to a week advance notice requirement for work, education, or medical trips (trips to medical facilities as opposed to return trips); however, that person would have more difficulty scheduling recreation, social, and shopping trips. A change in the time requirement for advance notice could be expected to affect these discretionary trip purposes. Such a change would be less effective than limiting trip purposes in the first place.

A first approximation of the effect of increasing the advance notice required can be obtained by using the results of an elderly and handicapped demonstration project in St. Petersburg, Florida. A 24-h advance notice is required for most trips; however, trips to be taken on Monday require 3-d advance notice. Ridership on Monday is only 65 percent of ridership on other weekdays. Therefore, this analysis assumes a reduction of 35 percent for a change from a 1 to 3-d advance notice.

Finally, if costs of service can be recovered through third-party payments, the net cost of the special mobility service would be affected. For example, Medicare now pays taxis and special vehicles to transport clients for medical purposes. An assumption that half to three-quarters of the medical trips are reimbursible by Medicaid would yield additional revenue between \$600 000 and \$950 000/year. Unfortunately, current regulations prevent Medicaid travel reimbursement at a higher rate than that charged to others for the same service. Thus, if a regular fare is \$0.25 for this service, \$0.25 is all Medicaid pays. Changing this regulation is important to fully use existing funds to pay for medical trips made by the elderly and handicapped.

The impact that changing the various parameters has on ridership and costs for the special service system described in Table 4 is shown in Table 7. Costs are most sensitive to fares. Limitations on trip purpose also appear to be an important parameter for controlling the costs of this service.

## SUMMARY

This paper provides a theoretical development of a taxi-operated service to meet the travel needs of the severely disabled. The service developed is based on a similar service operated by the Gothenburg Transit Authority.

Data on the handicapped from various sources indicate that about 1.5 percent of the population require a special door-to-door service and that each eligible person makes about 1.4 trips/week.

A service that operates 90 h/week at a fare of \$0.25 would cost about \$11 million/year for an SMSA of 3 million persons. An increase in fare from \$0.25 to \$1.00 would reduce costs by about 60 percent. Restricting trip purposes to work, medical, and recreation would reduce costs by about 50 percent. Increasing the advance notice requirement from 1 to 3 d would reduce costs by about one-third.

Taxi operating costs range from \$6.74/h for regular taxis to \$8.62/h for special vans. Such costs are low relative to typical public transit hourly operating costs and demonstrate the feasibility of a taxi-operated service.

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# Duplication Between Demand-Responsive Systems and Fixed-Route Systems

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The purpose of this study was to determine the degree to which a specialized door-to-door transit service for the elderly duplicated existing fixed-route service in Cedar Rapids, Iowa. The analysis measures the proportion of elderly who could use the existing fixed-route system for their trip making and therefore do not need the door-to-door system. The study proposes alternatives that can be implemented to increase service and to ensure service to those who need it.

In response to growing demands by elderly persons for door-to-door transit service and to federal guidelines, the city of Cedar Rapids, Iowa, implemented a door-to-door demand-responsive service for the elderly April 15, 1974. The Regional Transit Corporation (RTC) operates the city's fixed-route system, which has 20 (47-passenger) buses and 11 routes. Service is provided from 5:45 a.m. to 5:45 p.m. Monday through Saturday. The fare is 30 cents for adults and 20 cents for senior citizens with a senior citizen card. Six of the 11 bus routes operate on 30-min headways. The maximum headway is 70 min (for one route only).

RTC also operates the Senior Citizen Transit Service (SCTS), which only serves the elderly and handicapped. This service consists of two new 31-passenger buses equipped with radio units but not with wheelchair lifts. The hours of service are from 9:00 a.m. to 8:00 p.m. Monday through Friday. The fare is 20 cents for persons with senior citizen cards or who are handicapped. All other senior citizens must pay a 30-cent fare. Reservations are requested at least 24 h in advance. This demand-responsive service operates only in the city of Cedar Rapids.

## TARGET POPULATION

All Cedar Rapids residents over the age of 62 are eligible to use the SCTS regardless of socioeconomic status. The elderly population is concentrated in and around the

central business district. This distribution is similar to that in other urban areas (1). Even though many elderly live in the downtown area near activities they still need public transit. Many elderly are physically unable to walk short distances especially in the winter. Moreover, they do not live near needed supplies and services, which are often located at the periphery of the city. For many elderly public transportation is a necessity.

## PERFORMANCE MEASUREMENTS AND PROBLEMS

The SCTS, like other demand-responsive services, is able to provide service for about 36 passenger trips/vehicle/d. Scheduling problems, roadway repair and congestion, and service from many origins to many destinations greatly limit the ability of the system to serve more elderly. Two major problems have arisen since implementation. The first is that the demand surpassed the ability of the SCTS to provide service. The service is booked by 1:00 p.m. the day before. Thus, some elderly or handicapped must either postpone their trip or use another mode.

The second major problem is that the service is more expensive to operate than originally anticipated and budgeted. There were 3.3 passenger trips/vehicle/h at \$2.77/passenger trip through August 1974. Other urban demand-responsive systems (2, 3) averaged 7 trips/vehicle/h at a cost of \$0.40 to \$1.20/passenger trip.

Although the economic performance measures suggest that the SCTS operates below a norm, the observed performance may be partially explained by three factors. First, unlike the SCTS, the average given above is based on systems whose target population is the general public, not just the elderly. The elderly, a large proportion of whom are also handicapped, require more time entering and exiting vehicles. This results in lower vehicle productivity. Second, extensive construction in the downtown Cedar Rapids area during the study period necessitated vehicle rerouting and detours. Third, the study was conducted shortly after the service was begun and before it had yet reached its potential (Table 1). The negative influence of these three factors may not fully account for the performance of the system, and a more

complete analysis is suggested.

## STUDY

The purpose of the SCTS is to meet the transportation needs of the elderly in the urban area. The extent to which the service actually serves the people who need it is an important consideration in measurement of the service performance. An operational definition of need has been developed for this study based on access and time.

This study is concerned with measuring the extent of duplication between the public fixed-route service and the SCTS. Duplication is defined as that proportion of trips made on the demand-responsive system that could have been made on the existing fixed-route system.

One of the acknowledged limits of the conclusions and study design is that the measures defining need are not sensitive to unseen physical problems such as asthma, heart condition, arthritis, and climatic conditions. Therefore, the extent of service duplication is probably overestimated.

The data used in this study were taken from the daily logs of the SCTS for August 1974. Trip records provided the name of the trip maker, origin address, destination address, the number of the fixed routes nearest the origin and the destination, and any difficulties the trip maker had walking or boarding. A trip was defined as a one-way journey from an origin to a destination.

The number of trips that did not satisfy one of the following conditions could have been taken on the fixed-route system and represents the extent of duplication.

1. The trip by fixed route would have involved a travel time of more than 30 min. (Travel time by transit was not given in the available data; therefore, we assumed that, if a transfer was involved, the bus trip took more than 30 min.)
2. The user had an obvious physical handicap that impeded his or her walking, access, or riding ability.
3. The user had to walk more than two blocks to reach a bus stop or walk more than two blocks from a bus stop to a destination.

Conversely, the number of trips that did satisfy one of the conditions represents the degree to which the system was used by those who needed door-to-door service.

As mentioned previously, the number of handicapped in the study was underestimated because the study included only those persons with an obvious ambulatory handicap. Any handicap that was not visually apparent to the driver could have been overlooked. The study also did not include nonambulatory persons because the fixed-route vehicles were not equipped for wheelchair users.

Initially we assumed that each of the three conditions was mutually exclusive and calculated the number of trips that met each condition separately. In the final analysis, we considered the three conditions simultaneously to avoid double counting.

## ANALYSIS

During the 18-d study period there were 1270 passenger trips, or an average of 71 trips/d, and an average of 36 passenger trips/d for each of the two vehicles.

Figure 1 shows that demand for the system varied considerably from day to day over the study period. Using a 3-d moving average to smooth fluctuations in daily ridership, an upward trend in ridership is observed. (This is reasonable considering the system was only 3 months old at the time of the study.)

Figure 2 shows that the fluctuations in ridership varied consistently. Ridership was lowest on Monday, increased during the week, and peaked on Friday. This fluctuation is partially explained by the fact that users were requested to make reservations 24 h in advance. Thus, trip requests for Monday had to be made on Friday of the previous week.

An interesting feature of the service was that it was used almost exclusively by females, as shown below:

Sex	Trips		Adjusted Percent
	Number	Percent	
Male	100	7.9	10.0
Female	896	70.5	90.0
Unknown	274	21.6	Allocated
Total	1270	100.0	100.00

Of the total trips taken on the SCTS 44 percent would have required a transfer if the fixed-route system had been used. Based on the first condition, duplication is 56 percent. Of those elderly using the SCTS, 20 percent had a physical impairment (observed by the drivers) that limited the rider's mobility. Therefore, based on the second condition, the extent of duplication between the systems would be about 80 percent. Figure 3 shows the distribution of walking distance from trip origins and destinations to the nearest fixed route; 15 percent of the trips would have required a walk of more than two blocks from the origin and 13 percent of the trips would have required a walk of more than two blocks to the destination. Accordingly, 72 percent of the trips would have required a walk of less than two blocks to or from the route.

In the final analysis the conditions were analyzed collectively to avoid double counting. The following table indicates that 30 percent of the trips made on the SCTS could have been made on the existing fixed-route system.

Item	Trips	
	Number	Percent
Need SCTS	890	70.1
Do not need SCTS	380	29.9
Total	1270	100.0

This estimate may be too high because the criteria were not sensitive to weather conditions and less obvious handicaps.

Even an adjusted estimate does not indicate that the Cedar Rapids SCTS is inefficient or ineffective. The SCTS was implemented to serve all elderly, and the service is scheduled to capacity daily. Therefore, the service is effective. Service can possibly be provided more efficiently, but an in-depth analysis of operations is beyond the scope of this study. However, the following alternatives might lead to increased supply and efficiency.

## SCTS ALTERNATIVES

The alternatives can be divided into three categories: supply, demand, and funding.

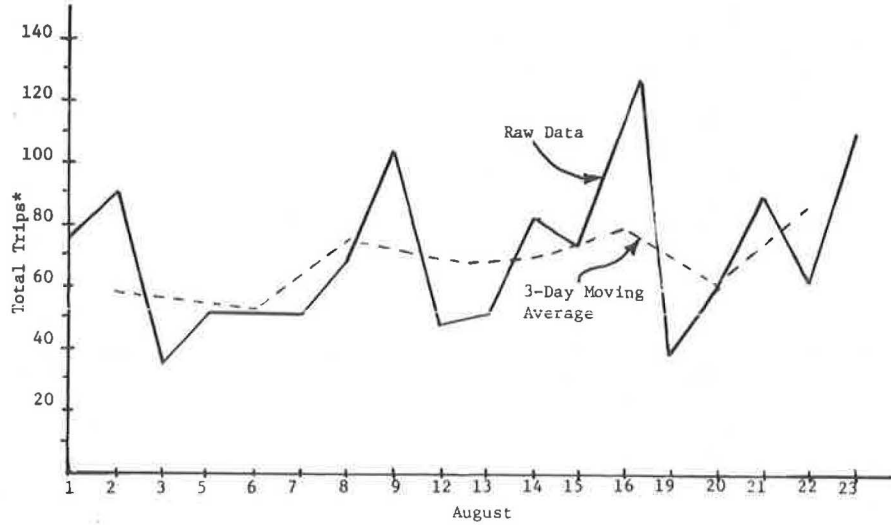
The supply of service could be increased by changing the number of vehicles, hours of service, or level of service. This could be accomplished by purchasing more vehicles or by using backup systems and volunteers. Extra vehicles might be rented from charter bus companies for use during peak periods. Other services have relied on volunteers, subsidized local taxi systems, or paid employees to use their own cars

**Table 1. Service changes between 1974 and 1975.**

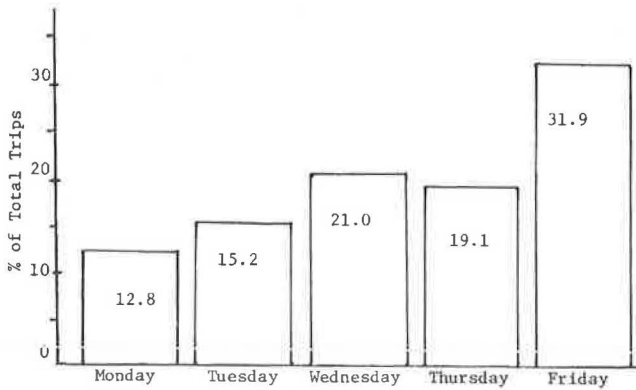
Date	Revenue (\$)	Net Operating Cost (\$)	Passenger Trips	Vehicle Distance (km)	Operating Cost per Passenger Trip (\$)	Operating Cost per Kilometer (\$)
August 1974	356.00	3460	1781	4736	1.94	0.73
August 1975	467.00	3608	2333	4532	1.55	0.80
Change, %	+31	+4.3	+31	-4.4	-20.1	+9.6

Note: 1 km = 0.62 mile.

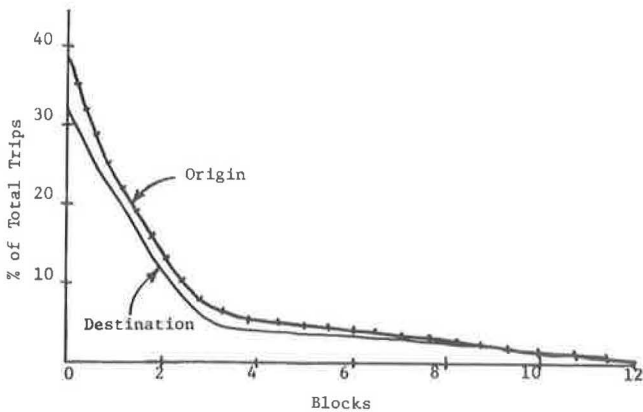
**Figure 1. Daily ridership.**



**Figure 2. Distribution of weekly ridership.**



**Figure 3. Distribution of distance to bus stop.**



to provide service during peak periods. Service could be extended to include weekends. This would have the advantage of being able to satisfy some of the unmet demand and the disadvantage of increasing total and marginal costs.

A change in the level of service might be implemented in a number of ways or in combination. Users might be required to call 48 h in advance to facilitate better planning of more efficient routes and arrangement of scheduled pickups. Limiting the amount of time the driver must wait for a rider would increase productivity, but might defeat the objective of the service.

Each vehicle could also be restricted to a certain area or zone of the city. A transfer between vehicles would then be required for interzonal trips. Service might also be increased by facilitating transfers to the fixed-route system for those persons who are capable.

Other methods for influencing efficiency include controlling demand through eligibility and service-level restrictions. However, the demand alternatives should be considered only if the system cannot be expanded and if it were decided that only a portion of the elderly would be served. A reduction in demand is the antithesis of the goals of most transit systems and the U.S. Department of Transportation. If controlling demand is necessary, the number of users could be restricted by limiting service to specified areas on particular days. For example, Monday service might be provided to only those people in the northwest quadrant of the city. A user living in any other part of the city would not be able to use the system on that day. Similarly, service might be restricted to certain trip purposes on particular days. Friday might be limited to only shopping trips; Thursday might be limited to medical and dental trips. Destinations might also be constrained. For example, on a particular day users might have access only to the central business district or designated shopping centers.

The number of trips a person might take over a

certain time period might also be restricted. For example, users might be permitted access to the system only twice a week. This restriction in turn would increase the number of potential users who would have the system available to them.

Another alternative would be to set up a priority system by trip purpose. Categories of trip purpose would be ranked according to necessity and importance. High-priority trips would receive service before ones of lower priority, regardless of trip requested first.

Major changes require substantial funds and the flexibility to use those funds. This study focuses on funding sources and not flexibility. A transit system requires support from all geographic and political levels—local, state, and federal. Funding sources exist at all levels and include public and private community agencies. Membership fees might also be initiated. Such fees might entitle the user to reduced fares or unlimited rides. Memberships might be purchased by agencies for clients.

State social service agencies might be asked to pay the actual operating costs of a trip for a certified user. The state departments of transportation might also have funds available for special transportation services in the form of matching capital or operating assistance. The sources of funding from federal agencies are numerous (3).

## CONCLUSION

The results of this study suggest that at most 30 percent of the users of the Cedar Rapids SCTS might have been able to use the fixed-route service. However, many decisions based on this finding depend on an improved measurement of need and on the goals of the service. If the primary goal is to provide service to anyone who qualifies as an elderly person, then the service is effective. On the other hand, if the goal is to provide service to the elderly and handicapped who have no other means of transportation, such systems should be expanded to guarantee service.

The findings are preliminary. The analysis was performed without prior knowledge of Cedar Rapids SCTS goals and without data from users of the service on the real and perceived barriers to using the fixed-route system. A more conclusive judgment of duplication between fixed-route and SCTS could be reached only after a more comprehensive analysis in other cities.

## ACKNOWLEDGMENT

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# Citizen Participation in Rapid Transit Planning

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This paper relates the experience of metropolitan Dade County, Florida, in implementing an extensive, bilingual citizen participation program for planning the county's proposed rapid transit system. The overall goals of the program are to ensure that local residents have the opportunity to contribute to the county's transit plans and that public understanding, acceptance, and support of the system are achieved. To accomplish these aims, 25 neighborhood forums and 7 district citizens panels were created and integrated into the county government's decision-making process. The formation of these groups was part of a totally open community involvement process in which any interested resident could take part in the formulation of transit plans for each of eight time-phased decision points. During a 12-month period over 14 000 residents participated through 470 public meetings and hearings. Some of the major results of the program were the resolution of major community transit issues, significant citizen modification to the design guidelines and criteria for the system, and the establishment of long-term citizen participation structure. The success of the program has confirmed the value and feasibility of citizen participation in proceeding with the final detailed design and construction of the system.

Citizen participation in the planning of a rapid transit system in Dade County, Florida, is an excellent example of successful community-government cooperation. In planning the most significant public works project in the 79-year history of Greater Miami, residents were offered the opportunity to become intimately involved in shaping the future life-style and destiny of their community. From June 1974 through June 1975, 470 meetings were held and attendance was always encouraging. Below is a summary of the public involvement.

Item	Number	Participation	
		Total	Avg
Meetings			
Orientation	29	1 166	42
Organizational	14	962	68

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\*Mr. Castle was with Kaiser Engineers, Miami, Florida, when this research was performed.

Item	Number	Participation	
		Total	Avg
Public forums	235	4 040	17
Citizen panels	77	4 167	54
General	13	1 110	85
Transit Advisory Committee (includes subcommittees)	66	920	14
Public hearings (includes municipalities)	21	1 985	95
Public Officials Coordinating Council	13	221	17
Transportation Technical Advisory Committee	2	60	30
Total	470	14 631	31
Speakers bureau	40	1 320	33
Communications Committee meetings	35		
Reports			
Progress	16		
Newsletter	10		
Milestone			
Data	6		
Draft	8		
Addenda	9		
Special events			
Displays	8		
TV appearances	15		
Radio programs	24		
News conferences	5		
News releases	39		
Public service announcements	14		
Meeting announcements	34		

In addition, representatives of all 27 municipalities in the Miami metropolitan area, the county's state and federal legislators, and representatives of various state and local public agencies took part in the total planning effort.

## CONCEPT

Conceived as a totally open, bicultural community involvement process, the program combined the town meeting atmosphere with a systematic planning process to arrive at major recommendations and decisions.

To give the program as broad a base as possible, a community participation structure was designed to integrate three geographic levels of public review and comment: neighborhood forums, representative district

panels, and a countywide advisory committee. Any resident who wanted to participate in this structure could do so merely by expressing interest and by attending meetings.

As alternative concepts were developed by the consultants the public was given the opportunity to review these concepts plus source material used in development and to express preferences or suggest additional alternatives. Public participation was thus active rather than reactive. The role of the consultants was, therefore, to develop technically feasible alternatives and recommendations that met the expressed needs of local residents rather than merely to design a system and test the public's reaction to it.

The citizen participation program had a significant impact on the county decision-making process. The role of the decision makers was not one of simply reviewing and approving a consultant design but of resolving conflicting public views and arriving at solutions that best served the greatest number of people. Although the concept provided that the ultimate decisions would be made by the elected county officials, it also ensured that these decisions would reflect the overall values, needs, and priorities of the community.

A fundamental aspect of the program is its long-term nature. Designed to provide citizen participation in preliminary engineering decisions, the program is also designed to continue to function through final design, construction, and initial operation of the transit system.

## OBJECTIVES

The basic goal of Dade County's transit improvement program has been to provide transportation facilities to meet the needs of the people of Dade County. To achieve this goal required identification of those needs, satisfaction of the needs to the extent that resources and technology would permit, and acquisition and maintenance of public acceptance and support to proceed with implementation of the project. Accordingly, the objectives of the citizen participation program were to

1. Determine the transit-related needs of the community as expressed by its residents,
2. Identify community priorities that residents assign to their perceived needs,
3. Maximize public awareness and support of the transit improvement program,
4. Maximize public participation in deliberations leading to transit-related decisions,
5. Save time and legal costs of extensive changes in plans and major construction, and
6. Provide final decisions that consider values, needs, and priorities of the community.

## STRUCTURE

To achieve these objectives, a citizen participation framework was created to provide a flexible, formalized structure. An important consideration in setting up this framework was determining the amount of structure necessary to generate meaningful comments and suggestions from local residents. Too much structure would block the flow of citizen input vital to the success of the program; too little structure would lead to an unmanageable flow of data that would be impossible for the transit consultants to integrate into the plans. What resulted was a balance between these extremes: a structure that was adaptable to community differences, yet facilitated citizen input in a timely and orderly manner. In addition, the structure established a common meeting ground for interaction among elected officials, local residents,

public agency officials, and transit consultants. Beginning at the grass-roots level the structure channeled the flow of information through three interrelated organizations as shown in Figure 1.

1. Public forums or neighborhood group meetings were held at convenient periods to discuss issues and concerns posed by the transit consultants and to interact with the citizen panels, the next organizational level of the citizen participation program.

2. Citizen panels were made up of designated representatives from the public forum and met openly with the county-consultant team to receive transit information, evaluate alternatives, raise issues, submit consensus recommendations, and provide representation at the next organizational level, the Transit Advisory Committee.

3. Transit Advisory Committee (TAC), established by county officials to advise the Board of Commissioners on transit matters, was composed of county commissioners, county officials, representatives of the citizen panels, and representatives of the state and other governmental and nongovernmental agencies.

A fourth level of participation, though not an organizational structure, was provided in the form of a public roster for those expressing a desire to be included on all informational mailings. The public roster was both a mailing list and communication network for over 4500 citizens and organizations who demonstrated an interest in the transit improvement program.

In addition, two other groups were established to expand the community's input and recommendations to the consultant team; however, these groups were not part of the citizen participation structure.

1. The Public Officials Coordinating Council (POCC) was composed of designated representatives of the governing bodies of Dade, Broward, and Palm Beach counties as well as representatives of the major municipalities in Dade County, the Policy Committee of the Miami Urban Area Transportation Study (MUATS), the School Board, the Hospital Board, and the Dade County legislative delegation. The POCC provided policy advice and guidance on all public issues involving rapid transit.

2. The Transportation Technical Advisory Committee was composed of nationally known consultants who have expertise in transportation or related areas. This committee worked with county staff and consultants on specific technical issues raised and was in a position to advise on such matters.

The county was ultimately divided into seven regional forum districts by natural geographical boundaries (Figure 2). Each district had one citizen panel and two to five public forums. The number and boundaries of public forums in each district were determined by participating citizens and varied to accommodate travel distances to meetings, population densities in the community, and preferences of neighborhood residents. A total of 25 forums were created.

Each forum had at least three elected officers who made up the membership of the citizen panel for their district: a chairperson, a vice-chairperson, and a secretary. Similarly, each citizen panel had an elected president, vice-president, and secretary; the president and vice-president served as regular members of the TAC. The primary function of both forum and panel officers was to represent the consensus of their respective neighborhoods and districts in submitting community recommendations to the planners and decision makers. Thus, the interrelationship of these groups

was a key link in the citizen communication process.

Special interest groups were actively sought as participants in the program by direct mailings to those on the public roster, various news media, the Transit Speaker's Bureau, and informal meetings with representatives of special interest groups. Input on major issues was obtained from these groups by active participation at the public forum level and citizen panel level or by appointments to the TAC standing and select committees.

The standing committees' major purposes were to ensure that the preliminary engineering activities proceeded as scheduled and according to the consultant's contract, to study each issue involved in its respective subject area so that adequate perspective was maintained, to monitor the quality of the consultant's work, and to report formally to the TAC.

The select committees were essentially ad hoc committees whose principal objectives were to review each Milestone report, monitor the work of consultants, and provide recommendations and professional opinions on the particular milestone topics assigned to them.

Figure 1. Citizen participation structure.

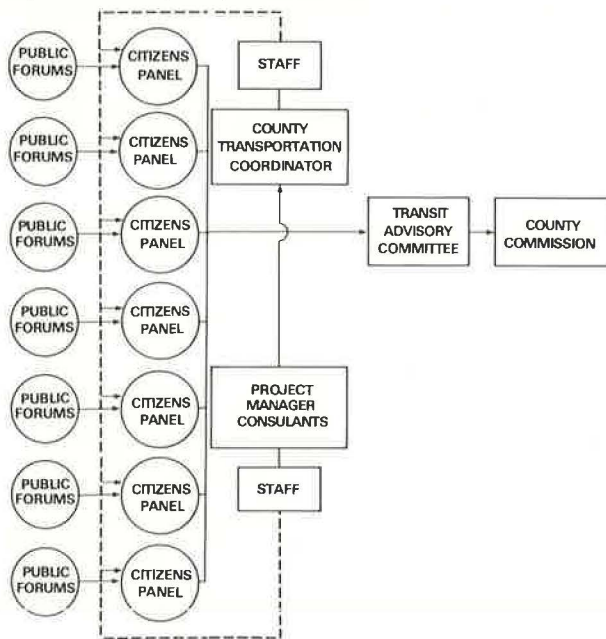
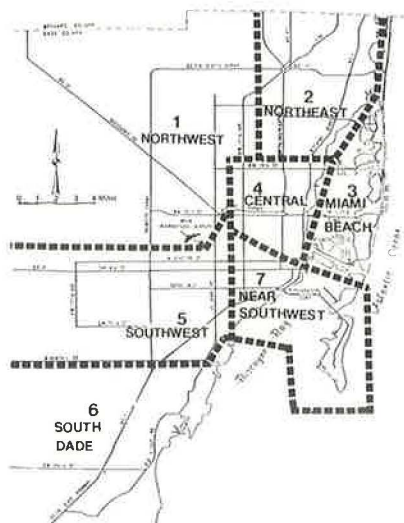


Figure 2. Dade County regional forum districts.



The consultant team interacted frequently with each of the standing and select committees to provide information and to receive input from the members. This interaction occurred mainly during regularly scheduled committee meetings and was initiated at the request of the committee chairperson.

PROCESS

To activate the citizen participation structure, a series of interrelated events and activities were implemented in three separate phases beginning in June 1974.

Phase 1: Community Orientation Meetings

Prior to the actual involvement of the citizens in the planning and decision-making process, a series of 29 orientation meetings was held throughout the county over a 2-week period. Approximately 1200 residents attended. The purpose of these meetings was to fully inform citizens about the transit improvement program and related activities. The meetings were held in conveniently located public buildings; Spanish and English were spoken. An average of four meetings per district were held.

The meetings consisted of a brief explanation of the purpose of the meetings, a short slide presentation highlighting the preliminary engineering and public improvement programs, and a question and answer period to clarify points raised in the slide show. Material printed in both Spanish and English was distributed that explained the preliminary engineering and how citizen participation would be incorporated into the planning process. Also distributed were citizen interest cards for those residents who wanted to be included on the public roster mailing list.

Notice of the meetings was extensively publicized by

1. Bilingual public service announcements on radio and television,
2. Mailings to over 2000 organizations and individuals on the county manager's mailing list and to a sample 6000 citizens on the registered voters list,
3. Mailings to 5400 organizations and individuals on the Third Century mailing list created for the local U.S. bicentennial celebration,
4. Personal contact with key organizational leaders to reinforce the need for their involvement in the program,
5. Posters and bilingual handbills on local buses encouraging transit riders to get involved and to contact the county's Citizen Information Service for details,
6. A special news conference by the vice-mayor of Dade County to brief media on meetings and to broaden public awareness of meetings and the role of citizens in the program, and
7. A special bilingual release to all newspapers, radio, and TV stations.

Phase 2: District Organization Meetings

Following the community orientation meetings, a public meeting was held in each district to organize concerned citizens at the neighborhood level into a network of public forums previously mentioned. Bilingual information publicizing these meetings was prepared and distributed to the public.

The mailings to the residents on the public roster contained notification of meeting dates, times, and locations; they also contained a tentative agenda for the meeting and a summary report on the community orientation meetings.

At the district organization meetings, conducted

jointly by members of the county-consultant team, over 900 residents were briefed on the program, presented organizational guidelines for discussion, and assisted in organizing their public forums and citizen panels.

Public forums created at these meetings varied in size from 15 to 150 people. (Throughout the course of the program an average of about 600 residents formed the nucleus of active participants.) Each forum elected officers, adopted a set of operating procedures similar to Roberts Rules of Order, and prepared to participate in the milestone decision process described below.

Prior to the start of this process, however, the forum officers from each district met at a county general meeting to form their respective district citizen panels and to elect panel officers.

### Phase 3: Milestone Decision Process

The focal point for citizen participation in the preliminary engineering program was the eight project decision points or milestones. These milestones covered everything from development of design criteria to the recommendation of equipment, transit routes, station locations, safety and security features, and architectural-urban planning guidelines. For each of these milestones a comprehensive review and input process was jointly developed and implemented by the county-consultant team with the assistance of the forums and panels (Figure 3).

The initial activity in this process was a data presentation by the consultants to a series of formally scheduled district meetings of public forums. At these meetings each participant received a background report highlighting the major issues, alternatives, and items requiring citizen input for the particular milestone under study. Participants were also given a supplemental visual presentation to help clarify the written material and to answer general questions.

Residents were then given between 1 and 2 weeks to review the data, meet with their neighborhood forums, and submit written recommendations through their officers at a county general meeting of all seven district citizen panels. At the same time, members of the TAC and the POCC were also presented with data for review and comment.

During a 2 to 3-week interval, the consultants analyzed the various recommendations received from the com-

munity and prepared a draft milestone report. These reports contained the consultants' recommendations on the respective milestone and included the disposition of each suggestion submitted by the community plus the rationale for its acceptance, rejection, or deferral.

Following the identical sequence of events as the data presentations, the draft reports were then cycled through a second round of community review (i.e., district presentation, forum deliberation, and general meeting recommendations). During this stage, the TAC subcommittees assigned to a particular milestone conducted an in-depth analysis of the consultants' proposals as did the citizen groups and various federal, state, and local public agencies. This intensive analysis usually resulted in several meaningful revisions to the draft report. These changes, plus all other comments received, were reproduced by the consultants in a special addendum.

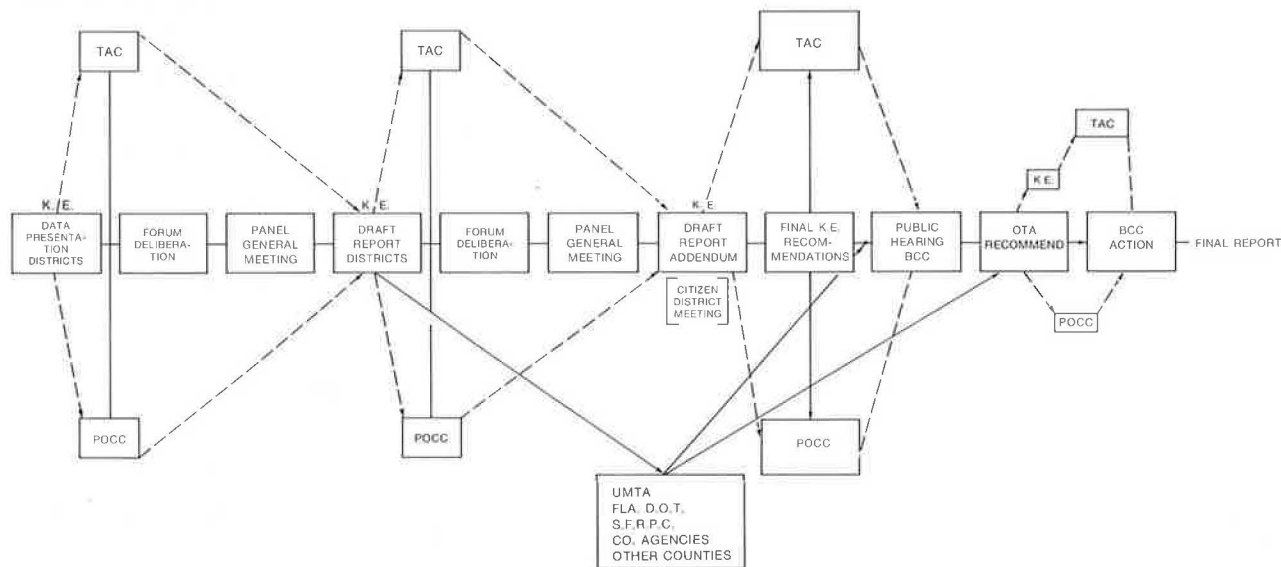
Once revised, the draft milestone report was ready for public hearings conducted by the Board of County Commissioners. From start to finish this two-step planning cycle took an average of 59 d and systematically laid the groundwork for the decision-making process.

The first step in the decision-making process consisted of formal public hearings. Following legally prescribed procedures, the hearings were held in the north, central, and south sections of the metropolitan area. A unique feature of the hearings was that citizen panel presidents copresided at the hearings with the county commissioners. Also, representatives of the neighborhood public forums attended the hearings.

Among the noteworthy by-products of these hearings were a number of well-founded suggestions, a good balance between pro and anti viewpoints, and a surprisingly constructive problem-solving atmosphere. This outcome was somewhat unique when compared to previous local hearings on transportation and was credited by observers to the open, participatory planning process established by the program.

Based on all of the community input received up to and including the public hearings, recommendations of the county transportation coordinator were then submitted to the Board of County Commissioners for action. Following such actions of the commission as adopting, accepting, and modifying a given milestone, the draft report and addendum were classified as a final report and this report was used as a basis for later planning.

Figure 3. Milestone process.





Because of extensive citizen input and revision, the final decisions made by the county commissioners incorporated to a great extent the views of the community.

#### RESULTS OF CITIZEN PARTICIPATION PROGRAM

A key indicator in measuring the effectiveness of a citizen participation program is the extent to which local residents are able to influence the planning and decision-making process. The ability of the program to accomplish this aim depends to a great degree on the manner in which the consultants and the elected and appointed county officials respond positively to the proposals of citizens during milestone decision processes.

During the preliminary engineering program the interaction of citizens with the consultants and county officials evolved into an extremely constructive and productive exchange of needs, values, and priorities. A variety of significant results developed from this process.

##### Citizen Influence on Consultant Team Planning Process

Citizen participation in the planning process played a significant role throughout preliminary engineering in the recommendations and guidelines submitted by the consultants. Among major program outputs influenced strongly by citizen involvement were

1. Definition of the county's 1985 Transportation Service Network,
2. Development and modification of the county's 1985 Rapid Transit Core System,
3. Modifications to the service criteria (approximately 25 percent),
4. Revisions to the system characteristics (approximately 20 percent),
5. Changes in the development and land use policies (approximately 50 percent),
6. Amendments to the safety and security criteria (approximately 15 percent),
7. Modifications in the station architectural criteria (approximately 30 percent), and
8. Major revisions in the environmental impact analysis (primarily in the evaluation of alternative transit systems and in the projections of noise and air pollution for the 1985 Rapid Transit Core System).

##### Public Influence on Citizen Participation Program

In addition to the substantive changes brought about through public involvement, a number of modifications were made to the citizen participation program. Among the major changes was the creation of an additional citizen panel district early in the program. The initial geographic structure called for six districts. However, during the community orientation meetings, residents in the city of Miami made a strong case for dividing the central district (Figure 2) into two separate districts to provide more equitable representation of this densely populated area. After reviewing the merits of the proposal, the county's project director authorized the change, thus creating a seventh district.

Another significant modification to the program occurred to citizen panel representation on the TAC. The original organization plan for the committee allocated only one slot for each panel president (or a total of seven citizens). However, feeling that this seriously diluted citizen influence on the committee, the panels requested

that district vice-presidents also be given regular member status (bringing the number of citizens on the TAC to fourteen). This request was also authorized.

Many other procedural and operational changes in the public program were brought about as a direct result of citizen influence.

##### Citizen Impact on County Decision-Making Process

Citizen influence on the county's decision-making process has been felt most strongly through three interrelated activities: citizen panel input into the project Milestone reports, participation on the TAC and its various sub-committees, and input submitted at the various public hearings conducted throughout the project.

The impact of these activities is best evidenced by the fact that the county's policy-making body, the Board of County Commissioners, has either adopted or accepted each of the eight draft milestone reports and the environmental impact analysis with little or no modification. Since each of these documents contained a substantial number of citizen recommendations, the final decisions made by the commission underscore the significance of public input and clearly demonstrate its impact.

##### Identification of Major Community Transit Issues

One of the primary and more beneficial outcomes of the citizen participation program has been the early identification of sensitive community issues relating to the transit program. By surfacing these issues early in the planning phase, the community has the opportunity to settle these issues in a timely and satisfactory manner.

Among the major community issues identified during preliminary engineering that will require resolution during future phases of the program are the restudy of route alignments and stations for two major north-south corridors, the feasibility and desirability of placing the main east-west corridor underground in the central business district of downtown Miami, and the timetable for possible provision of the rail service for northeast and northwest Dade County.

##### Model for Resolving Conflict on Major Community Issues

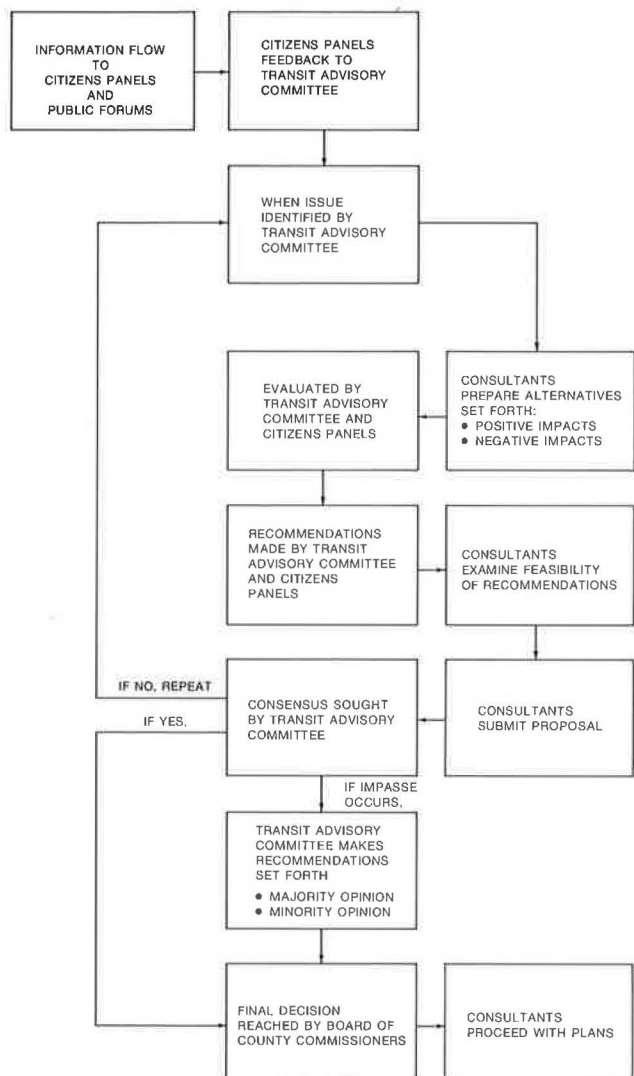
Through creation of the citizen participation structure and the milestone decision process, a systematic means of settling major transit disputes has been established (Figure 4). Although actual application of the model was adjusted to fit varying situations, the basic process was followed throughout the preliminary engineering program.

Among the issues that were addressed by using the model were the selection of a vehicle technology for the 1985 core system; the reexamination of ridership projections for transit corridors serving Miami Beach, northeast Dade County, and Hialeah; the location of a route alignment and stations for the Little Havana area; and the modification of the Hialeah rail segment in the 1985 core system.

##### Long-Term Citizen Participation Structure

Through efforts of the citizens and the county-consultant staff, the citizen participation program provided the residents of Dade County with a well-established framework for long-term community involvement in the planning and implementation of transportation. Any interested citizen can participate in this structure by

Figure 4. Citizen participation model for resolving issues around milestone decisions.



requesting to be included on the Public Roster Mailing List, by joining one of the 25 neighborhood public forums, and by seeking election to one of the 7 district citizen panels. Additionally, citizens can seek appointment to the TAC and its subcommittees.

#### LESSONS LEARNED

The experience of the Dade County Transit Improvement Program indicates the necessity and value of involving citizens in planning processes. The open two-way flow of information, ideas, and values is essential to attract and maintain community support of transportation improvements. However, to achieve effective communication with the community requires mutual trust and respect, timely feedback, a demonstrated willingness to accept valid suggestions, and frequent reinforcement by key decision makers.

Further, no one communication device is sufficient or can be universally applied; instead, a variety of specially tailored techniques and formats are required to achieve an open exchange of community viewpoints. During the course of the program we used all types of meeting formats: informational large-group assemblies; small, informal data-gathering sessions; subcommittee

problem-solving workshops; large-scale community seminars; county input sessions; and informal meetings with individual community opinion leaders. These contacts with the community were supplemented with public information activities that included a transit speakers' bureau, special television and radio open-phone broadcasts, college and public school discussion programs, news conferences and releases, newsletters, storefront posters, bus cards, and shopping center exhibits.

Extremely vital to the community involvement process is the level of commitment by elected and appointed public officials and the technical consulting staff. Time after time, and meeting after meeting, these individuals were called on to address extremely complex issues, subject themselves to heated (and often unwarranted) criticism, and to somehow arrive at recommendations and decisions that properly balanced technical judgments with community needs and priorities. Without their intellectual and physical commitment to make this process work, the program might not have been able to establish and maintain its high level of integrity.

Also, without a corresponding commitment from participating residents, there would have been no citizen participation program. Their willingness to trust the process, to contribute long hours and hard work, to provide responsible leadership, and to keep pace with a demanding schedule of events was necessary for success.

Related to this point is the fact that citizen representatives were permitted to become regular members of the various key advisory committees created during the program. Citizen leadership, concerns, and insights contributed significantly to committee output and demonstrated the sincerity of county officials in using citizens at the highest planning and decision-making levels.

Probably the greatest difficulty encountered during the program was the constraint imposed by the project timetable. From start to finish, the citizen participation program took place in 12 months. Yet during that time citizens had to become fully oriented, organized, and involved in the technical planning process. Although citizens primarily played an advisory role (rather than a decision-making role) they were constantly being pressured to rapidly assimilate large amounts of data in relatively short time periods. Even with staff assistance in pinpointing key areas requiring citizen comment, the schedule frequently became overly demanding.

Similarly, the tight schedule created a terrific time pressure for the county-consultant team. The technical staff was continually striving to meet seemingly unrealistic report deadlines while attending three to four evening citizen meetings a week. This schedule resulted in an estimated 1918 program overtime hours (27 percent above the original estimate). No major deadline was missed; however, the program's rigorous schedule required almost a double workload for the technical staff during peak activity.

Another problem related to time was the difficulty in providing an ample follow-up period to allow participating citizens to reach closure on a given decision point and to see the results of their efforts before proceeding with the next milestone. This problem was further complicated when, during certain periods, residents were simultaneously involved with three or four milestones, each at different stages of review. Yet, despite these handicaps, somehow citizen participants were able to work their way through the maze of data.

Finally, because of the duration and intensity of the program, sustaining a high level of citizen interest and involvement became difficult at times. Although we anticipated high and low community interest, depending on the issue under study at the time, we found offering sufficient

incentives to continually motivate large numbers of residents for each milestone almost impossible; e.g., some issues would draw several thousand participants, and others would attract only a few hundred.

Early in the program the staff learned several things. First, because of the number of neighborhood forum groups, the schedule of community meetings to process technical data, and the related activities required to support these activities, our public involvement specialists and transit planners were too few to adequately cover activities. As a result, staff support for citizen meetings had to be put on a reservation and priority basis. Although we were able to provide some staff coverage for most meetings, there were occasions when citizens had to struggle through technical data without the benefit of an appropriate consultant on hand.

Also, some support services requested by citizens (e.g., clerical work, special mailings, graphic materials, and personal expenses) had to be provided by the participants. The county-consultant public involvement staff was continually trying to balance adequate staff support without overcommitting limited resources.

Expenses for the citizen participation program stayed reasonably close to the project budget. Projected originally at \$159 981, the actual cost ran \$171 538, or 7 percent above forecast. Considering that the original scope of work was greatly expanded and that numerous, unforeseen expenses occurred (primarily because of the heavy meeting load and increased public information materials), this overrun was not considered excessive. Quite to the contrary, we were surprised that the program was able to accomplish as much as it did on a relatively lean budget. However, much of this economy was due to the fact that many of the services and materials used were provided without cost or at cost by our suppliers and public relations subconsultants.

Another interesting facet of the program was acceptance by local politicians and by the media. At first concerns were expressed about the possibility of elected municipal officials' perceiving the public program as a threat to their power and influence. Again, to the contrary, we were pleasantly surprised to find that local officials were extremely receptive to the program and frequently endorsed proposals and recommendations of forums and panels in their communities. This reaction reflects not only the responsiveness of these officials but also the capability of the county's project director and his staff to create a climate of mutual respect and understanding between the metropolitan government and the cities. Without this climate the program would probably not have achieved its objectives.

Similarly, the mass media proved to be extremely cooperative and impartial in reporting the program's various activities and events. Hardly a week went by without a major article or report appearing on the transit program and the public's involvement in it. Coupled with the efforts of our communication consultants, this coverage was indispensable in reinforcing citizen efforts and in reaching all levels of the community.

## CONCLUSION

Final judgments of the merits of citizen participation in metropolitan Dade County's rapid transit system cannot adequately be made until the system is built and operating. Whether the system does, in fact, gain the full acceptance and support of the community remains to be seen.

Also, a key factor in constructing the system is securing necessary federal funds. In August 1977, the county had applied to the Urban Mass Transportation

Administration for these funds.

Nevertheless, certain conclusions can be drawn. Among these is the fact that this program, to our knowledge, represents the most extensive citizen participation effort of its kind in the preliminary engineering of a major rapid transit system in the United States. Although other urban areas have established public programs in the design and construction of transit systems, these areas have not been in a position to involve such a broad cross section of the community in the early planning and decision-making stages.

Also, the program has enriched and strengthened the data base for the final design and construction phase of the system. The guidelines and criteria established as a result of citizen input will provide the project's final design team with a comprehensive framework for initiating work on this phase.

In addition, the program sensitized transit planners and policy makers to the needs of the community and surfaced major transportation issues that require further study and resolution. These outcomes alone are extremely significant accomplishments.

Finally, the program has confirmed the value and feasibility of the participative process in urban problem solving. Because of the growing feeling of alienation and impotence experienced by many residents in metropolitan areas, there is an increasing need to provide citizens with genuine opportunities for involvement in controlling their collective destiny. Dade County's Citizen Participation Program has made an excellent start in that direction.

# Public Involvement in Paratransit Planning

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Repeated rate increases, allegedly declining levels of service, and growing community dependence on public transit due to rising costs of living and energy shortages brought the Dade County, Florida, taxi system under sharp criticism. Transportation planners found that analyzing the situation and recommending corrective measures were complicated and difficult because of the largely unregulated, traditionally private-enterprise nature of the taxicab industry. A taxi study task force was, therefore, established that consisted of industry representatives from fleets of every size, local governmental officials, and (after a series of public hearings) interested citizens. Administrative and regulatory alternatives and possible operational improvements were presented to the task force for review and comment. The alternatives ranged from partial to complete control of the taxi industry by Dade County. The task force concluded that uniform county regulation of taxicab service was essential, and legislation providing for county control of the taxi industry was passed by the Florida General Assembly in June 1974. A model ordinance to establish a taxicab bureau with county jurisdiction was then submitted to the taxi task force and later approved and passed in modified form by the county commission. By late 1975 the county became involved in rate making and also in requesting the taxicab industry to provide service to the transportation disadvantaged. An important outcome has been the continuance of the taxi task force, which perpetuates cooperation among citizens, government, and industry concerning transportation service issues that affect all.

In most urban areas, taxis carry less than 3 percent of all person trips; in the Miami urban area, taxis carry less than 1 percent of all person trips. Although planners forecast this market share will not exceed 1 percent in the future, current taxi service is receiving considerable attention largely because of numerous increases in taxicab rates. Taxi rates have gone up six times in the last 10 years, most recently in October 1975. Service in Dade County's major municipalities costs \$0.88 for the first kilometer (\$1.40 for the first mile), \$0.50 for each additional kilometer (\$0.80 for each additional mile), and \$8/h for waiting time.

In January 1974 a 90-d study was initiated by metropolitan Dade County to define the personnel and operating economies of the taxicab industry, to analyze existing

regulatory and administrative procedures governing daily services provided by the industry, and to integrate consumers' perceptions of taxicab industry performance with those of industry members and government officials responsible for regulating and administering the industry.

The 90-d study period (January 1 to March 31, 1974) was set to allow for preparation of any state legislation that might be recommended (the Florida General Assembly convenes between April 1 and June 30). In fact, legislation was drafted and subsequently passed by the General Assembly and signed by the governor in the summer of 1974. This legislation is intended to improve service to the Dade County consumer and provide consistently fair returns to owners and operators through more uniform, equitable regulation by one public body (in this case Dade County) rather than by 27 individual municipalities within the county.

## PARTICIPATION PROCESS

The study's decision-making process is shown in Figure 1. A task force of government, industry, and consumer representatives was established at initiation of the project; the county manager selected approximately 12 members from government offices concerned with regulating and administering taxicab services and asked the taxicab industry (through such organizations as the Southeast Florida Taxicab Association) to select approximately 12 representatives. The industry's representatives were taxicab owners, operators, and others (attorneys) familiar with the taxi industry. The fleets represented ranged from very small (5 or fewer taxis) to relatively large operations (50 taxis or more). Government representatives were selected from the Office of the Transportation Administrator, the Metropolitan Transit Authority, the Dade County Department of Traffic and Transportation, the Dade County Department of Aviation, local police forces, the Florida Department of Transportation, and the Dade County League of Cities.

Approximately 24 consumers, nominated from among people who had involved themselves in a public meeting process dealing with the taxicab issue, were invited to participate, and approximately 18 actively took part in the decision-making process. They represented

senior citizens, minority groups, professionals, housewives, and young people.

Selection and Involvement

The involvement of consumers, industry, and government representatives began immediately at six public meetings conducted throughout Dade County to help define taxicab service needs. These needs were subsequently analyzed and became the basis for recommendations for improvement of taxicab services in Dade County.

Considerable activity attended the public meetings. Two weeks before the first meeting, the meeting activities were announced at a press conference. During the following 2 weeks all media devoted generous space to the time and location of each meeting. More than 100 organizations such as civic groups, hotels and motels, retail outlets, and food chains were contacted to enlist support in advertising the meetings, and 1000 invitations were mailed to various interest groups and individuals in the county. Also, approximately 30 000 flyers were mailed, distributed door-to-door, and placed in Metropolitan Transit Authority buses and at the Miami Inter-

national Airport. A public hearing was aired on the radio station that has the largest audience of any station in Dade County, and 22 individuals called and spoke over the air. Few callers mentioned their names and none gave an address; therefore, their continued involvement in the taxicab program could not be solicited. However, their comments were documented and addressed in the analysis portion of the taxicab study.

Attendance at the six public meetings averaged approximately 30 persons; about a third of these voiced taxi service needs. The taxicab industry was well represented; in fact, overall, about 30 percent of the attendees were individuals involved with the Dade County taxicab industry. A significant number of the speakers at the meetings were representatives of the taxicab industry, most of whom were the taxicab industry members of the task force. The taxicab industry was obviously interested in the public meeting process and felt free to express its feelings concerning the taxicab situation in Dade County.

Taxicab service needs expressed at each of the six meetings and on the radio program were documented (and subsequently published), tabulated, and categorized

Figure 1. Dade County taxicab study process.

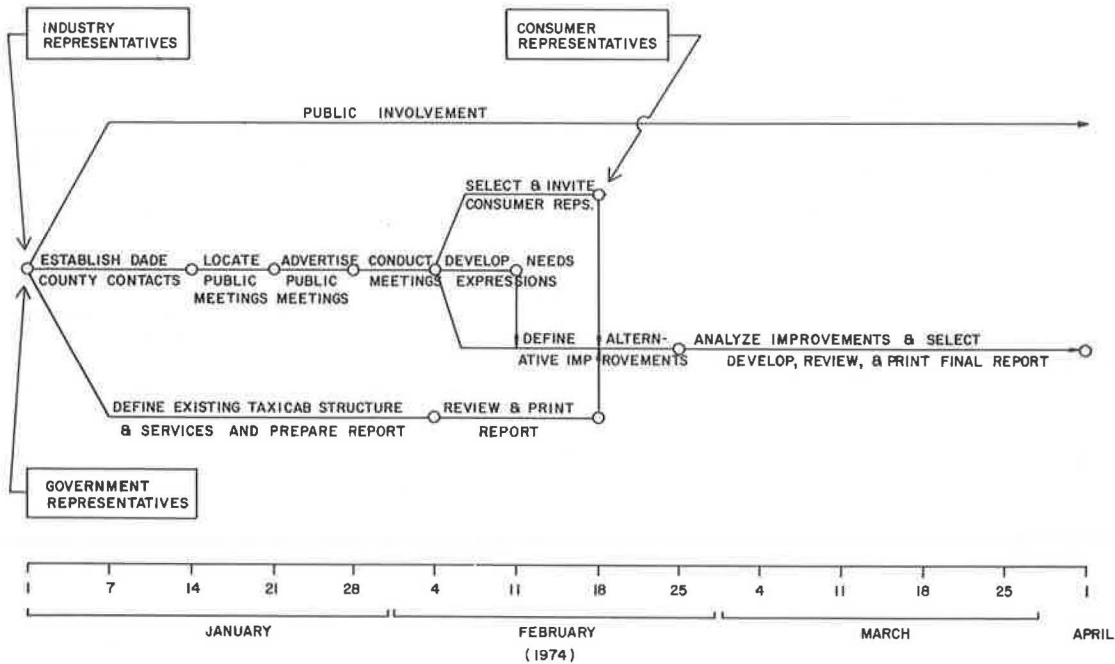


Table 1. Categories of taxicab service needs.

Category 1	Category 2	Category 3
Examine taxicab fares	Improve taxicab driver safety	Employ intermediate-sized cars as taxicabs
Improve taxicab driver courtesy	Improve and unify regulation and administration of taxicab system	Establish system of more rigorous and frequent taxicab inspection
Establish control of taxicab service in unincorporated areas	Employ taxicabs in social-service delivery system	Institute countywide identification cards for taxicab drivers
Improve airport taxicab service	Institute taxicab package delivery system	Integrate taxicabs with rapid transit system
Improve taxicab service to senior citizens	Subsidize taxicab rides	Integrate taxicabs with other ground access modes
Examine opening county	Improve taxicab service in Model Cities area	Give taxicabs preferential treatment
Reduce deadheading		Establish taxicab boards
Allow multiple-occupancy taxicab service		Prohibit smoking in taxicabs
Improve service to handicapped		Improve taxicab information display at airport
Institute reduced-rate taxicab programs		Create an emergency taxicab service
		Institute reading and writing tests for taxicab drivers
		Establish regional taxicab posts in suburbs
		Establish zone fare system
		Establish taxicab service contracts with employers
		Establish fixed-route and scheduled taxicab service
		Reduce time spent waiting for taxicab

so that they could be addressed in developing alternative improvements to the Dade County taxicab system. The needs expressed at all six meetings were grouped into three categories (Table 1):

1. Those needs expressed most often during the public meetings process,
2. Those concerning the physical aspects of taxicab transportation, including driver safety and use of taxis for providing social services and delivering packages, and
3. Those least frequently mentioned.

Category 1 needs conformed closely to the specific objectives of the project originally defined by Dade County. In other words, the needs most often expressed by the community were also those perceived earlier by metropolitan government when it prepared the work program from which the taxicab study was developed.

#### Alternative Evaluation

Approximately 6 weeks (half of the 3-month study period) were needed to recognize, invite, and involve the consumers in the taxicab study task force. During this period industry and government representatives interacted during six meetings to define study objectives, intricacies of the taxicab industry's structure, and current levels of taxicab service. A 400-page volume of the three-volume study reported on these issues and also included the needs expressions obtained during the public meetings. Because of the different degrees of momentum brought to the process by consumers on the one hand and the industry and government representatives on the other, the decision was made that the two groups' activities be juxtaposed but not fully integrated. Therefore, consumers met separately from the industry and government representatives during the last 6 weeks of the study although meetings were often conducted in adjacent rooms. The same information was presented to both.

This separation did not compromise the result of the study process; in fact it strengthened the process because the consumer component was not intimidated by a lack of understanding of the technical details of taxicab problems, which could have become a large problem because of the time constraint. This allowed the consumers to interact freely among themselves and to express their criticisms and concerns without reservations. However, in the future, consumers should be fully involved with the industry and government members of the task force. More information on this is included in a later section of this report.

#### ALTERNATIVES CONSIDERED

In response to needs expressed at public meetings and from discussions of the taxicab study task force, two categories of alternatives were developed: regulatory-administrative and operational. In essence, two administrative alternatives were considered that had a number of operational innovations that could increase the desirability of Dade County taxi services.

#### Regulatory-Administrative Alternatives

The 17 municipalities regulating the taxicab industry in Dade County are not uniform in enforcement or extent of their taxicab ordinances. To ensure improved taxicab service and protection of the reputation and investment of professionals in the taxicab business, more order and uniformity should be brought to regulatory

and administrative functions of agencies responsible for industry policing.

#### Alternative A: Central Regulation and Local Administration

Alternative A (Figure 2) proposed that a metropolitan taxicab bureau be established by the Dade County commissioners to carry out regulatory and administrative functions. The taxicab bureau would be responsible for policing the taxicab industry in the unincorporated areas of Dade County and in those municipalities without taxicab ordinances. The taxicab bureau would also be responsible for monitoring municipalities with ordinances to ensure proper enforcement of minimum taxicab performance standards established in the county ordinance.

Under this plan municipalities would have the right to pass and enforce ordinances that contain at least minimum requirements established in the county ordinance. If a municipal ordinance met the minimum requirements and was properly enforced, the taxicab bureau would have no involvement in that municipality's taxicab affairs.

Municipalities that have no ordinances regulating taxicabs, do not elect to upgrade their current ordinances to minimum requirements, or do not enforce the minimum requirements would be relieved of the responsibility for regulating taxicabs. This responsibility would be assumed by the taxicab bureau under the direction of the county commissioners. The taxicab bureau would assume the functions and responsibilities now being performed by the Florida State Public Service Commission for the unincorporated area of Dade County and for municipalities without ordinances. These functions would include issuance of Certificates of Public Necessity and Convenience and taxicab permits.

The 17 municipalities now set taxicab fares for their jurisdictions, and the Public Service Commission sets fares for the remainder of the county. Rates in the municipalities are generally determined through a public hearing process. Justification for rate increases is based on statements prepared by the taxicab industry showing increases in the cost of operation. Typically, rate increases granted by a few of the larger municipalities prompt the others to follow suit. For taxicabs operating in the unincorporated areas of the county, rates may be changed simply by informing the Public Service Commission of the change. No hearing is required. Neither the municipalities nor the Public Service Commission undertakes a rigorous rate-making process in which requests for rate changes are accompanied by detailed financial and operating statements furnished by the taxicab industry.

Under alternative A, the taxicab bureau would assume rate-making responsibility for the total county including all municipalities. This process would allow standardization of taxicab rates and would ensure that rate changes result from a factual determination of financial need of the taxicab operation to make a reasonable profit.

Alternative A requires legislative changes at both state and local levels. Therefore, the study recommended state legislative changes in concept and proposed a detailed ordinance for consideration by the task force. Staffing recommendations were also made, accompanied by cost and revenue projections defining the financial implications of operating the taxicab bureau. A detailed specification of rate making was also suggested for alternative A.

#### Alternative B: Central Regulation and Central Administration

Alternative B (Figure 3) proposed that uniform regula-

tion be accomplished throughout Dade County by creating a centralized metropolitan taxicab bureau responsible for policy and procedural decisions. The bureau would be directly responsible to the commissioners of Dade County and would be responsible for administrative aspects of regulation, except for entry control. Entry control would be a cooperative function between municipalities and the taxicab bureau, but the municipalities would retain their right to grant the privilege of operating a taxicab within their corporate boundaries. Staffing, cost-revenue projections, legislative concepts, and rate-making procedures were also specified for alternative B.

Operational Alternatives

A number of physical improvements to taxicab service were recommended in the study. Although several (such as central dispatch) would require subsidization and would be more compatible with alternative B, these concepts were presented to the task force for review and comment.

Taxicab Pooling

Taxicab pooling involves small groups of users who have similar origins, destinations, and time schedules and who hire a taxicab on a regularly scheduled basis. This group is considered a single client for fare purposes. When the common fare is shared, the cost per taxicab pooler is reduced. In the combination of contributions, however, the taxi operator usually ends with a greater amount than he would have collected from one rider. Both passengers and drivers thus benefit from the arrangement.

Advantaged Taxicab Flow

Metropolitan Dade County is currently operating advantaged flow lanes to speed mass transit travel on I-95 and South Dixie Highway. These facilities could also be used by taxicabs. Priority treatment for taxicabs would mean faster and more reliable service, higher overall travel speeds, and lower operator costs and fuel consumption. Increased speeds, in turn, might translate to increased demand for taxicab services.

Figure 2. Taxicab improvement alternative A.

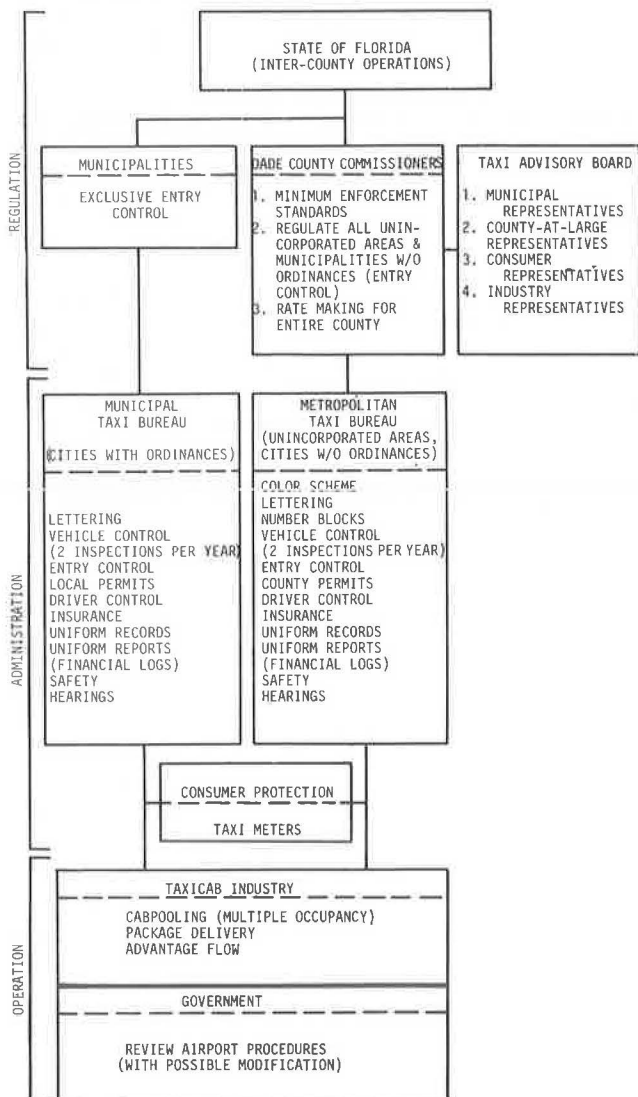
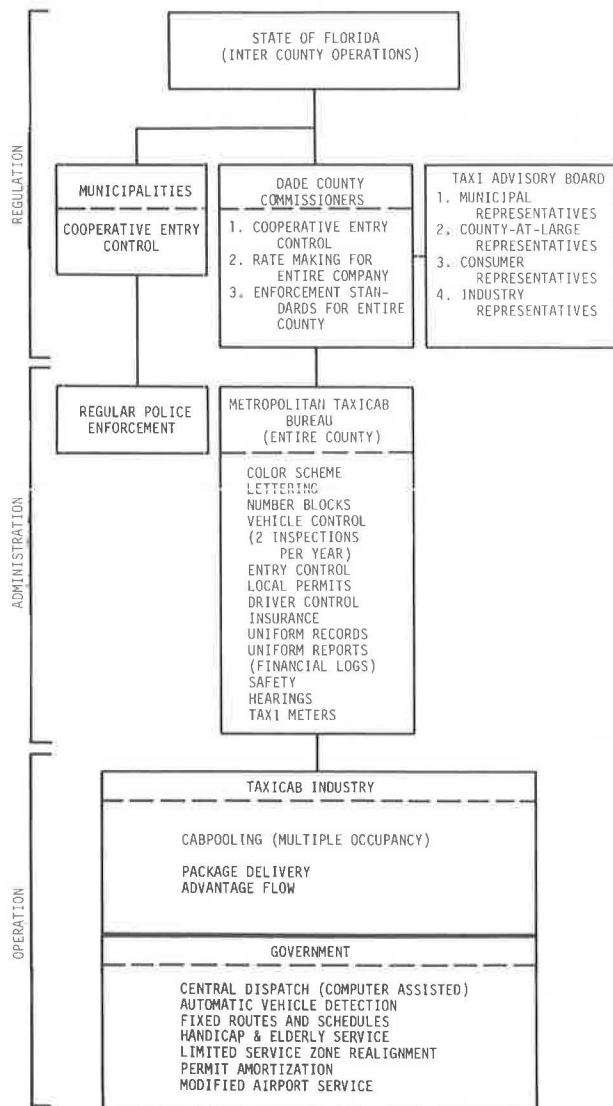


Figure 3. Taxicab improvement alternative B.



Package Delivery Service

Although taxicab service has been used exclusively to transport people, recently the service has become accepted for package delivery. Package delivery services have reportedly increased the number of trips of a taxicab company by as much as 15 percent.

Central Dispatch

In its most basic form, central dispatch would require dividing the county into three service zones. Each zone would have its own broadcast channel, dispatchers, telephone operators, and other personnel. All cabs operating in the zone, regardless of company affiliation, would be dispatched from a zone-based station. Basic central dispatch implies computer operation and automatic vehicle monitoring from one location. Central dispatch would further improve control over the total taxicab operation so that users of the system would be better served and more effective use would be made of each taxicab.

Analysis of Improvements

Results of an analysis of operational improvements are shown below.

Operational Improvement	Average Daily Taxicab Person Trips
Do nothing	52 414
Taxi pooling	55 450
Advantaged flow	55 638
Central dispatch (without computer)	61 537
Central dispatch (with computer)	67 560

Pooling and advantaged flow result in an approximate increase of 3000 trips/d over the do-nothing alternative. Central dispatch without computer assistance results in an approximate 20 percent increase, and central dispatch with computer assistance results in a 30 percent increase in average daily trips.

Analyzing the effects of other improvements such as special service to the handicapped and elderly, fixed routes and fixed schedules, or improved service to the airport was more difficult. However, these concepts were discussed with the task force, and operational innovations were recommended to be implemented on a daily basis.

PARTICIPATION PROCESS RESULTS

The regulatory-administrative and operational alternatives were presented to the task force at a series of meetings conducted in March 1974. At first, industry representatives were extremely skeptical of the value of the operational alternatives and somewhat resistant to changes in the rather loose regulatory-administrative framework that was in existence. Discussion among committee members was vigorous and often heated. However, because of the completely open and interactive process and as a result of an 8-h marathon meeting, task force members finally concurred in the administrative concepts. The task force also agreed that more uniform control of taxicab service was necessary to protect both the industry and the consumer and that state legislation should be broad enough to allow creation of a mechanism for countywide control. However, before that control was finally designed and implemented, all ordinances and other administrative procedures, particularly rate making, should undergo task force review.

Consumer members of the task force believed that

full and immediate countywide control of taxicab services was essential. As a result, the compromise position stated above best reflected the overall opinion of the task force membership that improvements to the taxicab system would have to take the form of more stringent regulatory-administrative control dispensed in small yet effective doses.

As a result of task force action, legislation was introduced to the Florida General Assembly in May 1974. Before the session concluded in June 1974, the bill had been passed and signed into law by the governor. The new law allows counties to control taxicab enterprises although some responsibilities are shared with municipalities who exercise responsible control of taxicab systems within their jurisdictions. In October 1974, following passage of this legislation, a proposed ordinance was presented to the taxicab study task force for review and comment. Later the ordinance was introduced to the county commission; in March 1975, the ordinance, as modified, was passed and the Taxicab Bureau was established that now is staffed by an executive director and two assistants.

The Taxicab Bureau submitted a series of rate-making procedures to the task force in the summer of 1975. These procedures were put into effect shortly afterward, and in October 1975 the county established a new rate structure. However, this new structure is effective for 90 d only. In that period, more and better data are to be provided by the industry and recommendations are to be made on new permanent rates, flat fares rather than metered rates, techniques for reducing deadheading, and the effects on taxicab productivity of opening the airport and other restricted areas in the county to all taxicab operations. These actions, in combination with the pending execution of a contract between the county and several taxi companies to provide subsidized service to the disadvantaged, mean that the Metropolitan Taxicab Bureau has initiated action on 8 of the 10 category 1 needs within 9 months of the bureau's creation.

OBSERVATIONS

Over the past 10 years the taxicab issue in Dade County has created controversy and anger. The industry has been increasingly criticized and pressured by consumers and newspapers. As a result, industry owners and operators have found themselves unpopular and in disagreement with the community and often with governmental officials, who must protect public interests.

In response to this public pressure, government officials made numerous attempts to initiate a taxicab study. After 3 years of unfinished studies, this project was initiated in January 1974. At that time, the taxicab industry was itself divided over whether to participate in the study process. Several owners and operators believed participation in the process would be equal to permitting the Trojan horse to enter their domain. However, most of the industry's leaders were convinced that only through cooperation could they influence the future course of action and thereby effectively protect the investment they had developed. Therefore, the industry entered into the participation process with a cautious willingness.

In hindsight, it can be reliably stated the taxicab industry is suspicious by nature. This condition is largely caused by financial pressure and a belief by the industry that it is harassed by the news media. To minimize the problem, government must be open and candid in its dealing with taxi owners and operators and dialog must be as continual as possible. Infrequent meetings dealing with inconsistent topics must be avoided; if not, considerable ground can be lost. This situation is typified by



the relative lack of cooperation between industry and government over the rate-making issue considered in the fall of 1975. Less than 15 percent of industry representatives completed survey forms on which an objective and fair decision on rate increases could be made. This situation arose, in part, because too little contact was made with the industry on the rate-making issue (no more than two meetings in 9 months). To recover from this position, the county granted a provisional rate of fare largely acceptable to the industry for 90 days while cooperation could be reestablished and more detailed rate-making analyses were conducted.

Throughout the study, gaining cooperation was often a risky task, for each task force member had to respect the others' right to disagree while trying to move toward the goal of taxi system improvement. For example, throughout the participation process, discussions on administration and regulatory controls were quite energetic and sometimes heated. However, the county promised the task force members an open and constructive forum, and at no point did interaction among members threaten to dissolve the task force. As a result, members, particularly taxi industry representatives, felt that they could freely express their views, however biased, and thereby influence the process; indeed, they were not without strength.

The time schedule on the study was both a blessing and a curse: a blessing in that it seemed to channel all meetings to a constructive conclusion, and a curse because it allowed only hurried involvement of the consumer. In the future more time and attention should be allotted to consumer involvement.

Although the segregation of consumers from the remainder of the task force encouraged freedom of expression, a more structural, integrated community involvement program is required if the community is to gain a more factual understanding of both the problems and opportunities associated with taxicab services. An organized approach is especially important to the advent of Dade County rapid transit development. The future of taxicab operations can be enhanced if more dialog (in proportion to that afforded rail rapid and bus transit) occurs; the future of taxicab services will be seriously threatened if this opportunity for dialog is not provided.

This concern over more community involvement is heightened by the fact that no direct input has been recently sought from the consumer. Although opportunities to discuss taxicab issues have been afforded at public hearings, discussions on ordinances, rate making, and so forth have been formally addressed only by government and industry representatives. This disregard of the citizen is inconsistent with the study's recommendation for a taxi advisory board. Immediate action on more direct consumer involvement should be taken before credibility is damaged.

Lack of funding appears to be a problem for continued study and implementation of taxi activities. All taxi work in Dade County to date has been accomplished by use of local and state funding. Paratransit appears to be gaining increasing attention at the federal level; serious consideration should be given to assisting local communities to study the role of taxis in the total transportation system. Such assistance would allow for more active, concerted interaction of the public, industry, and government on the taxi service issue.

## CONCLUSION

Metropolitan Dade County, which expects to grow in population to more than 2 million people by 2000, is giving attention to the development of a fully multimodal transportation system. Although most attention is directed

to highway, bus, and rapid transit modes, officials recognize the importance of paratransit modes. As a result of this study and the continuing involvement of the study's task force, effective dialog among consumers, transportation suppliers, and government regulators has produced improvements in a heretofore extremely criticized segment of the transportation system. In effect, Dade County has demonstrated that involvement of all parties affected by a transportation system can lead to development of improvement concepts that can be implemented.

# Citizen Participation in Transportation System Planning: A Case Study

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Techniques for citizen involvement are discussed in the context of the traditional urban transportation planning process. Deficiencies in past approaches to citizen participation and planning efforts are identified. A case study of a current project in which an intensive effort is being made to achieve citizen participation as part of a small urban area study is reported. The citizen participation program seeks to identify the appropriate roles for citizen input to a multimodal system plan. The project demonstrates techniques and identifies weaknesses in both the citizen participation process and the planning process. Preliminary findings and recommendations are presented.

Although most people associated with transportation planning agree that citizen participation is an integral part of the transportation planning process, they also recognize that meaningful citizen involvement in all phases of transportation planning is difficult to achieve. Citizen disputes over specific transportation projects demonstrate that citizens will quickly become involved when the impact of a transportation project is immediate. However, a significant level of citizen involvement in long-range areawide planning is almost impossible because citizens do not perceive the impact of these future plans on present mobility problems.

More citizen participation in system-level planning is not only warranted because of the difficulties associated with project-level planning, but also mandated by recent legal and administrative requirements. The most important of these are section 138 of the Federal-Aid Highway Act of 1970 and the implementing document, Federal Highway Administration Policy and Procedure Memorandum 90.4, which require that states develop process guidelines to ensure adequate consideration of social, economic, and environmental effects of proposed highway projects. These guidelines require a high level of citizen involvement in the entire highway planning process. The project described in this paper follows such guidelines developed as part of the Pennsylvania Department of Transportation's (PennDOT) Action Plan (1).

The purpose of this paper is not to outline techniques that can be used to achieve effective citizen participation in system planning since such techniques are documented elsewhere (2, 3). Furthermore, effective citizen participation is not the result of implementation of a series of techniques, but rather a total process. This paper briefly reviews the state of the art of citizen participation at the system planning level and describes the citizen participation program associated with a system planning study under way in central Pennsylvania.

## FUNCTION OF CITIZEN PARTICIPATION

A panel of authorities on the topic defined citizen participation as (4, p. 4)

... an open process in which the rights of the community to be informed, to influence, and to get a response from government are reflected and in which a representative cross section of affected citizens interact with appointed and elected officials on issues of transportation supply at all stages of planning and development. The participants in the process identify and examine all reasonable alternatives and their consequences to assist the appropriate decision-makers in choosing the course that they believe is needed and that they feel will best serve the needs and objectives of the community.

This process achieves more effective decision making in the public interest by ensuring that public decisions reflect the values, needs, and priorities of the people affected by the decisions. Active citizen involvement in all stages of the planning process also assists the planner in identifying issues of importance to local citizens and officials. Further, this process provides a vital input to the evaluation of environmental, social, and economic effects of proposed alternative plans.

Effective citizen involvement at the system planning level presents a difficult challenge to transportation planners. In recent years there have been numerous examples of successful citizen involvement at the project level. The immediacy of a project and its impact on local citizens have enabled planners to achieve a much greater awareness and involvement than in system planning, which is characterized by an extended time period and fewer obvious and direct impacts. Until recently,

the view was that a high level of citizen involvement in system planning was extremely difficult and of little value because citizens were concerned only with transportation planning when imminent projects had a direct impact on their lives and property. Now, however, an increasing number of citizens are expressing concerns about neighborhood, community, and regional problems (4). Transportation planners must accept the challenge of responding to this new concern and develop effective participation techniques at the system planning level.

#### PREREQUISITES FOR CITIZEN INVOLVEMENT

The experience to date as documented in recent literature identifies a number of prerequisites to effective citizen involvement in system planning (2, 3, 4, 5). The citizen must be willing to devote time and energy to become acquainted with the issues and involved in the process. Transportation planners must develop a process that warrants the citizen's time and energy (5). Some approaches commonly suggested include the discussion of short-term problems in the context of long-range planning issues, use of immediate concerns about mobility as a tie-in to future planning, presentation of alternative plans in specific terms so that citizens can visualize the impacts, and early and continuing involvement with local officials and citizen group leaders who have a continuing interest in community affairs (6).

Free access to information and technical assistance is a key ingredient in all citizen participation efforts (4, 6). To achieve intelligent citizen involvement in the planning process, citizens must have access to all the information available to planners and, perhaps more important, to impartial technical assistance for help in evaluating planning data. Efforts to accommodate this information need have ranged from merely providing access to planning files through hiring planning advocates to assist citizens in the development of alternative plans.

#### SYSTEM PLANNING PROCESS

How well does the citizen participation process interact with the technical planning process? Until recently, citizens were not involved in the planning process until the presentation of final plans, at which time a public meeting was held so that the end product could be presented to the citizens. Manheim (7, p. 43) suggests that "most of the current (comprehensive, cooperative, and continuing) transportation planning processes are still largely technocratic exercises in that the technical staffs are sometimes so busy with the mechanics of turning out the technical product that somehow the real issues don't get surfaced." If this evaluation of the process is correct, then citizen participation is unnecessary and therefore a public meeting at the end of the study is more than sufficient. If, on the other hand, the planning process is largely one of identifying and resolving political issues, then involving the public at large in the process becomes mandatory. Although this topic is discussed in detail in the following section, key entry points into the planning process that have been identified include the formulation of goals and objectives for the transportation plan, identification of problems and potential solutions, identification and assessment of environmental, social, and economic effects, and identification of implementation priorities.

#### CASE STUDY OF SMALL URBAN AREA SYSTEM PLANNING

The relationship of citizen involvement to the system

planning process can best be seen by examining a case study of an intensive effort to involve citizens in the Centre Region Area Transportation Study.

The Centre Region Area Transportation Study (CRATS) is being carried out in the State College, Pennsylvania, area. This study is not called for by section 134, Title 23 of the U.S. Code, since State College does not have a central city population in excess of 50 000. The study was initiated by PennDOT as a cooperative effort of federal, state, and local agencies because the area is of significant size and exhibits transportation needs of sufficient complexity to warrant a separate study. PennDOT has undertaken similar nonmandated studies in Hazleton, New Castle, and Sunbury.

The study area includes the Centre Region, which contains the borough of State College (population 33 000) and five surrounding townships. Total population of the study area is approximately 56 000. The principal employer and dominant force in the area is the Pennsylvania State University, which has more than 30 000 students and 7000 employees at the main campus in the heart of the region. The presence of the university creates an urban population in a largely rural area of central Pennsylvania. The area represents a microcosm of socioeconomic characteristics, life-styles, and values.

Initial discussions preceding the initiation of CRATS began in 1970. From the outset this study was intended to be innovative. A small area such as the Centre Region enabled experimentation in the planning process at moderate cost and time commitment. This study was innovative in scope, process, and citizen involvement.

The experiment was jointly funded by the Federal Highway Administration and PennDOT; local government agencies contributed. Additional funds were provided to the borough of State College under the technical studies grant for short-range transit planning. This multimodal study included consideration of highway, transit, bicycle, and pedestrian transportation. Bicycle and pedestrian facilities were given special attention because of their potential as transportation modes and not just as recreation facilities.

Unlike many areawide transportation studies, the CRATS program is an integral part of the comprehensive planning of both the Centre Region and Centre County in which the Centre Region lies. Because of this coordination, future land use and transportation could be related in an iterative planning process. In a departure from traditional studies in which only one land use plan was considered, local planning commissions and citizens reviewed five future land use strategies developed by local planners and agreed on two for additional testing of transportation system impacts. All of the background information and analysis developed for the comprehensive plan were brought to bear on the selection of land use strategies for the transportation plan.

To ensure citizen input, the Pennsylvania Transportation Institute (PTI), an interdisciplinary research unit of the Pennsylvania State University, was contracted with to manage and monitor the citizen participation program. A consulting engineering firm conducted the main technical work program and assisted in the citizen participation program. PTI was selected because of its background in the area plus its close working relationship with the local community citizens and officials. Although the contract was not a formal research contract, the purpose of the citizen participation program was to test and evaluate new ideas for involving citizens in the planning process and for facilitating community involvement in the CRATS program. The total cost of the study was approximately \$30 000. In addition to this cost, the consultant's contract included \$6000 for citizen participation. Local planning agencies were also expected to contribute

to the public participation program through staff services.

Preliminary phases of the CRATS study began in the spring of 1973, when data such as traffic counts and roadside interviews were collected. The study officially started in October 1973, when committees were formed. The Coordinating Committee had overall policy responsibility and was supported by the Technical Committee and the Citizen Advisory Committee (CAC). Because only six local governments were involved, all of which could be represented directly on the Coordinating Committee, a local government advisory committee was not needed.

The CAC followed guidelines proposed in PennDOT's action plan (1). These guidelines call for appointment, by each voting member of the Coordinating Committee, of two citizens to a steering committee. This steering committee then developed its own guidelines for expansion and operation of the total citizens' committee so that the expanded CAC represented the entire community.

### Citizen Participation Strategy

The strategy used to involve citizens recognizes four levels of citizen interest in transportation planning: persons totally uninterested, persons only occasionally interested, persons desiring to be actively involved in the process, and persons having the time and the interest to be intensively involved in the development and evaluation of alternatives. Specific techniques were developed to respond to the needs of all levels of interest, including those persons who have no particular interest at a given point but who might later become interested in the study. The following paragraphs briefly discuss some of the techniques used to achieve citizen participation.

### Mass Media

Mass communication techniques were used to inform all residents of the area of the existence of the study and its progress. The CRATS program achieved a high level of press coverage by both of the general distribution newspapers in the area as well as the daily student paper. All Coordinating, Technical, and Citizen Advisory Committee meetings were covered by the press, which often reported events on the front page. In addition, the newspapers prepared feature articles based on information provided by the committees. For example, when land use strategies were discussed, newspapers carried a series of six feature articles detailing the proposed land use strategy alternatives. Maps and descriptions of transportation alternatives were also published. Investigative reporting by the local newspapers also provided information and shaped opinions of local elected officials. Newspaper articles were a major source of information for elected officials.

The two local radio stations carried news items related to the study and devoted public service time to discussion of study elements such as the land use alternatives.

A close working relationship was developed with the local mass media. Background information was provided to reporters for news and feature articles. Experience indicated that providing background information was more desirable for a reporter's use than offering prepared releases. When a study's progress was of sufficient public interest, the news media would seek out opportunities to report it. Mass media, thought to be of principal value in informing citizens with only a passive interest in the process, were also of significant value in inform-

ing study participants. This double benefit was due to the high quality of reporting experienced during the study.

### Mass Mailing

A booklet, Citizen's Guide to Transportation Planning, was distributed to all households, apartments, and student dormitories (23 000 addresses) in the study area in the fall of 1974. This publication replaced the traditional publicity brochure that had limited circulation and provided insufficient information for public understanding of the study process. The 32-page citizen's guide described in simple terms the transportation planning process and how this process applied to the study area and, most important, identified the key entry points for citizen involvement in the process. Included with this booklet was a reply postcard that gave the recipient the opportunity to submit his or her name for inclusion on a mailing list for further information about the study; over 800 responses were received. The intent of this booklet was to alert study area residents to the study, an important prerequisite to their involvement, and to provide them with basic information needed to participate in the study.

Determining the effectiveness of techniques used in citizen participation efforts is usually difficult. Because this technique was costly, nearly 30 cents/booklet, a random telephone survey of 300 households in the study area was conducted during the week following the mailing. The results were both sobering and encouraging. Nearly 40 percent of the households did not remember receiving the publication even though it was markedly different from the usual "junk mail." About 40 percent stated that they either had already read it or intended to do so. The remaining 20 percent read it very briefly and then threw it away. Even though the study had been under way for over a year and had received excellent press coverage, two-thirds of those households that acknowledged receiving the publication said they had no previous knowledge of the study.

The objectives of distributing the citizen's guide were met. Knowledge of the study was increased and the reply postcard identified interested citizens who could be provided with additional information.

### Citizen Advisory Committee

The Citizen Advisory Committee was the principal vehicle for active citizen involvement in CRATS. Members of this committee represented citizens willing to devote time and energy to actively influence the planning decisions. The structure and conditions for membership on the CAC were such that no individual or group was excluded from participation in the transportation planning study. The steering committee determined that the CAC would consist of all persons having a continuing interest in the study. A two-phase approach was taken to solicit membership. First, approximately 80 organized groups that were known to exist in the region were contacted and invited to appoint members to the committee. This included specific transportation interest groups and general interest groups such as the League of Women Voters and the Kiwanis Club. In addition, large ads were placed in local newspapers inviting interested citizens to join the committee. The first meeting held in April 1974 attracted 42 persons in addition to the 14-member steering committee. Average attendance at subsequent meetings ranged from 20 to 40 participants.

Interest in transportation matters was high throughout the study area. Controversy over a limited access highway and short-range transit and bicycle facility plans focused attention on transportation issues. Elected

officials and planners tied action on these projects to the results of CRATS. Through the early phases of the study the large CAC functioned well since its role turned out to be one of listening. However, once the study reached a stage of interaction between the study team and citizens, a different approach was taken.

During the first year of the study, the CAC officers were elected by the CAC. These officers, although very interested in the activities of the CAC, were neither required nor allowed to assume the usual duties of such positions since much of the activity of the CAC was controlled by the study staff. The problems created by the presence of the dual responsibility of the chairman and the professional director of the citizen participation program surfaced during the attempt to nominate new officers. No one would serve as chairman since all potential candidates were unable to identify a useful role for the chairman.

As an alternative the nominating committee suggested, and the full CAC accepted, the formation of a steering committee of 10 persons to direct the citizen input. The director of the citizen participation program would serve as a resource to this group. In turn, the steering committee would help the director to develop the agenda for citizen activities. Members of the steering committee were selected by area of interest. By the time of the formation of the committee, the problem areas and issues of the study had been sufficiently defined to allow the members to identify particular interests.

During the active discussion of transportation alternatives, members of the steering committee served as chairpersons for public meetings on specific corridors. After the adoption of a plan, the CAC is expected to elect officers.

Membership on the CAC remains open; the only restrictions imposed by the current membership are that persons who desire to vote on an issue attend two prior meetings of the CAC and do not miss two successive meetings. This minimal membership requirement permits residents maximum opportunity to be members yet maintains attendance continuity to allow well-informed discussion of issues. Formal votes are seldom taken since the function of a CAC is to identify issues, not to decide on them. When votes are taken, the related discussion as well as the results are reported to the Coordinating Committee.

Early in the study, 13 by 18-cm (5- by 7-in) ads were prominently placed in local newspapers to encourage residents to attend CAC meetings. In addition, notices were mailed to persons who had previously attended meetings. To determine the value of the advertising, the ads were discontinued. Attendance at the meetings did not change in number or composition of participants. After this experiment only large meetings or special activities, such as the television program described below, were publicized with display ads. Brief announcements of CAC meetings and agenda were carried by the newspaper as regular articles.

The CAC was the focal point of efforts to actively involve the community in the planning study. All large public meetings were sponsored jointly by the Coordinating and Citizen Advisory committees. Individual members of the CAC, to the extent that they represented groups or neighborhood interests, were used as catalysts to engage their constituencies in discussion and consideration of the transportation planning issues. Small neighborhood and special interest group meetings at which residents were encouraged to express themselves were the most important contact with the public. Large public meetings, scheduled only three times during the study, were intended mainly to present information to the public and only then to promote active dialogue.

## Television Program

A televised "town meeting" was held in May 1975, when study problems and possible solutions had been identified. The program was carried on the local cable system. This medium was selected because of its ability to focus on the study area. The local cable broadcasting station had a coverage area of 20 counties although the particular program was of interest to residents of only a portion of one county. Because of the rural location of the Centre Region, most households are connected to the cable since it provides the only means of receiving all major public networks.

A further advantage of the cablecast was the lack of a time constraint. First a 17-min background module was presented. (This had been prepared and shown four times during the previous week.) Following a repeat of the background module came a live telephone call-in, question-and-answer period; questions were answered by a panel of study team members. The live portion of the program was allowed to continue as long as questions were called in (approximately 90 min). Such large amounts of time clearly could not have been made available on commercial television.

Evaluating the usefulness of the program is difficult. Over 30 callers phoned in questions. Most were intelligent and indicated understanding of the issues. The television medium, especially if a cable system is used, offers great potential for widespread dissemination of information. The town meeting format also provides a means for persons who might not otherwise participate in the process to provide suggestions or questions. The cost of such an effort depends on the local situation and the sophistication of the production. In this case the cost was approximately \$2500.

As stated earlier, the success of a citizen participation program is a function not of the number of techniques used but rather the degree to which citizens can become involved in a meaningful planning effort. Experience to date has indicated that problems encountered in the citizen involvement program have been related more to the technical planning process than to the specific participation techniques used. One of the failures of the citizen participation program, land use strategy evaluation, illustrates this point.

## Land Use Strategies and Citizen Participation

CRATS was innovative in that land use alternatives were considered as an integral part of the transportation planning process and not accepted from a previously adopted land use plan. For the purposes of CRATS, the regional planning commission developed five alternative land use strategies based on background data that had been assembled for its comprehensive plan. These alternatives range from a present trend strategy of limited control of development through various plans to concentrate growth to an extreme of a strict no-growth policy. The implications of each of these alternatives were described by neighborhood and municipality and presented to the governing bodies and planning commissions of each municipality. The land use alternatives were discussed at two CAC meetings and were explained in a series of newspaper articles, in a public service radio program, and in the public meetings of the elected officials and planning commissions of the six governments involved.

To provide for direct input to the Coordinating Committee, a large public town meeting was scheduled. The meeting, widely publicized in news articles and advertisements, was held to permit citizens to respond to the

proposed alternative land use strategies. The meeting was held in the evening at a centrally located school. Attendance was disappointing not only in number but also in composition. Fewer than 50 citizens attended; of those who did, most were either members of the CAC, the Centre Citizens Council (a group objecting to a local highway project), or the Chamber of Commerce. The meeting failed to attract citizens not previously involved in the discussion of land use strategies. The meeting, advertised as a listening session, consisted of a 15-min review of the subject matter to be discussed and then became an interaction among the Coordinating Committee, its consultants, and the audience. Very little of the 2-h discussion addressed the topic of the meeting—the specific merits of the land use strategies—but rather evolved into a discussion of the planning process. This result, while unexpected, has had a very positive influence on the study.

The citizens, in a dedicated effort to understand and become involved in the planning process, raised the very issues that make citizen involvement at the systems planning level difficult. A feeling of distrust of the planners surfaced in a discussion of how the alternatives were formulated and evaluated. Several citizens suggested that the data presented in the evaluation of the consequences of the land use strategies were biased toward the preferred choices of the professional planners. The data used in evaluating the alternatives were also challenged, indicating citizens' concern about the ability of the professional staff to evaluate adequately the alternatives.

One particularly difficult issue raised was the adequacy of information provided to citizens for their evaluation. Although a citizen audience was generally recognized to require much greater explanation of background data and education on methods used, balancing this need with financial and time constraints was difficult. One proposal resulting from this public meeting and subsequent CAC action was that testing of land use alternatives not be limited to two as called for in the work program, but be expanded to include perhaps all of the alternatives so that citizens and planners might have a better understanding of the implications on transportation of each of the land use strategies. This recommendation was reluctantly rejected by the Coordinating Committee on the grounds that it would increase the cost of the study and extend the time necessary for completion. In my view, this dilemma is one of the most perplexing issues in modification of the planning process to include citizen involvement. On the one hand, policy-making officials have an obligation to conduct fiscally responsible programs; on the other hand, there is a need to achieve a much greater community involvement and understanding of the planning process and resulting plans. Further research and experience are necessary to determine the value of information in systems planning.

#### Citizen Participation in Travel Forecasting

A common criticism of transportation planning is that travel forecasts are often overestimated, thereby leading to overestimation of need for, and benefit from, new facilities. The attempt to prevent construction of a limited-access bypass of the Centre Region focused on this issue. Citizens and local officials were cognizant of the importance of the travel forecasts and therefore took special interest in the forecasts for 1985 and 2000 produced by the consultants. The first set of travel forecasts indicated an increase in total travel of approximately 70 percent from 1975 to 2000, based on a relatively modest 1 percent/year population growth.

This travel forecast led to a projection of deficient highways that included nearly all arterial streets. The resulting forecast was challenged by members of all three study committees as ignoring present and future economic and energy trends. After substantial discussion, a revised forecast of approximately 35 percent growth in travel was developed. The primary difference in the two forecasts was a change from past trends of assuming a 3 to 5 percent growth in travel per person to an assumption of no change in the travel rate but a travel increase due to population increase.

The revision of the forecasts was brought about by local involvement in the ongoing study process. The change in travel forecasts had a profound effect on the identified problems and proposed solutions. The wisdom of reducing travel forecasts will be judged by time.

#### Evaluation of Transportation Alternatives

Consideration of alternative transportation plans followed the land use discussion. There was a lapse of nearly a year between these public discussions. This was due in part to the time required to develop land use data for the trip generation models and in part to turnover of key consultant personnel.

This lag raised questions of the credibility of the study in addition to creating a lack of public interest in the study. A serious mistake was made by attempting to continue CAC meetings and other small public meetings during this period when there was no new content to discuss. Several members of the CAC threatened to quit if something of consequence did not happen.

Learning from the experience of the land use discussion and the intervening period of little action, the steering committee of the CAC was called on to suggest a better approach to obtaining meaningful input during the evaluation of alternative transportation plans. This committee cited lack of detailed information on the alternatives as the most serious deterrent to informed participation. Their suggestions were used to develop the following process for public input.

The study area was divided into four corridors or problem areas. Interrelated project proposals were grouped on this basis. Detailed maps and explanations were prepared by the technical consultant. With the concurrence of the Technical Committee, PTI developed public handouts written in lay terminology. These handouts were supplemented by in-depth newspaper articles. The information on each corridor was made available to the CAC, other interested individuals, and groups prior to public meetings that were held to discuss each of the four corridors.

Proposals for all modes of transportation as they relate to a particular corridor were discussed at the meetings. After a public meeting on each area, smaller meetings were held with civic and special interest groups to identify as many viewpoints as possible.

After this round of meetings during the fall of 1975, the CAC with the assistance of PTI prepared written reports summarizing the issues raised during the public discussion and submitted them to the Technical and Coordinating committees for consideration. The Coordinating Committee will direct the consultant to develop a final recommended plan based on recommendations of the CAC and the Technical Committee. A further round of public meetings will be held at that time. The number will depend on the degree of controversy aroused by the recommendations.

## OBSERVATIONS ON CITIZEN PARTICIPATION IN SYSTEM PLANNING

Based on 2 years of experience with the system planning process, the following observations are offered.

1. The requirement of a participatory system planning process is more demanding than a nonparticipatory process. A process that is totally open requires greater flexibility in timing to allow for the uncertainties associated with public discussions and controversy. The credibility of the process is questioned if public discussion is cut short because of contractual requirements. The open process also places new demands on planners to provide data in understandable form. More important, many assumptions previously made by planners now must be supported by data. Citizens require support for crucial assumptions; rules of thumb are challenged.

2. The assumption that early involvement of citizens is desirable should be examined. Arousing citizen interest in CRATS before there was any content to discuss consumed unnecessary resources, but more important led to lack of interest when there was something to discuss. Unless citizens really have the opportunity to shape the work program and study design, they should not be involved until all data are collected and all models made operational. The suggestion is often made that citizens develop goals and objectives early in the study. This policy was not adopted as part of CRATS since the regional planning commission had recently involved citizens in developing goals and objectives. Whether these goals and objectives had any impact on the study is not clear. Because it is not clear that citizens can develop goals and objectives in the abstract, a wiser course would appear to be to hold consideration of goals and objectives until there is some appreciation of the possible available alternatives. Goals and objectives can be deduced from reaction to specific alternatives if the options reflect a range of real choices. This approach would avoid citizen involvement too far removed from the body of the study as in the case of developing goals and objectives prior to initiating the study.

3. The limitations of a system planning study should be clearly identified. As an innovative effort, CRATS was presented to the public and elected officials as a solution to all previous shortcomings of the transportation planning process in the citizen participation program. Lengthy consideration of land use strategies established that even the most extreme, politically viable land use strategy alternatives had little effect on transportation alternatives. In a period of modest population growth, major changes in land use are not likely. The range of transportation options to be considered was also overestimated. At least in a small community the options are limited. Highway proposals are constrained by severe fiscal limitations as well as environmental concerns. Transit and bicycles are much discussed modes of transportation within CRATS, but realistically do not provide alternatives for substantially reducing congestion. Evaluation of policy variables such as parking policy or energy pricing is limited by lack of techniques to measure impacts. The value of testing extreme policy options was questioned not only by study team members but also by citizens.

4. Currently there are institutional constraints that limit citizen participation. Conducting a participatory planning process often requires a departure from previous practice. The need for timing flexibility often is at odds with contract administration and fiscal constraints. As stated previously, built into an open process is the trade-off between extended discussion and

fiscal responsibility. Another policy that was confronted during the CRATS effort was the disclosure of information prior to approval of the Coordinating Committee. Previous practice called for committee approval prior to public release. This policy prevented meaningful citizen input prior to committee discussion. At the request of a member of the press this policy was changed. Policies concerning financial support for citizen development of proposals were also confronted. Technical assistance by PTI was made available to citizens, but no funds for development of proposals were offered.

## CONCLUSION

Actively involving citizens in the transportation system planning process is not a simple task. The abstract nature of system plans and the remote impact of long-range proposals have failed in the past to arouse citizens into active involvement in the planning. Further, the planning process, which has been considered to be a technical process, has not been responsive to community participation. Identification of entry points for meaningful participation by citizens and development of techniques for engaging them in this continuing process are crucial to the improvement of the system planning process.

This paper reported on a pilot project addressing these questions in an actual planning study. The Centre Region Area Transportation Study provided a laboratory for testing many myths and facts about citizen participation. There is a need for more experience with incorporating citizen participation into the planning process. The interaction between the technical process and the citizen participation process is critical to the success of the overall planning effort. Further work is needed to improve the integration of the two processes.

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# Citizen Participation and Role of Public Hearings

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This paper describes and comments on the procedures followed by state transportation agencies before and after public hearings on highway projects. Information was obtained through interviews with public hearing officers, or their equivalents, in state highway and transportation departments. Items addressed include hearing administration, prehearing strategies, hearing formats, and posthearing strategies. Hearing officers interviewed were also asked to submit written copies of their agencies' public hearing strategy and any other material pertinent to public hearings or citizen participation. From the information gathered, we have assumed that the procedures described are currently in use unless otherwise stated. State transportation agencies have either one of two administrative operations for conducting public hearings: 29 agencies have centralized administrations in which mandates emanate from the central office, and 21 agencies delegate the responsibility for hearings to district or regional offices. The trend is toward the use of independent moderators at public hearings, especially if the hearings are likely to produce controversy. The most efficient and widely used prehearing technique is the informal prehearing meeting, which all 50 agencies use in some form. Thirty-nine agencies hold hearings at night but only 3 agencies conduct morning hearings. Although the formats for public hearings held by state transportation agencies are similar, 12 agencies recess at the midpoint for 30 min to 1 h to answer questions informally.

The study from which this paper was derived had two objectives. The first was to provide a description of many of the public involvement techniques used by the 50 state highway and transportation departments. Analysis of these techniques was expected to provide information valuable to the Virginia department in evaluating its own public hearing strategy. The second objective of the study was to examine the role of the public hearing in each state to determine how strong a role the public hearing plays in decision making. Although some evaluation is included, the primary goal of this paper is to provide an account of the types of public hearings and the overall citizen participation techniques and procedures used in the 50 state highway and transportation departments.

The public hearing officer, or equivalent, in each

state highway and transportation department was contacted by telephone and asked to furnish a detailed description of his or her agency's public hearing strategy and any supplementary written materials, including the state's action plan. Fifty public hearing officers were interviewed; written procedures were received from over half, and action plans were received from 29.

## HEARING ADMINISTRATION

Four organizational structures for public hearing administration are identified.

Structure	Number of States
Centralized	
Autonomous division	5
Subsection within division	21
Two or more divisions	3
Subtotal	29
Decentralized	21
Total	50

### Centralized Administration

Of the 29 agencies that use a centralized operation for administration of public hearings, 5 assign one division the sole responsibility for administering the total citizen participation strategy, including public hearings. These divisions are generally quite small and are staffed with persons having considerable experience in department procedures as well as an aptitude for public speaking and diplomacy. The division personnel are concerned only with public involvement considerations and, based on interviews, personnel feel the result is a thorough and effective administration of the program. In spite of apparent desirability of this structure most other agency representatives interviewed feel that the current reevaluation of public hearings and the emergence of new public involvement techniques minimize the need for a separate public hearing division. In 24 agencies the people who administer public hearings are in a subsection of one of the major divisions. In 14 of the 24 agencies the division



containing this unit is the one that conducts environmental studies.

### Decentralized Administration

Of the 21 agencies that reported decentralized operations for the administration of public hearings, 6 have a central office staff member designated as a hearing officer (or specialist) who does not actually attend or moderate hearings. The interviews revealed that several agencies have begun to staff district offices with personnel who have expertise in public relations. The titles of these individuals are varied (community liaison officer, community values specialist, public affairs officer, or district public involvement coordinator), but they have the same basic responsibility: to maintain a continual and effective relationship between their agency and the public throughout the transportation planning process.

### Moderators

An important component of the public hearing, whether administered at the central office or district level, is the moderator. Sixteen of the agencies with centralized operations have a staff member who is designated public hearing officer or specialist, but in only 10 agencies does that person act as moderator at every hearing. Six agencies with decentralized structures have such designated hearing officers, and in only 1 agency does the person act as hearing moderator. In 22 agencies (Virginia included) the moderator is the district or resident engineer. Ten states use independent moderators, usually when the hearing is controversial in nature. This practice has been highly successful and its use will probably grow. The independent moderators in those 10 agencies have been radio announcers, local news personalities, members of boards of supervisors, state representatives, senators, the local newspaper editor, board of education administrators, or the mayor. The qualifications are that they be experienced in handling large audiences, possess a sincere interest in transportation, and not be employed by the transportation agency sponsoring the hearing.

### Comparison of Structures

The desirability of a centralized administrative structure for hearings stems from the fact that the staff is daily involved in departmental policy and procedures as well as public contact work and thus can become immediately aware of any changes in policy or project development that may occur. In 14 agencies responsibility for administration of public hearing strategy rests with the division charged to conduct environmental studies; the structure definitely has merit since environmental statements and public hearing record evaluations are closely related, especially from the standpoint of location, design approval, and final ratifications. The major drawback to a centralized administrative structure, however, may be the tendency to attempt to achieve public involvement from behind a desk rather than face to face.

Although a decentralized operation may entail a lack of program uniformity among all districts, the question arises as to whether such uniformity is necessary. Indeed districts may vary greatly in population distribution and characteristics, economic structure, and educational opportunities. Probably more often than not, district personnel are keenly aware of area needs and specific attitudes as a result of their daily contact with people in their district. Those interviewees work-

ing within a decentralized structure felt strongly that this, in fact, was the case. I feel that district operations can be strengthened by employing a district community relations or public information specialist to oversee the total public involvement program and serve occasionally as hearing moderator. This practice puts programs under specially trained persons whose sole daily tasks involve public participation rather than a multitude of other facets of highway construction.

In both centralized and decentralized operations transportation agencies are undecided as to who should moderate public hearings. As mentioned earlier, public hearing officers assume this function in 11 states. In every case these individuals possess a thorough knowledge of departmental policy as well as an ability to communicate effectively with the public. However, the average number of hearings held in those 11 states in 1973 was 28 whereas the average number held in all states in 1973 was 38. In states holding considerably more hearings (Virginia held 92 hearings in 1973) use of the public hearing officer as moderator at every hearing may not be feasible. Use of the district engineer is an obvious alternative, but this arrangement has both advantages and disadvantages. The district engineer no doubt possesses a thorough knowledge of geographic and demographic characteristics of his district. In fact, this person often knows the type of presentation and program that is most effective with respect to geographic and demographic characteristics. Several agencies, however, report that certain district engineers are neither effective communicators nor particularly interested in citizen participation. The problem of uniformity may arise as a result of these differences among district engineers. A disinterested moderator could have an adverse effect on a public hearing. The public might question the sincerity of the agency's program if the representative presiding at the particular hearing seemed disinterested and insincere. A public liaison specialist in each district office, who would also serve as public hearing moderator, might help to reduce the possibility of the public detecting agency apathy. The majority of agency representatives interviewed agree that transportation departments should use district public relations or central office public information staff with public relations experience rather than technical personnel to moderate public hearings.

Several agencies reported that their choice of moderator is based on the nature of the project. Nonagency persons serve as moderators at many large controversial hearings; the South Carolina State Highway Department, for example, uses 25 individuals to moderate hearings. In the Tennessee Department of Transportation lawyers are often moderators; and in Utah and Wisconsin road commission members act as moderators.

### PREHEARING STRATEGIES

The success and effectiveness of any agency's public hearing strategy depend on the public involvement activities that precede the formal public hearing. Highly influential are activities such as public or informational meetings, deliberations of citizen advisory groups, formal notification to owners of properties abutting or adjacent to the proposed project, publicity, and pre-hearing public viewing practices.

### Public Meetings

All state transportation agencies conduct some form of public meetings prior to formal hearings. The meetings usually are informal and provide an opportunity for

citizens to discuss alternatives before the final selection is made. Many agencies feel that they can more easily provide detailed information of their activities and obtain candid opinions from the public at these meetings than at more formal meetings. In fact, most of the persons interviewed consider informal public meetings to be the most efficient method for achieving citizen participation. At such meetings planners and public officials get not only negative community attitudes but positive attitudes as well. The meetings reduce the possibility of citizens not becoming aware of a highway project until the location or design hearing stage and, because of their informal nature, encourage reluctant citizens, inexperienced in public speaking, to express themselves. A summary of prehearing strategies is given below.

<u>Technique</u>	<u>Number of States</u>
Public meetings	50
Extensive	20
Optional or by request only	8
One meeting on most projects	22
Citizen advisory groups	20
Prehearing written notification	16
Newspaper advertisement	50
Legal section	40
Display	10
Sign at project site	5
Preliminary public viewing of plans	10

Twenty agency representatives reported that their agencies conduct extensive prepublic hearing programs, 8 reported that prehearing meetings are optional or are held only if requested or if a specific problem arises that warrants a special called meeting, and the remaining 22 reported holding at least 1 prepublic hearing or meeting on most major projects.

The number of informational meetings held differs among the states and also varies according to the significance attached to the project. Some agencies hold 3 such meetings at various stages in the planning process up to the time of the public hearing; others hold as many meetings as are necessary to achieve the goals of their programs on a project-by-project basis. One representative reported that his agency had conducted as many as 15 preliminary meetings on a particular project. Most of the persons interviewed, however, agreed that 1 informal meeting of some type should be held prior to the public hearing on projects of major significance.

The timing of these meetings varies from the same day of the public hearing to 1½ years in advance of the hearing, depending on the nature of the project. The greatest number of respondents feel that, if a single meeting is held, it should be 2 to 6 months prior to the initial formal public hearing. In the case of multiple meetings, the first one should be held 1½ years prior to the hearing and the last one a week before or even the same day as the formal hearing.

Several state agencies are testing a program, which has been successfully used by other agencies, consisting of a series of informal meetings culminating in the public hearing. Many of the agency representatives who already emphasize this approach feel that, if a systematic series of informative public meetings are conducted that resolve most of the problems normally surrounding transportation projects, formal public hearings will eventually cease to be needed except in isolated cases.

State agency representatives interviewed agree that the most difficult phase in which to achieve public involvement is the system phase. Several agencies are

testing a method that places the responsibility of increasing public involvement in the system phase on the state planning district or regional planning commissions (1). In many cases the commission holds at least one public meeting for each major plan revision.

#### Citizen Advisory Groups

Another public involvement technique being either used or tested by several agencies during the prehearing stage is a citizen advisory group. Usually composed of representatives of service organizations, businesses, and professional groups, this group represents geographic areas through which the proposed facility is to pass. Primary functions of the citizen advisory groups are to formulate community goals and objectives and to relate these goals and objectives to the transportation agency. In addition, the groups are expected to contribute to the social, economic, and environmental areas of the study of the proposed project. Selection to such a group is usually made by a committee of transportation agency managers and local or regional political representatives. In 17 agencies, the group is used in various stages of planning as both an aid to planning for the community and a method of obtaining public input to transportation decision making. In at least 3 other states the option for the establishment of such a group on a project basis is included in the action plan.

#### Additional Prehearing Techniques

Only 13 agencies promote extensive prehearing contact with citizens owning property abutting or adjacent to projects. Eighteen agencies reported only a nominal degree of prehearing contact, 6 indicated that they have little or no prehearing contact with abutting landowners, and the remaining 13 were noncommittal. In 16 states, a letter is always sent to owners to property abutting a proposed project to notify them of an upcoming public hearing or meeting. Although practices vary, the most frequently recommended interval of time for advance notification of a public hearing is 30 to 40 d. Several agencies mail notification letters to all landowners and occupants of properties within 0.8 km (0.5 mile) of the proposed project. The identities of the property owners are often obtained from local tax rolls. One state agency, at the time of the field survey, sends a letter containing a questionnaire and a meeting invitation to each owner of abutting land; this informational meeting is held 1 month prior to the initial public hearing.

A notification process used by the West Virginia Department of Highways is worthy of note. The process was conceived because several features of the state hamper the flow of communications within it: The topography is rugged, the population centers are widespread, and most of the state is rural. A list of persons to receive all department communications is developed from comment cards and requests by individuals and regional groups for specific projects. These cards are available at every public meeting and hearing held by the department, regional council offices, local planning commission offices, department county and district offices, and county government offices. In addition, a clip-out version of the comment cards is printed twice a year in all daily and weekly newspapers throughout the state. This process helps the West Virginia department obtain citizen opinion, informs citizens of the use of their opinions, and notifies interested parties of the social, economic, and environmental effects of a project in all phases.

Federal law requires that the first notice of intent to hold a public hearing be published in newspapers 30 to

40 d prior to the hearing. The most common practice is to publish this notice in the legal section of the newspaper. Ten agencies, however, place a display advertisement on a page other than in the legal section. Walton and Saroff (2) found that the legal notice ranks poorly as a means for informing the public of upcoming hearings. Newspaper feature stories rank first; publicity through organizations second; discussions with friends third; legal notices fourth; radio announcements fifth; and television announcements sixth. Most agency representatives supply news releases to local radio and television stations, but they report that, unless projects are highly controversial, coverage is usually negligible. Posting notices on and around the hearing site is reported to be an effective publicity method especially in rural areas where communication is sometimes difficult. Five states erect large signs at approaches to proposed project areas to advertise time, date, and location of upcoming hearings or meetings. Such signs are usually reusable and are thus not costly to erect. This technique is reported to assist in publicizing projects located in areas where individuals do not have daily newspapers.

Several agencies hold an evening prehearing public viewing of plans in the area of the proposed project for the benefit of persons who might not be able to view the plans at a city or county engineer's office during the day. Ten states hold a preliminary public viewing on the same day as the formal public hearing. In 3 states the informal session and public viewing are held from 2:00 to 5:00 p.m. and the formal hearing is held at 7:30 p.m. Some states hold viewings the day before the formal hearing; other states hold viewings anywhere from 1 to 30 d prior to the formal hearing. Most viewings are held at the site of the upcoming public hearings, and displays often are allowed to remain until the hearing has been held. In a few states these viewings are sometimes held in conjunction with informal informational meetings. In still other states the agency often sets up an exhibit of plans, maps, and so forth at an information center either at the site of the upcoming hearing or as near to it as practical (perhaps in an old store or abandoned dwelling). This information center is staffed (often until 9:00 or 10:00 p.m.) with persons who can answer questions concerning the proposed project and the upcoming public hearing. Most agency representatives interviewed think that a preliminary exhibit or display should definitely be a part of the overall citizen participation process, should be held at least 1 d prior to the hearing, and exhibits or information centers established several days or weeks prior to the public hearings should be staffed with personnel who can adequately field any questions the public might have.

#### Discussion of Prehearing Strategies

Every state transportation agency includes prehearing public meetings in public involvement programs although number and frequency vary widely. The consensus of agencies interviewed is that such meetings greatly expedite decision making by providing direct interaction with the community—an ingredient critical to achieving effective community participation. Most informants agree that informal meetings should not resemble formal public hearings in any way and should have two-way communication as their purpose. Some even feel the meeting room should be arranged so that all participants sit at a table or in a circle rather than as speakers and audience. Experience shows that preliminary meetings promote communication between transportation decision makers and citizens, help solve specific problems informally, reduce controversy at public hearings, and reduce the number and length of

formal public hearings. This is not to say, however, that formal hearings should be eliminated, but rather that they should follow informal meetings and serve to summarize and formalize informal discussions and agreements.

This research did not probe deeply into nationwide use of citizen advisory groups as a means of gaining public involvement, because in most agencies this technique either is being tested or is mentioned in the action plan as an optional means for eliciting involvement. Such groups or committees ideally add continuity to citizen participation programs and enable members to become more informed about transportation. Several respondents indicate that the selection and use of such committees are often somewhat complicated. The method for choosing the membership of such groups must be a sound one so as not to arouse public suspicions of favoritism. For example, advisory committee members selected because of their special expertise may not actually represent the community. Moreover, if members are appointed by local officials there may be resentment on the part of some persons not selected. Every effort should be made to make sure that the advisory committee meetings are open to the public and that they are not the only means for soliciting public opinion. When queried concerning the usefulness of such committees, the majority of the agency representatives responded that such committees should be used sparingly and membership be open to all persons desiring to work in the committee. Furthermore, agency representatives indicated that such committees should be advisory in nature and that no special authority should be given to committee recommendations and opinions.

Many transportation departments notify all owners of property adjacent to a project of meetings or hearings by letter or telephone. One method of initiating positive prehearing relations is for a public relations specialist to visit the residents in the project neighborhood in advance of the survey and to explain prospective plans to them. Each citizen is given a card containing a toll-free telephone number and names of agency individuals who can answer specific questions. The agency employs one or two people, either in district offices or in the central office, to answer questions. A few state agencies that use this operation report that the technique works quite well in relieving top officials of time-consuming calls, preventing citizens from becoming exasperated in attempting to reach the right person in the bureaucracy and keeping answers to questions consistent.

#### HEARING AND POSTHEARING STRATEGIES

Location and hour of the hearing, registration and recording techniques, meeting format, visual aids, and methods of departmental response to public inquiries are important items with important implications.

#### Location and Hour of Hearings

Every state transportation agency holds its hearings as near to the project site as is feasible. Thirty-nine of the agencies report that hearings are held after 6:00 p.m., three agencies report that hearings are held between noon and 6:00 p.m., and three agencies report their hearings are held before noon. Two agencies conduct hearings either in the morning or the afternoon, and two agencies hold hearings either in the afternoon or at night. One state holds hearings at three different hours (10:00 a.m., 2:00 p.m., and 7:30 p.m.) depending on the community involved. This state has a large population of retired persons and agricultural and industrial

workers who are able to attend meetings at different times. The four states that set aside two different hours of the day to hold public hearings also indicated that quite often prehearing meetings are held at the earlier hour and the formal hearing at the later hour, both on the same day. One agency even holds public hearings on weekends when necessary.

#### Registration and Recording Techniques

Nearly every agency has a method for registering persons who attend public hearings. In the most often used type of registration each attendee is given a card to sign when he or she enters the meeting. This card is returned either immediately after the opening of the hearing or after the adjourning of the hearing. In 25 states the registration is used to identify individuals who desire to make a statement. In 13 states individuals who desire to be heard raise their hands. In several states response forms for written statements (often accompanied by addressed, stamped envelopes) are given to each person attending the hearing; these forms can be either returned at the close of the hearing or mailed.

By federal law the proceedings of a formal public hearing must be recorded in some manner. Twenty-seven agencies use a single tape recorder to meet this requirement; three agencies use two tape recorders to guarantee that no part of the hearing goes unrecorded when one tape has to be turned over or the primary tape happens to break; 13 agencies use a court reporter exclusively; and 7 agencies use a court reporter or a tape recorder, depending on the controversy surrounding the particular hearing. Several agencies use tape recorders that have multiple microphones; most agencies use aisle microphones to facilitate each speaker's statement. One state uses as many as five microphones at the front of the meeting room and three or four additional ones in the aisles. Still another reports using a cannon type microphone that picks up sound from anywhere in the meeting room.

#### Meeting Format

The formats of the formal public hearings held by state transportation agencies are basically similar. Hearings are usually opened by a moderator who expresses the purpose of the meeting. Next, presentations are given by various officials of the transportation agency. Then, local and state government officials speak (usually to endorse the project), and finally citizens give statements. Twelve agencies have inserted a recess immediately following the departmental presentation. The recess usually lasts 30 min to an hour and provides citizens the opportunity to ask transportation officials questions.

#### Visual Aids

All agencies use visual aids at formal public hearings. Twenty-one agencies use slide presentations and 25 use aerial photos or maps to present alternatives. Most agencies are upgrading the quality of their visual aids, which is an indication of the importance of visual aids at hearings. The majority of the agencies favor showing a color aerial view of the proposed route (use of color film during recess periods was reported to be very effective). Several agencies report that another effective aid is a pamphlet that displays the highway corridor and presents the pros and cons of the project and reasons for the hearing. Some states attach to this pamphlet a response card addressed to the agency that contains space for citizen comments. Such pamphlets aid the agency in

helping to inform citizens of more technical aspects of the project and in obtaining addresses for use in writing and informing citizens of the decision made on the project.

#### Response to Inquiries

Only 2 agencies report that every question asked by citizens at the public hearing is answered at that hearing. Four agencies answer questions unanswered at the formal hearing in the final transcript of the hearing; no personal contact is made with the citizen after the hearing. However, 35 agencies answer questions not answered at the public hearing by a visit from someone from the district or central office staff or by mail. Also many agencies send each person who attended the public hearing the final decisions on the project.

#### Discussion of Posthearing Strategies

Although a few years ago most agencies held public hearings in the morning, now about 71 percent of the agencies hold hearings in the evening. This practice is certainly conducive to increased attendance and participation. In certain areas of the country hearings are held at a time most convenient to the members of the community involved in the project.

Court reporters are favored over tape recorders in 13 agencies for three basic reasons: Reporters eliminate the possibility of loss of data through malfunction of the recording machine, minimize citizens' fear of a microphone and reluctance to express pertinent comments before a microphone or in public, and add credibility (the court reporter is seen as another outside party willing to listen to citizens' views). A comparison of the cost differential between the two recording techniques could not be ascertained since the agencies using court reporters were about evenly divided on which method they felt was the most expensive. All 13 agencies agreed, however, that regardless of the expense involved the use of a court reporter is superior to the use of the tape recorder. One agency hired its own court reporter for all hearings so that uniformity in the transcripts could be achieved.

If tape recorders are used, a single boom microphone or an extra sensitive chassis-mounted microphone is suggested so that citizens' microphone shyness can be eliminated. The one agency that uses a cannon boom microphone reported that this microphone has eliminated citizens' hesitancy to speak. If neither of these types of microphones can be used, the microphones should be placed at several locations in the meeting room to minimize citizens' movement. Most agencies using microphones place them in such a way (usually in the aisles) that a person does not have to face the entire audience to pose a question or make a statement.

A very useful and effective technique used by several agencies is a recess for an informal question and answer period immediately following the agency presentation. The recess allows citizens to congregate at exhibits and ask questions of agency personnel. According to the agencies using this technique, only a few general questions are asked when the recess is over and the hearing reconvenes, and adjournment soon follows.

If a recess in the public hearing is to serve its purpose, a clear, concise visual representation of the project must be accessible. Agencies using recesses take special care to ensure that plans are not too technical for citizens to understand. Most agencies use an aerial photograph of the project area instead of, or in addition to, engineering drawings. An aerial mosaic that includes the proposed route shown in color appears to greatly improve the citizens' orientation. The placement of copies of maps

around the hearing room, which highway officials refer to in their presentation, is also a very effective means of communication. This technique helps to eliminate the possibility of many citizens crowding around a single map or drawing during the recess and promotes more individual communication between agency representative and citizen.

Because answering every question raised by citizens is often impossible at the public hearing, transportation agencies absolutely must have a procedure for answering these questions at a later date. Experience shows that the easiest method is a letter from the district engineer or district citizen participation specialist. Such a procedure helps to erase the bureaucratic image of transportation agencies often held by the public. Several agencies go one step farther and inform each person who attended the hearing of the final decision made on a project. This practice has proved extremely useful in informing citizens of the effect of their comments at the hearings. The experience of the agencies who inform citizens has proved this gesture important; if citizens are able to see (on paper or otherwise) that their involvement and opinions are indeed of use or have had an effect on a decision concerning the project, future involvement of the public on similar projects becomes easier to obtain.

#### CONCLUDING REMARKS

Although only 10 agencies report using independent moderators at hearings, the interviews reveal that this practice will probably become more popular and be the rule rather than the exception in the near future. Several other agencies (including Virginia) report having successfully experimented with use of nondepartmental moderators at potentially controversial public hearings. I feel that moderator selection should and will vary among states and individual projects but that each agency's hearing structure should include an option allowing for the use of an independent moderator when the project is deemed to be of extreme significance or potential controversy.

Prehearing activities are considered by public involvement administrators to be the most important aspect of the overall public participation program. All agencies hold, or have the option to hold, prehearing meetings of some sort. This particular public involvement technique was, at the time of the interviews, receiving a great deal of attention among the transportation agencies. Although the agencies had not totally perfected the meeting-hearing relationship, they appeared to be striving to do so. The nationwide trend, then, appears to be away from the formal public hearing and toward the informal prehearing meetings. The end result of this trend will likely be the alteration of the role of the public hearing to that of a summary or ratification meeting. General resistance to meaningful citizen participation by certain conservative highway officials may make the transition slow.

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