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Travel Behavior of Residents of Retirement Communities

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ABSTRACT

Urban travel estimation is reviewed in the context of a growing elderly population and the trend of development of retirement communities. The life-style characteristics of retirement communities are uniquely different from those of virtually all elderly groups previously studied, and the mobility of the inhabitants appears to be reflected in this life style. Traditional, and newly developed, travel demand models fail to incorporate parameters that account for the significant variation in travel demand of elderly people that exists as a function of life style. An alternative trip generation model is proposed that would estimate travel demand of elderly people on the basis of life style using measures of age, dwelling unit type, employment status, and discretionary or obligatory travel.

An important transportation planning objective is to provide accurate travel estimates that simulate current travel and reasonably approximate future target-year conditions. This product is considered an essential element in the timely delivery of effective, efficient transportation facilities and service to the users. Many key decisions that involve enormous expenditures of time, money, and resources hinge on accurate forecasts.

In the early 1940s it was recognized (and confirmed by subsequent population census) that elderly people comprise an increasingly larger proportion of the total population of the United States. Ascertaining the needs and desires of this segment of the population has already effected changes in the housing, health care, leisure industries, and related government programs, but travel demand forecasting has been slow to fully assess and consequently adjust to the travel behavior that is unique to the elderly population.

Although the transportation planner generally knows that individual trip rates are affected by age, only a limited amount of research has been devoted to comprehensively study the travel behavior of elderly people and seldom has this knowledge substantially affected the practice of forecasting travel. Urban transportation planning agencies in general do not incorporate an age parameter in the trip generation, distribution, and assignment-modeling procedures (1). Typically, travel demand forecasts for the elderly population and the delivery of facilities and service have come under the heading of "Transportation for the Elderly and the Handicapped," which insinuates the needs of elderly people are similar to those of handicapped people or that elderly people, who are not disabled by age, behave like any other trip maker. In reality, travel by elderly people is not so insignificant that it can be ignored and it is not so readily separable into "disabled" and "ordinary other" travel.

THE ELDERLY POPULATION IN PERSPECTIVE

Figures 1 and 2 (based on 1980 Census of Population, Characteristics of Population, U.S. Summary and Arizona, respectively) show the proportion of the population made up of each cohort for 1940 through 1980 as reported by the U.S. Census. For this discussion, a cohort is defined as all persons born within a common 10-year period. That is:

Cohort	Age (years)
1	0-9
2	10-19
3	20-29
4	30-39
5	40-49
6	50-59
7	60-69
8	70-79+

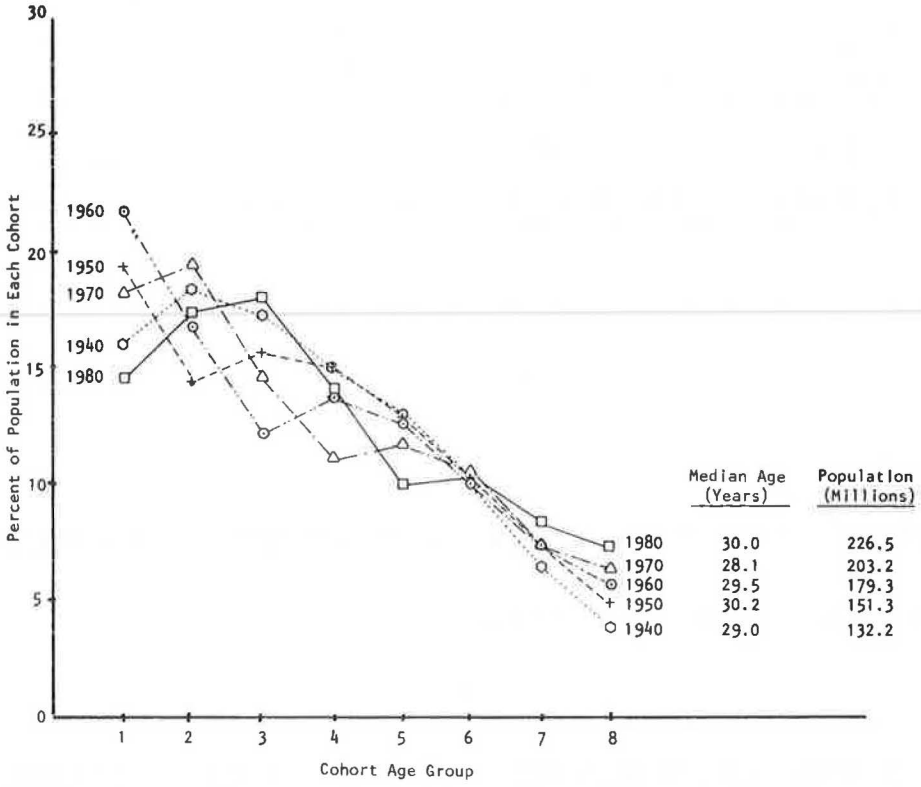

FIGURE 1 Percentage of population of each cohort for the United States, median age, and population—1940-1980.

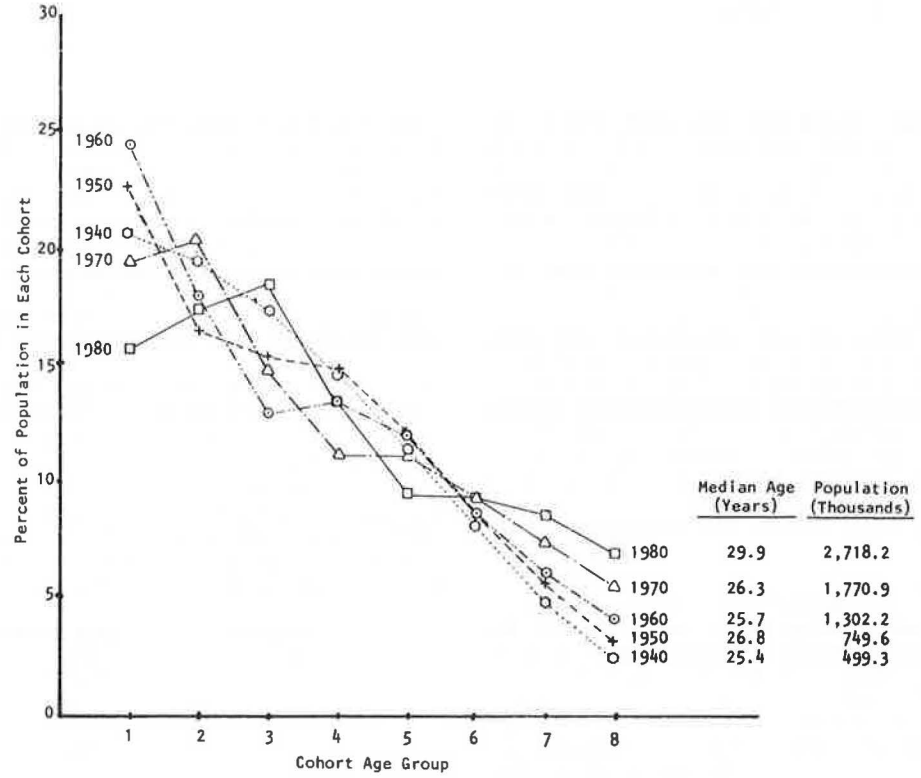

FIGURE 2 Percentage of population in each cohort for Arizona, median age, and population—1940-1980.

Note that all persons 80 years of age or older were assigned to Cohort 8. As is shown in Figures 1 and 2, from 1940 through 1980 there was a continual increase in the proportion of the population in Cohorts 7 and 8. As the population has increased, the number of persons 60 years of age or older has increased significantly from 13.7 million in 1940 to 35.8 million in 1980 nationwide--a threefold increase. In Arizona, the change has been from 38,000 in 1940 to 431,000 in 1980--an 11-fold increase.

From 1940 through 1960 the proportion of the population, nationwide and in Arizona, in Cohort 1 steadily increased. This represents the post-World War II baby boom. Just before 1970 the proportion of the population in Cohort 1 reached its peak and began a decline. However, the population wave created by the baby boom is moving forward in time as the baby boomers age. Its amplitude is diminishing, but it will continue to increase the proportion of the population in each successive cohort.

Since 1970 the population has been growing older because of the long-term downward trend of the birth rate and increasing life expectancies. In Arizona, these trends have been overwhelmed by the net immigration of people including the elderly. As Masnick and Bane (2) indicate, the baby boom will begin to have its most significant impact on the ranks of the elderly around the year 2010. Therefore, the proportion of the population that is elderly should continue to increase for at least the next 60 years. Census forecasts reported by Bell and Revis (3) indicate that the proportion of the population 65 years old and older will reach approximately 18 percent by 2040. They also indicate that by the year 2000, 40 percent of the population 65 years old and older will be over 75, increasing the ranks of what they term the "frail elderly."

This shift in age distribution to an older population has been accompanied by changes in housing and travel patterns. Retirement aged individuals often select unique living quarters and exhibit distinctly different travel behavior as indicated by trip purposes, trip rates, trip-length frequencies, and travel modes. The issues and problems of providing transportation for the elderly population are only beginning to be clarified.

Of particular interest from a transportation planning viewpoint is the current trend in Arizona of the development of retirement communities. Green Valley, Sun City, and Sun City West are examples of residential community developments primarily designed for and marketed to retirees. Green Valley is in the Tucson metropolitan planning area approximately 25 miles south of the Central Business District (CBD) adjacent to Interstate 19. Sun City and Sun City West are in the Phoenix planning area approximately 15 and 20 miles northwest, respectively, of the Phoenix CBD near US-89.

Figures 3-5 and Tables 1-3 provide an illustration of the character of these communities in relation to the cities of Tucson and Phoenix. The data were extracted from the 1980 Census (Figure 3 is based on 1980 Census of Population, General Population Characteristics, Arizona, Chapter B; Figure 4 is based on 1980 Census of Housing, General Housings Characteristics, Arizona; and Figure 5 is based on 1980 Census of Housing, Detailed Housing Characteristics, Arizona.) For Tucson and Phoenix, the data represent information for the incorporated cities. Green Valley, Sun City, and Sun City West are Census Designated Places (CDPs). [The Standard Metropolitan Statistical Area (SMSA) statistics were not used because they contain the data for the retirement communities and would, therefore, cloud the comparison.]

The residents of Sun City, Sun City West, and

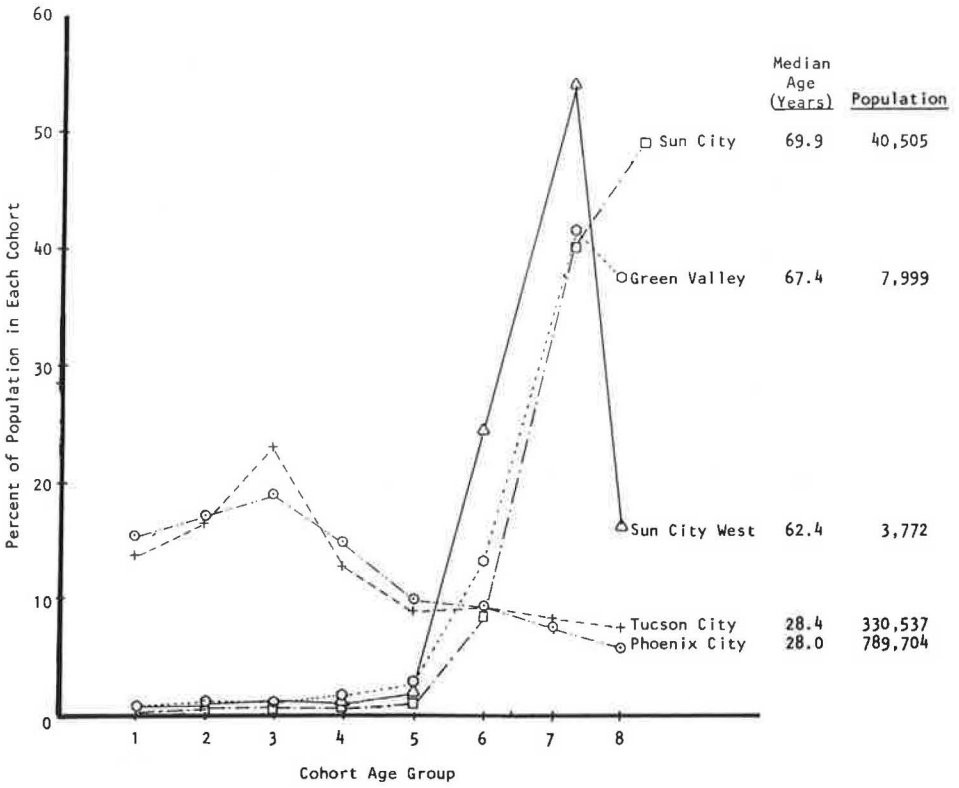

FIGURE 3 Percentage of city population in each cohort age group, median age, and population from 1980 Census.

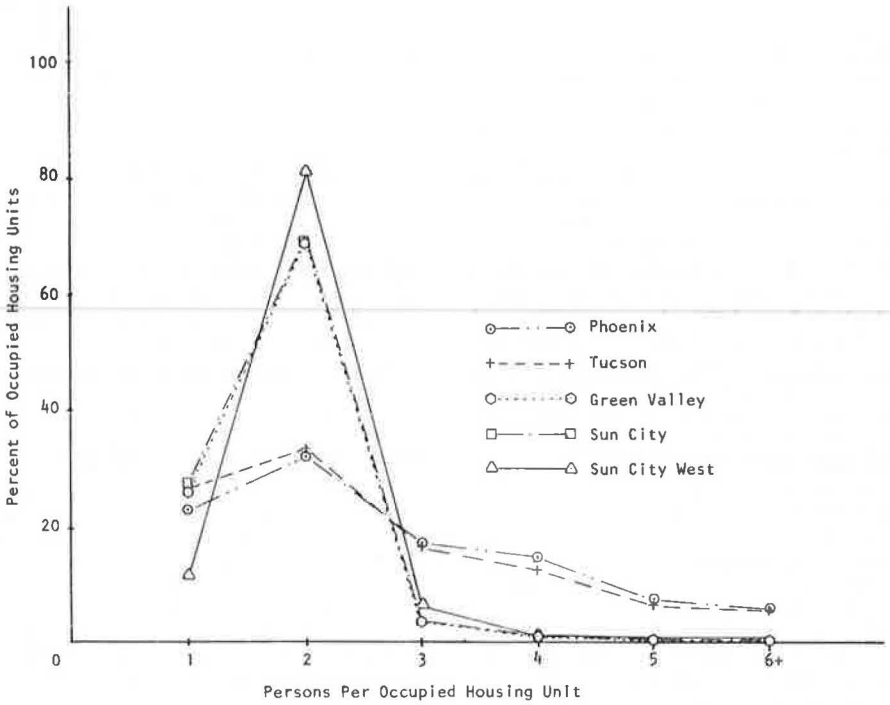

FIGURE 4 Persons per household for each community.

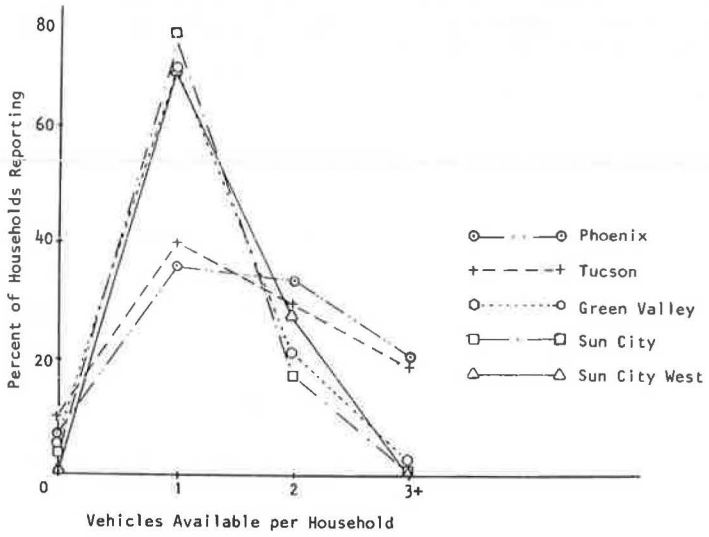

FIGURE 5 Percentage of households by vehicles available.

TABLE 1 Education, Race, and Labor Force Characteristics[a]

Characteristic	Location				
	Phoenix	Tucson	Sun City	Sun City West	Green Valley
Education					
High school grads (%)[b]	73.3	72.7	79.2	79.7	82.9
Completed 4+ years college (%)[b]	16.5	19.2	24.5	20.1	27.2
Percentage white race	84.3	81.7	99.9	99.4	99.3
Labor Force					
Families with no workers (%)	10.5	14.6	74.2	53.1	69.7
Nonworkers per 1,000 workers	102	113	920	520	694
Persons 16+ years old (%)	66.2	60.3	9.8	16.3	12.7

[a] Based on 1980 Census of Population, Volume 1, Chapter C, Part 4, Arizona, June 1983.
[b] For persons 25 years old and older.

TABLE 2 Socioeconomic Characteristics[a]

Characteristic	Location				
	Phoenix	Tucson	Sun City	Sun City West	Green Valley
Housing					
Number of units	308,302	137,249	25,347	3,558	6,160
Persons/occupied unit	2.74	2.57	1.77	1.97	1.81
One unit at address (%)	70.0	70.9	98.4	99.4	83.1
Median value of house ($)[b]	54,100	50,300	62,400	72,400	65,000
Median value of condo ($)[b]	56,000	49,000	55,900	67,700	45,800
Median rent ($)[b]	246	213	317	337	246
Built since 1974 (%)	19	14	24	99	47
Income					
Median/head of household ($)[b]	17,419	14,086	16,026	21,425	17,160
Mean/head of household ($)	20,784	16,849	19,370	24,747	20,499
Per capita ($)	7,551	6,473	10,943	12,658	11,182
Median of families with no workers ($)	8,655	9,411	17,480	19,189	18,070
Families below poverty level (%)	8.1	10.2	2.4	3.9	1.3

[a]Based on 1980 Census of Population, Volume 1, Chapters B and C, Part 4, Arizona, June 1983.
[b]All values in 1979 dollars; income is an annual amount.

TABLE 3 Family Structure[a]

Characteristic	Location				
	Phoenix	Tucson	Sun City	Sun City West	Green Valley
Persons 60+ years old living alone (%)	24.2	26.2	16.4	6.9	15.7
Households family occupied (%)	70.2	63.4	71.3	87.6	72.2
Married couple families (%)	81.5	80.0	95.7	96.9	96.1
Female householder, no husband present (%)	14.2	15.7	3.6	2.4	3.0

[a]Based on 1980 Census of Population, Volume 1, Chapters B and C, Part 4, Arizona, June 1983.

Green Valley have similar characteristics. Figure 3 clearly shows that the population of these communities is predominately 60 or more years of age. The labor force statistics given in Table 1 verify that the residents are generally retirees. They are white, affluent, married couples, well educated and living in detached single-family homes that average fewer than two persons per household (Figure 4 and Tables 2 and 3). Dwelling unit densities are low at 3.3 dwelling units per acre for Sun City, which is typical for this type of development (4). These developments are relatively new with a large percentage of housing units constructed after 1974. A relatively small percentage of the residents 60 years old or older live alone, and they appear to rely predominantly on private vehicles for transportation. Figure 5 shows that more than 95 percent of the households in these communities have at least one vehicle available.

A closer look at these retirement communities comes from an in-depth reader survey by the Green Valley News, which boasts 7,279 paid subscriptions out of 7,748 households and a 77.3 percent return of their two-page questionnaire survey of 300 households. (Note that these data were taken from a study conducted in January 1984 and, therefore, differ from the 1980 Census. Also, Green Valley has grown beyond the limits of the CDP indicated in the census.) According to the survey, 90.1 percent owned their home, 25.4 percent had bought a new car, and 70.7 percent opened a new checking or savings account during the 1983 calendar year. Shopping purposes, which account for 75 percent of the external trips to Tucson, occurred at least once a week for 28.9 percent of the Green Valley residents. It can be inferred from the data that a nearly equal percentage of Tucson trips were for dining out (72.8 percent), and medical and entertainment purposes were indicated by 34.5 and 24.1 percent of the respondents, respectively. The answers to these and 14 other questions confirm personal observations of Green Valley as a vibrant, mobile community that does not fit the sterotypic image of reticent elderly people (5).

These retirement communities also contain many of the activity centers generally associated with home-based travel. Shopping centers, financial institutions, medical facilities, golf courses, and other recreational facilities are typically designed into planned unit developments. They have proven to be attractive living arrangements and the development of retirement communities with these characteristics appears to be a growing trend. Since 1970 Sun City has increased in population 300 percent while the population in Cohorts 7 and 8 in Arizona has shown a 45 percent increase overall. Green Valley and Sun City West were developed after 1970 as were other similar communities in Arizona. Florida and California are experiencing a similar phenomenon.

The inhabitants can be expected to travel less than the typical urban dweller; however, not enough is known to accurately quantify their demand and, thereby, resolve the important issues of facility and service design. On the basis of travel forecasts using models that may be inappropriately calibrated, new bridge crossings and highway interchanges are contemplated in the Green Valley area and major upgrading of state routes near Sun City and Sun City West is being considered.

Reviewing the characteristics of the retirement communities indicates that the trip rates of these areas may be declining as the communities and the residents grow older. Sun City represents the oldest of the three communities with some of the development having taken place before 1970. Green Valley is

next chronologically, with extensive development having taken place between 1970 and 1975. Sun City West is the youngest with nearly all of the development having taken place since 1974. The population age, persons per household, income, and family structure data for the residents are rank-ordered precisely with the age of the communities. The possibility that the age of the residents will increase on average, and that household size will decrease with time, is supported by the 1970 Census statistics for Sun City. Between the 1970 and 1980 Census, the median age of Sun City residents increased from 67.5 to 69.9 years, and the average number of persons per household declined from 1.85 to 1.77.

The implication is that as the communities and residents age and the number of persons per dwelling unit declines as a result of the death of a spouse, trip making per dwelling unit will also decline. Hence, even within this particular life style and community, trip making per dwelling unit may vary significantly over time. Traditional modeling efforts have not taken this possibility into consideration. What is needed is a model that will forecast individual trip rates as a function of age and lifestyle variables.

TRAVEL BEHAVIOR OF RESIDENTS OF RETIREMENT COMMUNITIES

Current knowledge of travel of elderly persons has come primarily from studies of urban or suburban dwellers. These studies generally characterize the urban elderly population as relatively poor, transportation disadvantaged, and often dependent on public transportation (6-10). The daily person trip rates reported in these studies range from a low of 0.3 (10) to 2.68 (6) trips per person per day for elderly population subgroups stratified by income, automobile ownership, and the existence of a transportation disadvantage.

A significantly higher trip rate would be anticipated for the inhabitants of the retirement communities that are the focus of this paper. Previous studies (6,7) indicate increased trip making for elderly people with more affluent life styles. People with a "financially secure" life style described by Wachs (7) had the highest average trip rate of the elderly life styles studies in the Los Angeles area at 2.04 trips per person per day. The financially secure were described as similar to the residents of the retirement communities discussed earlier. However, the financially secure households were indicated as having significantly lower automobile ownership (28.4 percent with no automobile) and home ownership (approximately 40 percent renters). The implication is that retirement community dwellers would have an even higher propensity for trip making.

Retirement communities are defined by the Institute of Transportation Engineers (ITE) (11, Section 200) as follows:

> Retirement Communities--restricted to adults or senior citizens--contain residential units similar to apartments or condominiums and are usually self-contained villages. They may also contain special services such as medical services, dining facilities, and some limited supporting retail facilities.

The ITE reports an average weekday vehicle trip generation rate of 3.3 vehicle trip ends per dwelling unit for retirement communities. This figure is based on only five studies conducted in the San Francisco Bay area (12,13). One of the study sites was an apartment development. Three of the study sites were multibuilding complexes that had relatively large staffs that supplied extensive services and recreational activities. This type of facility was designed not only as a place to live, but also to satisfy the health care and recreational needs of the residents and thus reduce the need for travel. This type of facility will henceforth be referred to as an extended care facility. The fifth study site was a low-density, single-family, detached housing development with a golf course, service station, and grocery store--similar to the Green Valley, Sun City, and Sun City West areas.

Similar data for four other locations were also made available from the Maricopa Association of Governments, Phoenix, Arizona (4) and from the Florida Department of Transportation (14). The relevant statistics for these sites are given in Table 4. The data in this table were collected using cordon counts of vehicle traffic entering and leaving these sites, which were isolated and had minimal through traffic. These counts are not directly comparable to the statistics cited earlier, which were based on data collected for person trips at the household level. However, these data suggest that the type of dwelling unit is indicative of travel behavior of elderly residents and that the aggregation of trips per dwelling unit, irrespective of dwelling unit type, is improper.

At least two, and possibly three, stratifications by dwelling unit type are indicated. The mean vehicle trip rate per dwelling unit for extended

TABLE 4 Vehicle Travel Demand of Residents of Retirement Communities[a]

	California					Arizona			Florida
		Extended Care Facilities			Single-Family Homes	Single-Family Homes			Single-Family Homes with Apartments (1,500 homes + 800 apts)
	Apartments	1	2	3		1	2	3	
Dwelling units	108	300	46	3,122	460	125	60	176	2,300
Residents	150	347	90	5,463	835				4,500
Residents per dwelling unit	1.4	1.2	1.2	1.8	1.8				2.0
Staff persons		42	50	350	75				500[b]
Dwelling units per acre	18.6	34.5	10.8	5.6	1.5	3.3	3.9	3.3	
Weekday trips per[c]									
Dwelling unit	2.9	2.8	3.4	3.1	4.9	7.8	4.8	4.9	3.0
Resident	2.1	2.4	2.9	1.8	2.7				1.5
Person	2.1	2.1	1.9	1.7	2.5				1.4

[a] Based on Maricopa (4), California (12-13), and Florida (14) data.
[b] Includes 200 permanent employees and 300 new construction workers on-site at the time the data were collected.
[c] Total one-way vehicle trips.

care facilities is 3.1, whereas that for the single-family home communities is 5.6 (this does not include the Florida data that contain two dwelling unit types). Using the statistical T-test, these mean values were found to be significantly different at the 95th percentile level. It should be noted that travel demand for the extended care facilities is inflated by the inclusion of staff travel, which would indicate an even lower travel rate for the elderly residents. A third stratification may exist for apartment dwellers, although this could not be tested. Although this analysis is not definitive because of the small data sample, it does reinforce the idea that type of dwelling unit could be used as an indicator of both life style and travel demand for retirement communities.

Trip purpose stratification for the elderly population has been fairly well documented (6-8,15). Although the trip purpose categories vary between studies, there is general agreement that work travel decreases significantly after retirement and that social, recreational, and leisure travel becomes more prominent. However, Wachs (7) indicated a significant variation in trip rates with life style for discretionary trip purposes. The proportion of travel for work did not vary significantly between life-style groups.

Trip generation rates are not the only variables of interest for forecasting travel demand for retirement communities. Trip distribution has traditionally been an important element in the modeling chain. The calibration of the Gravity Model for trip distribution requires a distribution of travel by trip length or travel time. The effect of distance on travel of elderly people is not well documented. Ashford and Holloway (15) indicate that trip length remains relatively constant for adults regardless of age.

The conversion of person trips to vehicle trips using automobile occupancy rates is also necessary for quantifying highway volumes. However, little information is available describing the effect of age on automobile occupancy.

Although the potential for a uniquely different travel behavior pattern for retirement communities has been recognized, adjustments to the regional travel demand models are often hypothetical in nature and are not substantiated by empirical data. The conventional regional models are limited in the variables that are available for adjustment.

In Arizona the forecasts made from the regional travel demand models are refined by lowering the trip rates of the elderly population (sometimes by one-half) in order to assess particular sites or special generators. This practice begins to improve the accuracy of travel forecasts but it does not necessarily reflect the actual travel behavior of the elderly population or represent the self-contained nature of a retirement community separated by some distance from the urbanized portion of a metropolitan area.

LIFE-STYLE CONCEPT

The life-style concept of behavioral modeling suggests that different segments of the population can be clearly identified on the basis of specific characteristics of the individual or household and that these characteristics can be used to predict behavior. Definitions of life style primarily revolve around the theme of the allocation of an individual's time and resources to the activities of life (16,17). Life style is assumed to identify homogeneous groups that participate in the activities of life in a similar fashion.

Traditional travel estimation techniques have segmented the urban travel market on the basis of geographic location and, ultimately, of aggregate zonal demand characteristics. It is often assumed that the demand estimation error, caused by the variation of demand by individual households from the aggregate value, will be reduced if the zonal characteristics are homogeneous. Homogeneity for residential zones is typically defined by a similarity in the travel predictors of household size, income, and automobiles available. It is obvious from this discussion of retirement communities that similarity of household size, income, and automobiles available does not necessarily constitute a homogeneous population. Clearly, an elderly couple with an automobile and a $20,000 annual income will have significantly different travel behavior than a younger couple with the same characteristics.

Life-style market segmentation is an effort to further refine the composition of a homogeneous group. This approach is well known as a marketing tool for business (18,19); however, its application to transportation demand estimation is relatively new.

The use of life-style segmentation has been shown to improve trip generation forecasting through the inclusion of measures of household structure and residential location in existing travel forecasting procedures (16). It has been used successfully to discriminate between market segments in a joint mode and destination choice model (20), and it has been used to identify variations in travel demand for urban population subgroups (21). The parameters used to describe life style vary considerably among studies, and they are generally tailored to meet specific research needs. In each case the researchers developed an expanded list of measurable socioeconomic and demographic variables that demonstrated the segmentation of life style for the purpose of modeling transportation demand. They have explicitly recognized age as an important indicator of life style and predictor of travel behavior. However, they have each grouped the elderly population into a single 65-and-older life style and hence failed to account for the diversity of life styles and travel needs that exists within this group.

Wachs (7) has demonstrated that the variation in life styles of elderly people can be related to a significant difference in travel demand. The cross-classification presented by Wachs (7) assumes that the trip generation rate within a life style remains stable over time. This technique does not account for the potential impact of a new cohort entering a particular life-style category and bringing with it mobility standards different from those of the previous cohort. Nor does it account for the potential change in travel demand within a life style resulting from continued aging.

The application of any of these existing techniques appears inappropriate for the retirement communities discussed. The residents of these communities appear to have a unique life style that has yet to be fully evaluated and comprehended relative to its travel needs. Also, efforts to develop a transportation demand model should recognize the diverse life styles of the elderly population.

DISAGGREGATE LIFE-STYLE MODEL

Estimating travel, including that of elderly persons, should be based on reliable, easily obtained parameters that accurately simulate present conditions and prove to be suitable for future-year forecasts. Compared to the aggregate models, the disaggregate models are ideal for accounting for the

unique differences in travel patterns of various life styles. The disaggregate approach also offers the advantages of reduced data costs, improved accuracy in predicting travel responses to public policy, more relevant and timely output information, and a model structure more readily transferred from one geographic area to another (22). In view of the current status of transportation planning for elderly persons in Arizona (further primary data collection is about to start, public policies are beginning to emerge, and burgeoning retirement communities are being located throughout the state), a disaggregate model seems most appropriate. Because both the Phoenix and the Tucson regional transportation offices use disaggregate, cross-classification trip generation models, a similar model structure for the elderly population would facilitate its integration into the regional modeling chain.

The traditional methods of transportation planning need to adapt in theory and application to the emerging reality of a traveling elderly population. Research suggests that conventional methods and theory need to be more strongly focused on behavioral life styles of elderly persons for quantifying their travel demand (7). Supernak's (21) categorization of travel into obligatory and discretionary trips facilitates the modeling of travel by elderly persons and the subsequent planning of facilities and service:

1. Trip rates for elderly persons are rationally explicable, especially relative to the diverse trip-making behavior within the aged population and in comparison to the typical trip generators of the more generalized regional models.
2. Travel measures such as trip length frequencies, peaking characteristics, and special distribution of trips are ascertained more precisely by this stratification.
3. Assessment of the effectiveness of plans and programs such as carpooling, flexible work hours, and suppression of peak-period discretionary travel is made clearer under this modeling approach.

Beyond this categorization into obligatory and discretionary travel, a cross-classification matrix of trip purposes and life-style parameters, which will meet the test of reliability, efficiency, and temporal stability, is needed.

The most difficult aspect of formulating a model for forecasting travel by elderly people is the selection of the independent trip generation variables. Research has shown (7) that the activities and mobility to which a person has become accustomed are likely to continue into the elderly and retirement years. In the future the retirement communities in Arizona are likely to see cohorts with a larger portion of licensed drivers primarily reflecting today's increase in licensed females. This phenomenon is not easily represented by surrogate parameters like automobile availability, age, household type, employment status, or residential zone descriptors as suggested by Allaman et al. (16).

Even if all of Allaman's parametric values were the same for the elderly traveler in the year 1980, that person in all probability will have behaved differently from the elderly traveler of the year 2000 or from the elderly traveler from the 1960 era. Thus the formulation of a model, if pursued to an academically satisfying conclusion, could entail postulating all of the correct parametric descriptors of life style, the collection and analysis of further data, and the arrangement of these parameters into a temporally stable model. This would be an expensive undertaking, beyond the scope of this research, and likely to produce a model the data input requirements of which would be beyond the limit of practicability.

After a review of what primary data have been collected on travel by elderly people, it is apparent that retirement community travelers are primarily distinguished from other elderly travelers by the era of their birth (and consequent formation of life styles and mobility predilections) and their cultural, economic, and health tendencies. Thus "date of birth" and the "type of dwelling unit" (including some measure of value) are suggested here as the preferred surrogate parameters for many of the significant influences on travel of elderly persons. Trip rate data used in the ITE studies affirm the existence of distinctly different travel patterns according to the type of housing occupied. It appears that extended care nursing homes and in-city apartments for the elderly have uniquely lower trip rates than does the single-family detached house of a planned retirement community (9,23). This is probably because distinctly different people with different activities, mobility patterns, and tendencies inhabit these dwelling units. The "date of birth" or age and the "type of dwelling unit" parameters have the added feature of being readily available and commonly forecast with confidence about the temporal stability of the data. The resultant trip rates for a given cohort age group and a potentially quantifiable relationship between preretirement and postretirement travel in the obligatory and discretionary categories can also be estimated with confidence.

The disaggregate life-style model for travel by elderly people is thus formulated as

$$T = f(B,C,D,E)$$

where

- T = a particular cell of obligatory or discretionary travel within the cross-classification matrix;
- B = birth date, which identifies cohort mobility tendencies;
- C = category of travel, obligatory or discretionary and further subdivided by trip purpose;
- D = dwelling unit type (including some measure of value and categorized as extended care facility, apartments for the elderly, or single-family detached); and
- E = employment status, employed or not employed.

CONCLUSIONS

On the basis of the preceding evaluation, the following conclusions can be drawn:

1. As the proportion of elderly people in the population is growing, the attractiveness of retirement communities, as described here, appears to be an increasing trend.
2. On the basis of the life-style characteristics of the inhabitants of retirement communities, their travel behavior would appear to be uniquely different from that of the elderly groups previously described in the literature. Their propensity to travel would appear to be much higher, with a large portion of trips having destinations within the community. However, this hypothesis requires data collection for further testing.

3. The sorting of housing into categories such as apartments, extended care facilities, nursing homes, and single-family detached housing appears appropriate for improving travel demand estimation for the elderly population.

4. Birth date and descriptions of dwelling unit type appear to have a high potential for use as independent variables in a life-style-based travel demand estimation model.

5. Existing travel demand models generally fail to incorporate the effect of aging beyond 65 years of age on travel demand and fail to recognize the diversity of life styles of elderly persons.

RECOMMENDATIONS

On the basis of this study, the following recommendations for further research are made:

1. Observations of the retirement community life style suggest a travel behavior substantially different from that of other elderly populations or from the urban traveler in general. High automobile occupancy rates, licensed golf cart transporters, frugal use of time and money resources, and remarkably unique external and local travel behavior are begging to be measured, analyzed, and synthesized into a calibrated model. Such work must begin with a well thought out, comprehensive collection of primary data.

2. Although life-style models have considerable conceptual appeal, one needs to be formulated and tested against the conventional models that have generally proven to be quite accurate and useful in the planning and implementation process.

3. Cohort mobility tendencies have been recognized, but a method to systematically monitor and appraise them over time and then integrate them into the forecasting of travel by elderly people should be developed.

4. The self-containment objectives of the retirement community hinge on providing the land uses that support the desired activities of the elderly residents. External local travel patterns and sitings of businesses and public facilities within or nearby indicate the extent to which this objective has been accomplished. A time series analysis of land-use development and external travel is needed.

5. Developers of retirement communities aim to provide the amenities that will attract elderly residents. The efficient arrangement of land use along with an integrated transportation system designed for the particular mobility needs of this life style would further the communities' goals and those of the developers. An assessment of these land-use and transportation attributes and their congruence with resident needs ought to be undertaken and the direction of planning for these attributes revised or reinforced accordingly.

6. The modeling of travel by elderly people suggested in this paper is an attempt simply to address the wide variation in travel for that segment of the population. However, this model needs to be tested.

7. With similar differences in life styles for the young and middle aged, further research and model formulation (perhaps in the disaggregate form of cohort age group, obligatory and discretionary activities, dwelling unit type, and employment status) is recommended. The proposed model need not apply just to the elderly population.

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Estimating the Cost of Providing Transportation Services to Elderly Clients

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ABSTRACT

The purpose of this paper is to help individuals and organizations engaged in the provision of transportation services to the transportation disadvantaged better understand and control the cost of those services. Presented is the "parametric cost estimation methodology," which resulted from a study conducted by the Institute for Economics and Social Measurement, Inc., and Ecosometrics, Inc., for the U.S. Department of Health and Human Services, Administration on Aging. In this study methodologies were developed for assessing the costs of both transportation and in-home services provided to elderly clients under Title III of the Older Americans Act. The study produced (a) a research report summarizing the application of the resource-based cost methodology that was developed for these two studies and (b) a cost assessment manual for use by local service providers. Data used to develop the cost methodology were collected from in-depth interviews with all transportation service providers in 16 randomly selected planning and service areas across the United States (a total of 49 providers were included in the sample). Providers were contacted in person for information on factors such as the basic costs of resources, the amount of resources required to produce services, service specifications, and consumption patterns and rates. From the data, parametric cost formulas were developed that relate resources used with services produced and consumed. A brief overview of the results of the research and of how to use the methodology to construct and analyze the true cost of operating transportation services is presented.

The issue of how to achieve the greatest level of program effectiveness within available resources has always been of paramount concern for service providers who find themselves operating within limited budgets. In recent years this issue has become even more critical for providers of transportation services to the disadvantaged as budgets have been cut and the cost of services has been rising. Complicating the challenge of providing cost-efficient services is the severe lack of knowledge about the actual cost of providing services and the specific factors that create substantial differences in cost from area to area or organization to organization.

Selected results of a 3-year research project, conducted by Ecosometrics, Inc., and the Institute for Economic and Social Measurements, Inc., for the U.S. Department of Health and Human Services, Administration on Aging, are presented. Although the primary purpose of these studies was to examine the difference in the cost of services to elderly clients in urban and rural areas, one of the major products of the studies is a cost estimation methodology that can be used by local service providers to estimate current or future service costs. A simpler version of the methodology applied to secondary data on transportation services was applied to secondary data in a previous phase of the study (1). The development of this new approach to cost measurement was precipitated by the realization that generally available cost estimation methodologies and previous