

New Developments in Transportation for the Elderly and Handicapped

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TRANSPORTATION RESEARCH BOARD
NATIONAL RESEARCH COUNCIL

WASHINGTON, D.C. 1984

Transportation Research Record 973

Price \$8.60

Editor: Elizabeth W. Kaplan

Compositor: Harlow A. Bickford

Layout: Theresa L. Johnson

modes

1 highway transportation

2 public transit

subject areas

12 planning

16 user needs

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Printed in the United States of America

Library of Congress Cataloging in Publication Data

National Research Council. Transportation Research Board.

New developments in transportation for the elderly and handicapped.

(Transportation research record; 973)

1. Aged—Transportation—Congresses. 2. Handicapped—Transportation—Congresses. I. National Research Council (U.S.) Transportation Research Board. II. Series.

TE7.H5 no. 973 [HQ1063.5] 380 s [362.6'3] 84-29583
ISBN 0-309-03755-7 ISSN 0361-1981

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Addresses of Authors

Balog, John N., Ketron, Inc., Hickory Hill Plaza, 151 South Warner Road, Wayne, Pa. 19087

Bell, William G., Center on Gerontology, Florida State University, Tallahassee, Fla. 32306

Brög, Werner, SOCIALDATA, Institute for Empirical Social Research, Hans-Grässel-Weg 1, 8000 München 70, Federal Republic of Germany

Brown, Michael, Pennsylvania Department of Transportation, 1215 Transportation and Safety Building, Harrisburg, Pa. 17120

McKnight, Claire E., Urban Transportation Center, University of Illinois at Chicago, Box 4348, Chicago, Ill. 60680

McLaren, Mara Lee, Research Branch, Canadian Transport Commission, Hull, Quebec K1A 0N9 Canada

Menninger, Heather, Caltrans Transportation Project, 289 Amber Court, E, Upland, Calif. 91786

Pagano, Anthony M., College of Business Administration and Urban Transportation Center, University of Illinois at Chicago, Box 4348, Chicago, Ill. 60680

Pawlak, Robert J., Transportation Systems Center, U.S. Department of Transportation, Kendall Square, Cambridge, Mass. 02142

Revis, Joseph S., Joseph S. Revis and Associates, 2804 Battery Place, N.W., Washington, D.C. 20016

Ribbeck, Karl, Ministry of Transport, Kennedyallee 72, 5300 Bonn 2, Federal Republic of Germany

Saltzman, Arthur, Department of Marketing, California State University, San Bernardino, Calif. 92407

Simpson, Catie, Mobility Training Specialists, 4880 Sunset Terrace, A, Fair Oaks, Calif. 95628

Starks, Jane K., 3538 Rosedale Avenue, Dallas, Tex. 75205

Trends and Changing Priorities in Specialized Transportation: Elements of a Policy Agenda for the Eighties

WILLIAM G. BELL and JOSEPH S. REVIS

ABSTRACT

To contribute to a reappraisal of policy direction for specialized transportation in the United States, recently acquired data and developments deemed to have an impact on state and local planning for the remainder of the 1980s are reviewed. The intent is twofold: first, to identify and analyze recent social and demographic changes germane to the elderly and to transportation services designed for their use and second, to estimate the policy and program implications of these developments for the transportation network for the rest of this decade.

This paper is an abbreviated version of a monograph (1) prepared for the Technology Sharing Branch, U.S. Department of Transportation. Descriptive material is drawn largely from two major sources: (a) demographic and social data on those 65 years old and older compiled by the 1980 U.S. Census of Population (2) and (b) findings and recommendations emerging from the 1980 Mini-Conference on Transportation for the Aging (3).

BACKGROUND

Beginning in the early 1970s there was a major effort in the United States to respond to two key transportation issues of concern to the elderly: personal mobility and accessibility of transportation resources. A number of studies, service demonstrations, and advocacy efforts kept the need for increased specialized transportation resources before Congress, the federal government, and the transportation industry. Special legislation was generated, fresh federal funding sources developed, and new programs initiated. As a consequence, local transportation services had grown markedly in number and scope by the end of the 1970s.

At the beginning of the 1980s there was in place a substantial infrastructure capable of delivering a significant volume of specialized services to transport the elderly and other transportation-disadvantaged groups. One study prepared for the U.S. Administration on Aging (AOA) estimated that between 2,800 and 3,000 local transportation programs for the elderly were being funded under Title III of the Older Americans Act alone (4, p. 1). That estimate did not include specialized transportation programs for which primary funding was provided by other major federal sources such as Section 18 of the Surface Transportation Assistance Act, Section 16(b)(2) of the Urban Mass Transportation Act, and transport services funded with the assistance of Titles XIX

and XX of the Social Security Act. Nor does the estimated number of specialized programs funded by AOA include such other local programs as those offered by public transit agencies in the form of modified services for special groups, local paratransit services, and service provided by private providers.

In early 1980 the arrival of a new administration in Washington coupled with other unrelated economic developments foretold that a series of changes lay in store for the specialized transportation network. Some of these new influences were being felt in the early 1980s at state and local levels, others were to exercise their effect later. Among these major developments, to be discussed more fully in a later part of this paper, were the following:

1. Stringent national resources and a subsequent constraint on funding domestic public programs,
2. Inflation and its effect on levels of service,
3. Higher energy costs and their impact on operational budgets,
4. More sustained effort to increase participation of the private sector,
5. Diminution of effort within the U.S. DOT [based on proposed new regulations specifying substantive and procedural requirements to assure non-discrimination against the handicapped in the use of federal transportation funds (5)] to enforce provisions of Section 504 of the Rehabilitation Act of 1973, and
6. Stronger demand for use of volunteers as a cost-cutting measure.

One of the few programs that gained strength in the early 1980s was funding for rural public transportation subsequent to passage of Section 18 of the Surface Transportation Assistance Act of 1978, with funding effective in 1979. Since 1980 states have received an annual allocation based on a formula reflective of each state's nonurban population. The authorized level of national funding for 1981-1983 was about \$75 million per year. In January 1983 Congress authorized continuation of funding for Section 18 at about \$80 million per year for 1984-1986. Currently Section 18 tends to concentrate on supporting rural transportation services already in operation. New projects are difficult to initiate and implement, though it is widely acknowledged that rural transportation service is not comparable to that found in urban parts of the United States.

Because of the recently imposed limitations on federal funding for transportation in general, state and local governments are placed in the position of having to reevaluate their role vis-à-vis specialized transportation services. States have to make two critical decisions: (a) whether and how to replace funding from federal sources either to sustain existing levels of service or to initiate new services and (b) if federal funds are to be replaced, determine the extent to which state and local fiscal resources can or should be used to fund specialized transportation.

The status of specialized transportation is linked intrinsically to demographic changes associated with the population of aging persons in the United States. Despite the mythology about the unchanging quality of the elderly, the demographic characteristics of older Americans are dynamic and changing rather than static and unyielding. The decennial census of the U.S. population, as well as other sources, generates reliable data periodically on the composition of the aging population, thus enabling policymakers to update their perceptions of this growing population group in the United States.

CHANGES IN THE DEMOGRAPHICS OF THE AGING

Data from the 1980 U.S. Census of Population affirmed a recent trend discernible with each succeeding census: The United States is steadily becoming an aging society. Not only is the aging population increasing, it is increasing at a faster rate than the general population. Moreover, within the group 65 years old and older, the group 85 years old and older is growing at a more accelerated rate than the group as a whole.

Analyses of the composition and characteristics of the population of older Americans in 1980 reveal significant differences from their 1970 counterparts. Demographic changes within the aging population include shifts in the age structure, in the male-to-female ratio, in educational attainment, in labor force participation, in economic position, in the percentage classified as poor, and in the growth of the number of minority elderly. The conclusion is inescapable: The elderly of the 1980s differ markedly from the elderly of the 1970s and will make new planning demands on specialized transportation services.

Between 1970 and 1980 the number of Americans 65 years old and older increased both absolutely and as a percentage of the general population. As of April 1980 the elderly in the United States totaled ap-

proximately 25.5 million or 11.3 percent of the population. In contrast in April 1970 the elderly population totaled just under 20 million or 9.3 percent of the national population. The increase in the number of elderly persons during the decade takes on added meaning when it is recognized that in the 10-year period under analysis the U.S. population increased by 11.4 percent but the aging population increased almost 2.5 times more, by 27.9 percent.

The number of elderly people is increasing at the rate of approximately 600,000 per year. It is estimated that by 1985 the population 65 years old and older will reach 27.4 million; by 1990 the total may rise to 30.5 million and represent an estimated 12.3 percent of the total population in the United States.

In the 1980 Census, the aging of the older population is underscored by the increase in the population aged 85 years and older (Table 1). While the age groups 65+, 65-74, and 75-84 years old, between the two most recent census periods, measured at about the same rate, from 25 to 28 percent, the number of people 85 years old and older increased at more than double that rate, by an impressive 59 percent.

Some planners refer to the elderly 75 years old and older as the frail elderly, though there is no assurance that frailty arrives inevitably with one's 75th birthday. It follows, therefore, that persons who live an additional 10 years are more likely to be beset with physical limitations and physical frailty, suggesting the use of assistive devices such as wheelchairs and walkers. These impaired riders will require the attention of specialized transportation providers.

Changes in Male-to-Female Ratios

When data by sex in the two census periods were compared, both sexes displayed increased rates of survival, reasserting the long-standing demographic dominance of females over males in the aging popula-

TABLE 1 Resident Population 65 Years and Older in the United States, by Age and Sex, April 1, 1980, and April 1, 1970^a

Age and Sex	Population		Percent distribution		Population change 1970-80	
	1980	1970	1980	1970	Number	Percent
Total both sexes	25,544,133	19,972,336	100.0	100.0	5,571,797	27.8
65 to 74 years	15,577,586	12,442,573	61.0	62.3	3,135,013	25.2
75 to 84 years	7,726,826	6,121,627	30.2	30.6	1,605,199	26.2
85 years and over	2,239,721	1,408,136	8.8	7.1	831,585	59.1
Male	10,302,601	8,366,945	100.0	100.0	1,935,656	23.1
65 to 74 years	6,755,199	5,440,350	65.6	65.0	1,314,849	24.2
75 to 84 years	2,865,974	2,437,244	27.8	29.1	428,730	17.6
85 years and over	681,428	489,351	6.6	5.9	192,077	39.3
Female	15,241,532	11,605,391	100.0	100.0	3,636,141	31.3
65 to 74 years	8,822,387	7,002,223	57.9	60.3	1,820,164	26.0
75 to 84 years	4,860,852	3,684,383	31.9	31.8	1,176,469	31.9
85 years and over	1,558,293	918,785	10.2	7.9	639,508	69.6

^aAdapted from Population Profile of the United States: 1980 (2, Table 4, p. 9).

tion. The older women become, the more they outnumber their male peers.

The data in Table 1 indicate that at each year of age beyond 65, females outnumber males. This phenomenon is most striking in the age group 85 years old and older. By 1980 the number of males in the 85+ year old group increased by 39.3 percent compared with 1970, but the number of females in this age group increased by almost 70 percent. The results suggest that specialized transportation programs of the late 1980s can anticipate serving a growing number of clients who are more than 85 years old and that a majority of these riders will be female and probably widows.

Changes in Educational Levels

In 1980 two of five older Americans had achieved at least a high school education, compared with the period 10 years earlier when fewer than one in three elderly persons could make that claim (2, Table 18, p. 25). High school graduates among the elderly are slightly more likely to be female than male but are certain to be preponderately white rather than Black or of Hispanic origin. The chance of encountering a 65 year old white person who has completed 4 years of high school is 70 percent better than that of encountering an elderly Black person or an elderly person of Hispanic origin who has done so.

Another educational change shown by the 1980 Census is the growing ratio of elderly with one or more years of college. An estimated 25 percent of the elderly in 1980 reported at least one year of university education in contrast with 1970 when the rate was less than 20 percent.

Educational attainment is as significant for elderly people as it is for other members of industrial society. The correlation between educational background and subsequent income that in turn may translate to an improved capacity to purchase health care, housing, and transportation, among other essentials, has been sufficiently documented in the social science literature to require no more than mention here.

Changes in Employment Status

The number and proportion of older persons, both male and female, in the labor force exhibited a decline between 1970 and 1980. The decline was sharper for males than for females--from 26.8 percent to 19.1 percent for the former and from 9.7 percent to 8.1 percent for the latter (2, Table 21, p. 33).

Forecasts suggest a continuation of the trend of self-separation by the aging from the labor force. There are, however, a number of offsetting factors that could change the pattern. These factors include (a) the improved educational level of the elderly that indicates that older people are not necessarily in low-skill positions or in employment categories being phased out by technological changes; (b) presumed better health as a consequence of improved economic position, which suggests the capacity to stay on the job longer; and (c) passage of the 1978 amendments to the Age Discrimination in Employment Act, which only recently raised the mandatory retirement age from 65 to 70 years and may not have had sufficient time to exercise its influence on retirement patterns.

Perhaps the long-run trends of labor market participation by the elderly may change as the pressure for retirement eases because of these and other influences. However, at the beginning of the 1980s there were fewer civilian noninstitutionalized older

Americans of both sexes in the labor force than there were in the 1970s. About one in five older men and one in twelve older women were working in April 1980 compared with April 1970 when one in four elderly males and almost one in ten elderly females were gainfully employed.

Changes in Economic Status

Two somewhat contrasting trends emerge from the 1980 Census report detailing the poverty status of the elderly in 1979 and 1969 (Table 2). The economic position of older people has improved considerably in the 10-year period; this is supported by the data on improved educational attainment discussed earlier. Not all the elderly in the United States were able to reap the rewards of improved educational levels. A hard core of the elderly, about one in six or seven or 15.1 percent fell below the poverty line in 1979. This was a considerable drop compared with 25.3 percent in 1969. Given the inflation of recent years and the consequent drop in purchasing power, the 15.1 percent identified as poor are probably worse off economically than were their counterparts in 1969.

As is the case of younger age groups, poverty among the elderly is associated with race. Black elderly persons are about 2.5 times more likely to be poor than are white elderly. Hispanic elderly are about twice as likely to be poor as are whites.

White elderly persons clearly improved their economic position between 1969 and 1979, both in absolute numbers and in the ratio of their peers falling below the poverty level, despite the substantial increase in the aging population in this period.

The economic position of elderly Blacks is less clear. Although the ratio of Blacks who are poor decreased, the actual numbers of Blacks falling below the poverty line increased between 1969 and 1979.

Though not covered by the data in Table 2, there is a sex differential among the elderly poor; more aging women than men fall below the poverty line, and many of them are widows.

Summary of Demographic Changes

The changes in demographic characteristics of older Americans in the 1980s compared with those of the 1970s can be summarized as follows: Older Americans are far larger in number and their number is increasing as a ratio of the total population; more of them are female, particularly in the upper ranges of the age spectrum; their survival rate has increased, resulting in far more people in the age group 85 years and older; their participation in the labor force has decreased regardless of sex; they are better off financially than they were 10 years ago and are better educated; a hard core of about one-sixth of the elderly, composed largely of minority females, is still living below the poverty line.

A note of clarification is in order here. The emphasis on the increasingly aged quality of the elderly population of the 1980s needs to be balanced to avoid a presentation that inadvertently distorts policy conclusions derived from findings of the 1980 Census. As Neugarten points out appropriately, given the diversity and irregularity of the aging process, mere age by itself tends to be irrelevant as a basis for social policy.

[T]he thesis is that older persons are a heterogeneous, not a homogeneous group; that in a society in which age is becoming in-

TABLE 2 Poverty Status of Persons by Family Status, Race, and Spanish Origin, 1969 and 1979^{a,b}

Characteristics	Total	1979			Total	1969		
		Below Poverty Level Number	Percent of Total	Percent Distribution		Below Poverty Level Number	Percent of Total	Percent Distribution
All Races								
All persons	217,848	25,343	11.2	100.0	199,517	24,147	12.1	100.0
65 years and over	23,743	3,586	15.1	14.1	18,899	4,787	25.3	19.8
In families	191,418	19,394	10.1	76.5	184,891	19,175	10.4	79.4
Householder	58,426	5,320	9.1	21.0	51,588	5,008	9.7	20.7
65 years and over	8,792	797	9.1	3.1	7,208	1,276	17.7	5.3
Unrelated individuals	25,585	5,600	21.9	22.1	14,626	4,972	34.0	20.6
65 years and over	7,656	2,243	29.3	8.8	5,716	2,703	47.3	11.2
White								
All persons	188,048	16,823	8.9	100.0	175,349	16,659	9.5	100.0
65 years and over	21,446	2,840	13.2	16.9	17,370	4,052	23.3	24.3
In families	165,277	12,213	7.4	72.6	162,779	12,623	7.8	75.8
Householder	51,389	3,515	6.8	20.9	46,261	3,575	7.7	21.5
65 years and over	7,916	587	7.4	3.5	6,604	1,036	15.7	6.2
Unrelated individuals	22,095	4,351	19.7	25.9	12,570	4,036	32.1	24.2
65 years and over	6,928	1,837	26.5	10.9	5,173	2,322	44.9	13.9
Black								
All persons	25,385	7,838	30.9	100.0	22,011	7,095	32.2	100.0
65 years and over	2,019	716	35.5	9.1	1,373	689	50.2	9.7
In families	22,133	6,614	29.9	84.4	20,192	6,245	30.9	88.0
Householder	6,042	1,666	27.6	21.3	4,889	1,366	27.9	19.3
65 years and over	789	205	25.9	2.6	547	224	41.0	3.2
Unrelated individuals	3,104	1,143	36.8	14.6	1,819	850	46.7	12.0
65 years and over	667	390	58.5	5.0	485	355	73.2	5.0
Spanish Origin								
All persons	13,244	2,863	21.6	100.0	(NA)	(NA)	(NA)	(NA)
65 years and over	563	147	26.1	5.1	(NA)	(NA)	(NA)	(NA)
In families	12,202	2,555	20.9	89.2	(NA)	(NA)	(NA)	(NA)
Householder	3,100	610	19.7	21.3	(NA)	(NA)	(NA)	(NA)
65 years and over	212	40	19.0	1.4	(NA)	(NA)	(NA)	(NA)
Unrelated individuals	957	273	28.6	9.5	(NA)	(NA)	(NA)	(NA)
65 years and over	141	72	51.1	2.5	(NA)	(NA)	(NA)	(NA)

^aNumbers in thousands, persons as of March of the following year, noninstitutionalized population.

^bAdapted from Population Profile of the United States: 1980 (2, Table 30, p. 51).

creasingly irrelevant as a predictor of lifestyle or as a predictor of need, policies and programs formulated on the basis of age are falling increasingly wide of the mark; and that income and health care and housing and other goods and services should be provided, not according to age, but according to relevant need.

. . . But the policy issues are complex and do not, in the actual instance, take the form of simple either-or decisions. It is usually some combination of age and need, as well as other economic and political factors, that policymakers are struggling with, and it is not always an easy matter to disentangle the issue of age irrelevancy (6, pp. 27-28).

TRANSPORTATION IMPLICATIONS OF DEMOGRAPHIC, ECONOMIC, AND SOCIAL CHANGES

As is well illustrated by the demographic data cited, the past decade produced significant shifts in the composition of the aging population. The elderly of the 1980s and 1990s will differ appreciably from their earlier counterparts in several ways. Although the implications of these changes have yet to unfold fully, their consequences for planning and programming transportation for the elderly are already identifiable. These changes point to the major policy areas that will need to be considered by state and local jurisdictions during the remainder of this decade.

Changes in Age Structure of the Elderly Population

Unquestionably the most significant change that has

already occurred and will continue in the 1980s and presumably the 1990s is the increasing survival rate for older Americans. As has already been noted, the rising proportion of the population over 75, particularly women, is expected to have profound implications for meeting the health and related requirements of this population. However, in the immediate future certain transportation aspects will have to be taken into account.

The demands of the elderly for specialized transportation will increase in the 1980s. This is apparent from the sheer rise in the numbers of older people, the high costs of fuel, the increase in costs of purchasing and owning an automobile, and an established and growing demand for mobility among the elderly.

Most of the riders of specialized transportation services are likely to be female, of advanced age, and members of minority groups. The economic position of about one-sixth of the aging population, approximately 5 million persons, will create a core group who are likely to be transportation disadvantaged, in the full sense of that term, and candidates for specialized transportation services.

Specialized transportation programs will need to consider serving an older, probably less physically able, population than heretofore. The marked growth of the 85 years and older population will place increasing demands on the specialized transportation network. That network will need to take into account a group of riders who will have some difficulty in ambulation yet be desirous of maintaining a measure of mobility and independence.

Work-oriented trips on the part of the elderly will be on the decrease both for specialized transportation programs and mass transportation. With diminishing numbers of older persons of both sexes

in the labor force a larger proportion of older people will be seeking trips to destinations that are more varied than employment locations.

Car ownership will be maintained by a high proportion of older people but they will make frequent to occasional use of specialized transportation as an alternative for selected trips. Given the alternative life-styles of older people of the 1980s and the high costs of fuel, owning and operating an automobile, and parking costs in urban areas, older people will make selective use of specialized transportation for some trips, reserving the automobile for hard-to-reach locations and places to which specialized transportation is unavailable or awkward to use.

A related factor will be the high incidence of licensed drivers among the elderly, particularly among women, in the future. The elderly population 65 or older previously included women who had never learned to drive and were not licensed drivers. They were from a generation for which driving was not a tradition and they were accustomed to having someone drive them. They were also accustomed to using public transportation. Though the loss of mobility associated with aging and increasing dependence on others was a threat, it was not as serious as it will be psychologically and in terms of real mobility for the elderly of the 1980s and 1990s. The elderly of the next two decades will come from a population that has always driven regardless of sex. Since World War II, the proportion of male and female drivers has been roughly the same and a large part of the adult population of the late 1940s and 1950s will be in the elderly population of the 1980s and 1990s. The demands of those unable to drive for physical or economic reasons are likely to be for a substitute for the automobile; however, conventional public transit may not satisfy their needs as well as personalized dial-a-ride or specialized systems.

Accessibility is likely to be an important issue for the elderly in view of the expected increased limitations on mobility. Given the high proportion of women who have driven previously, the high incidence of frail elderly, the greater emphasis on group living and home-delivered services to maintain independence as long as possible, there is likely to be some preference for a combination of personalized specialized accessibility instead of lift-equipped or related conventional transit accessibility. In light of the driver licensing characteristics previously described, the emphasis on automobile-like transportation will be especially evident among the women who numerically dominate the age group. This may also result in increasing conflict between the elderly disabled and the younger disabled for whom mainstreaming is an important issue.

Though the rural elderly have participated in the migration to the Sunbelt states, they have not done so in the same numbers or at the same rate as the urban elderly. One consequence is that the rural elderly who remain behind are often the poorest and most vulnerable members of their communities. It seems quite evident that for the rural elderly, during the remainder of the 1980s and into the 1990s, the need for transportation is likely to continue and be at a higher level than that of their urban counterparts. Their needs will be compounded by lower incomes, lower available public budgets, a more dispersed population, difficulties associated with trip making, and the lack of a developed state or local network even vaguely comparable to those of urban areas.

Changes in Educational Level

As noted earlier, between 1970 and 1980 older Americans exhibited a marked improvement in their educational levels. That trend, if continued during the next decade, carries considerable significance for transportation.

To the extent that education and income are correlated, the elderly of the 1980s and 1990s will be able to better afford, own, and operate automobiles. If this is true, automobile ownership and usage are likely to be greater among the elderly than in the past. To the extent that this is not affected adversely by inroads from inflation, the elderly in the next two decades are likely to make different demands on specialized or public transit services. Obviously, if, because of energy or environmental issues, major urban policy shifts with respect to transit use are implemented during the decades, this projected increased automobile use by the elderly will not materialize.

Although it is true that there is likely to be a larger proportion of the population 75 years and older, the evidence makes it quite clear that they are likely to be healthier and stronger--particularly the age group 65-74. Personal vehicles are likely to be operated for longer periods and physical limitations will be less significant than during the past two decades.

To the extent that the rural elderly have lower educational attainment and income, their position will worsen vis-à-vis the urban elderly. Although rural public transportation programs have been developed, the funding levels are well below the needs and, perhaps more important, these funds have been largely used for funding transportation projects already operating rather than for developing statewide or interconnected rural systems. This is due partly to budget constraints but it is also partly due to shortsightedness. Given that framework, unless changes occur, the transportation conditions in rural areas, though improving, are likely to be relatively worse than those in urban areas.

Employment and Retirement

Employment data described earlier indicate that, from 1970 to 1980, the share of the elderly aged 65 years or older in the labor force declined, with a substantially smaller rate of participation and decline reflected in the data for women. These declining labor participation rates, if continued, will have transportation impacts.

However, there may be forces that may alter the pattern of what has been called by one observer "a linear life plan"--that is, a straight-line progression from extended schooling during youth, through some 40 consecutive years of work or homemaking or both in middle life, to retirement in old age. The present projections for early retirement are extrapolations of past trends, and there are a number of factors that may cause these trends to change. Among the possible forces for change that have been suggested are (a) mandatory retirement prohibited before age 70; (b) liberalized Social Security retirement tests that would permit greater earnings; (c) increased efforts to create a climate favorable to the employability of older persons; (d) wider use of a variety of techniques and practices that would enable a greater number of older persons to be gainfully employed (e.g., training, retraining); (e) more flexible working arrangements (e.g., part-time, longer vacations); and (f) continued trends in the increased cost of living. None of these forces of

change are particularly unusual and most are already present or under way in American society.

There are also a number of other demographic, economic, and social factors that could contribute to a turnaround as older people increasingly choose work over retirement. Changes in the age of retirement as a result of shortages in specific skills and the added cost of longer retirement periods, for example, may make it necessary for people to continue to work after age 65. Present trends toward early retirement at some income levels may become a growing source of social tension for some elderly persons and require return to work in the face of inflation. If sharply increased taxes are necessary to maintain existing social benefits in the face of budgetary constraints, pressures may grow to reduce benefits or increase the age of retirement. Those pressures and forces have already become manifest.

In addition, the improved physical well-being of the elderly and the fact that the physical demands of work are declining may also encourage some to postpone retirement. There is already some evidence that part-time work represents a major activity for workers 65 years or older; there are initial indications that part-time work could become an important component of employment and income for older people. The transportation implications in this case are quite different than they are for early retirement.

If early retirement trends continue, the elderly in the 1980s and 1990s are likely to exhibit trip patterns quite similar to those of the previous decade. There will be decreasing concern for work trips. Increasingly, the network of private and public transit and paratransit systems will have to focus on serving the elderly for their personal trips related to recreation, shopping, personal services, access to agencies and activity centers; trips to visit friends and family; and trips to church and other social activities. These are largely the trip purposes being served most frequently by present systems, be they transit, specialized, or paratransit services, serving the elderly.

The intercity transportation needs of the elderly are likely to increase significantly as better health and higher incomes generate more desire for travel for recreation and to visit family and friends. This pattern is already discernible and suggests that greater concern will have to be focused on these intercity needs. Because many of the rural elderly move their residences only short distances in retirement, the need for better local, regional, and intrastate bus services appears likely to be important during the next decade.

If retirement is postponed or delayed, different transportation implications emerge. Jobs held by the elderly may have locational characteristics somewhat different than those of the labor force as a whole. For example, to the extent that the elderly work more part time, especially in service and domestic jobs, their work trips will involve access to locations not well served by transit and, typically, require a "reverse commute" trip (i.e., service in a direction counter to the main flow of users and often with poorer service).

To the extent that jobs for the elderly are more dispersed than those of the nonelderly, they will have greater difficulties finding ways not only to go to work but to seek work. Interviews become 2- or 3-hr treks that would discourage even the most hearty and enthusiastic.

Part-time work represents a major source of work activity among workers 65 years or older. Studies related to part-time work indicate that about half of the employed persons in the age category 65 years or older worked part time in 1975--46 percent of the

men and 56 percent of the women (7, pp. 28 ff.). The same study noted that nine of ten older men and women indicated that their part-time status was voluntary.

There is a significant concentration of employment of the elderly, especially women, in the services, sales, and clerical sectors. In 1973 about 65 percent of the women and 30 percent of all employed persons 65 or older were in these occupational groups (7, Table 6, p. 34).

Data suggest that the service, sales, and clerical occupations tend to be more dispersed in their locations than other occupational groups (i.e., more dispersed origins and destinations). Many service and sales jobs are not well served by central-business-district-oriented public transportation systems. In addition, the work hours of service jobs are more varied, so the lack of good off-peak service makes public transportation even more difficult to use--especially for women who are particularly dependent on public transportation because fewer are licensed drivers. The three factors of job location dispersion, off-peak hour working times, and the low incidence of driver's licenses for women, in combination, undoubtedly result in greater transportation difficulties for many of the working elderly. In the future the latter condition is likely to change; increased numbers of women are learning to drive and the difference in the number of men and women with driver's licenses is expected to narrow sharply.

A review of driver licensing and renewal procedures in the United States in 1975 indicated that there is a substantial degree of nonstatutory discretion in the administrative practices and procedures connected with the process, especially as it relates to the driving examiner (8). There also appears to be evidence of a lag between driver licensing and renewal procedures and knowledge about the driving performance and safety record of elderly drivers.

The private automobile is the most important form of transportation presently being used by working elderly for searching for and getting to work. Unless major policy changes occur at the local level in land use patterns or in the role of the automobile, the pattern of dependency on the automobile is likely to persist over a relatively long period of time.

Given the long-term nature and difficulty of changing land use and the location of employment centers and the patterns of use of the private automobile, improved transportation to and from work places for older workers will require a form of transport that is a variant of the automobile. This suggests that the development of paratransit systems will be essential for improving transport for working older Americans in the future.

In view of the fact that large urban areas tend to have better transportation facilities than small urban areas, in most small and medium-sized cities the working elderly are vulnerable because of the lack of good public transportation. Furthermore, the evidence indicates that the rural working elderly (as are other rural elderly) are doubly vulnerable: There is frequently no public transportation of any kind available, and employment opportunities are substantially fewer and more widely dispersed.

Given the importance of driving and the automobile for working older Americans (and older Americans generally), it is not surprising that the loss of the driver's license is considered synonymous with a major loss of independence. If the working careers of older people are to be promoted over longer periods, some effort must be made to assure that driver licensing and license renewal procedures

are based on proven relationships between age and driving ability. Though older drivers tend to drive somewhat differently than younger drivers, the evidence does not indicate that they are less safe or are involved in a larger number of accidents. There appears to be a great deal of discretion left to individual driver examiners, and study is needed to determine whether, in fact, the procedures discriminate at the examiner level.

Shift to Suburban Residential Locations

In general, the elderly population has been becoming increasingly suburbanized, and the decade of 1970-1980 was no exception. The pattern of elderly moving out of central areas since the 1930s was continued over the last decade. In 1970 about 65 percent of the elderly 65 years or older lived in suburban or nonmetropolitan residential locations. By 1979 that share had increased to about 70 percent (9, Table 49). This suggests increasing concentrations of the elderly in suburban locations that are probably not well served by public transit. If this suburbanization continues, a number of transportation issues will need to be considered.

Because suburban locations are generally less well served by transit than are central city locations, the elderly will have greater need for transit systems that are circumferential in nature in contrast with radially oriented systems focused on central business districts and work locations.

If the elderly's suburban trips are focused largely on social, recreational, personal, and service agency needs, there will be fewer trips to central areas and more to local neighborhood and regional facilities. This suggests that future planning considerations must take into account this increasing need for neighborhood and localized transportation services (10).

Because conventional transit services do not easily (cost efficiently) serve the trip patterns of localized and neighborhood trips and circumferential travel to more dispersed (noncorridor) trip destinations, the pressure for specialized paratransit services will be further intensified.

Although it is difficult to fully assess the income potential of the future elderly for using private transportation services, current pricing practices and resistance to shared-riding in many locations keep the cost of private services too high for many elderly. The development of more universal shared-ride systems and pricing; shared vehicle renting and leasing by the elderly, especially in congregate housing; and other forms of shared ownership and use are likely to represent important options for the elderly and opportunities for the private sector.

Because the elderly's suburban residential locations are lower in density and their destinations more dispersed, the suburban elderly are likely to try to keep using their personal automobiles as long as possible. Under the circumstances, the issue of fair and adequate driver license renewal procedures, described earlier, will become an important issue during the next decade and into the 1990s.

IMPLICATIONS OF NATIONAL TRENDS FOR STATE AND LOCAL PLANNING

The major transportation implications expected to result from demographic, social, and economic changes during the past decade have been reviewed. There remains for consideration the more general forces that have significance for state and local

planning of transportation for older Americans. These are forces that are, to a considerable extent, subject to national policies and economic conditions.

Inflation

The impact of inflation on the economy is well understood although efforts at strong and sustained monetary controls are of somewhat more recent origin. Setting aside for the moment the issue of the economic consequences associated with efforts to control inflation, the decade of the 1970s saw consumer price increases significantly greater than those of previous decades. Consumer prices increased at a rate of about 1 percent per year over the first half of the 1960s and at a rate of about 5 percent per year in the last half of that decade. During the 1970s, consumer prices increased at an average rate of about 7 percent per year from 1970 to 1975 and by the second half of the decade the average annual rate had increased to more than 10 percent and was rising rapidly. By 1980 double-digit inflation consumer price increases were the rule rather than the exception.

By mid-1983 efforts to get inflation under control were beginning to produce significant results. By early 1983 the Consumer Price Index was showing rates of increase well under 10 percent. However, the lower inflation rates of 1982 were accompanied by substantially reduced levels of industrial activity and higher levels of unemployment. Though all economists by no means agree, it is generally accepted that "squeezing out inflation" requires some sacrifice that is measured in unemployment. Differences in opinion are focused on the two key issues, aside from technical questions, of how to control and how much control needs to be exercised.

Not all aspects of the factors discussed in this section are the exclusive domain of national administrators. Some can be dealt with at the local and state levels. However, it is important to keep in mind that the federal government plays an important policy role in helping to control these factors as they relate to transportation. The questions of how much unemployment is acceptable to the public to achieve reductions in inflation and whether price levels can be held down while achieving reasonable levels of growth and employment are not simple and make up the heart of the controversy among economists at the technical and professional levels and among policymakers at the political level.

It is not the purpose of this paper to enter into this controversy. The primary objective is to note that inflation is an important consideration at state and local levels in planning for specialized transportation services. No clear answer has yet emerged. Though inflation, at the time of writing, appears to be under control, the extent to which the associated unemployment has been tolerated has yet to be tested beyond the public opinion polls that suggest that the public's tolerance is nearly exhausted.

The second issue still remains. Can recovery, which in early 1983 had begun to show signs of life, continue during a long period without accompanying price increases? The issue is somewhat confused by the fact that the U.S. economy is undergoing some of the most profound structural changes in its history and these cloud the patterns of economists' forecasts and expectations. In the next decade, it may well be that inflationary rates above 10 percent will be avoided. But it is, at this juncture, by no means a certainty. If the economy grows rapidly and if major new investments and associated increases in savings are made to provide a future competitive

base for the U.S. economy, significant inflationary pressures will be present during the decade. Holding price increases in the range of 8-10 percent per year would not only have to be considered reasonable but a good achievement.

In that context, state and local jurisdictions would do well to hedge their bets and protect their planning and programming of transportation services by using more conservative assumptions about anticipated inflation rates. Trend rates of 8-10 percent would not be unreasonable, and if actual rates fell below that level it would have the effect of leaving some margin to adjust budgets downward--an easier process than is the reverse.

Energy

The 1970s were characterized by fuel scarcity and price increases that resulted in sharp increases in the costs of transportation. In fact, energy cost increases were an important contributor to the rising cost of transportation during the decade. For example, the special Consumer Price Index (CPI) on energy increased from 107.0 in 1970 (1967 = 100) to 275.9 in 1979 and 381.7 in 1980--an increase of about 3.6 times. The comparable increase in the Consumer Price Index as a whole for the period 1970-1980 was about 2.2 times (from 116.3 to 246.8). Not surprisingly, transportation costs increased at rates comparable with the CPI: from 111.1 to 249.2 from 1970 to 1980 (about 2.2 times) for private transportation and from 128.5 to 251.6 (2.0 times) over the same period for public transportation.

As in the case of inflation, all forms of transportation were affected by these changes in energy availability, either directly in the form of sharply increased costs or, in more acute situations, by the lack of availability of energy (fuel) for transportation services. A wide range of activities has been implemented to conserve energy, and these successful efforts have led to a decline in fuel costs and increased availability of fuel and related energy sources. Unquestionably, national policies on energy use and conservation will have important consequences for the cost and availability of fuel for transportation in the years ahead. Even though fuel supplies are presently plentiful and prices have stabilized (and even declined), during the next decade one must assume that new shortage situations will occur. Their scope and intensity will depend on national policy and decisions. There is a variety of programs at the state and local levels that can and should be undertaken for conserving energy to assure the availability of transportation services developed to serve the elderly.

During the energy crisis of the 1970s, priority allocation of fuel was to those transportation services that served the elderly. In the 1980s, the same energy impacts are likely to continue though not with any clear pattern of predictability. This suggests that careful planning, programming, and priority setting are even more important in the provision of transportation to the elderly in both the public and private sectors.

Funding Limitations and Related Considerations

If one accepts the assumption that the next decade is likely to be characterized by (a) strong efforts to promote economic growth within acceptable levels of inflation, (b) reductions in current federal deficits as a major policy target with any growth of the deficit limited to real economic growth, and (c)

intermittent but somewhat unpredictable energy shortages, then one must also accept the fact that the federal funding constraints that have marked the period since 1979 will persist throughout the 1980s.

Closer attention is likely to be given to issues of cost-effectiveness and to the links between the federal budget and national objectives and policies. In a recent report on public works infrastructure and policy considerations for the 1980s, the Congressional Budget Office (CBO) noted with respect to transit that

Adjustment in federal policies to improve the cost effectiveness and targeting of spending could permit transit needs to be met within current federal spending, and might even allow a reduction in the penny of the new tax on motor fuel that goes to transit. Such changes could include lowering the federal matching ratio, revising the distribution formula to favor cities that rely most heavily on transit, disbursing federal monies in transit block grants with few federal stipulations as to their use, and permitting experimentation with nontraditional modes (11, p. 37).

The strategies and policies posited by the CBO are not new and represent directions already initiated by previous congresses and presidents. In the context of transportation for the elderly, the suggestion by the CBO that nontraditional transportation modes be developed and encouraged is a step in the right direction. Conventional transit has, generally, not well served the elderly because its focus has been and continues to be on work trips. The same CBO report comments that ". . . mass transit's benefits to disadvantaged groups, such as the poor, elderly, and the disabled, are often taken for granted. Though this assumption appears valid for highly specialized public transportation services, such as 'dial-a-ride' vans, most forms of mass transit serve predominantly higher-income persons of working age" (11, p. 49).

In light of the scarcity of national budgeted resources there are a number of important issues that will need to be considered by the states and by local jurisdictions in planning their transportation services during the next decade.

In an environment of scarce resources and tight budgets, planning and priority setting are even more important than when budgets are more plentiful. Greater efforts will be needed by state and local jurisdictions on the planning and priority ordering of both system design and service.

Greater levels of local and state fiscal support will be required in the 1980s if transportation services are to be maintained. Some services may warrant reduction or discontinuance; these are issues that will need to be faced as part of the priority-setting process. It will also be essential to measure fiscal capacity and innovative sources of fiscal support at the state and local levels. Some states have already taken initial steps in this direction.

Human service agency transportation funds, particularly those of Section 18 and Section 16(b)(2) of the UMTA transportation program, provide important sources of funding for such services. However, funding by human service agencies for transportation for the elderly (and other clients) has already become somewhat more constrained and is likely to be worse over the decade for the reasons noted. Though coordination of these transportation services is not easy or without its costs, the need for coordination

will be more and more important, especially if transportation services by agencies being funded by state and local sources are to be effectively used to serve the elderly. Integration of these transportation services needs to be coupled with a multifaceted approach that includes a variety of transportation services, such as dial-a-ride, cooperative ownership and vehicle use, and pooling, that are tailored to the specific needs of clients and are reasonably cost-effective.

Studies of transportation services for the elderly, especially specialized services, indicate a considerable use of volunteers and contracting with the private sector (4). Interest in these two areas has intensified during the last several years; neither is without problems and difficulties. They are not a panacea for providing transportation to the elderly or for solving all the related problems. However, they do represent a potential that needs to be tapped more intensively than in the past, and the stimulus of constrained budgets at the state and local levels should encourage greater exploration of efforts in these directions.

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Marketing Functions in Human Service Agency Transportation

ARTHUR SALTZMAN*

ABSTRACT

Human service agency transportation (HSAT) is the title given to a family of specialized transportation services that have been developed to provide better mobility for clients of human service agencies. Historically, marketing for nonprofit organizations such as HSAT has either been ignored or reduced to a minor function. More recently it has been recognized that even organizations that are not in the private sector need to have a consumer orientation. They should identify their potential customers, analyze the needs of their clients, design an attractive product, and then promote this product. In short, the nonprofit sector needs a marketing program. The first objective is to describe the origin, development,

and current status of HSAT and how these factors affect the marketing environment. The other major objective is to describe how marketing functions are conducted by these transportation systems.

A wide range of nonprofit agencies is responsible for the delivery of social, health, and welfare services to special groups such as the elderly, the handicapped, the developmentally disabled, and the poor. Many of these human service agencies have determined that transportation for their clients is a

*When this work was done the author was Director of the Transportation Institute, North Carolina A&T State University, Greensboro.

serious problem. Often an agency has opened its doors for business and rapidly found that it was able to serve only a fraction of its potential client group because of access problems. This usually stems from the client's lack of an automobile and from a lack of adequate public transportation (1).

Many solutions to agency client transportation problems have been attempted, resulting in a plethora of local special transportation services. These services constitute a relatively young but significant sector called human service agency transportation (HSAT). HSAT may be defined as client transportation systems of human service agencies that are provided or financed primarily for the purpose of improving the mobility of the agency's clientele. This sector is also referred to by other names such as client transportation systems or social service transportation.

These transportation systems take several organizational forms. First, and most commonly, transportation is simply integrated into the existing human service agency structure. Because local agencies are usually small, these single-agency transportation systems rarely operate more than 10 vans, and two to four vans are usual. A small transportation unit within the agency provides service to agency clients for the purpose of facilitating access to agency programs. In these situations the person in charge of transportation usually has several other program responsibilities, although when a system grows to more than five vehicles, a full-time transportation manager is often put in charge of the system.

A second organizational form occurs when several agencies consolidate their systems to achieve economies of scale as well as other expected benefits of consolidation (2). The consolidated transportation agency can be an independent entity or a component of an existing human service agency. Consolidated agencies may operate several hundred vehicles and have budgets of more than \$10 million or they can be much smaller.

In recent years many of these agency-run systems have been supplemented or superseded by city- or county-operated systems. These municipally owned systems often combine a transportation service that is oriented toward agency clients with one that serves members of the general public who are not associated with any human service agency, such as the elderly and the handicapped.

These variations in organizational form mean that the appropriate marketing strategy is somewhat different for each type of system. Other aspects of social service transportation also have an impact on how marketing functions are done, who should do them, and the importance of each function to the organization.

MODERN MARKETING CONCEPTS

The reviewing of how HSAT does marketing goes beyond the narrow concept that marketing is synonymous with selling and promotion. As Kotler puts it "selling is just the tip of the marketing 'iceberg'" (3, p. 6).

The modern private-sector organization recognizes that selling is only one function of marketers. Rather than focusing on selling and promotion, the orientation is toward serving consumer needs (4). A first step in this process is understanding the markets. Next, the organization must attract resources and convert them into products, services, and ideas that are responsive to the demands of the markets. The final step is the effective distribution of the organization's output to the consumers.

A central theme of this approach is the mechanism of exchange (5), which allows the producer and the consumer to transfer something of value to acquire what they need. This leads to the following definition of marketing:

Marketing is the analysis, planning, implementation, and control of carefully formulated programs designed to bring about voluntary exchanges of value with target markets for the purpose of achieving organizational objectives. It relies heavily on designing the organization's offering in terms of the target markets' needs and desires, and on using effective pricing, communication, and distribution to inform, motivate, and service the markets (3, p. 6).

This consumer orientation and exchange perspective can be applied to human service agency transportation. However, because this is a nonprofit sector, there are several aspects that call for special attention.

INFLUENTIAL CHARACTERISTICS

There are four influential characteristics of nonprofit agencies reviewed by Kotler (3, p. 9).

Multiple Publics

There are three primary publics to which HSAT must be responsive: agencies whose clients are users of the system, the clients themselves, and government and private entities that provide funds for their operation. From a marketing perspective, each of these publics has a different set of needs that must be considered. This is different from a private organization whose primary public is its customers.

Multiple Objective

Having multiple publics results in multiple organizational objectives for HSAT. The clients' major objective for the service is improved mobility. However, they have a qualitatively different orientation toward the service than most users of public transportation because (a) they may be going to receive life-sustaining assistance, (b) the service is personalized, and (c) the trip itself may have a social value that is independent of its linking function. These factors tend to intensify client attachment to the system.

Human service agencies should have their own sets of objectives for their client transportation systems. For a marketing program to be responsive to these organizational objectives, they must be clear and unambiguous as well as attainable by the organization. Mainly because of their multiple constituencies, human service agencies seem to have difficulty developing an implementable set of objectives.

Funding agencies have their own agenda that, invariably, is related to their sources of funding. For government agencies, which are disbursing public monies, the major stated concerns are the proper use and control of funds. Political considerations are also prevalent although these are not often explicitly stated.

Private funding sources are also concerned with how their grants are being used; however, these grants usually contain far fewer stipulations and requirements than do government contributions to human service agencies.

Services Rather than Physical Goods

The product of HSAT is a service rather than a good. The evaluation of these services by the multiple publics is much more subjective than it is with goods because many attributes of the service are intangible.

Another characteristic that impinges on the marketing of the product is that it is perishable. Empty seats on a vehicle result in an underused resource because this service cannot be stored.

Public Scrutiny

Public-sector organizations are constantly exposed to public scrutiny. This is especially true for HSAT because of the high visibility of the vehicles in the community. It is this visibility that has led directly to the current trend toward coordination and consolidation of services. Underused vehicles advertising their agency names in bold lettering have attracted the attention of many public officials who believe that coordination or consolidation of services will be more efficient and effective than single-agency operation (2).

MARKETING TASKS

All agencies involved in transporting their clients perform some marketing tasks. However, agencies typically do not perform each task uniformly well, nor are marketing functions well integrated into the other management activities of the organizations.

In this section each of the essential marketing functions for HSAT is described. The review of each function is not meant to serve as a how-to manual but rather to identify specific activities that are (or should be) conducted under each function. In cases where organizational form or size influences the particular function being discussed, how the different types of organization would need to modify their approach will be indicated.

DEVELOPING A MARKETING PLAN

For the marketing function to be effective, management must develop a marketing plan that indicates each of the marketing activities, what each activity will cost, when it will be conducted, and who in the organization is responsible for each component. The formulation of a comprehensive marketing plan is a difficult process for HSAT, as it is for most non-profit organizations. The plan may be in the head of the system's general manager, but usually it is not formalized and scrutinized by others in the organization. The agency may know that a survey will be conducted and that some promotional efforts are needed, but there is no comprehensive plan for all these activities.

It is unrealistic to expect that such a plan will be in place when an HSAT organization commences operation. Nonprofit organizations tend to develop a more sophisticated planning process as the need for an annual plan is recognized (3, p. 174). In the early stages the budgeting process represents the organizational plans. Each department's budget must be based on some notion of the activities it will conduct. A budget is prepared that reflects those activities and the funds that are expected to be available.

The larger HSAT organizations will soon progress to a project-planning phase, where plans are developed for individual projects such as a client pro-

file or a review of the pricing system. What is needed is for HSAT to progress to an annual marketing plan and, ultimately, to a point where the annual plan is a reflection of a long-range strategic plan that takes the broadest possible view of the opportunities for the organization to meet its objectives (3, p. 175).

CONDUCTING RESEARCH

Marketing research is performed to get important information on current and potential riders. Management wants to know who their clients are and what travel needs they have (6). This information will be used in the design of the service and as input to other marketing functions.

Maintaining an accurate inventory of the type of passengers the system is serving ensures that the provision of service is tailored to their needs and that the planning of service to meet those needs is based on actual data. An annual on-board survey of system users should be made to assess the quality of the service and to be certain that the agency is enhancing its clients' mobility. This can be done by including in the survey questions that ask the clients for their perceptions about the transportation service. Characteristics to be inventoried include

1. Age,
2. Sex,
3. Handicap,
4. Automobile availability,
5. Household characteristics (e.g., living alone or with family),
6. Availability of alternative travel modes,
7. Frequency of use,
8. Trip destinations,
9. Percentage of trips to major activity centers, and
10. Service quality measures.

Another type of research must also be conducted: Operational information on the service must be collected on a regular basis. Data on ridership by type of service and route are needed to enable management to evaluate the system. This research effort should be closely coordinated with the client research effort.

Data from these two research efforts must be used to evaluate and improve the service. The evaluation process will be discussed in another section of this paper.

DESIGNING THE SERVICE

Human service agency transportation systems have correctly rejected the line-haul orientation of conventional transit in designing their services. This is appropriate. Although human service transportation agencies and conventional transit organizations are both nonprofit agencies, they have very different service objectives. For transit, the primary focus is moving masses of people at a reasonable cost. Social service agencies concentrate on the delivery of services to individuals. They also serve different target groups. Clients of HSAT are mostly the elderly, the handicapped, the developmentally disabled, the poor, and other disadvantaged persons. Conventional transit serves the general public but tends to focus on meeting the travel needs of commuters. Trip purposes are related to target groups. Transit concentrates on the work trip, HSAT on passenger access to medical services, counseling,

meals, and other life-sustaining activities.

These differences are manifested in service design. Services of HSAT are designed to be more demand responsive than those of conventional transit. The aspect of HSAT most essential in reflecting its consumer orientation is that it provides door-to-door service. Some HSAT services have been described as door-through-door to indicate that the drivers often accompany frail or disabled passengers from their homes to the vehicle and then into their destinations. Conventional transit achieves high efficiency because it attempts to serve heavily traveled corridors with line-haul service, which requires the travelers to congregate at designated stops. There are exceptions to this. Many conventional operators have attempted to take the "mass" out of mass transit by instituting demand-responsive dial-a-ride services. These more personalized services are very expensive on a per trip basis and, therefore, are not prevalent.

Human service agency transportation is more demand responsive in other ways as well. Transit routes and schedules are only infrequently changed, but HSAT vans are constantly being redirected. Although most HSAT vans are not controlled on a minute-to-minute basis by a dispatcher, a new customer request can usually be added to the service within 24 hr. Of course, the level of responsiveness of the service has a large impact on efficiency (7). In general, the more responsive a system is the higher its cost will be per passenger served.

There are numerous other design parameters. Some of these are beyond the control of the agency. For example, the geographic area to be served will usually be dictated by the location of the agency and the location of client residences. Similarly, operating hours are dependent on the hours of the agency, except for trips that are not agency related. Eligibility criteria are also dictated by the agency. Choices about vehicle use, wages to pay drivers, and limitations on trip purposes are those over which the agency has more control. An exhaustive discussion of the system design parameters is given by Einstein (8). His analysis also includes a review of how each of the design choices will affect the performance of the system.

EVALUATING AND IMPROVING SERVICES

Input to the evaluation process consists of data from the research efforts, previously discussed, as well as financial and operational information. Using this information, management can calculate performance measures for the entire service or for any component of it (9). The performance measures or indicators must meet two basic criteria: They must be derived from the goals and objectives of the system, and they must be based on reliable data that are readily available at a reasonable cost. Unfortunately, for human services in general and HSAT in particular, these criteria are difficult to meet. The problem of having multiple objectives has already been discussed. The other problem, lack of reliable data, is endemic to human services. Cooper and McIlvain (10, p. 14) report that human service organizations have the lowest level of data sophistication and availability of eight classes of nonprofit organizations. However, recent efforts at developing microcomputer-based management information systems for HSAT should provide better evaluation data in the future (11).

When HSAT agencies have developed a set of objectives, often in the form of a mission statement, they usually mention the concepts of efficiency and effectiveness. Using transit industry definitions,

the term efficiency relates to how well the available resources, in terms of labor and capital equipment, are being used. Thus, the cost per service hour would be a measure of how cost efficient the agency is in operating its fleet of vehicles. The effectiveness concept includes concern about how well the system is used by passengers. Thus, a primary measure of effectiveness is cost per passenger trip (12). Both efficiency and effectiveness indicators should be used in the evaluation process.

The basis for the evaluation process is shown in Figure 1. This diagram illustrates the key role of the evaluation mechanism in the operation of HSAT. Management should use the evaluation process to determine how well the system is meeting its multiple goals and objectives. The key to the entire process is the feedback from the evaluation process to system operation. Modifications to the system should be based on evaluations, or the evaluation process has little value. Evaluations serve to focus attention on problem areas and to guide management in making improvements to the service. Changes to the service could include revisions in the way dispatching is done, modifications to schedules and routes, and adjustment of service hours.

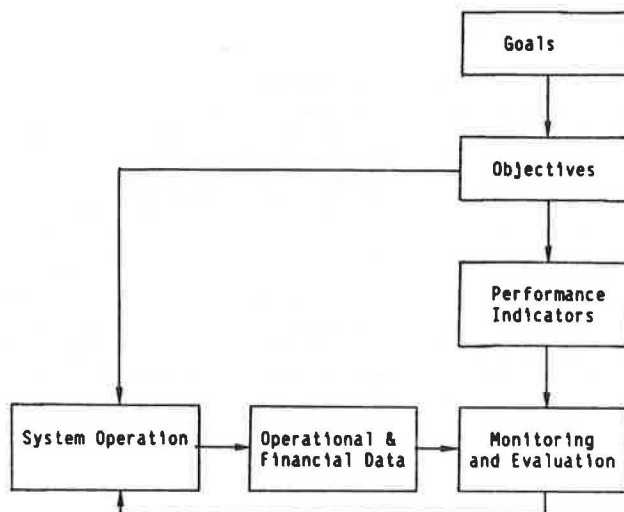


FIGURE 1 Basis for evaluation process.

PRICING SERVICES

For most nonprofit agencies the question of how much to charge for their product has been particularly difficult to answer in recent years. The financial difficulties faced by all levels of government are forcing agencies to reevaluate the extent to which users should pay for tax-supported services (13, p. 190). User charges have been of great concern to public transportation agencies because of increasing costs and large government subsidies.

However, for the single-agency situation, pricing the HSAT service is subject to a set of conditions different than those for public transportation. Riders sponsored by social service agencies do not pay any fare out-of-pocket because the participating agencies pay for the full cost of operating the system.

In the situation where fares are to be charged, Einstein (8, p. 54) suggests that the following conditions are significant:

1. Users must be able to afford fares;
2. Funding sources must permit fares;

3. Insurance policies must cover the increased liability associated with fares; and

4. The operating organization must be able to collect, count, and redistribute the revenues.

What must be added to this is the political dimension. Public policy, which reflects community sentiment, is likely to be willing to provide HSAT at low or no cost to the users. This is so even though the services are extremely costly to operate. Passengers of HSAT rarely pay more than 20 percent of the cost of the service.

PROMOTING THE SYSTEM

Promotional programs also reflect differences in service orientation between conventional transit and HSAT. Media advertising is justified for conventional transit because the general public is the customer. Customers of HSAT do not usually have to be convinced to ride the vehicles. For single agencies transporting only their own clients, no promotional efforts directed to clients are necessary. Of course, this does not negate the need for good public relations.

The promotional effort of a multiple-agency consolidated system should be concerned with selling additional agencies on using the system. In this situation the agencies, rather than individual clients, are making the choice about which transportation service to use. This is somewhat similar to the industrial marketing situation where organizations, rather than individuals, are making the choices about the products and services they want to purchase from other organizations (14,15).

A promotional effort to attract passengers might be indicated in one situation: when a service is being offered to non-agency-related elderly or handicapped persons. However, what usually occurs in this case is that the transportation system has to restrict, rather than attract, passengers. When such a transportation service is initiated some media promotional efforts may be required to inform eligible passengers of the availability of the service. Inevitably the demand soon overwhelms the supply, and the problem becomes not how to get more passengers but, rather, whether to expand the service to accommodate excess demand or put some restrictions on its use. These restrictions are usually in the form of a limitation on the number of monthly rides an eligible client can request or a limitation on eligible trip purposes. Some systems have restricted access by means of an eligibility list, which is closed when the system is oversubscribed.

The need still remains to conduct promotional activities for community relations and general image building. This is part of the positioning concept recommended by Schauer (16). Typical devices used for this type of marketing include brochures, presentations to user and advocacy groups, press releases, face-to-face discussions with human service agency officials, newsletters, and information and referral services (8, p. 240).

CONCLUSION

Human service agency transportation has developed outside the conventional transit industry and exhibits significantly different marketing dimensions. Whereas a good many transit marketing efforts are oriented to capturing additional passengers, HSAT marketing is more concerned with providing a service that is responsive to the needs of agency clients.

Several themes suggested by some pioneers in the

area of nonprofit marketing have been discussed. These pioneers believe that "virtually everything about an organization talks" (17, p. 6). Thus, all HSAT agencies must have a marketing orientation if they are to succeed in meeting their mission of providing better mobility for the elderly, the handicapped, and other disadvantaged persons. The major concern raised in this paper is that of the deficiencies of the marketing function in HSAT.

ACKNOWLEDGMENT

This work was produced under a grant from UMTA to the Transportation Institute of North Carolina A&T State University. The author is solely responsible for the content of this paper. The author thanks Peter Schauer of Boonville, Missouri, for his invaluable assistance in developing the concepts presented here.

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Paratransit and Bus Accidents Involving Elderly and Disabled Passengers: Evacuation and Rescue Problems and Solutions

JOHN N. BALOG and ROBERT J. PAWLAK

ABSTRACT

The provision of efficient and safe methods for the effective evacuation and rescue of elderly or disabled passengers from standard and modified vans, body-on-chassis small buses, and heavy-duty transit buses is necessary to ensure passenger safety. Standard methods are not always effective for these patrons because of their physical or mental condition or their insufficient ability to manage self-evacuation. Effective methods and equipment are identified and developed as a function of transit use by the elderly or disabled, accident incidence types for the various transit vehicles, a study of actual transit vehicle characteristics and their crashworthiness, and an analysis of emergency preparedness forces. Needed equipment is identified and suggestions are made for familiarity and simulation training, development of standard operating procedures, debriefing after actual accident experiences, and sharing technology. An industry-wide project review committee was established to comment on the development of evacuation and rescue scenarios and alternative methods. Transit operators, state departments of transportation, and transit equipment manufacturers were interviewed as part of this U.S. Department of Transportation-sponsored research.

The provision of efficient and safe methods for the effective evacuation and rescue (E&R) of passengers from public transit vehicles is necessary to ensure passenger safety. Methods applicable to the general public, however, may not always be useful in the E&R of elderly or disabled passengers as a result of their physical condition and often of their insufficient ability to manage self-evacuation. The identification, development, and implementation of effective methods for safely evacuating and rescuing such passengers is absolutely necessary and increases in importance as greater accessibility is provided.

The research reported here was sponsored by the Transportation Systems Center and the Urban Mass Transportation Administration (1). The specific goal was to identify and evaluate alternative methods that can be used to ensure the safe and timely E&R of elderly or disabled passengers from standard and modified paratransit vans, body-on-chassis small buses, heavy-duty urban transit buses, and intercity buses. The term elderly and disabled includes any member of the population who is either elderly or handicapped. One does not have to be both elderly and disabled to be part of the population to which this research is directed. Particular concern is assigned to those who, because of age, disability, or age and disability, would find it difficult to escape unaided from an accident involving a public transit vehicle.

An industry-wide project review committee commented on the development of E&R scenarios and on the evaluation of alternative methods, equipment, procedures, and techniques that were identified or developed by this research program.

THE TRANSPORTATION HANDICAPPED

The transportation characteristics of the elderly and disabled population have been extensively studied during the last decade or so (2-4). Much of this work has been concerned with defining a subgroup of the population referred to as the transportation handicapped. Section 16(c) of the Urban Mass Transportation Act of 1964, as amended, defines a transportation handicapped person as

Any individual who, by reason of illness, injury, age, congenital malfunction, or other permanent or temporary incapacity or disability, is unable without special facilities or special planning or design to utilize mass transportation facilities as effectively as persons who are not so affected.

The transportation handicapped differ considerably in the severity and extent of their disabilities, attitudes toward their physical and mental limitations, income, age, and mobility. Because of these differences, the transportation problems and needs of the transportation handicapped also differ widely.

A variety of mobility problems is experienced by the transportation-handicapped population. A national sample survey (4) of the transportation-handicapped population base of 7.44 million persons studied by UMTA revealed the statistics given in Table 1. One can infer that many transportation-handicapped individuals experience some combination of the eight mobility problems. It is important to realize that any of these problems can negatively affect E&R efforts.

EVACUATION AND RESCUE FROM PARATRANSIT VANS

Paratransit vans are growing in popularity among the elderly and disabled and are providing significant numbers of trips in areas where coordinated or special effort systems exist. The E&R of elderly and disabled passengers from paratransit vans is more difficult than from other highway transit vehicles because the percentage of elderly and disabled passengers in vans is much greater than in full-size transit and intercity buses. This can mean that the only able-bodied occupant of a van that has been involved in an accident is the driver. Even if the driver is uninjured or only slightly injured, he or she may not be capable of single-handedly extracting elderly and disabled passengers from the involved vehicle. The help of properly trained rescue, emergency medical services (EMS), and police personnel will generally be required for non-fire-related incidents. In fire-related emergencies, the passengers and the driver may have to rely on the help and assistance of witnesses, nearby motorists, and other Good Samaritans before professional E&R personnel arrive on the scene.

Vans have become commonplace on the nation's highways and typical emergency response individuals may think they are already familiar with vans. However, in paratransit usage, vans are often equipped to seat as many as 15 individuals, may be modified with lifts and tie-down devices to serve the special needs of the disabled, or may be equipped with a raised roof structure. The passengers are consequently tightly packaged within the vehicle.

The critical problems associated with the E&R of elderly and disabled passengers from vans result from an interaction of the characteristics of the emergency-causing incident (ECI), passengers, vehicles, E&R forces, and modifying factors.

TABLE 1 Incidence of General Mobility Problems Among Transportation Handicapped People

Mobility Problems	Transportation Handicapped With Problem (%)
Difficulty going up or down stairs/inclines	64.9
Difficulty stooping/kneeling/crouching	60.6
Difficulty walking/going more than one block	56.9
Difficulty waiting/standing	56.2
Difficulty lifting or carrying weights up to 10 lbs.	47.3
Difficulty moving in crowds	41.4
Difficulty sitting down or getting up	40.5
Difficulty reaching/handling or grasping	33.5

NOTE: Percents add to more than 100% because of multiple general mobility problems among transportation handicapped people.

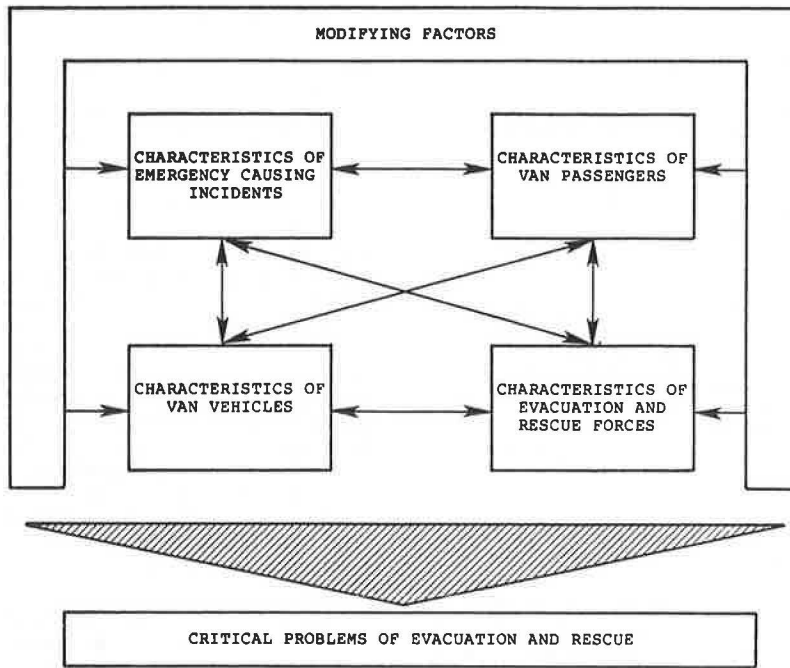


FIGURE 1 Components for developing critical evacuation and rescue problems.

Emergency Characteristics

The interaction of these characteristics in the development of critical E&R problems is shown in Figure 1. An ECI may be any of the following events: driver incapacitation, collision, rollover, fire, water immersion or submersion, or any combination thereof.

Incapacitation of the driver is an interesting ECI. If it happens while the van is in motion, it can lead to 10 combinations of ECIs as shown in Fig-

ure 2. Even if incapacitation happens while the vehicle is stopped, an emergency could develop if, for example, the passengers are retarded to the point of not being capable of taking control of the situation; the passengers, perhaps wheelchair users, are disabled to the point that they cannot easily leave the van to seek help; or the senility of the passengers prevents them from taking direct positive action. Figure 2 can also be used to define schematics of other emergencies initiated, respectively, by a collision, a rollover, fire, or water immersion or submersion.

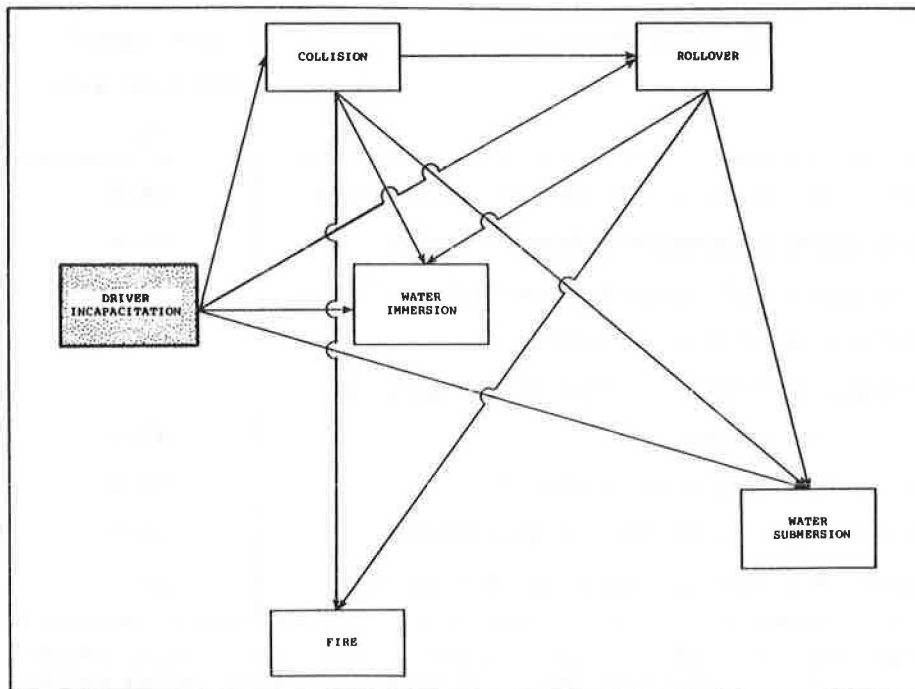


FIGURE 2 Schematic of various emergency-causing incidents initiated by driver incapacitation.

Of the ECIs or combinations thereof, those that involve fire or water immersion or submersion may allow the least time for E&R. If the first evidence of a van fire is smoke, the operator may have time to evacuate all occupants before the vehicle becomes totally involved. Such an evacuation would have to be conducted by the operator in a very physical manner; there probably would not be sufficient time to use a wheelchair lift or ramp. Evacuation should always occur before any effort is made to fight a fire. If the first evidence of a fire is flame, only those most easily assisted would probably have time to escape; a form of triage would occur.

For example, a paratransit association recently experienced an emergency when the engine compartment of a modified van ignited without warning and from an unknown cause. The vehicle was lift equipped and was carrying 11 retarded adults and a driver. When smoke appeared, the driver evacuated the passengers through the right front door. After getting what he thought was everyone off the van, he counted the passengers and found that one was missing. He re-entered the vehicle and had to physically remove one passenger who had become immobilized as a result of the emergency. Recognizing that retarded individuals have a tendency to wander off, he told all of them to form a single-file line and to move away from the vehicle. Figure 3 is a photograph of the burned van in a storage yard.



FIGURE 3 Modified paratransit van: fire as the emergency-causing incident.

Submersion in water would probably result in few survivors. Presumably each of the occupants would be initially dazed by the impact with the water and instinctive reactions would govern. With a lift-equipped van, the right side door in most cases would not be functional as an exit. Similarly, the rear door of any van equipped with a full-width rear seat would be difficult at best to use, particularly with the force of the water against it. This would leave only the two cab doors as the most probable exits. The driver side door would be less than ideal for volume escape because of the seat and the position of the steering wheel. The expectation that many passengers would survive a submerged-van accident is minimal.

The outcome of other ECIs (and combinations) can be mitigated to a greater extent because of the probability that some time will be available for E&R and EMS personnel to arrive on the scene and to administer appropriate treatment. However, complex extrication may be required if the van has rolled over. In the accident shown in Figure 4, a council



FIGURE 4 Susanville, California, accident: van in final resting position at accident site.

on aging van was struck on the left front by an opposing pickup truck. Six passengers were killed, and five sustained significant injuries. Two of the injured were pinned in the wreckage. The upside-down orientation of the van made gaining access to the victims extremely difficult. A crushed roof and van body distortion also contributed to the problems of E&R and the administration of emergency medical services.

Passenger Characteristics

The characteristics of van passengers play an important role in the development of critical E&R problems. In the worst cases, passengers may be only partly mobile, nonambulatory, senile, retarded, blind, deaf, or some combination thereof.

These characteristics can cause the following problems for E&R and EMS personnel during an emergency: Passengers may not be able to effectively communicate; passengers may have preexisting conditions, perhaps medical, that may affect the type of emergency treatment required and the manner of its administration; passengers may become entrapped or impaled by the very aids that generally improve their life experience (e.g., wheelchairs, tie-downs, walkers, crutches, prostheses); passengers may not be rational; passengers may not be able to physically contribute to extrication maneuvers; or passengers may have to be specially packaged before removal from the vehicle and transport to a hospital.

Van Characteristics

The characteristics of paratransit van vehicles also contribute to the development of critical E&R scenarios. For example, they possess a greater propensity than automobiles to overturn and to have doors jam. They are often fully loaded with as many as 15 occupants; they are often equipped with a wheelchair lift device that, in the stored position, can prevent emergency exit through the door in which it is placed (Figure 3 shows a typical blockage); they are often equipped with a full-width rear seat that can prevent easy emergency exit through the rear door; and they may have been modified with a roof structure that has reduced the structural integrity of the vehicle and that allows greater crush penetration into the passenger compartment or contributes to the ease of passenger ejection.

Rescue Worker Characteristics

Also contributory to the development of scenarios of critical E&R problems are the characteristics of the E&R forces. Assuming that all the personnel are appropriately motivated to respond to emergencies in an effective manner, the two relevant characteristic bundles are availability of necessary and appropriate equipment and demonstrated ability to make the best use of all resources as a result of proper education, training, and simulation exercises.

Because most E&R forces currently have only minimal experience with van accidents, perceived basic equipment needs are the result of speculation. Only more experience and the simulated extrication of elderly and disabled passengers from paratransit vans will provide an answer. In any case, this factor can contribute to critical E&R problems.

Definitive statements can be made about education and training. The better educated and trained the E&R force, the more impressive is their performance in an actual emergency. This cannot be overstated. A paratransit van accident is an infrequent occurrence and may require the application of unique and complex techniques. The only way to be prepared is to be familiar with what to expect from the vehicles and with what to expect, or not to expect, from the passengers.

Modifying Factors

The type of ECI and the characteristics of the van vehicle, the passengers, and the E&R forces all interact to form a unique emergency situation. However, there are several modifying factors that can further contribute to the complexity. They include, for example, the time of day of the accident, the day of the week, the location of the accident, and the potential for secondary injuries.

The first three modifying factors can be addressed simultaneously. If the incident is in an urban area, it is probable that it will be identified quickly and that E&R and EMS personnel will be able to reach the scene quickly. In contrast, a rural setting may mean that precious time is lost before a passerby notices the accident, particularly if it is of the off-the-road or water immersion or submersion type, and before E&R personnel can arrive on the scene. Similarly, with time of day and day of week, the response time and the number of respondees may affect both the timeliness and the adequacy of emergency actions and treatment.

With highway vehicles, there is always the potential for secondary injury to passenger victims and for primary injury to rescue forces, other motorists, witnesses, and spectators. Such injuries may be caused by an after-the-accident fire or explosion; involvement of other vehicles with the wreckage, rescue equipment, personnel, or victims; ineffective or improper use of equipment; and inappropriate extrication methods or procedures used on the victims.

Emergency Response Effectiveness

The effectiveness of the E&R of elderly and disabled passengers from paratransit vans is a function of actions in three distinct temporal frames: preaccident, prearrival on-site (after accident), and on-site.

The most effective E&R procedures are founded on the following preaccident actions: the use of quality personnel, the continuing education of personnel, the continuing training and simulation experi-

ence of personnel, and the availability of a reasonable quantity of specialized equipment.

Every effort must be made to ensure that the best available personnel are identified and hired for E&R and EMS duties. They must be sensitive, properly motivated, dedicated to the saving of lives and the minimization of injuries, and reasonably intelligent. These carefully selected individuals must be given the opportunity to become fully educated about the frequency of use of paratransit vans by elderly and disabled passengers; the physical, mental, and emotional characteristics of elderly and disabled passengers; the characteristics of the prostheses and orthopedic aids used by elderly and disabled passengers; the characteristics of the paratransit vans, including special modifications, primarily used by elderly and disabled passengers; and the need in most cases to handle and treat elderly and disabled passengers differently than passengers who are not elderly or disabled.

This necessary education is best accomplished by requiring classroom instruction; direct contact with elderly and disabled individuals and the paratransit vehicles they use; and simulations of paratransit van accidents, including collisions, rollovers, fires and water immersion or submersions, using actual or mock elderly and disabled "victims." A single simulation is better than none but the best E&R responses will come from forces that have experienced multiple simulation exercises designed to acquaint personnel with the uniqueness of paratransit vans and elderly and disabled passengers.

It is necessary for the E&R unit to own a basic set of equipment and to be fully familiar, through training and simulation, with its characteristics and capabilities. It is also important to provide simulation training that will encourage personnel to be innovative when necessary to react to unusual or unexpected circumstances.

The effectiveness of E&R procedures is also dependent on the prearrival on-site actions of the emergency preparedness forces. When notice of a van accident is received, it is imperative that the following be obtained in addition to regular information: whether it is a paratransit van; the name of the agency operator (usually on side of van); if the van has rolled over; and the number of occupants of the van.

If it is a paratransit van, it can be immediately assumed that all of the passengers are elderly or disabled and that extrication will require considerable effort. An appropriate, probably large, contingent of E&R and EMS personnel should be dispatched to the scene along with an adequate number of ambulances.

While this contingent is on its way to the scene, the dispatcher or other designated individual should call the agency operator to determine the preexisting medical conditions of the passengers and to associate those conditions with specific individuals. This information should be radioed immediately to the rescue and EMS forces. A representative of the operating agency should also go to the site, if it is within a reasonable distance, to provide assistance and information to the forces and reassurance to the passengers.

When on-site, the E&R and EMS personnel must bring all of their education, training, experience, and capabilities to bear on the problem at hand. This means recognizing the presence of elderly and disabled passengers, assessing their injuries, taking immediate life-saving actions, stabilizing injuries, packaging victims appropriately (it may be necessary to assume fractures to all limbs and spinal injury if para- or quadriplegics are on board), extricating victims from the vehicle, and

transporting them to hospital facilities. This often has to be accomplished without any aid from the injured passengers.

The agency operator of paratransit vans should also help E&R personnel before the occurrence of an accident. It is recommended that all van operators provide the E&R and EMS forces in their service area with the following information: agency name, address, and telephone number; names and telephone numbers of responsible primary and backup officials; description of vehicles in fleet including passenger carrying capacity; characteristics of the passengers most generally transported; and any other information that could be useful to E&R and EMS personnel in the event of an accident.

Each agency should develop an identification card that is carried by each passenger and contains such pertinent information as name and address; date of birth; description of the individual (eye color, height, weight, hair color, and so forth); person to notify in case of emergency (and telephone number); existing medical condition or injuries; unusual characteristics (e.g., senility, retardation, deafness, missing limbs, wheelchair user); and name and telephone number of attending physicians, doctors, and therapists. These client-specific cards should be bound in plastic for durability. The intent of the system is to provide E&R and EMS personnel with specific on-site information about accident victims.

It is also recommended that all paratransit vans be equipped with two-way radios (mounted to be accessible to passengers as well as to the driver) and permanently posted with instructions on how to use them. In the event of an accident or emergency, the driver could call for help. If the driver is incapacitated, a passenger could call for help. If the radio is still operable after an accident, E&R personnel might want to converse directly with the agency about a victim.

Another recommendation is that every paratransit van should bear the name of the sponsoring agency on its side and should have a unique identification number. Again, these measures could speed the flow of critical information to E&R and EMS personnel.

Because there are so few paratransit vans compared with passenger cars, their involvement in an accident is a rare, or even unique, event for rescue and EMS personnel. It is, consequently, imperative that these personnel be fully debriefed about their experiences and that the results be disseminated. Actual experiences could serve as the basis for the development of more effective training programs and simulations, the clarification of what equipment and procedures were appropriate and useful, and the determination of what voids exist and need to be filled. Documentation and full dissemination of such experience would indeed benefit the industry.

EVACUATION AND RESCUE FROM BUSES

As might be expected because of their widespread availability, buses are relied on most frequently by elderly and disabled people. Buses are used by 22 percent of the total elderly and disabled population and provide 41 percent of their trips.

The frequency with which elderly and disabled people will be encountered on a bus is a variable quantity. Historically, a large proportion of transit riders have been the captive transit dependents, which include the elderly. Overall elderly people may have represented 40 percent of all transit riders. However, the temporal distribution is not uniform. The number of elderly passengers is significantly lower during peak hours, which are largely devoted to work-oriented trips, and higher during

off-peak service. Consequently, although bus occupancy may be lower during the non-peak period, the proportion of elderly passengers on board may be much higher. Generally, with the exception of some special express bus commuter services, it is probable that there will be elderly passengers on board every bus trip.

The aurally and visually impaired are also frequent users. The deaf and hearing impaired are difficult to recognize but may need special help during an emergency because they would not receive verbal directions unless they were in a position to read lips. The blind person is distinguished by the presence of a cane or a seeing-eye dog. However, currently only about 3 percent of the visually impaired population use dogs.

Although the overall incidence of wheelchair users within the general population is known to be around 0.2 percent, their transit ridership characteristics are not yet defined. Obviously those systems with inaccessible fleets have zero ridership. It must be emphasized that no major metropolitan area has as yet established a fully accessible bus transit system. However, in Seattle, where an overall environmental as well as transportation commitment to accessibility has been made, the rate of wheelchair ridership is approaching that expected from their population incidence and similar trends are evident in some smaller cities such as Johnstown, Pennsylvania (Cambria County Transit Authority) where a high level of accessibility is provided.

Buses may most conveniently be divided into three categories: body-on-chassis and other small buses used in paratransit for elderly and disabled passengers in small cities or rural areas; heavy-duty transit buses designed for long life, low maintenance operation in regular fixed-route transit services; and motor coaches designed for over-the-road intercity service. Buses experience the same ECIs as vans but their large size and weight generally protect passengers. It is apparent, though, that existing methods for E&R of elderly and disabled passengers leave a lot to be desired. Many of the suggestions previously offered in the paratransit van section are also directly related to E&R from buses: familiarity training; equipment training; operational procedures; simulation training; debriefing after accidents; and technology sharing. In this section some of the problems and solutions that are bus-specific will be considered.

Emergency Equipment and Information

Some common emergency equipment is adequate and should be required by operators to be on board. However, it is apparent that some new equipment needs to be developed and implemented by system operators, bus manufacturers, and emergency personnel.

The transit operator should require all purchased buses to be equipped with an appropriate hand-held fire extinguisher and a first-aid kit. Drivers should be trained to initially fight a fire after all passengers have been evacuated and to administer basic first aid. Agency operators of buses should display their names on the sides of their vehicles and provide all relevant emergency information to rescue personnel before the occurrence of an accident. Passenger information should also be available for use by emergency personnel at the time of an accident. Drivers should identify and demonstrate the use of all emergency exits to passengers using a custom-designed procedure.

The manufacturers of buses should recognize that their vehicles could be involved in an emergency in-

cident. Therefore, information on how to get out of the bus, directed to passengers, and information on how to get into the bus, directed to rescue forces, should be displayed. For example, information on the location of emergency exits should be clearly and permanently attached to the interior of the vehicle. Ideally, passengers should have more than one egress option. Information should also be posted on how to open the exit. This is an area where standardization of symbols and location of information is needed. Figures 5 and 6 show positive emergency exit signage and, in the case of the body-on-chassis bus shown in Figure 6, instructions on how to open the exit.



FIGURE 5 Emergency exit signage: school bus fitted for E&H passengers.



FIGURE 6 Emergency exit signage and instructions on a body-on-chassis small bus.

Rescue forces need to know which windows are meant to be used as exits. Generally, buses have no information on their outside that would help emergency personnel or Good Samaritans gain access to the interior of the vehicle. Yet, if a bus turns over on its door side, the only available exits are the windows or the roof escape hatches. With respect to the escape hatch, no information is on the top (outside) of the bus or on its side indicating existence of the hatch. The two most widely used roof escape hatches vary greatly in their design and in ease of opening from the outside.

Information should also be placed on the outside of vehicles about how to open doors. Some intercity coaches are equipped with an outside door opener but

no attention is drawn to it by words or symbols. One can appreciate that this is done with the intent of preventing theft and vandalism. However, the goals of access and security could probably both be realized with a clever application. In some ways, this is similar to the universal key concept for rail transit systems.

The final suggestion to manufacturers is the need to produce a reasonably inexpensive, reliable, and effective engine compartment fire suppression system. Several currently exist that are effective in some ways, but improvements could still be made. A suppression system can be the first step in the E&R process associated with a fire incident; and, indeed, such a system could either eliminate the cause of the emergency or provide valuable time.

Emergency forces also need additional equipment for effective use of window exits. If a bus equipped with hinged windows turns on its side or on its roof, the windows, once disengaged, fall by gravity to the side of the bus in newer models or remain vertical and facilitate escape. In contrast, accidents in which the vehicle remains upright and the door is blocked or rendered inoperable require that the emergency exit windows be used. The simple question is how does one keep the window open while EMS personnel and supplies enter the passenger compartment and while injured passengers, some on stretchers or backboards, are removed? Obviously, expandable poles can be used and need to be made available at low cost to emergency forces. In addition to facilitating access, an effective device would prevent a 40- to 80-lb window from falling on a passenger or an emergency worker.

Related to the window exit equipment situation is the need for a short ladder that can be used to reach the windows from the ground if the bus is upright or to reach the side of an overturned bus (Figure 7). This should not be a difficult development problem. A question to be raised is whether such ladders should be carried on the vehicle during revenue service.



FIGURE 7 Urban transit bus accident.

Last, emergency personnel should be creative in their response to an emergency. For example, the author witnessed an accident simulation that included a victim with a spinal injury. The EMS personnel struggled for quite some time trying to place a canvas and stave spinal immobilization device on the victim. In reality, this victim would have probably suffered a great deal during this struggle.

However, it seems apparent that the victim was already in a contoured device, the seat, and it would have been more effective to strap him to the seat and remove the seat from the vehicle.

Learning and Sharing

Every transit system or operator investigates each accident that it experiences to determine whether it was avoidable and to determine disciplinary action. Few systems or operators debrief with the intent of identifying which E&R methods were effective and which were not, what changes should be made to standard operating procedures if they exist, and what modifications should be made to the vehicles or their safety equipment. Yet this is exactly the type of information that needs to be collected. If it were collected, it would be disseminated to all interested individuals and groups and produce a positive educational benefit. For example, the body-on-chassis bus shown in Figure 8, which reportedly rolled over and landed on its side, clearly exhibits a crashworthiness capability of which other operators should be made aware.



FIGURE 8 Body-on-chassis small bus accident.

The sharing of technology associated with the crashworthiness of transit vehicles and the techniques of E&R from them is encouraged. The dissemination of this paper and the complete final report (1) contribute to this goal. Systems and operators are also encouraged to contribute to the identification and development of E&R equipment and techniques. A formal program sponsored by the American Public Transit Association might afford a means of distributing the cost burden among all operators.

SUMMARY

The provision of efficient and safe methods for the effective E&R of elderly and disabled passengers from paratransit vans, body-on-chassis small buses, heavy-duty urban transit, and intercity motor coaches is necessary to ensure passenger safety.

Elderly and disabled individuals can be the majority of passengers on standard and modified paratransit vans and on body-on-chassis small buses. In contrast they are found to lesser degrees on urban transit buses and intercity motor coaches. Their incidence on vans and small buses is expected to increase because of the special-effort services being

provided by transit operators. The existing incidence of travel on the remaining kinds of buses is expected to remain constant.

Standard paratransit vans seem to possess sufficient crashworthiness characteristics but appear to be more inclined than automobiles to roll over in accidents. Modified vans, if properly constructed, possess safety characteristics similar to those of standard vans. However, poorly designed raised roof structures, wheelchair lifts that block entrances and that are not effectively counterbalanced, and other poorly accomplished modifications have been proved to reduce the degree of safety associated with some modified vans.

Body-on-chassis small buses, if properly designed and constructed, seem to possess sufficient crashworthiness characteristics but appear to be more inclined than automobiles to roll over in accidents.

Heavy-duty urban transit buses and intercity motor coaches seem to exhibit positive crashworthiness characteristics. The crashworthiness of highway transit vehicles is important because it influences the kind of crush that can be withstood and as a result the amount of entrapment that may occur and the kind of equipment and procedures that must be used for extrication.

Standard automotive E&R techniques serve as a basis for the E&R of elderly and disabled passengers from transit vehicles but are not sufficient in and of themselves. Passengers may be only partially mobile, nonambulatory, senile, retarded, blind, deaf, or some combination thereof. These characteristics cause problems for E&R and EMS personnel. Elderly and disabled passengers may not be able to effectively communicate; they may have preexisting conditions (e.g., medical) that may affect the type of emergency treatment required and its administration; they may become entrapped or impaled by the very aids that improve their life experience; they may not be rational or able to physically contribute to extrication maneuvers; and they may have to be specially packaged before removal from the vehicle and transport to a hospital.

Various identified scenarios of emergency-causing incidents and accident types were determined. Evaluation of the methods and equipment characteristics with respect to these scenarios reveals a number of shortcomings that fall into the following generic categories: familiarity training; equipment training; operational procedures; simulation training; technology sharing; and debriefing after accidents.

There is a definite need for emergency preparedness individuals to become familiar with the characteristics of transit vehicles and the environments in which they operate, and with the characteristics of elderly and disabled passengers. Transit operators need to interface with emergency forces to contribute to preaccident familiarity.

There is a definite need for the development of specific E&R equipment and for creativity on the part of rescue forces in the use of currently available equipment.

There is a definite need for the development and implementation of standard operating procedures for transit operators and for emergency forces. These developments should be accomplished jointly.

There is a definite need for properly designed and conducted simulation training exercises, which occur regularly and which fully involve all relevant parties including actual or mock elderly and disabled passengers.

There is a definite need for the expansion of existing technology-sharing programs to include information on E&R. This will require E&R forces, transit operators, and others within the industry to fully document experiences and to convey this information

to appropriate governmental or industry officials.

Finally, there is a definite need for the debriefing of all personnel involved in transit accidents, which required the E&R of elderly and handicapped passengers, in order to gain additional information on the effectiveness of existing techniques and equipment and to identify newly developed methodologies and equipment. This needs to be done in concert with a technology-sharing program.

ACKNOWLEDGMENTS

The successful completion of any project can be attributed to a number of individuals who serve without seeking direct recognition of their contributions. For this project, the number is significant: Arthur L. Flores, William T. Hathaway, Irving Litant, Stuart Palonen, Richard J. Porcaro, Donald E. Sussman, and Stephanie H. Markos from the Transportation Systems Center; Adbo S. Ahmed, Roy Field, Jeffery G. Mora, Lloyd G. Murphy, and Patricia Cass from the Urban Mass Transportation Administration; George L. Cancro, Robert S. Carpenter, Richard Fasy, Farnham Folsom, Terrence J. Moakley, Thomas O'Brien, Albert Sergio, Robert Williams, and Carmello Strano, the members of the industry-wide review committee who spent significant amounts of time contributing their expert comments on the draft documents and at review committee meetings; Robert E. Scott from the

subcontractor, the University of Michigan Transportation Research Institute; the Montgomery County Paratransit Association, the California Highway Patrol, and the Kentucky State Police, all of which provided photographs of transit vehicles involved in accidents; and Coach and Equipment Sales Corporation and Wayne Corporation for providing interior photographs of their transit vehicles.

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Funding of Demand-Responsive Transportation for the Elderly in Pennsylvania with State Lottery Funds

MICHAEL BROWN

ABSTRACT

The funding of demand-responsive transportation has taken a unique turn in Pennsylvania since the passage of Act 101 of 1980. Through Section 406 and a subparagraph of Section 203, funds have been made available for counties to plan, establish, and operate shared-ride demand-responsive transportation systems that are preferentially for the elderly and also open to the general public. Senior citizens age 65 and above ride at 25 percent of the established shared-ride fare, and the balance is paid by the Commonwealth of Pennsylvania through the State Lottery Fund. The general public rides at the regular fare. The lottery funding has provided a stable source of revenue for demand-responsive systems because there is no ceiling on operating funds. The program has strengthened existing providers and enabled new ones to begin service in previously un-

served areas, thereby making inexpensive transportation available to hundreds of thousands of elderly individuals. The development and details of the program are reviewed, and its evolution through the first 3 years of operation is summarized. Data on payments and ridership are included, as is a review of the impact that the program has had in its short history: making general public demand-responsive transportation services available in most areas of the state and contributing enormously to the mobility of Pennsylvania's citizens, particularly those in rural areas who had previously had very little public transportation service.

One of the major developments in transportation during the late 1960s and the 1970s was the rapid evolution of shared-ride demand-responsive services. Such services developed as a supplement or alterna-

tive to traditional fixed-route bus services and call and demand taxi services, and generally were created to provide service to those individuals without access to fixed-route services (e.g., residents of rural areas) or who found it difficult or impossible to use fixed-route services (e.g., handicapped or poor individuals).

During this period a long series of studies and demonstration programs examined and experimented with the numerous variations of demand-responsive services that had come into being worldwide. By the end of the seventies, all the studies and demonstrations pointed to several areas of major concern that would have to be addressed if demand-responsive services were going to be able to help alleviate the problems of the transportation disadvantaged. The major problem was lack of a consistent funding base on which providers could depend. Efforts to generate interest in demand-responsive services at the local level continually floundered on that point. The demonstration programs illustrated the problem most clearly because they made money available for short periods of time, usually a year or two, then required the services to support themselves. Because operating revenues could not support the service and because the local tax base was generally unable or unwilling to do so, the services were cut back or discontinued altogether. Only those services that were directly associated with client transportation for specific social service agencies were able to operate successfully. Here also the quality and quantity of service fluctuated according to the results of the annual budgeting process at the federal, state, and local levels.

Without the commitment of government to fund the operating deficits of demand-responsive service as it did urban fixed-route systems, such services continued to be marginal at best. To make things worse, in Pennsylvania as in so many other places, the high inflation of the late seventies, coupled with a slowdown in government's ability to absorb rapidly expanding social service program costs, began to eat away at the social service transportation network as well.

ACT 101

It was in this general atmosphere that, in 1980, the Pennsylvania legislature took up the task of consolidating numerous state laws governing transportation. Representatives of predominantly rural areas had for a number of years been complaining of the inequities of one program in particular, the Free Transit Program for Senior Citizens. The Free Transit Program provided fixed-route operators who participated in the program with 75 percent of the average fare for each senior citizen they allowed to ride free during nonpeak operating hours.

Rural legislators pointed out that fixed-route bus service existed almost exclusively in urban and suburban areas and, as a result, their constituents contributed to the lottery fund by buying tickets but were denied any corresponding benefits because transportation services did not exist for them to use. Realizing that fixed-route transit service could not be successful in rural areas, the legislature added provisions to the new law making lottery funds available to plan, develop, and operate shared-ride demand-responsive transportation systems that would be primarily for senior citizens but also open to the general public. The consolidation bill passed and was signed into law by Governor Thornburgh as Act 101 in October 1980. For the first time a continuing source of funds was made available to sup-

port demand-responsive transportation services. The Pennsylvania Department of Transportation was given overall responsibility for the administration of the program after consultation with the Department of Aging on the operating guidelines to be implemented.

Section 406

The funding of demand-responsive transportation services is embodied in two separate sections of Act 101, and each section has a somewhat different approach. Section 406 is a county entitlement program and makes a specific amount of lottery money available to each county (except Allegheny and Philadelphia counties). The amount is based on a formula involving the number of senior citizens in each county, and no county is eligible for more than \$600,000 or less than \$37,500. The county commissioners from each county have to be the applicants for the funds. The funds will lapse only if the county fails to develop some kind of system within 5 years, and they can be used in a variety of ways (Table 1):

TABLE 1 Summary of Applications and Approvals for Section 406 Funds as of March 31, 1984^a

Type	No. of Applications	No. Approved	Funds Requested (\$)	Funds Approved (\$)
Planning	42	42	567,481.00	567,481.00
New or expanded (capital funds)	76	73	5,274,422.00	4,198,707.67
Revenue replacement	39	39	1,393,992.00	1,393,992.00
County transportation systems	<u>16</u>	<u>16</u>	<u>507,346.91</u>	<u>507,346.91</u>
Total	173	170	7,743,242.58	6,667,527.58

^aSixty-one counties applied.

1. For counties wishing to establish or expand shared-ride demand-responsive transportation services, Section 406 funds up to 100 percent of the cost of planning.

2. Section 406 also pays up to 100 percent of eligible capital and start-up costs. Section 406 funds have been used by counties to purchase a wide variety of capital equipment, such as vehicles, radios, computers, office furniture, buildings, mechanics' tools, and copiers. Start-up costs paid for have included radio and newspaper advertising, driver and staff training, telephone installation, wages and benefits, and printing. More than \$4 million in capital or start-up grants have been approved, and more than \$2 million in payments were made through December 1983.

3. In addition, Section 406 funds can be used for revenue replacement. Each senior citizen age 65 and above riding on shared-ride demand-responsive services must pay 25 cents or 25 percent of the regular adult fare, whichever is greater. This senior citizen payment may also be made by a third party, such as an area agency on aging. The remainder of the fare is paid with state lottery funds. The general public rides at the regular adult rate.

4. Counties also have the option of developing their own system, totally owned and operated by county personnel and using county equipment. Senior citizens ride free and the lottery fund pays 75 percent of the total operating costs. The county is responsible for the balance of operating costs. A fare

structure may be established for general public riders if the county desires.

Section 406 requires that counties become directly involved in the planning process for demand-responsive services. It requires that an integrated transportation network be developed and that the services not compete with existing forms of transportation. In addition, as mentioned previously, Allegheny and Philadelphia counties were specifically excluded from the provisions of Section 406. This was done to emphasize the desire that the more rural counties develop shared-ride systems.

Section 203

Allegheny and Philadelphia counties were not altogether excluded from the program, however. The other part of Act 101 that relates to demand-responsive transportation is Section 203, and providers in Allegheny and Philadelphia counties were eligible for Section 203 funds immediately, whereas providers in Pennsylvania's other 65 counties had to wait until July 1, 1982, to become eligible. The following list is a summary of Section 203 applications and payments for fiscal year 1983-1984, as of March 31, 1984.

Total applicants	78
Total contracts approved	82
Applications pending	12
Total funds applied for	\$15,448,272.00
Total funds approved	12,577,110.00
Total payments made (1983-1984)	7,232,819.16
Total payments made (1982-1983)	4,529,479.65

The use of the term "providers" indicates a major difference between Sections 203 and 406. Whereas Section 406 is a county entitlement program, under Section 203 any eligible provider can apply directly for a grant. Eligible providers are defined as any one of the following:

1. Any private carrier certified by the Pennsylvania Public Utility Commission to provide shared-ride or paratransit service;
2. Any county or local government;
3. Private nonprofit corporations that are "substantially under county control"; this means that the county commissioners approve all fares and services and any changes to either; and
4. Public transit authorities that provide shared-ride service.

Clearly, grants under Section 203 could be made to a variety of providers. In addition, there was no requirement in Section 203 that service provision be coordinated. As the two programs got going, this was to become a significant issue.

PROGRAM DEVELOPMENT

Because guidelines on Section 406 were developed first, that portion of the program got started first. It quickly became evident that there was great potential and a great necessity for flexibility in the program. The Department of Transportation in its administration of the program developed program guidelines that emphasize three basic requirements:

1. The service had to be demand responsive,

2. Reimbursement was only for senior citizens age 65 and above, and

3. The service had to be open to the general public.

Many counties began by using a part of their entitlement for planning purposes, and to date over half of the 65 eligible counties have done some planning, and \$500,000 have been committed statewide for that purpose.

Because the law said nothing about who was responsible for the planning effort, each county was free to draw on whoever was capable of performing the work. A great many counties hired consultants who were experienced with transit planning; other counties did the work through their transit authorities and planning commissions. Still other counties did no planning at all. The latter have systems in place that already meet the eligibility criteria. They began using their entitlement monies for improvements, expansion, and service provision.

Counties have used the largest portion of their entitlement funds for capital and start-up costs. When counties had developed and submitted an acceptable plan, they were free to purchase goods and equipment to be used to meet the requirements for service as set forth in the plan. As long as the kind of service to be provided was eligible for funding, any capital and start-up costs associated with its development, improvement, or expansion were fundable at 100 percent through Section 406.

The operational part of the program has been most challenging, both during the early phases of the program and on a continuing basis. The requirement that local transportation services had to be coordinated led to some interesting and troublesome developments in several counties. Because of the variables, such as the history of transportation in the county and the working relationships between the county commissioners, the social service agencies, and any private and public carriers, every county's system developed in a unique way.

Because the law did not prescribe in detail how systems were to be organized, who should run them, and who was to be in charge, those questions had to be answered in the local planning process. On numerous occasions the Department of Transportation program administrators were asked to referee local disputes of various kinds, but the administrators took the position that this was not an appropriate role. The department took the position that all eligible providers had to be given the opportunity to participate and in some instances had to insist that some agencies or private providers who were being excluded be given that opportunity. The degree of participation and the overall structure of the system, however, were ultimately local decisions. Because it is a county entitlement program, decisions about the structure of the system ultimately rest with the county commissioners. As a result, every county's demand-responsive system has developed in a slightly different fashion from every other county's. A sample of the differing setups includes

1. Service operated directly by the county in county owned and operated vehicles. These are usually run through a designated lead agency, such as an area agency on aging, a community action agency, or a county transportation office.

2. Service contracted to private carriers (bus and taxi companies).

3. Service provided by public carriers (transit authorities).

4. Services provided by private and public nonprofit corporations, such as community action agencies, YMCA.

5. Services provided by social service agencies (area agencies on aging) but open to the general public.

6. Services provided by various combinations of the aforementioned provider types.

Except for a very few instances, all these services, including those operated by social service agencies, were open to the general public and charged a fare. As might be expected, there was a good deal of initial reluctance, particularly among many social service agencies, to open the service to the general public. The fear was expressed that general public ridership might clog the social service delivery system and make agencies' service to their respective clients more difficult. However, because only senior citizens were entitled to discounted fares and the general public had to pay full fare for trips, the Department of Transportation was fairly certain that a large percentage of general public ridership was extremely unlikely. In spite of the fact that more general public ridership would be desirable, it has not yet materialized to any substantial degree. Vehicles crowded with businessmen and students while agency clients are left behind have proven to be a theoretical rather than an actual problem.

In light of the historical difficulties of getting social service agencies to participate in coordinated transportation efforts, it is worth emphasizing that the carrot in Pennsylvania's demand-responsive program is the 75 percent reimbursement for senior citizen trips. Most senior citizen transportation in Pennsylvania is provided by local or regional area agencies on aging, which generally have the largest and most sophisticated of the social service transportation systems, particularly in rural areas. Agency concerns for their clients notwithstanding, the obvious advantage of having clients age 65 and above transported at only 25 percent of the former cost attracted directors of services for the aging and county commissioners. The law expanded service not only by making each local dollar stretch nearly four times as far but also by stipulating that the service had to be available to all senior citizens. This had the effect of eliminating income and other restrictions (such as car ownership) that had made some senior citizens ineligible for transportation services in some places.

MAINTENANCE OF EFFORT

Because of the obvious financial incentives for aging services participation in the Section 406 program, there was a fear in the Department of Transportation that agencies would use the program to transfer the burden of funding senior citizen transportation from their own budgets to the Section 406 program. Agencies, it was believed, would continue to provide the same levels of transportation as before and steer their 75 percent savings into other aging programs that were being squeezed by tighter budgets and increasing demand. The Section 406 program would then ironically become one which subsidized other aging services rather than transportation. As a result of these concerns the department developed what was called a maintenance-of-effort requirement. Social service agencies that were providing transportation to aging clients before their participation in the Section 406 program were required, as a condition of participation, to dedicate an equal percentage of their total budget to transportation after their entry into the 406 program.

Almost immediately, however, a movement was begun to have the requirement eliminated or modified. Area

agencies on aging claimed that the requirement handcuffed them in their efforts to allocate diminishing resources efficiently. They also tended to think that the rule interfered with agency directors' control of their own resources. While the issue was being discussed, however, the requirement was enforced.

The Section 203 program necessitated a reappraisal of the requirement. Because Section 406 is a county entitlement program for which the county commissioners are the applicants and because most local aging programs were to some degree under county control (either directly by virtue of being county agencies or indirectly by virtue of receiving county money for local matching requirements and other needs), some direct enforcement leverage was possible: County commissioners would have the responsibility of seeing that the requirement was met through their contract with the commonwealth. Such was not necessarily the case under Section 203. Under Section 203, any eligible provider could apply directly for a grant, so there was not necessarily any direct relationship between social service agencies funding transportation services for their aging clients and the providers of those services. Under Section 203, a taxi company could provide services for an area agency on aging but would have no right or power to enforce a maintenance-of-effort requirement on the agency. Moreover, because the reimbursement is paid directly to the contractee (in this case, the taxi company), there would be no way to recover grant monies from an agency that did not meet the maintenance-of-effort requirement. This practical difficulty, plus the assurances of the Department of Aging that federal regulations required area agencies on aging to continue to provide funding for client transportation, led the Department of Transportation to drop the maintenance-of-effort requirement in July 1982.

RELATIONS WITH THE PUBLIC UTILITY COMMISSION

The participation of private carriers in the Section 406 and 203 programs also necessitated a new working relationship between the Department of Transportation and the Pennsylvania Public Utility Commission (PUC). Transportation for hire in Pennsylvania is regulated by the PUC, and providers must obtain a tariff that specifies their rates, service territory, and the kind of service to be provided.

Shared-ride demand-responsive service was being provided by private carriers with PUC certification before the Section 406 and 203 programs originated. However, there is no precise definition of this kind of service in PUC law. The operating rights issued were variously titled paratransit, nonexclusive call and demand, and special operations. But they are defined negatively: Shared-ride demand-responsive services are anything that is not exclusive call and demand, group and party, or scheduled fixed-route service. This category came into being chiefly as a response to the desire of private carriers to provide service to social service agencies. At the beginning of the Section 406 program, the PUC had a file of about 40 carriers who were providing shared-ride demand-responsive services.

If these carriers and others who wanted to participate in the program had been able to do so with the existing tariff format, things would have been much simpler. But there was a catch: Most of the tariffs in existence had been developed to facilitate the movement of groups of individuals to and from social service agencies, and rates had been established almost exclusively on an hourly or a per mile basis. The wording of Section 406 and Section 203, however, is very specific. It says that each

senior citizen must pay 25 cents or 25 percent of the regular adult fare (whichever is greater) for being transported on shared-ride demand-responsive services. It was clear that, to be eligible for the program, providers had to establish a fare structure on a per person basis.

Some early meetings with the PUC on coordinating the program seemed to create more misunderstandings than they resolved. The PUC's initial reaction to the department's informing potential participants that they had to have a per person fare structure was that the department was usurping PUC regulatory responsibilities. Some members of the PUC staff questioned the legality of private carrier participation because the PUC law had not been amended to bring it into conformity with Sections 406 and 203.

The Department of Transportation's response to these objections was that there was nothing in the program that was specifically inconsistent with PUC regulatory prerogatives, including the approval of per person tariffs. Such tariffs were legal even before the Section 203 program existed, and a few carriers already had them. In addition, participation in the Section 203 program is voluntary, so tariff changes are not being forced on carriers. It is still the PUC's job to approve tariffs. However, if rates are not expressed on a per person basis, the provider does not qualify for the program.

As the program has continued to evolve, relations between the Department of Transportation and the PUC have improved a great deal. There is much more mutual understanding about the requirements of the program as mandated by the law. Good communications have been established between PUC and Department of Transportation staff members.

RIDERSHIP AND AGE VERIFICATION

Along with having the right kind of tariff and providing the right kind of service, providers under both programs have been given the responsibility of developing age and trip verification methodologies. Because fare subsidies are only for those individuals age 65 and above, providers had to develop methods for assuring the Department of Transportation that each individual for whom reimbursement is being requested is at least 65 years of age and that the person actually made the trip. This has been the most difficult part of administering the program.

Because of the diversity of program participants, no attempt has been made to establish a uniform age and trip verification methodology. Each provider has been required to develop its own, and approval of the proposed methodologies is a prerequisite for approval of grants. Although providers had some initial difficulties establishing acceptable procedures, that has become much less of a problem as the program, and information about it, has spread. Many new applicants are using the same methodologies and forms that previously successful applicants have developed. Acceptable forms of age verification include (a) drivers' licenses, (b) Pennsylvania free and reduced fare transit ID cards, (c) birth certificates or baptismal certificates, and (d) ID cards issued by the provider. Trip verification methods vary also. The provider needs to demonstrate the existence of a paper trail that can be audited. Systems where the passenger signs a trip receipt or pays for the trip in scrip are recommended for trip verification purposes.

IMPACT OF THE PROGRAM

The first service using Section 406 funds began op-

eration in June 1981. In the 2.5 years that have passed since then, demand-responsive transportation service in Pennsylvania has expanded and flourished. During the 1981-1982 fiscal year, service was provided under Section 406 because Section 203 did not go into effect statewide until July 1, 1982. Beginning with the 1982 fiscal year, most providers began operating under, or switched their operations to, Section 203. Counties eligible for both sources of funds wished to conserve their remaining Section 406 funds for future capital purchases and service changes. As a result, ridership under Section 406 has remained quite low, with less than half a million rides provided in the 1981-1982 fiscal year, and about 380,000 in 1982-1983 as the Section 203 program began.

Ridership under Section 203 has experienced an explosive growth. The first Section 203 grant was approved in June 1982. The number of rides increased from 407 in 1981-1982 to 1,955,000 in 1982-1983 and is already over 1,600,000 for the first 6 months of 1983-1984 (Table 2). Of those nearly 3.6 million trips to date, about 2.8 million have been lottery-fund subsidized trips taken by senior citizens age 65 and above. Complete figures for the 1982-1983 fiscal year show that the average senior citizen trip cost \$4.45 of which \$3.33 was paid from state lottery funds.

TABLE 2 Ridership Summary: Shared-Ride Demand-Responsive Transportation

Fiscal Year	Senior Citizens ^a	General Public	Justified Payments ^b (\$)	Average Cost/ Senior Citizen Trip ^c (\$)
1981-1982				
Section 203	407	0	4,657.69	15.259
Section 406	<u>333,813</u>	<u>143,839</u>	<u>726,812.57</u>	<u>2.903</u>
Total	334,220	143,839	731,470.26	2.919
1982-1983				
Section 203	1,244,718	323,693	4,529,479.85	4.852
Section 406	<u>259,737</u>	<u>123,721</u>	<u>490,069.34</u>	<u>2.516</u>
Total	1,504,455	447,414	5,019,549.19	4.448
1983-1984 ^d				
Section 203	1,186,862	416,047	4,644,346.97	5.217
Section 406	<u>60,544</u>	<u>46,591</u>	<u>149,979.72</u>	<u>3.302</u>
Total	1,247,406	462,638	4,794,326.69	5.125

^a Age 65 and above.

^b Justified payments are up to 75 percent of full fare for each senior citizen age 65 and above transported.

^c Justified payments represent about 75 percent of the cost of the senior citizens' trips; this column represents the average total cost of a senior citizen trip.

^d 1983-1984 numbers are for July through December only.

Many of the trips provided to senior citizens under the lottery program are not really new trips; they are trips that would have been taken under the preexisting social service and public transportation networks. Nevertheless, the Section 406 and Section 203 programs have dramatically increased the overall availability of transportation in Pennsylvania, not only for senior citizens but for the general public as well:

1. Many social service agencies providing transportation to elderly persons have been able to expand the scope of their services immensely because their transportation budgets now buy many more trips. Many agency directors have been able to liberalize restrictions on trip purposes and extend their services to more rural areas.

2. Rural transportation services have expanded the most dramatically. The major cripples of rural

transportation services, inadequate funding and high service costs, have both been remedied by the lottery program. Transportation services can be priced at the cost of service and still generate significant ridership because of the 75 percent lottery reimbursement for senior citizen riders.

3. The Section 406 and Section 203 programs have created rural transportation services available to the general public in many areas where no such services existed at all. Most rural service in Pennsylvania was formerly provided by social service agencies and was restricted to agency clientele. By law, program participants were required to open these services to the general public. Although the per trip cost is often quite high and general public riders are unsubsidized, the services now do exist and are available to everyone who needs them.

4. The programs have been of great benefit to private and public carriers who are eligible to participate. About half the program participants are taxi and paratransit companies and transit authorities, and they have collectively seen a substantial

increase in their senior citizen ridership and total revenues.

The services provided under the Section 406 and 203 programs are still in a stage of rapid growth, and it is difficult to predict where that growth will level out. In 1982-1983 about 50 providers participated in the program for at least part of the year. In 1983-1984 that number has risen to nearly 70 and is expected to go still higher. Although some providers that have been in the program for several years have seen their ridership stabilize, the newer ones are still experiencing a lot of growth as news of the program penetrates their service areas.

The good news about this kind of growth is that it is not rising toward a financial ceiling that will eventually curb further growth or even cause reductions in service as service costs increase or funds are cut. As long as the state lottery fund continues to be healthy (and to date it has been very healthy, with a current surplus of well over \$200 million) there will be no ceilings on the availability of funds for demand-responsive transportation in Pennsylvania.

Number and Status of Mobility-Handicapped Persons in the Federal Republic of Germany

WERNER BRÖG and KARL RIBBECK

ABSTRACT

In December 1980 a joint study, "Number and Status of Disabled Persons by Target Groups," was commissioned by the Ministry of Youth, Family and Health (that had the main responsibility for the study), the Ministry for Employment and Social Order, and the Ministry of Transport of the Federal Republic of Germany. A multistage survey concept was developed for the empirical part of the study. An initial gross sample of 66,000 persons was used (in various sampling stages) to determine the number of officially recognized disabled persons, as well as the number of disabled persons not officially registered. For a subgroup of approximately 6,400 disabled persons (gross) and a control group of about 2,300 nondisabled persons, data on mobility were also collected by having the target persons fill out diaries for a sample day. One of the basic aims of the project was to identify the sociodemographic structure of mobility-handicapped persons with special reference to those who hold the free travel passes provided by the government. A comprehensive picture of the actual number of mobility-

handicapped people in the Federal Republic of Germany and respective cross-tabulations are given. An outline of further evaluations of mobility and the underlying conceptual approach is also provided.

The empirical study of mobility-handicapped persons, which is the subject of this paper, incorporated not just one but several surveys. The research objectives, in fact, included surveys of mobility-handicapped people who needed nursing care and surveys of mobility-handicapped people who did not.

The research project began in 1978-1979 when a representative sample survey was carried out for the West German Federal Ministry of Youth, Family and Health to identify the number and status of persons who need nursing care and live at home. It was proposed that the data would make possible an estimate of the cost framework for the insurance and legal aspects of nursing care. The survey instrument used for this study collected all information necessary to differentiate between the healthy, the acutely ill, those in need of various levels of nursing care, and a threshold or borderline group made up of the "no longer healthy" who were at the same time "not yet in need of nursing care." One of the most

important indicators in this context was the radius of action of the target persons (1).

In addition to the data from this survey, more detailed activity data relating to a sample travel day were available from a previous survey of the same persons. These data had been collected as part of a special review financed by the Federal Ministry of Transport as part of the project, "The Mobility of Handicapped Travellers--A Pilot Study of Those Needing Nursing Care." By combining both data sets, it was possible to derive very detailed data about the mobility of all persons living at home who needed nursing care as well as about specific subgroups (2). People with very reduced or only a very basic level of mobility could, for example, be contrasted with nonhandicapped control persons. The whole exercise was done, therefore, at a comparatively low cost.

In interpreting these data it was, of course, necessary from a planning viewpoint to bear in mind that those persons needing nursing care represented only a proportion of all mobility-handicapped persons. During the Year of the Disabled, however, it was intended to carry out studies of disabled persons, including mobility-handicapped persons. The Federal Bureau of Statistics had already decided several years earlier that

The disabled have been shown to be . . . a diverse group, which has become ever more inhomogeneous since the reduction of the number of persons with war disabilities; a group which can only be surveyed to a limited extent by methods such as household surveys (3, p. 493).

Socialdata was therefore commissioned to develop a conceptual framework for a major study, "The Number and Status of Disabled Persons by Target Group, with Special Reference to the Structure and Needs and the Function of Self-Help Organisations." The actual study was finally commissioned in December 1980 as a cooperative project between three federal ministries: the Ministry for Youth, Family and Health (project leaders); the Ministry for Employment and Social Order; and the Ministry of Transport.

The goal of this study was to supply sufficiently disaggregated, target-group-oriented data on handicapped persons living in the Federal Republic of Germany. Until then, the only data that had been available had dealt with persons who had the official status of "handicapped." These data were insufficient to achieve the goals of the survey for a number of reasons:

1. The classification is achieved using standardized rating criteria that can establish the handicap according to various levels of reduction in earning capacity (REC). The intensity of the REC level is measured by the extent of the functional losses of the body or by the size of the functional impairment that is attributable to the impaired member or part of the body. On this basis it is impossible to deduce the percentage of the population with comparable handicaps that has not been given or has not sought official recognition as handicapped for whatever reason.

2. The official statistics include no data that are suited to describing the living conditions of the handicapped in such a way that it is possible to comment on the size and composition of the subpopulations whose needs are not being fulfilled.

3. The causes of severe handicaps are not very well disaggregated; more than three-quarters of all persons who are officially acknowledged as handi-

capped with an REC of at least 30 percent are lumped in the category "other causes or several causes" or "other illnesses (including those resulting from vaccinations)."

4. The official statistics are distorted by the facts that some deceased persons are included in the files and tens of thousands of persons whose documents are currently being processed are not included.

INITIAL SURVEY

To carry out the study, the survey design that was selected to fulfill the demanding statistical requirements was large scale, from a methodological viewpoint. The sampling frame consisted of 26,700 representatively selected private households (representing 66,000 persons) in the Federal Republic of Germany and West Berlin.

As part of a written mail survey, possible handicaps of all persons in the household other than those already officially recognized as disabled were also recorded. The indicators for these disabilities were (in addition to the disabilities and the functional impairments listed) any aids needed to travel outside the home, the need for any medical or other basic care, the need for assistance with the care of the household or with communication, and impairments of bodily, spiritual, or mental well-being as defined by the World Health Organization.

The sample was selected shortly before the survey using random routes and, when they were available, address lists because recourse to any official lists that could have been used as a weighting mechanism was not possible. There was, therefore, no person-related data available for any of the sample households.

The survey was completed with a final response rate of 71 percent of the valid gross sample. This was sufficient, in the light of the survey objectives, to

1. Classify handicapped persons on the basis of the nature of their disabilities (including a handicap in mobility) in conjunction with a medical diagnosis (i.e., filter questions);
2. Verify a suspected handicap; and
3. Provide descriptive data on sociodemography, income, living conditions, mobility, education, occupation, degree of information about disease or handicap, how the individual is cared for, how the disease or handicap is attended to, and recreational and social integration including any possible deficiencies.

The analysis of the broad range of data was necessarily manual to satisfactorily deal with the open-ended questions and the individual responses. Based on this close examination, it was possible to place the respondents in the following groups:

1. Officially recognized handicapped persons;
2. Persons who were not officially recognized as handicapped; however, in the light of all information gathered about them, it was highly probable that these persons could also be classified as handicapped (level 1 suspects); and
3. Persons not officially recognized as handicapped who responded to the prestudy in a way that indicated it was possible that they were handicapped (level 2 suspects).

MAIN SURVEY

Persons who received the next person-related ques-

tionnaire as part of the main survey were all persons from these three groups (i.e., a total of 9,700 "official" and "suspected" handicapped persons). It was expected that their tendency to respond or not to respond would depend on the form of their disability. Within each group two age groups were defined (18-24 years of age, and 65 years and older). This meant that the sample was divided into six sections and created the possibility of dealing with each of the individual "fields" with the necessary intensity by employing different questionnaires for each subgroup. After 2 weeks in the field, the response rate (based on the valid gross sample) was between 80.5 percent (level 1 suspects, 65 years and older) and 87.3 percent (officially handicapped, 65 years and older).

The survey instrument for interviewing these groups had to fulfill the following functions:

1. Verification of suspected handicaps;
2. Classification of those confirmed as handicapped with respect to the nature of their functional impairment or disability;
3. Preparation of descriptive data (e.g., socio-demographic data and data on living and income situation); and
4. Identification of needs or deficiencies in life-style or living conditions (e.g., mobility, education or occupation, medical care, household maintenance, organization of free time, communication, and social integration).

Six to 12 months were allowed to elapse between the initial inquiries made of the households and the main survey dealing with disabled individuals. This was done to ensure that temporary acute illnesses at the time of the initial study would not be classified incorrectly as statistically relevant handicaps.

A "Representative Survey in the Federal Republic of Germany to Determine the Mobility Behavior of the (Mobility)-Limited Who Live at Home and of Their Household Members" conducted for the Federal Ministry of Transport by Socialdata is a further part of the main survey. The initial survey had already identified the representative proportion of "mobility-limited" people living in private households in

the Federal Republic of Germany (including socio-demographic descriptions; differentiation according to degree, type, and cause of the disability; necessary aids; and so forth). It was, therefore, the task of this survey, which was conducted as a postal survey on a random sampling day, to measure the out-of-house activities of the mobility-limited persons and their household members, as well as to show mobility relevant deficiencies in the way in which the persons were provided for.

CHARACTERISTICS OF MOBILITY-HANDICAPPED PERSONS

According to the definition selected, 11.9 percent of the German population (i.e., just about every 8th person) is mobility handicapped and living at home. Of these, however, only three-quarters fulfilled the definition of handicap in the main study. The remaining quarter, therefore, includes persons who, strictly speaking, have great difficulties with mobility but are not considered handicapped. For the purposes of this paper, the term mobility handicapped will be used in the collective sense for all persons previously described. In total, this collective group represents 5.29 million German persons over 18 years of age (excluding persons living in institutions). Just two-thirds (61 percent) of these are officially recognized as handicapped. This proportion is significantly lower than the proportion of all handicapped persons (76 percent) who are officially acknowledged. In contrast, only about three-fifths of all handicapped persons can be classified as mobility handicapped; consequently the total handicapped community has about 1.7 million more persons than the mobility-handicapped community. Not even half of all mobility-handicapped persons are entitled to free use of public transport. This proportion is actually less than that for all handicapped persons. This means that only two-thirds of those persons with free travel passes are mobility handicapped in the current sense; in contrast, more than 3 million mobility-handicapped persons are not entitled to free travel (Table 1).

Every twentieth person who is mobility handicapped is so limited in his or her ability to move

TABLE 1 Characteristics of Mobility-Handicapped Persons

	HANDICAPPED			MOBILITY HANDICAPPED		
	Proportion of the total Population %	Absolute (Rounded) Millions	Proportion of the Handicapped %	Proportion of the total Population %	Absolute (Rounded) Millions	Proportion of the Mobility Handicapped %
<u>Handicapped</u>						
- Yes	15,7	6,98	100	8,9	3,96	75
- No				3,0	1,33	25
<u>Mobility Handicapped</u>						
- Yes	8,9	3,96	57	11,9	5,29	100
- No	6,8	3,02	43			
<u>As handicapped</u>						
- officially acknowledged	11,9	5,29	76	7,2	3,83	61
- not officially acknowledged	3,8	1,69	24	4,7	2,46	39
<u>Free Travel Pass</u>						
- available	7,0	3,10	44	4,9	2,12	40
- not available	8,7	3,86	52	7,0	3,17	60

Note: Commas should be understood as decimal points.

that these people actually need to be categorized as immobile. This does not imply, however, that these people are constantly immobile. On the contrary, out-of-house mobility provides such basic necessities of life that, despite the utmost individual difficulties, it cannot, as a general rule, be totally suppressed. This specification is valid also for two further groups, those persons theoretically dependent on other people and mechanical aids (P+M) and those theoretically dependent only on other people (P). For these two groups, this means neither that this assistance is assured nor that out-of-house activities take place only when it is available. About one-third of the mobility-handicapped population uses various mechanical aids when they leave the house, and a good half of these can be mobile only with the assistance of another person. In absolute terms this results in about 2 million persons who use mechanical aids and about 1.3 million persons who actually need to be accompanied by another person. Although it can be assumed that the majority of those mobility-handicapped persons discussed so far also have problems with structural impediments, the last group (S) has problems only with structural impediments and needs neither mechanical aids nor the assistance of another person. This group of 2.38 million persons includes almost half of the mobility handicapped (Table 2).

Sixty-one percent of the mobility-handicapped persons are officially recognized; more than half of these (33 percent) have been recognized as having a reduction of earning capacity of at least 80 percent. Official recognition is particularly high among the P+M and M groups (theoretically, mechanical aids only are necessary), the handicapped for whom the formal criteria are most easily recognized. It is interesting that group P+M has the highest number of REC values of 80 percent and more and that most REC values for group M are between 50 and 75 percent. Obviously the bodily defects in the P+M

TABLE 2 Categories of Mobility-Handicapped Persons

MOBILITY HANDICAPPED IN THE CATEGORY:		Total	Absolute (Rounded)
		%	Millions
I	(Theoretically <u>I</u> mmobile)	5,2	0,28
P+M	(Theoretically dependent on Other <u>P</u> eople and <u>M</u> echanical Aids)	11,6	0,61
P	(Theoretically "only" dependent on Other <u>P</u> eople)	24,8	1,31
M	(Theoretically "only" dependent on <u>M</u> echanical Aids)	13,5	0,71
S	("Only" difficulties with <u>S</u> tructural Impediments)	44,9	2,38
TOTAL		100,0	5,29

Note: Commas should be understood as decimal points.

group are, or have become, so great that they can no longer be adequately compensated for by the use of mechanical aids. Similar relations exist between groups P and S. It can be assumed here also that the mobility problems of group S--to the extent that they do not result in the use of mechanical aids--would lead to an increased reliance on the assistance of a second person in many cases. In contrast, it can be concluded from the rather lower level of official acknowledgment of group I (theoretically immobile) that this is a group of persons who are similar to those persons who live at home and require nursing--the group studied in the pilot survey of this project (Table 3).

TABLE 3 Persons Officially Acknowledged as Handicapped

OFFICIALLY ACKNOWLEDGED	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
	%	%	%	%	%	%
Officially acknowledged as handicapped	61	45	70	58	80	55
- with an REC ⁺) of less than 30%	1	3	-	0	1	1
- with an REC ⁺) of 30 - 45%	4	2	1	3	4	6
- with an REC ⁺) of 50 - 75%	23	8	16	12	38	28
- with an REC ⁺) of 80% and more	33	32	53	43	37	20
Handicapped - not officially acknowledged	39	55	30	42	20	45
TOTAL	100	100	100	100	100	100

⁺) REC=Reduction in earning capacity

SOCIODEMOGRAPHY OF MOBILITY-HANDICAPPED PERSONS

Females represent two of three mobility-handicapped persons, and in each of the mobility-handicapped groups the proportions are approximately similar. The only exception is group M. The reason is possibly a higher proportion of war invalids and, more particularly, a more concerted effort by men to retain the ability to work and thereby their out-of-house mobility (Table 4).

Average age increases constantly from group S to group I. To oversimplify, it can be said that every second person in group S is less than 65 years old, that just over every second person in group M is between 50 and 75 years old, that every second person in group P is between 65 and 80 years old, that almost every second person in the P+M group is over 75 years old, and that nearly every second person in group I is more than 80 years old (Table 5). From this it can be surmised--again in simplified terms--that with increasing age many of the members of group S will move to group P, from group M to the P+M group, and from group P to group I.

The household size of each group varies significantly. The relatively large households of group I can be explained rather well by the special situ-

ation of the persons affected; the nursing and care needed generally require a large family unit. In contrast, the size of families in which the groups P+M and P are found is alarmingly small; the high proportion of single-person households (51 percent and 47 percent) has to be viewed against the need for an accompanying person. Only in group S does the household size still lie well above the overall average; the number of mobility-handicapped people in the household, however, rises proportionally (Table 6).

This household structure corresponds very closely with the marital status of those persons affected; a large proportion of widows and widowers contribute to the small household sizes in the groups P+M and P. In contrast, in group I it is readily recognizable that the existence of multigeneration households has created the conditions for avoiding the move to an institution (Table 7).

In support of the conclusions about age and sex, the share of full- or part-time workers is largest in group S. In groups I, P+M, and P, pensioners represent almost two-thirds and housewives about one-fifth of those persons affected. Nevertheless, 7 percent of persons in group I are employed at least part time, generally in light craft activities. In sum, about every eighth mobility-handicapped person is formally classified as unfit for work (Table 8).

TABLE 4 Sociodemography of Mobility-Handicapped Persons, by Sex

Sociodemography	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
Sex	%	%	%	%	%	%
- Male	36	32	30	34	53	35
- Female	64	68	70	66	47	65
TOTAL	100	100	100	100	100	100

TABLE 5 Sociodemography of Mobility-Handicapped Persons, by Age

SOCIODEMOGRAPHY	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
Age Group	%	%	%	%	%	%
- 18 to 50 years	13	10	8	11	14	16
- 51 to 65 years	26	11	18	15	31	33
- 66 to 75 years	29	22	28	29	26	32
- 76 to 80 years	16	14	22	21	18	11
- 81 years or more	16	43	24	24	11	8
TOTAL	100	100	100	100	100	100

TABLE 6 Household Size of Mobility-Handicapped Persons

HOUSEHOLD SIZE	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
	%	%	%	%	%	%
<u>Household Size</u>						
- One Person Household	40	28	51	47	44	33
- Two Person household	35	34	36	32	28	40
- Three and more Person Household	25	38	13	21	28	27
TOTAL	100	100	100	100	100	100
<u>Household Composition</u>						
- Average Household Size (All Persons)	2,01	3,18	1,68	1,85	1,97	2,08
- Average Number of Mobility Handicapped (18+ years)	1,12	1,07	1,11	1,08	1,06	1,17
- Proportion of Mobility Handicapped in % (18+ years)	56 %	34 %	66 %	58 %	54 %	56 %

Note: Commas should be understood as decimal points.

TABLE 7 Sociodemography of Mobility-Handicapped Persons, Marital Status

SOCIODEMOGRAPHY	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
	%	%	%	%	%	%
<u>Marital Status</u>						
- Single	10	7	10	11	11	7
- Married	54	44	47	47	57	62
- Widowed	33	48	41	39	29	28
- Divorced	3	1	2	3	3	3
TOTAL	100	100	100	100	100	100

LIVING SITUATION OF MOBILITY-HANDICAPPED PERSONS

The most apparent bodily defects of mobility-handicapped people are functional impairments of the legs. Almost every second person suffers either impairment of both legs or has already had part or total amputation of one or both legs. This proportion rises to about three-quarters for the P+M group, and for group S it is over two-thirds. Comparable impairments of the arms are apparent primarily in groups I and P+M. In the P+M group problems with the hands or feet occur more frequently than average. Every third mobility-handicapped person also has a serious increase in difficulties with the spine and the bodily functions associated with

it; every fifth person has balance difficulties; and 29 percent have mobility-related disorders that are related to rheumatism. Every 20th mobility-handicapped person is almost blind in one or both eyes or has greatly reduced vision in both eyes; every ninth person is almost deaf or has a high level of hearing impairment. For each of the mobility-handicapped groups there are correlations that can be directly related to the differing age structures (Table 9).

Mobility handicaps do not cease at the front door of the home; they have a general effect on the ability to move within the home as well. Admittedly the need for assistance drops by one-third from group I to group S, but, as is the case for the statements about movement and mobility, this does not imply

TABLE 8 Sociodemography of Mobility-Handicapped Persons, Employment Status

SOCIODEMOGRAPHY	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
	%	%	%	%	%	%
<u>Employment Status</u>						
- Full-time or part time emp employed	15	7	5	6	20	17
- Currently unemployed	1	-	-	1	2	2
- Pensioner	52	64	63	62	52	48
- Housewife	19	21	16	19	13	21
- Student/Apprentice	1	-	0*)	1	1	1
- Unable to work	12	8	16	12	12	11
TOTAL	100	100	100	100	100	100
*) Less than 0.5%						

TABLE 9 Bodily Defects of the Mobility Handicapped Population

BODILY DEFECTS	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
	%	%	%	%	%	%
<u>Functional Impairment/Amputation</u>						
Arms	19	24	32	18	17	15
Hands	13	14	24	12	12	9
Legs	47	57	73	37	68	36
Feet	18	19	30	17	17	14
<u>Problems with</u>						
Spine	33	25	33	28	36	36
Balance	21	34	30	25	15	17
Rheumatism	29	20	32	27	26	32
<u>Recognition</u>						
(Almost) blind/very visually handicapped	5	7	4	8	4	3
(Almost) deaf/very aurally handicapped	11	13	17	15	8	7

anything about the hardships related to movement. In addition, in several cases, the assistance of mechanical aids is also necessary within the home. This is also true for group S and more particularly for group P persons who do not need these aids outside the house (Table 10).

Every fourth mobility-handicapped person stays home frequently because of insecurities associated

with the handicap. This proportion increases markedly from group S (one in eight) to group P+M (almost one in two). Associated with limited freedom to move are feelings of loneliness. The greater the handicap, the more frequently such feelings occur. An even clearer correlation with the degree of mobility handicap occurs with the frequency with which holidays were taken in the previous year. Only 17

TABLE 10 Movement Within the Home

MOVEMENT WITHIN THE HOME	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
<u>Assistance needed</u>						
to move around	4	24	12	6	0	1
to push, carry	1	6	6	1	1	0
because bedridden	1	20	-	-	-	-
<u>Aids within the Home</u>						
Stick	16	25	43	16	29	3
Crutches	4	6	19	1	9	-
Wheel Chair	2	8	11	1	1	-

percent of group I compared with 57 percent of group S were able to do this. Holiday travel frequency of mobility-handicapped persons is about one-quarter less than the comparable value for the total population (Table 11).

CONDITIONS UNDER WHICH OUT-OF-HOUSE ACTIVITIES OCCUR

Mobility-handicapped people have several specific difficulties when moving outside of the home. The frequency of these difficulties correlates with the indirectly expressed ranking of the individual handicapped groups according to the degree of mobility handicap. Particular problems occur for long walking trips; almost two-thirds (60 percent) of mobility-handicapped people have difficulties. This aspect is of particular importance because walking is the travel mode most frequently used by all handicapped groups outside the home. Approximately one in four (28 percent) mobility-handicapped persons has problems crossing streets or feels handicapped because of general weakness (25 percent); related to this, every fifth (21 percent) person finds frequent stumbling a particular hindrance. In contrast, problems with orientation, reported in every seventh case (14

percent), suggest that mobility handicaps are not related only to weaknesses of the body or functional impairments. In addition, mobility-handicapped persons have difficulty, which is often significant, with structural impediments. Flights of stairs (escalators, slopes) are the biggest problem by far. The greatest proportion of these problems is experienced by group S (compared with groups M and P), suggesting that it is precisely these people for whom the introduction of mechanical or personal assistance can be very effective, as long as the handicap is not too advanced, as is the case for group P+M. In contrast, curbs, doorsteps, and other smaller steps are much more minor impedances that produce an above average barrier effect only for the P+M group. Finally, the greater mention of opening and shutting doors by the P+M group can be related to the frequency of functional impairments of the arms or hands in this group (Table 12).

According to the definition, mobility-handicapped individuals in groups P and P+M include all those persons who, theoretically, need to be accompanied outside the home. This assistance can be provided in two of three cases by another person; for longer trips, particularly by the P+M group, a driver service of some kind is necessary. That this type of

TABLE 11 Social Contacts

SOCIAL CONTACTS	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
Frequently at home because insecure	24	*)	47	42	17	12
Sometimes lonely	28	35	37	35	26	22
Holiday within the last year	47	17	33	37	52	57
*) Not applicable						

TABLE 12 Difficulties Outside the Home

DIFFICULTIES OUTSIDE THE HOME	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I *)	P+M	P	M	S
	%	%	%	%	%	%
<u>Problems with</u>						
Curbs, Doorsteps	30		49	30	29	21
Stairs	46		57	42	39	53
Doors	9		28	8	6	5
<u>Difficulties</u>						
With longer walks	60		41	63	62	52
Crossing the Street	28		57	40	20	15
Because of General Weakness	25		37	35	18	20
Because of Frequent Stumbling	21		36	28	18	17
With Orientation	14		26	22	7	7
*) Not applicable						

assistance is not always available and that, in spite of this, certain trips must be made has already been discussed in a similar context and must be recognized as a specific feature of the analysis of the handicapped. Mobility-handicapped persons who must use mechanical aids for their out-of-house mobility fall into two groups (P+M and M). Crutches or arm supports (54 and 50 percent) are most frequently used by both groups. The walking stick, walking frame, or wheelchair is used with similar frequency, although fewer handicapped persons (group M) use a walking stick more often (42 percent compared with

25 percent), and the most handicapped individuals (group P+M) need a walking frame or wheelchair most often (35 percent compared with 12 percent). The resulting 7 percent of the mobility-handicapped population who use either a walking frame or a wheelchair is divided approximately 1/4:3/4 between these two aids. This constitutes an absolute number of about 320,000 citizens over 18 years of age who use a wheelchair and live at home (Table 13).

The limited mobility caused by handicaps is reflected directly in a limited number of out-of-house activities. Trips to the cinema, theater, and con-

TABLE 13 Mobility Aids

MOBILITY AIDS	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I *)	P+M	P	M	S
	%	%	%	%	%	%
<u>Mechanical Aids</u>						
Walking Stick	9		25	-	42	-
Crutches	14		54	-	50	-
Walking Frame, Wheel Chair	7		35	-	12	-
<u>Assistance of Others</u>						
Attendant	27		62	68	-	-
Driver service (for longer trips)	21		70	52	-	-
*) Not applicable						

certs are particularly affected; for every fourth mobility-handicapped person they are almost always impossible. Next in line are trips on official business, which in every fifth case are almost impossible. Almost all other trips are equally difficult. There are clear differences between the individual groups of handicapped people. Expressed somewhat simply, it can be said, with specific exceptions which have been mentioned, that out-of-house activities are almost always impossible in every second case for the P+M group, in every third case for group P, in every twelfth case for group M, and in every twentieth case for groups S.

It must be noted that this simplified classification relates to such elementary activities as the purchase of groceries and, more important, visits to doctors and thereby illustrates the daily problems of mobility-handicapped individuals. Knowledge of the possibility of being able to carry out activities outside the house, nevertheless, gives only limited information about the general radius of action of the handicapped. For this reason the results discussed previously will be compressed as follows:

1. At least three of the activities reported as almost always impossible involve a very strictly limited radius of action,
2. At least three of the activities were reported as frequently impossible and involved a limited radius of action,
3. At least three of the activities were reported as sometimes not possible and involved a less limited radius of action.

According to these categories, just less than a sixth of the mobility-handicapped population has a very strictly limited radius of action. There are very clear graduations from the P+M group to group S although, even in group S, almost every tenth person has a very strictly limited radius of action and

every sixth person is limited to some extent (Table 14).

Public transit becomes particularly important for the mobility-handicapped population because of the limited opportunities to use a car and the difficulties experienced when walking. Nevertheless, one-third of the mobility-handicapped population cannot use public transit or can only use it with difficulty or with the assistance of someone else. This proportion rises to half for group P and to almost two-thirds for the P+M group; and 29 percent of the most lightly affected group (S) are affected. All modes of public transit are equally difficult for mobility-handicapped individuals to use; only taxis present fewer problems. Although the degree of difficulty decreases constantly from the P+M group to the S group, there are two significant differences: When compared with the fixed-track modes, bus use is more difficult only for groups M and S; in contrast, the use of buses for groups P and P+M seems to be somewhat easier. Rail-type modes, both above and below ground, present more difficulties to the latter groups (Table 15).

ELIGIBILITY FOR FREE TRAVEL ON PUBLIC TRANSIT

A fundamental policy for the support of mobility-handicapped people in the Federal Republic of Germany is the entitlement, under certain circumstances, to unlimited travel on public transit. These circumstances are of a fairly formal nature (generally a REC of at least 80 percent) and therefore correspond to the definition of official recognition—one of the major reasons that only 40 percent of the mobility-handicapped population has this entitlement. In addition, until now, little has been known about the actual effect of this sociopolitical policy. For this reason, in this section the mobility-handicapped population has been divided accord-

TABLE 14 Out-of-House Activities

OUT-OF-HOUSE ACTIVITIES	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I *)	P+M	P	M	S
<u>Range of Action</u>	%	%	%	%	%	%
Very severely limited	16		34	27	18	9
Limited	15		35	23	18	16
Less severely limited	70		31	50	64	75
TOTAL	100		100	100	100	100
<u>(Almost) Always Impossible</u>						
Grocery Shopping	16		48	31	8	4
Doctor's visits	15		45	29	5	4
Official errands	19		54	40	8	5
Liesure walks	14		44	24	7	4
Visits to Friends, Relatives	15		45	29	6	3
Visits to Cinema, Theatre, Concerts	26		62	47	16	10
*) Not applicable						

TABLE 15 Problems with Public Transit

PROBLEMS with PUBLIC TRANSPORT	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I *)	P·M	P	M	S
	%	%	%	%	%	%
<u>Use of Public Transport</u>						
- not possible or only with assistance	18		37	37	16	7
- possible with difficulty	17		25	15	23	22
- basically possible	65		38	48	61	71
TOTAL	100		100	100	100	100
<u>Degree of Difficulty (Index**)</u>						
- Bus	1,9		2,9	2,4	1,8	1,5
- Tram	1,9		3,0	2,5	1,7	1,4
- U-Bahn	1,9		3,1	2,7	1,6	1,4
- Train	1,9		3,1	2,6	1,7	1,4
- Taxi	1,6		2,4	2,0	1,5	1,3

*) Not applicable
 **) 1,00 = No difficulties
 4,00 = Use impossible

Note: Commas should be understood as decimal points.

ing to eligibility for free travel. The corresponding behavioral data, therefore, can be better interpreted against this background.

In general, it can be shown that, using the formal definition, those persons who receive free travel have characteristics similar to those of the handicapped population overall, and those who do not receive free travel are more similar to those who are mobility handicapped. The proportion of men

entitled to free travel (50 percent) is, for example, notably higher than that of men with no free travel (30 percent). In the age structure there are also clear differences: almost half the free travelers are less than 65 years old, and fewer than one-quarter are more than 75 years old (Table 16).

As a consequence of the different age and sex distribution, the personal availability of a car to the free travelers is much higher. This is evident

TABLE 16 Sex and Age of Mobility-Handicapped Persons Entitled to Free Travel

SEX and AGE	Total		Mobility Handicapped	
	%	%	with Free Travel Pass *)	without
<u>Sex</u>				
- Male	36		50	30
- Female	64		50	70
TOTAL	100		100	100
<u>Age Groups</u>				
- 18 to 50 years	13		13	12
- 51 to 65 years	26		34	24
- 66 to 75 years	29		30	24
- 76 to 80 years	16		12	17
- 81 years or more	16		11	23
TOTAL	100		100	100

*) The two groups do not always equal the total since persons who did not respond were excluded from the analysis.

both from car ownership (27 to 17 percent) and from license holding (36 to 26 percent) (Table 17).

Because they are generally younger, persons entitled to free travel are not only better able to use public transit but, because of greater car availability, are also better able to use motorized individual transport. Because use of nonmotorized modes would also be easier for the younger persons eligible for free travel, it can be concluded that the execution of out-of-house activities is generally much easier for these people. In other words, free travel entitlement is more likely to apply to mobility-handicapped persons who have the least severe mobility limitations.

DIRECTIONS FOR THE ANALYSIS OF MOBILITY

The work presented here leads to the following conclusions:

An important characteristic of handicapped persons is the fact that they are not able to carry out their day-to-day activities without limitations. Some of these activities can or must be engaged in outside the home. These activities--the so-called out-of-house activities--can be relatively reliably measured. Because there are mutual dependencies between the ability to do out-of-house activities and those within the home, certain conclusions about the life situation of handicapped persons in general may be drawn from their program of out-of-house activities.

An analysis restricted to handicapped persons and based on these considerations does not give a satisfactory conclusion about the nature and range of ac-

tivities that can no longer be fully or partially engaged in as a result of a handicap. In addition, because the sociodemographic structure of the handicapped population generally differs substantially from that of the population at large, and because this sociodemographic structure at the same time significantly influences the pattern of out-of-house activities, such comparisons are not sufficient to determine relevant mobility deficits. This problem can be solved, however, if a group of control persons is constructed. These comparable persons need to be selected so that they represent as exactly as possible the sociodemographic structure of the relevant handicapped group. For this it would be necessary to carry out a comprehensive survey of the mobility behavior of the total population. A survey such as this also makes it possible to view the relevant variables of the nonmobility-handicapped population against the mobility data of the handicapped and their control persons. From the comparison of the out-of-house mobility of the mobility handicapped with the selected control person, the mobility deficiencies of the mobility handicapped can be estimated.

An analysis based on these principles allows the basic needs associated with out-of-house activities to be presented using relevant qualitative characteristics. These characteristics are based primarily on the ability to leave the house at all (out-of-house proportion), the daily frequency of leaving home (number of trips), the activity program of the mobile persons (trips, out-of-house activities, travel mode used), and the time spent at the individual out-of-house activities and the time needed to reach them. The most important results of this analysis will be presented in future publications.

TABLE 17 Car and License Possession

CAR and LICENCE OWNERSHIP	MOBILITY HANDICAPPED IN THE CATEGORY:					
	TOTAL	I	P+M	P	M	S
Target Person owns a car						
- Yes	20	12	16	9	34	25
- No	80	88	84	91	66	75
TOTAL	100	100	100	100	100	100
Target Person has						
- a licence to drive a car	30	16	20	15	43	38
- an other licence	1	-	2	0	2	2
- no licence	69	84	78	85	55	60
TOTAL	100	100	100	100	100	100

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Effect of Size and Type of Organization on Quality of Special Transportation Services

CLAIRE E. McKNIGHT and ANTHONY M. PAGANO

ABSTRACT

An index of quality of service for special transportation services for elderly and handicapped persons was developed and used to analyze the relationships of quality to the size of the provider and to the type of organization of the provider. For a sample of 42 special services it was found that quality increases with size of ridership and that private organizations provide greater quality of service than do public organizations.

To efficiently deliver special transportation for the elderly and handicapped it is necessary to choose an appropriate method of providing service. This involves an analysis of a variety of issues including the size of the provider and whether the provider should be public or private. Researchers have studied these questions from the point of view of cost efficiency (1); however, the quality of the service that is provided should also be considered. The relationships between type of provider (i.e., its size and public or private nature) and the quality of transportation service are analyzed. To depict these relationships, a measure of quality was developed. The measure was applied to a sample of special transportation services for the elderly and handicapped, and the relationships between the quality of service and other characteristics (primarily size and type) were statistically analyzed.

In the first two sections of this paper the development and application of the index are discussed. The third and fourth sections cover the relationship between quality and size and type of organization. In the next two sections the interrelation of size and type of organization is discussed

and the relation of quality to productivity and to the provision of wheelchair service is introduced. A summary of the conclusions of the analysis is presented in the final section.

INDEX OF QUALITY

The measure of quality of service that was developed is a hierarchic index. It is composed of eight general aspects of a special transportation service:

1. Reliability and on-time performance,
2. Comfort,
3. Convenience of making reservations,
4. Extent of service,
5. Vehicle access,
6. Safety,
7. Driver characteristics, and
8. Responsiveness to user.

Each aspect is composed of specific attributes or general measurable characteristics. For instance, under the general aspect reliability is the attribute, "delays while on the vehicle." This attribute can be measured in expected minutes of delay per year.

The different aspects are of different relative importance to quality of service. Thus each aspect was assigned a weight that is proportional to its relative importance. The weights are designed so that they sum to 10. Similarly, each attribute has a different importance to its relevant aspect. Therefore, the attributes also were assigned weights. The weights of all the attributes that contribute to one aspect also add to 10.

The weights were developed from a survey of elderly and handicapped users and potential users of special transportation services. A questionnaire was sent to a sample of 659 elderly or handicapped people. In the questionnaire, the respondents ranked the attributes according to their importance to the

relevant aspect and ranked the aspects according to their importance to quality. One hundred fifty-seven usable questionnaires were returned. The rankings were turned into a set of weights using psychometric scaling techniques. The final index, including all the attributes and the weights, is given in Table 1. The development of the index is discussed in greater detail elsewhere (2,3).

APPLICATION OF THE INDEX

Data on 42 providers of special transportation for the elderly and handicapped in the Chicago metropolitan area were collected by personal interview and observation. Of the 42 providers, 26 are run by governmental or public bodies, 10 are run by private, nonprofit organizations (PNPs) and 6 are run by private, for-profit firms (PFPs). Three of the provider organizations have the primary purpose of providing special transportation, and the rest of the providers are parts of larger organizations. For 13 providers, the larger organization's primary purpose is to govern or provide government services. These are generally townships, park districts, or local municipalities. Five of the services are provided by firms specializing in transportation; three of these are taxi companies and two are bus oper-

ators. Thirteen providers are social service agencies and three are sheltered workshops.

Table 2 gives some typical characteristics of the providers. The service areas range from small, urban, densely populated areas to large, countywide or multicounty areas encompassing suburban and rural regions. Population densities range from 380 people per square mile to 14,200, with an average of 4,450 people per square mile. Ridership follows the same pattern. Half the services have riderships of fewer than 20,000 trips per year, but there are a few with very large riderships (more than 100,000). For the average provider, 7 percent of the trips are made by wheelchair users. However, 13 of the services provide no wheelchair service, and wheelchair users make more than 10 percent of the trips of 10 providers.

On the average, two-thirds of the service is demand responsive (door-to-door service with each trip individually scheduled). However, the largest services are less likely to provide demand-responsive service. When the size of the providers is taken into account, only 39 percent of all the trips in the sample are demand responsive. The average service provides 19 percent subscription service (door-to-door service with trips permanently scheduled), but 46 percent of the total trips are subscription.

TABLE 1 Index of Quality of Service

Aspects ^a	Attribute ^b
1.75 Reliability	3.9 Arriving at destination on time 2.9 Notification of delays or cancellation of service 1.3 Wait time for pick-up at home 1.2 Wait time for pick-up away from home 0.7 Few delays while on the vehicle
1.61 SAFETY	4.4 Low probability of a traffic accident 2.7 Low probability of falling 2.5 Low probability of personal assault 0.2 Type of tie down 0.2 Position of the wheelchair in the vehicle
1.36 VEHICLE ACCESS	1.9 Height of first step 1.8 Short distance from house or destination to vehicle 1.4 Number of steps 1.4 Assistance in getting from vehicle to destination 1.2 Assistance in carrying packages 1.2 Width of the aisle 1.1 Presence of a wheelchair lift or ramp
1.31 DRIVER CHARACTERISTICS	2.9 Knowledge of general needs 2.6 Courtesy and friendliness 2.0 Ability to handle medical emergencies 1.6 Neatness and professionalism 0.9 Familiarity with habits and needs of individual user
1.29 CONVENIENCE OF MAKING RESERVATIONS	2.9 Being picked up at time selected by traveller 2.6 Shortness of reservation time 2.3 Convenience of return reservation procedure 2.1 Accommodation to changes in reservations
1.07 EXTENT OF SERVICE	2.7 No or few restrictions on where vehicle will go 2.6 Total number of hours of service 1.8 Low rate of turning down reservations 1.6 Service on weekends 1.3 Service on evening
0.87 RESPONSIVENESS	3.9 Courtesy and friendliness of telephone operators 3.7 Ease of getting clear information on service 1.9 Receptiveness to complaints and user suggestions 0.5 Procedures for follow-up on complaints
0.74 COMFORT	2.5 Guaranteed seat or location for wheelchair 1.9 Sheltered waiting areas for pick-ups away from home 1.4 Condition and cleanliness of vehicle 1.4 Smoothness of the ride 1.4 Air conditioning and good ventilation 1.4 Seats at waiting areas for pick-ups away from home

^aThe number in front of the aspect is the weight of that aspect or its relative contribution to quality of service.

^bThe number in front of each attribute is the weight of that attribute.

TABLE 2 Characteristics of Providers (n = 42)

	Mean	Range
Years in operation	9	1-35
Service area (square miles)	240	1-2030
Population density of service area	4450	380-14,200
Fleet size	14.6	1-35
Annual ridership (one way trips/year)	45,030	525-650,000
Percent of trips by wheelchair users	7	0-55
Percent of service provided as: ^a		
Demand responsive	67	0-100
Subscription	19	0-95
Route deviation	5	0-100
Fixed route	8	0-100
Charter	1	0-40
Vehicle productivity (trips/vehicle hour)	4.3	.7-15
Sources of revenue (%) ^a		
Fares	14	0-100
Federal subsidy	18	0-100
Other government subsidy	51	0-100
Private subsidy	6	0-100
Other sources	12	0-100

^aThese figures are averages for providers and do not take the differences in size of the providers into account.

Five percent of the average provider's service is route deviation, and 8 percent of all trips are route deviation. The average system provides 8 percent of its service as fixed route, and 6 percent of all trips are fixed route.

The average productivity is 4.3 trips per hour. The services that have very low productivities generally are those that dedicate a vehicle to a particular round trip, leaving the vehicle and driver idle while the passengers are at their destination. The services with very high productivities provide a large proportion of their service as fixed route.

Government subsidy is the major source of operating revenue with the federal government providing about 18 percent and state and local governments providing about 51 percent of operating revenue. Fares (and suggested donations from riders) provide about 14 percent of revenue. Fourteen of the 42 providers collect no fares or donations from passengers. Private subsidies from groups such as United Way, Catholic Charities, or other charitable organizations as well as donations from individuals account for about 6 percent of revenue. Other sources include cross subsidies within organizations and purchases of service by other agencies and account for about 12 percent of revenue.

To apply the index to the providers, a performance measure for each attribute and a method of relating the measure to the level of satisfaction for the attribute were developed. The relation between the level of satisfaction and the performance measure is called a scoring function. The scoring functions are designed so that the score or level of satisfaction for complete satisfaction is one and the score for no satisfaction is zero. Returning to the example of "delays while on the vehicle," the measure is expected minutes of delay per year, which is based on actual delays in the past year. The scoring function assigned a value of 1 to no delays and a value of 0.1 to the expected delay for the worst (i.e., most delay) case in the sample. Perform-

mance measures and scoring functions were developed for all the attributes in the index (2).

Using the scoring functions, each provider was given a score for each attribute. Then each provider was given a score for each aspect by summing the weighted attribute scores. (The weights are those given in Table 1.) Finally the provider was given a score for quality by summing the weighted aspect scores. Thus, the quality score for each provider is

$$Q_k = \sum_j \sum_i W_j W_{ij} S_{ijk}$$

where

Q_k = quality score for provider k,
 W_j = weight for aspect j,
 W_{ij} = weight for attribute i of aspect j, and
 S_{ijk} = score for attribute i of aspect j for provider k.

The averages and ranges of scores for the aspects and for overall quality of the sample of special service providers are shown in Table 3. The values of the scores for different aspects cannot be compared (e.g., 6.7 for reliability compared with 8.3 for comfort) because the scoring functions are not necessarily on the same scale. However, the amount of variation in scores for a particular aspect is meaningful. The standard deviations indicate that providers vary the most in the extent of service they provide, in the ease of vehicle access, and in driver characteristics. They vary the least in safety, which probably indicates that all providers recognize the importance of safety. The overall score for quality varies relatively little for its size; this may indicate that providers that are poor in some aspects compensate by doing better in others.

TABLE 3 Scores for Quality and the Aspects of Quality

	Mean	Range	Standard Deviation
Quality	68.2	45.8 - 82.9	7.25
Reliability	6.7	3.3 - 8.7	1.29
Safety	7.7	4.9 - 8.7	0.86
Vehicle access	6.6	1.2 - 9.5	2.02
Driver characteristics	5.8	1.3 - 8.7	1.96
Convenience	7.5	5.0 - 9.5	1.12
Extent of service	5.3	1.9 - 10.0	2.04
Responsiveness	7.1	3.4 - 10.0	1.63
Comfort	8.3	3.9 - 9.7	1.36

EFFECT OF SIZE

The 42 providers in the sample were divided into three categories based on annual ridership. The boundaries of the size categories were chosen at natural break points in the sample. Table 4 gives the means of the scores for each aspect and for overall quality for each of the three groups.

It can be seen from the table that overall quality tends to increase as the size of the provider increases. Three aspects, extent of service, vehicle access, and safety, also show increased scores with increases in size. The other aspects generally do not show any tendency to vary with respect to the size of the provider.

The data in Table 4 indicate that size of service area does not have a consistent relationship with size of ridership. The data also show that larger organizations tend to have a greater percentage of

TABLE 4 Effect of Size of Provider

	Small (ridership under 15,000)	Medium (ridership between 15,000 and 50,000)	Large (ridership over 50,000)
Sample size	16	17	9
Scores			
Quality	65.9	68.5	71.9
Reliability	6.6	6.9	6.7
Safety	7.3	7.7	8.1
Vehicle access	6.2	6.6	7.3
Driver characteristics	5.7	5.5	6.4
Convenience	7.5	7.5	7.4
Extent of service	4.4	5.6	6.2
Responsiveness	7.1	6.8	7.8
Comfort	8.4	8.2	8.1
Type of organization (number of organizations)			
Public	11	11	4
Private-non-profit	4	4	2
Private-for-profit	1	2	3
Service area	560	213	558
Percent of trips by wheelchair users	3	7	13
Percent of trips provided by:			
Demand responsive	77	71	42
Subscription	13	15	37
Fixed route	6	9	9

trips by wheelchair users. Finally, larger organizations provide a smaller percentage of their service as demand responsive and a greater percentage as subscription than do the medium and small services.

Table 5 gives correlations between overall quality and individual aspects and several other characteristics of the providers. The correlation coefficients that are underlined are significant at the 10 percent level or better. The majority of the coefficients for size of ridership are positive, which corresponds with the data in Table 4. However, none of the coefficients for ridership are significantly different from zero at the 10 percent level. (The

other correlations indicated in the table will be discussed in later sections.)

Regression analysis was also used to investigate the relation of quality and size. A number of models involving various measures of size were tested. The best model was

$$\text{QUALITY} = 39.1 + 1.67 \ln (\text{RIDER}) + 13.8 \text{ DR} + 17.7 \text{ SUB} \\ (5.59) \quad (2.59) \quad (4.93) \quad (4.83)$$

$$R^2 = 0.508$$

$$F = 13.09$$

TABLE 5 Correlation of Quality Scores with Other Characteristics

Scores	Correlation Coefficients for				
	Rider ^a	Profit ^b	Public ^c	Productivity ^d	WC ^e
Quality of service	0.15	<u>0.28</u>	-0.25	<u>-0.38</u>	<u>0.54</u>
Reliability	-0.00	0.07	-0.13	-0.10	<u>0.43</u>
Safety	0.15	0.03	0.03	0.01	<u>0.45</u>
Vehicle access	0.05	<u>0.34</u>	<u>-0.30</u>	<u>-0.68</u>	0.17
Driver characteristics	0.11	-0.21	-0.06	-0.04	<u>0.43</u>
Convenience	-0.05	0.25	<u>-0.34</u>	0.04	0.01
Extent of service	0.23	<u>0.57</u>	-0.03	<u>-0.36</u>	0.09
Responsiveness	0.11	-0.22	0.16	0.09	<u>0.34</u>
Comfort	-0.14	0.13	-0.25	<u>-0.51</u>	0.06

Note: The correlation coefficients that are underlined are significant at 10 percent level or better.

^aRider is the annual ridership of the provider.

^bProfit is a dummy variable which equals one if provider is for-profit and zero otherwise.

^cPublic is a dummy variable which equals one if provider is a government agency and zero otherwise.

^dProductivity is average riders per vehicle hour.

^eWC is a dummy variable which equals one if provider serves people in wheelchairs and zero otherwise.

where

QUALITY = overall quality score (range from 0 to 100),

RIDER = annual one-way trips,

DR = proportion of service that is demand-responsive (range from 0.00 to 1.00), and

SUB = proportion of service that is subscription (range from 0.00 to 1.00).

The numbers in parenthesis are t-values. The model and all the coefficients are highly significant (at the 2 percent level or better) and the model explains about 50 percent of the variation in quality. Although the correlation between quality and ridership was not significant (see Table 5), the natural logarithm of ridership is significant in this model at the 1 percent level. This is due partly to the effect of the mode on quality in the model and partly to the intercorrelation between size of provider and mode of service (see last rows of Table 4). The model gives a better indication of the effect of size on quality than the averages in Table 4.

The model indicates that quality increases continuously with size--rapidly at smaller riderships (under about 50,000) and more slowly at larger riderships. In addition, providers of demand-responsive service will tend to have significantly higher quality scores than route deviation or fixed-route services, and providers of subscription service will tend to have even higher scores.

The effect of demand-responsive and subscription service in the model is interesting. Demand-responsive service is defined, for this study, as door-to-door service where each trip is individually reserved. The reservation period may vary from 15 min to 2 weeks. (Separation of demand-responsive services into those with same-day reservations and those with 24-hr or longer reservations did not improve the model.) Subscription service is defined as door-to-door service with a permanent reservation. Demand-responsive service is generally considered of higher quality than fixed-route service, everything else (e.g., extent of service) being equal; therefore its role in the model is as expected. However, subscription service had been expected, because it is less flexible than demand-responsive service, to have a slightly lower coefficient than demand-responsive service. One explanation for its higher coefficient is that it generally is more efficient than demand-responsive service; savings attributable to greater efficiency may be used to increase quality in other ways.

EFFECT OF TYPE OF ORGANIZATION

The 42 providers were separated into public (i.e., government operated), private nonprofit (PNP), and private for-profit (PFP). Table 6 gives the means of the scores for each of the three types of organization. Overall quality tends to increase as the type of organization moves from public to private nonprofit to private for-profit, which agrees with the correlations given in Table 5. For all aspects except driver characteristics and responsiveness, the private for-profit organizations have the highest score or are tied for the highest score. For four of these, however, the differences are not great.

With regard to extent of service, there are quite large differences between the three types of organization, with the PNP organizations having the lowest scores. This is probably because many of the PNP organizations are social service agencies that pro-

TABLE 6 Effect of Type of Provider

	Public 26	PNP 10	PFP 6
Sample size			
Scores			
Quality	66.8	69.0	73.1
Reliability	6.6	7.0	7.0
Safety	7.7	7.6	7.7
Vehicle access	6.1	6.8	8.2
Driver characteristics	5.7	6.6	4.7
Convenience	7.2	7.8	8.1
Extent of service	5.2	3.7	8.1
Responsiveness	7.4	7.1	6.3
Comfort	8.0	8.7	8.7
Annual ridership	26,500	28,000	153,600
Service area (square miles)	62	468	635
Percent of trips by by wheelchair users	5	4	21
Percent of trips provided by:			
Demand responsive	78	44	59
Subscription	9	33	41
Fixed route	13	0	0

vide transportation for limited purposes, frequently to serve one program.

PFP organizations have the highest score for extent of service, which is confirmed by the strong correlation in Table 5. However, in some cases, actual extent of service for PFP providers may be limited by contractual arrangement. The PFP organizations operate by a contract or purchase of service agreement with a public or PNP agency or, sometimes, with several different agencies. The contract specifies the extent of service (e.g., geographic boundaries, hours of service) that is to be provided, which frequently is less than the extent that the PFP operator is capable of providing. When the PFP operators were scored, they were given the score for the greatest extent that they were able or willing to provide, because any limitation of that extent of service was due to the contract negotiated with the purchasing agency rather than the limitations of the operating agency. However, a user would only experience the extent of service specified in the contract. This will be discussed further in the next section.

There are also large differences in ease of vehicle access among the three types of organization. The PFP organizations apparently have the vehicles that are the easiest to access. On the other hand, the PNP organizations score lowest for driver characteristics and responsiveness to the user. Examination of the attributes grouped under these two aspects implies that PFP providers are less personal than the nonprofit providers. However, Table 5 shows that these relationships are not significant.

The for-profit organizations tend to provide many more trips per year than do the nonprofit organizations, and a greater percentage of the trips are made by wheelchair users. A large portion of the service provided by the PFP organizations is subscription. The public organizations provide mostly demand-responsive service, but they also provide a significant amount (13 percent) of fixed-route service. The private organizations provide no fixed-route service.

RELATION OF SIZE AND TYPE OF ORGANIZATION

As the data in Table 6 indicate, public and PNP providers tend on the average to be small, and for-

profit providers tend to be large. Table 7 is an attempt to isolate the effects of size and type of organization on quality of service by dividing the sample into nine groups, cross tabulated by size and type of organization. Because of the effect of contractual arrangements on extent of service for PFP providers mentioned previously, overall quality excluding the extent of service aspect is also included below the overall quality of service scores. The number of cases in many of the cells is too small for the results to be significant, but the table does suggest tendencies that could be checked through further research. The table indicates, as does the previous analysis, that overall quality of service increases with size and that quality is lowest for public providers and highest for private for-profit providers. However, the scores for quality of service excluding extent of service do not follow the same pattern. In this case the PNP services have the highest quality, although quality still tends to increase with size. This seems to indicate that potential extent of service is the major advantage of PFP providers over PNP providers. The public providers still tend to have lower quality of service than do private providers when extent of service is excluded.

TABLE 7 Effect of Size and Type of Provider

	All Sizes	Small	Medium	Large
All types	68.2 ^a	65.9	68.5	71.9
	62.6 ^b	61.2	62.5	65.4
	(42) ^c	(16)	(17)	(9)
Public	66.8	64.9	67.8	69.4
	61.3	60.0	62.0	62.9
	(26)	(11)	(11)	(4)
PNP	69.0	67.3	69.3	71.5
	65.1	64.0	65.0	67.4
	(10)	(4)	(4)	(2)
PFP	73.1	71.9	70.1	75.5
	64.5	64.0	60.8	67.2
	(6)	(1)	(2)	(3)

^aAverage score for quality of service.

^bAverage score for quality of service excluding extent of service.

^cNumber of cases.

OTHER RELATIONSHIPS

The correlations of productivity and wheelchair service to quality and its aspects were given in Table 5. There is a significant negative correlation between productivity and quality, which is primarily the result of the negative correlation of productivity with comfort, extent of service, and vehicle access. This indicates that the special services with the highest productivity (i.e., riders per vehicle-hour), have the lowest quality of service. Although data were not collected on costs for this sample, other studies (4) have indicated that services with high productivity tend to have low unit costs. The not very surprising implication is that services with high quality also have high unit costs (i.e., cost per passenger trip). The effect of demand-responsive service in the regression model also indicates that costs go up with quality because unit

cost tends to be higher for demand-responsive services (1,4).

The data in table 5 also indicate a highly significant positive correlation between wheelchair service and quality. Providers that serve wheelchair users tend to have higher levels of quality, particularly for reliability, safety, driver characteristics, and responsiveness to the users. These relationships suggest that providers of these services place a greater emphasis on quality of service than does the typical service in the sample. This confirms indications from earlier studies that operators that provide wheelchair service are often more professional (4).

CONCLUSIONS

This study has provided evidence that large special service agencies tend to provide higher quality of service than small agencies, particularly very small agencies, and private agencies tend to have higher quality of service than public agencies. These findings support the policies of encouraging agencies to coordinate or consolidate their services and encouraging public agencies to contract with private operators rather than operate their own services. However, the differences in quality between types of agencies, while significant, were not large, and several agencies were exceptions to these trends. It should not be expected that quality will automatically be improved by increasing size or changing the sector of provision. The quality of service of any provider should be evaluated just as total cost and productivity are evaluated.

ACKNOWLEDGMENT

The research presented in this paper was funded by the University Research and Training Program of UMTA, U.S. Department of Transportation. The views expressed are those of the authors and not necessarily the views of the sponsoring agency.

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Comparison of Urban Paratransit Systems in Canada

MARA LEE McLAREN

ABSTRACT

Levels of service provided to disabled persons by urban paratransit systems in cities across Canada, where the level of service is determined as a function of the number of rides provided relative to the population of each city, are compared. Service levels are then related to estimates of basic demand that could be expected in each city and to the estimated capacities of each system to provide service. This may be useful to managers of paratransit systems for justifying the need for additional funds or vehicles, for highlighting areas with the potential for improvement, and for explaining difficulties in coping with existing demand.

The term urban paratransit system, as used in this paper, refers to a parallel urban transit system put in place to provide accessible urban transportation services to disabled people who, because of their disability, find it difficult if not impossible to use the regular public transit system. A typical paratransit system consists of a small fleet of vans or buses, some of which are equipped with mechanical lifts and wheelchair tie-downs.

Levels of service found in cities across Canada, where the level of service is determined as a function of the number of rides provided relative to the population of each city, are compared. Service levels are then related to estimates of basic demand that could be expected in each city and to the estimated capacities of each system to provide service. Issues related to efficiency and economy will not be covered; the focus is on demand and supply questions only.

A methodology for estimating the disabled population in a city is presented. It is based on the relationship between age and the incidences of transportation disabilities and uses results from a nationwide survey entitled "Special Needs in Public Transportation" undertaken by Statistics Canada in August 1983 on behalf of the Canadian Transport Commission. Based on this analysis, the proportion of the population that is transportation disabled appears to vary little across Canada.

The goals of the paper are to demonstrate that there are broad differences in the levels of service found in communities across the country, and that there are large amounts of unsatisfied demand in many population centers. In addition, it is hoped that the results presented in this paper will prove useful for city and regional planners, administrators, and operators of paratransit systems for determining potential demand and adequate service levels for their communities in relationship to others.

SAMPLE

This study covers cities and metropolitan centers in Canada with populations of more than 50,000. The

sample size (about 50) is both large enough to be useful and small enough to be easily analyzed. In addition, the paratransit systems of these cities form a relatively homogeneous group in that they are, with few exceptions, all multivehicle systems operating long hours parallel to an existing urban transit system. They provide door-to-door service; allow trips for any purpose when space is available; and offer both a subscription service, where the user books once for regular, usually work-related, Monday-to-Friday trips, and a single-trip reservation service, where the user books each trip separately. This service may be called demand or advance, depending on the length of the prebooking period, which can vary anywhere from 0.5 hour to 2 weeks.

DATA SOURCES

The basic operating statistics for each city were provided by the Canadian Urban Transit Authority, which regularly surveys the paratransit operators, and the Ministry of Transportation and Communications for Quebec, which maintains statistics on that province's systems. Other supplemental information was gathered through a telephone survey of actual operators. The section on demand estimation uses statistics from the 1981 Census and the Canadian Labour Force Survey of August 1983, both conducted by Statistics Canada. In addition, some results are used from the "Special Needs in Public Transportation" survey that was jointly sponsored by the Canadian Transport Commission and Statistics Canada in August 1983. The purpose of this survey was to determine the number of transportation-disabled people in Canada; the assistance they require when traveling by air, rail, or intercity bus; and the barriers or difficulties they encounter.

Another source of data was the information directory, "Urban Transportation Services for Physically Disabled Persons in Canada," put out by the Canadian Rehabilitation Council for the Disabled in December 1981. It contains passenger and operating statistics for both large and small paratransit systems in Canada. There are major problems with some of the data in the directory, because the questions were interpreted in various ways by respondents to the survey. Thus the directory has been used only as a source of supplemental information in this study. However, it is mentioned here because it formed the original impetus for this work and was used as the basis for a preliminary analysis.

When the information directory first became available it was hoped that the user statistics provided in it would provide the basis for an educated guess concerning the number of transportation-disabled Canadians. However, a preliminary investigation of the statistics revealed some rather curious figures. For example, many small cities provided numerically more rides than did many much larger cities. Some systems had most of their clients in wheelchairs (e.g., 90 percent); others had very few (e.g., 10 percent). Services with very restricted eligibility criteria provided more rides per capita than did many services with less restrictive eligibility criteria. Eligibility criteria themselves varied a great deal from place to place. For ex-

ample, some systems do not carry disabled children, others will not carry the mentally disabled, still others do not carry the blind, and so forth.

Eventually it was decided to abandon the attempt to estimate the number of disabled persons and to concentrate instead on simply trying to understand and explain the figures observed. This study developed from that work, notwithstanding that along the way more reliable and comprehensive sources of data became available. Unless otherwise specified, the paratransit data used in this study are for 1982.

ANALYSIS OF SERVICE LEVELS

To compare the levels of service provided in each population center, the following usage rate was defined:

$$\text{Usage Rate} = R/P$$

where R is the number of rides provided per year and P is the total population of center served by paratransit system. Thus, if one city were twice as large as another, it would have to provide twice as many rides as the smaller city to have the same usage rate.

It was mentioned earlier that the eligibility criteria used by each system to determine who may use the service vary. Many systems restrict service to those with physical disabilities, such as people who use wheelchairs or mechanical aids of some kind--people who find it impossible or extremely difficult to board a bus. Thus, blind, mentally retarded, disoriented, epileptic, or deaf individuals who for nonphysical reasons may find it impossible or difficult to use a regular public transit system would not qualify. Other systems will accept, perhaps, the blind but refuse the mentally disabled or vice versa. Others will refuse to allow disabled children to use the service. There is no pattern to this; there are no federal guidelines; where provincial guidelines exist, individual operators within a province interpret them in various ways.

To provide a reasonable basis of comparison, systems were grouped into three categories: those that provide service to the physically disabled only, those that in addition allow other transportation-disabled individuals to use the service, and a small group that has broad eligibility criteria and that also provides a school bus service to disabled school children. The third category seems necessary because, although most school boards in Canada provide their own school bus service for disabled children, a few boards contract this out to the local paratransit system. These trips are not separated in their operating statistics, and the vehicles used are part of their overall operations. In addition, the number of school children may be small, but their daily trips add up quickly and can form a sizable portion of overall trips provided. The nature of the trips (many-to-one, one-to-many) allows for quite efficient scheduling and routing. Thus, it was decided to keep this group in its own category.

Figure 1 shows a plot of usage rates by each of the three eligibility categories described. For those systems with the highest usage rates within each category, usage rates do in fact increase as eligibility criteria broaden. However, within a category all usage rates appear, and many systems that provide rides for the mobility disabled alone still achieve much higher usage rates than many systems with broader eligibility criteria. The top services approach usage rates of 0.4 if they are restricted to the mobility disabled and 0.5 with broader eligibility criteria.

DEMAND ANALYSIS

The question arises of whether the basic demand for paratransit service could vary so dramatically from place to place as to explain the differences in the level of service shown in Figure 1. In other words, it is possible that all systems are responding equally well to the demand and need for paratransit service, and the differences observed in the usage

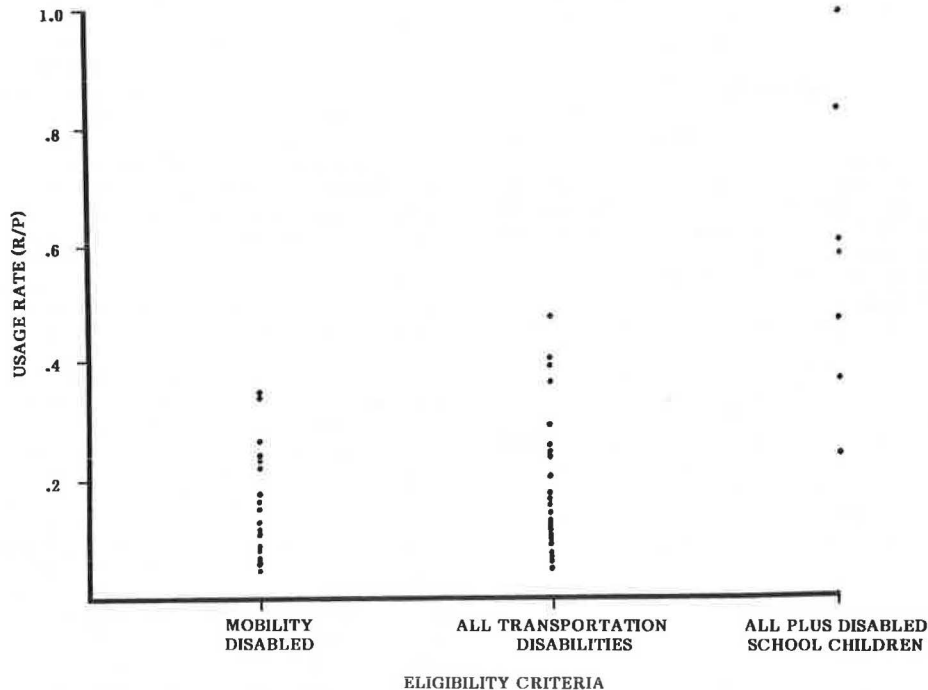


FIGURE 1 Usage rates by eligibility criteria.

rates reflected only differences from city to city in the incidences of transportation disabilities?

An initial analysis suggests that there is no dramatic difference in the proportion of the population that is disabled in the various localities across Canada. Direct statistics on the number of disabled people in each city are not available. However, results from the "Special Needs in Public Transportation" survey do show a strong relationship between age and disability. As is shown in Figure 2, the elderly make up approximately 10 percent of the population in general but form 82 percent of the disabled population. Children, on the other hand, make up about 23 percent of the general population but only about 5 percent of the disabled. Percentage-disabled figures for each major age group follow and are plotted in 5-yr age groupings in Figure 3.

Age Group (yr)	Percentage Transportation Disabled
0-14	0.5
15-64	1.1
65+	14.7
All ages	2.3

It should be noted that the "Special Needs" survey did not include the age group 1-14 years. In this study the estimates for children aged 1 to 14 are based on the average for those aged 15 to 29.

The implication of these statistics for the future is rather sobering but need not be covered here. What these statistics do provide is a relatively simple way of estimating the percentage of disabled one can expect to find in a city, based on

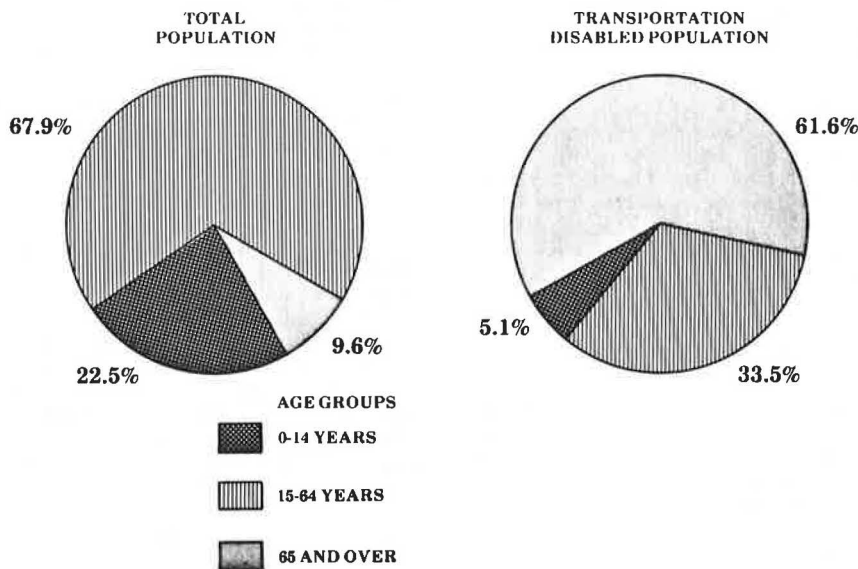


FIGURE 2 Transportation disability statistics.

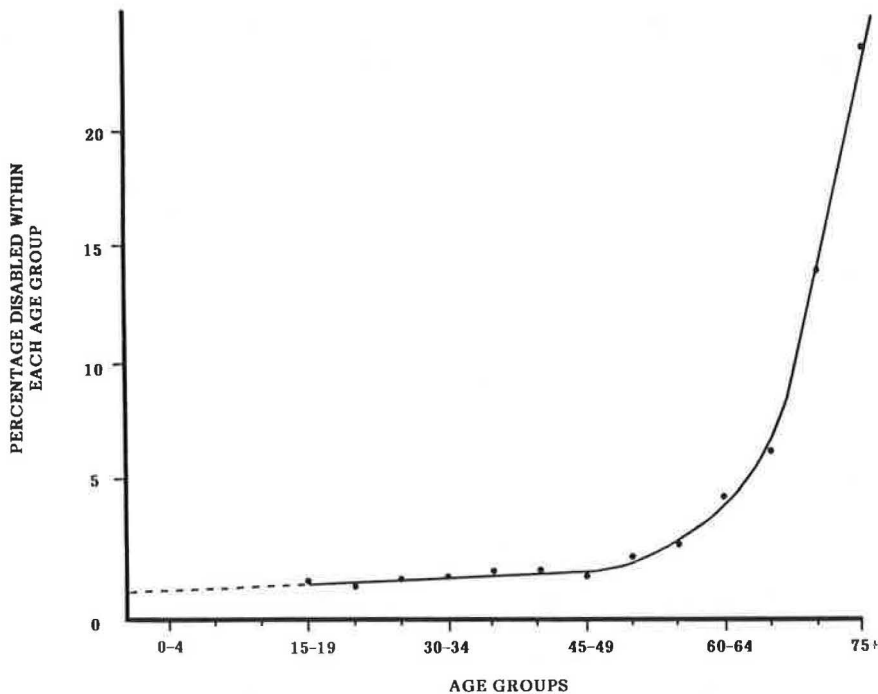


FIGURE 3 Percentage transportation disabled by age group.

the percentage of elderly living there. The percentage disabled in the 0-64 age group is estimated to be 1.0 percent, and for those 65 and older it is 14.7 percent. Thus, if city A had P_A percentage of its inhabitants 65 and older, then the estimated percentage disabled, P_D , would be

$$P_D = 0.010 * (1 - P_A) + 0.147 * P_A \quad (1)$$

This is a linear equation and is plotted in Figure 4.

For each city in the sample one can estimate the percentage of disabled people from percent elderly census information and then determine a scaling factor, λ , defined as

$$\lambda = \% \text{ Disabled in City A} / \% \text{ Disabled in Canada} \quad (2)$$

For example, if a city has 13 percent of its population aged 65 or older, then from Figure 4 its estimated disabled population would be 2.77 percent of its total population. The Canadian average percentage disabled is 2.31 percent. So this city would have a scaling factor of $\lambda = 2.77/2.31 = 1.20$ or an estimated disabled population 20 percent higher than average. Its usage rate would have to be 20 percent greater than the usage rate for a city with precisely the national average of disabled people if the two cities were in fact providing the same level of service to their transportation-disabled communities. To compare cities, a scaled usage rate can be defined as

$$\text{Scaled Usage Rate} = \text{Usage Rate} / \lambda \quad (3)$$

which adjusts each usage rate to the equivalent usage rate one would expect to see if the same level of service were to be provided in a hypothetical city with exactly the Canadian average number of transportation-disabled people.

Usage rates for all cities in the sample were rescaled in this manner and replotted as shown in Figure 5. (Scaling factors will be provided by the author on request). If true demand for service were driving each of the various systems, and service levels were in fact very similar, when differences in demand levels had been taken into account, one would have expected to see the scaled usage rates show a tendency toward grouping or bunching about

some natural usage rate for each category. No such grouping, or even an indication of movement toward grouping, can be observed. This is not surprising, because an examination of the λ values shows that differences of more than 20 percent in the proportion disabled are rare. Correcting for expected differences in the number of disabled people in a community can be considered fine tuning at this state, or perhaps of interest mainly to individual operators in determining how well demand is being met. But the evidence at hand does not support the assumption that usage levels are currently determined by the demand or need for service. Systems do not appear to be demand driven, and many systems are operating well below the levels one would expect to see if equivalent and first-rate service were available across the county.

It should be noted that this demand analysis is necessarily rather crude. It implicitly assumes that an increase or decrease in the proportion of the population who are disabled translates directly to an equivalent increase or decrease in the demand or need for paratransit service. In reality the connection may be more tenuous. The average disabled individual of working age may wish to use a paratransit service far more often than a disabled person over 65. If true, this would have the effect of minimizing any differences in the resulting demand one could expect between cities even where there are differences in the proportion of disabled individuals, if such differences in the proportions were related solely to different age profiles. Also, there may in fact be some cities with much higher disability incidences, even when age demographics are taken into account. For example, severe polio epidemics many years ago might have increased the number of disabled in a particular city, or hazardous working conditions that may have existed in mines or smelters might affect disabled statistics in a city. In addition, the "Special Needs" survey omitted people in institutions that may, as a matter of public policy or economics, have all been centered in a particular city within a region. Be that as it may, detailed disability statistics by city are, to the best of our knowledge, simply not available, and the best information available suggests that demand differences do not vary enough from city to city to explain the differences in usage rates observed.

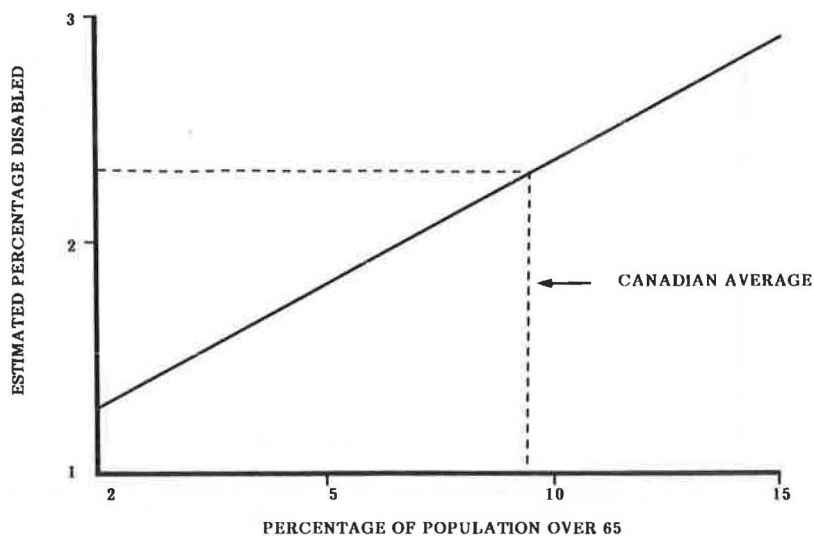


FIGURE 4 Predicting transportation-disabled population as a function of the percentage of elderly.

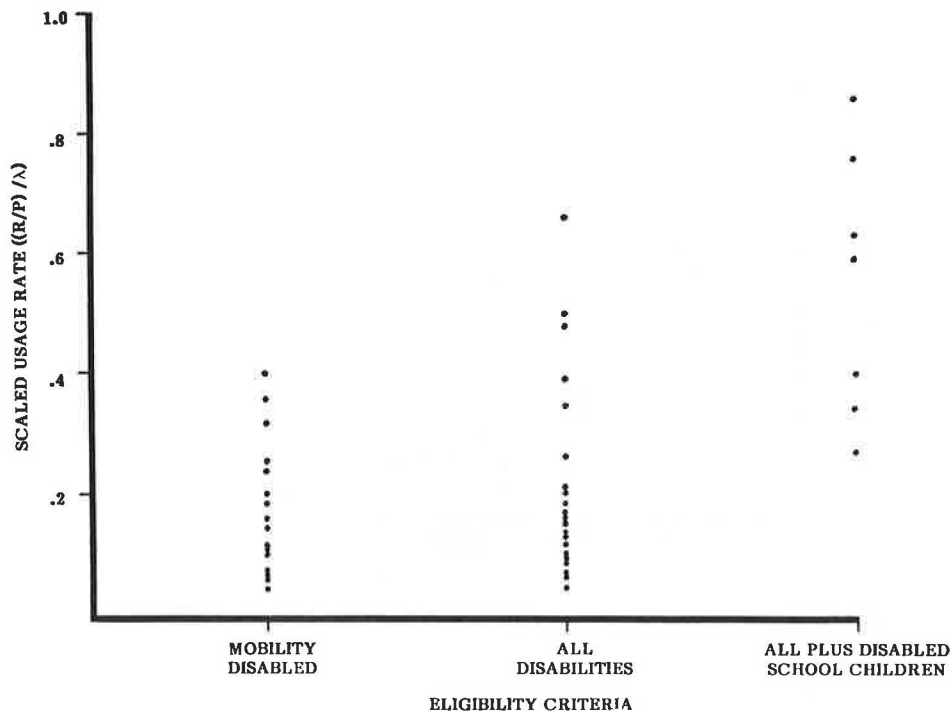


FIGURE 5 Scaled usage rates by eligibility criteria.

SUPPLY ANALYSIS

If it is not demand that determines service levels, perhaps it is supply. In this section the relationship between supply and service levels is investigated.

The number of vehicles is used as a measure of the capacity of a system to provide service. At first glance this may appear to be a rather crude measure of capacity because some vehicles are much larger than others. However, a review of the most commonly used measure of system efficiency, passengers per vehicle-hour, used in paratransit systems across Canada shows values that range from about 2 to 5, all of which can be achieved by a small vehicle, even a car or taxi. Thus, although large buses in theory can carry more people, it is questionable whether paratransit systems are able to use this extra capacity to any appreciable extent. For the kinds of gross effects under examination here, it was decided that vehicle counts were an adequate measure of capacity.

To allow for meaningful comparison between cities with different populations, the ratio of people to vehicles was used as a relative measure of capacity:

$$\text{People-to-Vehicle Ratio} = P/V$$

where P is the population of center and V is the number of vehicles in paratransit service.

A few paratransit systems make use of taxis to provide some rides. Where this occurs the vehicle counts for that city were scaled up to reflect the proportion of rides provided via taxis. That is,

$$V(\text{scaled}) = V \times [R(\text{fleet}) + R(\text{taxis})] / R(\text{fleet}) \quad (4)$$

where R(fleet) is the number of rides provided per year by paratransit vehicles and R(taxis) is the number of rides provided by taxis.

Figure 6 shows a plot of usage rates (i.e., rides per year per total population) against the people-

to-vehicle ratio. The relationship, although not perfect, clearly shows that high usage levels are associated with low people-to-vehicle ratios, and vice versa. From the graph one can see that in order to reach usage levels of 0.4 to 0.5 one needs at least one vehicle for every 15,000 people in the general population, that one in 12,000 would be better, and that very few systems attain such ratios.

One might think that the variability observed about the line in Figure 6 reflects differences in operating efficiencies, with those systems above the line more efficient and those below less efficient. But at least some of the variability appears to be explained by another cause, for, when systems farthest from the line were investigated, it appeared that those much above the line in general had the shortest distance to cover per passenger; that is, an average vehicle distance per passenger of about 3 to 5 km, whereas the average vehicle distance per passenger is defined as the total number of kilometres covered by all vehicles in a year divided by R, the number of rides provided. Conversely, those systems farthest below the line generally had much longer vehicle distances to cover per passenger--on the order of 12 to 18 km.

Intuitively the longer the distances to be covered the smaller the number of passengers that can be carried in any given time. This is confirmed in Figure 7 that shows a plot of average vehicle distances per passenger against passengers per vehicle-hour statistics for each system. As average vehicle distances per passenger increase, passengers per vehicle-hour statistics decrease, and vice versa. From conversations with paratransit operators, it seems that passengers per vehicle-hour statistics are often used to compare the relative efficiencies of different systems. Figure 7 shows that such comparisons can be misleading and should not be used in isolation. Perhaps passengers per vehicle-hour statistics should be used mainly for measuring the effect of operating changes within a system, all other things being equal. However, one can imagine artificial methods of boosting this statistic (for ex-

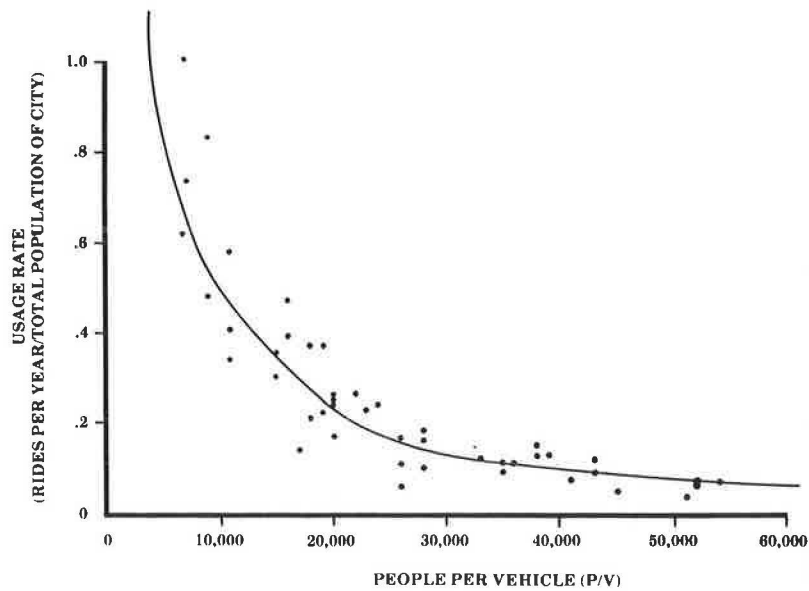


FIGURE 6 Usage rate versus vehicle ratio.

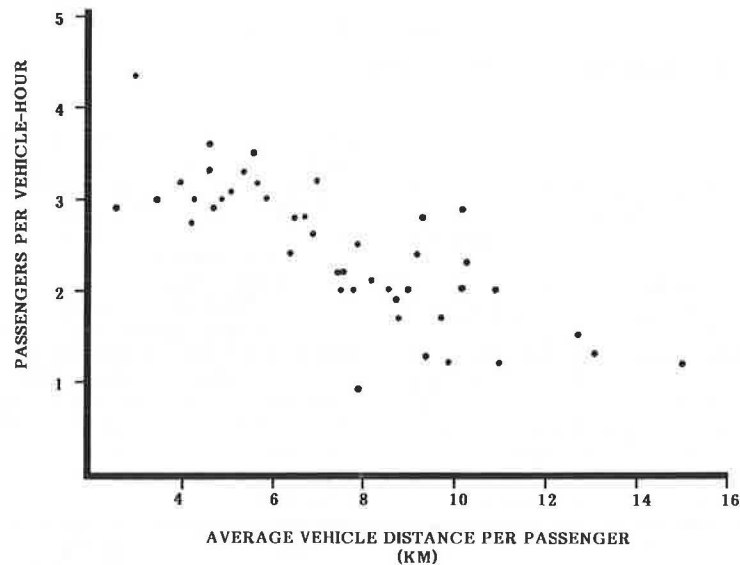


FIGURE 7 Passengers per vehicle-hour versus average distance.

ample curtailing off-peak-hour service or restricting the area served) that would boost the passengers per vehicle-hour statistics but degrade service.

To study the distance effect further, Figure 8 shows separate plots of those systems with short or long average vehicle distances per passenger. It is clear that at least some of the variability observed in Figure 6 is explained by the relative distances the various systems must cover in providing service. Other factors that are not included in "distance" but that also may help explain the variability include traffic congestion and network effects. For example, two cities might have identical populations and paratransit vehicles, but, because of where disabled users live, where and when they want to travel, the area covered by the city, and the road network, the average trip might take 45 min in one city and cover 10 km whereas in the other city it might take 15 min and cover 5 km.

It should be noted that this study counts all vehicles, including "spares," which puts those systems

with old or unreliable vehicles at a disadvantage because they may have to keep a much higher proportion of their fleet on standby. Also, there is some variation in the number of hours of operation among systems, particularly for paratransit systems in smaller cities because these usually match the hours of operation of the regular urban transit system that may not operate, or may have reduced hours, on weekends.

Therefore, although there are, no doubt, differences in operating efficiencies among systems, there is no reason to think these differences are great. What evidence there is, in fact, suggests that most systems are doing the best they can with the vehicles they have at their disposal, that service levels are determined to a large extent by the number of paratransit vehicles a system has, and that many operators (including, incidentally, those in some of our largest cities) are operating at levels that meet only a small fraction of the potential demand.

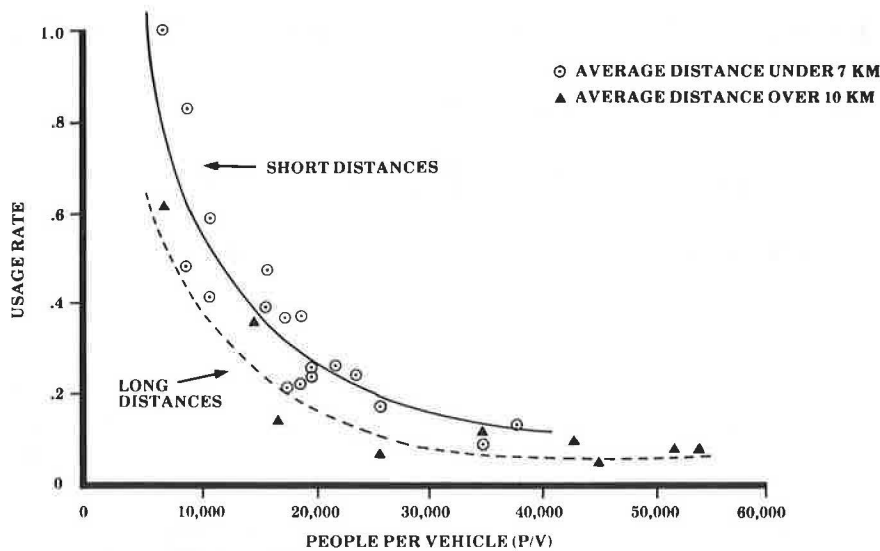


FIGURE 8 Usage rate versus vehicle ratio for short- and long-haul operations.

Thus, many operators have the unhappy task of rationing a scarce resource. This may explain to a large degree some of the, at first glance, arbitrary and inconsistent eligibility criteria that have been observed. A paratransit system manager might be loathe to widen eligibility criteria when a system does not have enough facilities to handle the existing demand. These and other congestion indicators are discussed next.

CONGESTION INDICATORS

Congestion indicators include

1. Stringent eligibility criteria--Systems accept and reject various disability groups in an apparently haphazard manner. Such groups include the blind, the mentally disabled, disabled children, and the deaf.
2. Restrictive procedures and usage results--One system allows a user to take at most three rides per day. Another requires bookings to be made in effect 2 weeks in advance of the trip, but only confirms the trip 24 hr in advance. Another allows "social" trips during off-peak hours only. Another allows only wheelchair users to use the demand service.
3. High levels of complaints--Complaints are mainly about booking problems.
4. High refusal rates.
5. High cancellation rates--These seem to be related to long advance booking periods. Disabled people may not know in advance if their health will allow the trip or even if they will still want or need the trip, but to guarantee the trip it must be reserved long in advance.
6. Long waiting lists--These exist particularly for subscription service.
7. Black hole syndrome--Many operators are not really aware of where their system is in relation to the true demand for service. Many of the indicators contribute to artificially suppressing the demand for service to the point where many operators, regardless of their position on the service-level curve, feel that if they just had "one more vehicle" they could handle the demand. When that "one more vehicle" arrives, it is completely swallowed up with extra demand within a month or two, and the system appears to be back where it was.

CONCLUSIONS

Major conclusions are that service levels do vary dramatically from system to system in a way that does not appear to be explained by possible differences in the level of demand but in a way that is directly related to the size of paratransit fleets. There are high levels of unsatisfied demand across the country and a chronic shortage of fleet capacity. It seems that the various paratransit systems exhibit no strong differences in efficiencies.

It is to be hoped that the results presented in this paper will prove useful to operators and urban transportation planners in monitoring and comparing the levels of service that are provided. Many operators may not know where their system stands in relation to basic demand and to other systems, and such information would be useful. In the past measures such as passengers per vehicle-hour were the statistics on the basis of which comparisons were made, and from results presented in this paper it would appear that such comparisons can be misleading if used in isolation from other factors. There is reason for concern that efforts at improving service in some paratransit organizations may be focused on improving efficiency, as measured by passengers per vehicle-hour statistics, when a more fundamental problem may exist; namely, the lack of vehicles. It is hoped that this paper will encourage discussion of this point.

ACKNOWLEDGMENT

The author wishes to thank the many patient and dedicated individuals working with paratransit systems who took the time to discuss their operations and who provided so much interesting and illuminating information. I also wish to thank Brian Bell, Diane Cofsky, Roger Roy, Debbie Prupas, and Ingrid Cheshire for their invaluable assistance in the collection of the data required for this study.

This study was done under the direction of the Office of the Coordinator, Transportation of the Handicapped, Canadian Transport Commission. The views expressed and conclusions reached are those of the author alone and do not necessarily reflect those of the Canadian Transport Commission.

Mobility Training Program: Methods and Costs of Teaching Mentally Retarded Persons to Ride Public Mass Transit in Sacramento

JANE K. STARKS, CATIE SIMPSON, and HEATHER MENNINGER

ABSTRACT

An examination is presented of the Mobility Training Program that was implemented in Sacramento, California, in response to an increasingly common phenomenon: the influx of mentally retarded clients of social service agencies to special efforts paratransit systems. In this instance, mobility training was initiated through the cooperative efforts of local special efforts providers, the regional transit agency, and various social services and was designed to divert mentally retarded users of paratransit to the fixed-route bus system. As is typical of most training programs, a high rate of success was attained. Ninety-five of the ninety-seven clients accepted for training achieved independent travel ability. Eighty-five clients have continued to use the fixed-route system. Although the procedures followed in training clients remain constant, per capita training costs vary widely among different training programs. Therefore, the costs of mobility training in Sacramento are examined closely to determine how different strategies and policies affect both the cost and the cost-effectiveness of mobility training. The administrative location of training in the metropolitan planning organization increased the overhead cost. However, labor policies permitting the use of paraprofessional trainers on a part-time basis, plus instruction practices that emphasized training at frequent intervals and exclusively during bus travel, greatly minimized the direct costs of training. Therefore, the cost of training in Sacramento was less than costs reported for some other programs. In addition, mobility training plus subsequent travel is far more cost-effective than other special transit supply options in the Sacramento regional transit service area.

During 1982 the Mobility Training Program (MTP) in Sacramento trained ninety-five adults, of whom all but five were mentally retarded, to travel independently on the fixed-route bus system. The MTP was initiated through the cooperative planning of special efforts transit providers and local social service agencies, and financed by state funds dedicated to special transportation needs. The purpose of training retarded persons was to reduce the demand of these citizens for peak-period subscription-type travel on local special efforts and human services specialized transit modes.

The circumstances that prompted recourse to mobility training in Sacramento are not unique. A rel-

atively recent influx of mentally retarded patrons onto various special efforts paratransit systems has severely tested the ability of some of these systems to preserve previous levels of demand-responsive services. Although social and human service agencies have been the usual providers of mobility training, the recognition that mobility training permits the substitution of much less expensive mass transit modes for costly paratransit services has induced local special efforts systems and community organizations to inaugurate training programs in Detroit and Oakland, as well as Sacramento, that have been funded or in other ways supported by regional or state transportation agencies.

This paper, therefore, is addressed to three different audiences who might wish to undertake or to support mobility training for transit-disabled persons in their communities:

- Social service agencies whose transportation expenditures have preempted the provision of primary services to their clients;
- Paratransit systems that are operating at capacity and therefore wish to divert patronage to fixed-route modes in order to serve the unmet transportation needs of persons for whom mobility training is not appropriate; and
- Fixed-route transit systems, whether or not subject to federal or state accessibility directives, who seek to address the mobility needs of transit-handicapped persons in a manner that can increase route productivity without the need for costly operational or equipment modifications.

First, what mobility training is, why it is needed, and for whom it is appropriate are outlined. Then the implementation of the MTP and the training procedures that were used are described. Third, the cost components of mobility training at the MTP, including costs that are attributable to the strategies used to implement training, as well as costs that are related to client characteristics are discussed. Fourth, the cost-effectiveness of the MTP is examined in relation to the costs of alternative transit supply options. The last part of the discussion is devoted to policies and perceptions that limit the service-effectiveness of mobility training.

Because of the scarcity of published information about mobility training, especially information presented from a transportation planning perspective, data from other training programs have been included to more fully illustrate some of the issues examined in this paper.

CATALYSTS FOR MOBILITY TRAINING: NEED AND ABILITY

Mobility training is a generic, nonmodal specialized transportation service that provides personal instruction in travel skills to enable people to use

conventional fixed-route transit in an independent fashion. Mobility training programs for the retarded have been adapted from earlier training programs created for the blind and have retained a basic emphasis on pedestrian skills and route recognition (1). Persons who are mentally retarded, who can also be described as developmentally disabled, reveal significantly subaverage intellectual ability and deficits in adaptive behavior that are manifested during the developmental years (2). Therefore, mobility training for mentally retarded persons emphasizes instructional techniques that overcome the cognitive barriers--poor visual acuity, deficient verbal skills, retention difficulties--that can prohibit their use of mass transit. A more complete discussion of the various travel barriers that confront the mentally retarded is available in an earlier paper (3).

As noted elsewhere, it is unclear to what extent mentally retarded individuals are represented in the data enumerating the national population of travel-handicapped persons (4-6). Nonetheless, mentally retarded persons should figure prominently in the national count of the nominally transit disabled. This is due to the fact that 3 percent of all U.S. citizens, nearly 7 million persons, will be identified as mentally retarded at some point during their lives (7).

Demand for Paratransit Services

In the 1970s mentally retarded persons became the focus of federal and state expenditures that resulted from various legislative mandates [e.g., Intermediate Care Facilities for the Mentally Retarded, 1972; Rehabilitation Act, 1973; Supplemental Security Income, 1974; Education for All Handicapped Children Act, 1975 (8)]. Consequently, social service administrators have observed that transportation has emerged as a critical factor in enabling mentally retarded clients to take advantage of the community-based educational, rehabilitative, and vocational programs made newly available to them (9-14).

Encouraged by low-fare or no-fare policies, social service agencies have become increasingly, and in some instances overwhelmingly, dependent on the most costly mode of travel for their mentally retarded clients: door-to-door demand-responsive services provided by special efforts systems. For example, more than one-third of the special efforts systems' ridership of the Southeast Michigan Transportation Authority (Detroit), Houston, and Fort Worth, and more than half of the ridership of Getabout, in southern California, is comprised of mentally retarded users (5,6).

Estimates of national or local costs of transportation services for the transit-handicapped are highly problematic. It has been noted that, in general, expenditures for transportation services by social and human service programs have been extremely difficult to differentiate from other program costs (5). However, cost data obtained from a recent study by the Department of Developmental Services (DDS), which represents approximately 56,000 mentally retarded persons in California, does suggest the magnitude of transportation spending for these citizens. For example, continuing a recently established trend of sharply escalating costs, the DDS spent a minimum of \$20 million in fiscal year 1982 for purchased transportation, predominantly door-to-door specialized services, for more than 12,000 mentally retarded clients (13). These clients represent less than 2 percent of the 604,931 state residents identified as transit handicapped by the

1980 Census of Population and Housing. Yet, expenditures by a state agency, which represents a single category of special needs recipients, exceeded the total (\$19 million) state funds allocated by the California Transit Development Act to address the transportation needs of all transit-handicapped Californians.

The DDS has uncovered instances where transportation costs for some individuals are inordinately high. In the most extreme case paratransit service for one client cost \$112 per day, approximately \$28,000 per year. Furthermore, the payment of premium fares has not guaranteed the provision of superior levels of service: round-trip fares of \$66, \$72, and \$84 have been charged for clients who must spend 3 to 4 hr daily in transit.

Currently the DDS has issued policy recommendations favoring mobility training, when feasible, over the purchase of specialized transportation services (13). It seems probable that, if and when more agencies explicitly examine the costs of transporting their clients, mobility training will be more widely instituted as an alternative transportation measure.

Latent Independent Travel Ability of Mentally Retarded Persons

In 1972 the President's Committee on Mental Retardation asserted that at least 89 percent of all mentally retarded persons can be successfully mobility trained (14). The high rates of achievement attained by all programs described in the literature attest to this claim: 99 percent of 140 clients trained at the Center in Mental Retardation in Los Angeles (6), 98 percent of the 97 clients from the MTP, 80 percent of the clients from the Ray Graham Center in Chicago (15), and more than 72 percent of the 68 clients trained by the Wayne County Association for the Retarded in Detroit (16) were successfully taught independent travel skills during each program's first year of operation. Between 1972 and 1982, 85 percent of the children trained by the New York City Board of Education acquired proficiency in independent travel (17).

However, no criterion is available that can be used alone to preselect successful candidates for mobility training or even to restrict eligibility for special transportation services; intelligence quotients certainly are not useful. Psychometric measures have been emphatically rejected as invalid for predicting the probability of whether a higher-functioning individual can be successfully trained (1,16,18). Only 3 percent of all mentally retarded persons can be uniformly regarded as intrinsically incapable of training because they are profoundly retarded; that is, their IQs range from 0 to 20 points (14). However, even here it is the exception that tests the rule: The Wayne County Association for the Retarded successfully trained a severely retarded person with an IQ of 20 to travel a route in the city of Detroit that required him to transfer between buses (16).

Similarly, just as it has been impossible to predict what personal or intellectual characteristics permit the retarded person to successfully adjust to living and working in the community (7), it has been difficult to determine the prerequisite attributes of the successful mobility training candidate. For example, the DDS attempted unsuccessfully to statistically differentiate 216 successful candidates from both the MTP and the East Bay training programs from a sample population of 2,505 mentally retarded counterparts who had not undergone training (13).

The DDS did, however, subjectively isolate 20 attributes of 216 mobility-trained persons. These attributes are believed to correlate with successful mobility training (10). The mentally retarded mobility-trained person

1. Is not profoundly retarded,
2. Is not severely impaired by cerebral palsy,
3. Is not severely impaired by epilepsy,
4. Does not have combined severe loss of hearing and vision,
5. Is ambulatory or moves independently in a wheelchair,
6. Is toilet trained,
7. Has control of bladder during the day,
8. Has control of bowels during the day,
9. Has not caused serious physical injury within the past year,
10. Does not have a major problem with self-injurious behavior,
11. Does not cause serious property damage,
12. Does not have a major problem with running away,
13. Does not inappropriately undress self in public place,
14. Is not overly resistive,
15. Is able to associate time and events,
16. Is able to keep attention focused on a single activity,
17. Is able to follow safety rules,
18. Remembers instructions,
19. Has either verbal or nonverbal expressive language, and
20. Has either verbal or nonverbal receptive language.

These attributes are believed to correlate with successful mobility training. Although intuitively reasonable, this list is not a valid preselection tool; virtually the entire non-mentally retarded mass transit ridership could safely be presumed to meet the criteria. Furthermore, the high rates of success reported by training programs suggest that such selection tools are superfluous, if only because it is probable that only those candidates who are regarded as likely to succeed are referred for training. In addition to innate ability, the variables that currently determine selection for training are the individual's proximity to transit, the approval of parents or guardian, and the individual's need for transportation to a particular destination.

MOBILITY TRAINING PROGRAM

Background

Sacramento County is a low-density, largely suburbanized region with a population estimated in 1980 to be approximately 783,381 (19). The city of Sacramento, the urban center, has 275,741 residents. The population density of the city, 2,981 persons per square mile, is six times greater than that of surrounding communities. The average density of the countywide area is 709 persons per square mile.

Two aided transit systems operate under the aegis of the Sacramento Rapid Transit District. Both systems, Regional Transit (RT), the fixed-route bus system, and Paratransit, Inc. (PI), the special efforts system, are the major suppliers of specialized paratransit services. A total of 1,310 one-way trips per weekday are provided by RT and PI. Approximately 85 percent, or 1,113 trips, are taken by mentally retarded clients of social service agencies.

Regional Transit, which serves the county of Sacramento, supplies 70,000 trips daily on a fleet of

240 buses (23 of which are lift-equipped). From its fleet RT also operates the RT Special, a specialized fixed-route service used exclusively by mentally retarded patrons who are sponsored by the Sacramento Association of Retarded Citizens. The RT Special serves 350 people on eight routes during off-peak hours and provides approximately 716 one-way trips per weekday to congregation sites.

Paratransit, Inc., supplies advance-notice, demand-responsive, and subscription doorstep services to the frail elderly and physically disabled, in addition to the mentally retarded, within Sacramento city limits. Twenty of PI's 28 vehicles are lift-equipped. In fiscal year 1981 PI provided an average of 594 trips per weekday and 54 trips per weekend day.

The circumstances that prompted the implementation of mobility training in Sacramento confirm the more general observation that claims for service by special users, which are addressed through community-based planning and financed through dedicated funds, constitute a significant impetus for the adoption of paratransit innovations (20). Regional Transit, PI, and various social service agencies formed a coalition to institute mobility training as a means of reallocating existing systemwide demand for paratransit service by diverting mentally retarded users to RT's conventional bus service. In Sacramento, limited paratransit capacity adversely affected providers and consumers of special transportation services. Both the RT Special and PI had waiting lists for their subscription services. Moreover, PI's overall capacity had become increasingly devoted to subscription travel, to the detriment of elderly or physically handicapped patrons with more occasional needs for travel. Before the MTP was begun, PI was unable to fulfill 35 percent of trip requests for demand-responsive services (21).

Regional Transit formally submitted the proposed training program to the California Department of Transportation. The Secretary's Discretionary Fund for Public Transportation Needs, created by Senate Bill 620, supplied the grant monies. Regional Transit subcontracted the grant to the Sacramento Area Council of Governments (SACOG), the metropolitan planning organization, who implemented the MTP during a 1-year demonstration period.

The SACOG organized the Mobility Training Advisory Committee (MTAC) to assist the development of the MTP and to oversee the conduct of training. The following agencies participated: RT, PI, Alta California Regional Center, the California Department of Rehabilitation, the Community Services Planning Council, the Easter Seal Society, Goodwill Industries, the Developmental Disabilities Council, Resources for Independent Living, the Sacramento Association for the Retarded, Training Toward Self-Reliance, and United Cerebral Palsy. The committee met monthly and proved to be a fruitful source of client referrals. Training began in January and concluded in September 1982. The MTP is currently administered by PI on a fee-for-service basis.

Instruction

A uniform training curriculum is dictated by the cognitive attributes of mentally retarded persons and by the need to ensure client safety. Therefore, virtually all reported training programs, including the MTP, rigorously adhere to training procedures that include the following elements: instruction in pedestrian and pre-mobility skills and emergency procedures, one-to-one instruction on the fixed-route mode until the client achieves mastery of the route, and covert observation of the client from a separate

vehicle when the client first travels alone (1,3,11, 15-18,22,23).

During the first year 97 clients were accepted for training. Thirty-three percent of these clients were diverted from the RT Special; 15 percent were diverted from PI's subscription service. Over half, 52 percent, of the clients had relied on served trips from family members before training.

To be accepted for training the client had to meet several eligibility criteria. She or he had to be ambulatory (assisted by walking aids if necessary), sighted, able to sit and stand unassisted, able to communicate name, address, and telephone number (or display printed information), able to communicate needs if verbal, and able to display acceptable social comportment.

Before instruction began, the trainer examined the route to be taught locating bus stops and identifying, and perhaps photographing, landmarks that indicated destinations or transfer points. The trainer also prepared documents for the client, including emergency identification and route cards in addition to bus passes.

The client's premobility skills were evaluated by the trainer in the client's home. This assessment accomplished two purposes. The first objective was the diagnosis of the client's idiosyncratic strengths and deficits in travel and pedestrian skills so that an appropriate training regimen could be devised. The second, more subtle, purpose of the home-based interview was the introduction of the trainer to the client in familiar, reassuring surroundings. This allowed the trainer to identify, and perhaps alleviate, any fears for the safety of the client disclosed by the family or care provider.

Training was conducted on the route at the times needed for travel so that disruptions in the client's attendance at workshops or programs were avoided. Contact between the instructor and the client was frequent, usually twice daily, so that newly learned skills could be quickly reinforced. More details concerning training will be presented later. However, a comprehensive explanation of the training process used at the MTP, as well as descriptions of the specific disabilities attendant to mental retardation, is available in the MTP Mobility Training Handbook (23).

COSTS OF THE MTP

The uniform character, noted earlier, of training procedures employed by various training programs contrasts sharply with the diversity and flexibility displayed by these same programs in how mobility training has been implemented. Training, to date, has been administered in diverse institutional settings, under various funding arrangements, on different scales of magnitude, and used different labor policies. The variability evinced in the ways mobility training has been undertaken is accompanied by variation in training costs among programs. Costs range from \$288 per person, reported for the Center in Mental Retardation in Los Angeles (6), to nearly \$1,800 per person, reported by the Wayne County Association for the Retarded in Detroit (16).

Some portion of the disparity between per capita costs of training is probably attributable to differences in clients' abilities or in the learning difficulties presented by particular transit systems. However, some of the disparities in cost may reflect inefficiencies in the conduct of training. In this section what the MTP cost and why are examined carefully to identify policies and strategies that will minimize the cost of training so that more individuals can be trained per dollar amount of investment.

Training Cost Components

The ratio of the total number of persons successfully trained, 95, to the full cost of training, \$65,700, yields a per capita cost of training of \$692 for the MTP. Table 1 shows both the reconstructed full costs and the expenses of the MTP. All training was performed during travel, and there were no vehicle or equipment purchases. Therefore, direct and indirect services were the only cost components.

It was observed that some social service agencies may underestimate the need for, and therefore the costs of, overhead for mobility training. The majority of both costs and manhours expended for training at the MTP was devoted to the performance of many important indirect services: accounting, monitoring, program start-up, hiring and orientation of trainers, marketing, preparation of the training manual, data collection, route selection, client assessments, and obtaining bus passes.

TABLE 1 Training Cost Components of the Mobility Training Program

	Direct Costs (\$)	Indirect Costs (\$)	Total Costs (\$)
Salaries	18,500.00	25,250.25	43,750.25
Benefits			
Office rent			
Utilities			
Communications			
Supplies			
Books			
Data processing ^a	0.00	14,199.75	14,199.75
Memberships ^a			
Legal Services ^a			
Consultants ^a			
Mileage	3,957.00	0.00	3,957.00
Printing	793.00	0.00	793.00
Total grant expenses	23,250.00	39,450.00	62,700.00 ^b
RTD-donated bus passes	3,000.00		
Full costs	26,250.00	39,450.00	62,700.00

^a Indirect expenses of SACoG that were not incurred by the MTP.
^b Standard accounting procedures (direct labor costs constitute the basis against which indirect costs are charged) were used by the Sacramento Area Council of Governments to derive the expenses of the MTP (23).

Table 2 shows how financial costs were allocated among direct and indirect services. Indirect services cost \$39,450, an amount representing 63 percent of total financial costs. Although trainers performed several indirect services (client assessments, route selection, data collection), their salaries were treated entirely as a direct cost. Spending for training clients, the only direct service, was altogether \$23,250, approximately 37 percent of the total financial cost. This dominant relationship of indirect to direct costs manifested by the MTP would probably hold true for any training endeavor, regardless of total program expenditure.

Impact of Institutional Setting on Training Costs

The MPT exemplifies the general observation that the provision of paratransit services by large organizations, which possess a complicated management infrastructure, imposes a burden of overhead costs for administration; such costs will preempt funds that could better be used for service delivery (20).

The administration of the MTP by SACoG increased total costs in two ways. First, the MTP was located in a large, diverse agency that practiced standard accounting procedures whereby direct labor costs constitute the basis against which indirect costs

TABLE 2 Labor and Cost Inputs Allocated by Staff Level

Staff Level	No. of Persons	Manhours			Expenditures		
		Avg Hours per Person	Total Hours	Percentage of Program Total	Avg Hourly Expense per Person (\$)	Total Expense (\$)	Percentage of Program Total
Indirect							
SACoG	7	74	519	8	43.95	22,810.61	36
Project coordinator	<u>1</u>	1,884	<u>1,884</u>	<u>28</u>	8.83	<u>16,639.39</u>	<u>27</u>
Subtotal	8	300	2,403	36	16.42	39,450.00	63
Direct							
Trainers	<u>6</u>	714	<u>4,287</u>	<u>64</u>	5.42	<u>23,250.00</u>	<u>37</u>
Overall	14	477.9	6,690	100	9.37	62,700.00	100

are charged. The salaries and expenses of the trainers were assessed for some of SACoG's overhead expenses that did not correspond to actual training costs. Therefore, overhead expenses not incurred by the MTP, such as data processing, memberships, legal services, and outside consultants, were cross-subsidized by the MTP grant funds.

More critical, overhead costs were increased by the participation of senior staff members of SACoG in the MPT. As shown in Table 2, seven full-time administrative SACoG staff members, most of whom were highly compensated in terms of salaries and benefits, devoted, on a part-time basis, a total of 519 manhours that were billed to the MTP. Although these individuals contributed 8 percent of the total of 6,690 manhours expended on the MPT, the average hourly cost of their services, \$43.95, totaled \$22,810.61, which represented 36 percent of the total grant monies of \$62,500. The project coordinator, who was hired for the exclusive purpose of supervising the MTP, was the only SACoG staff member involved full time in the training project. However, she contributed over 78 percent of the manhours required for administration at an average hourly cost of \$8.83, less than 43 percent of the total overhead cost of \$39,450.

Finally, the assertion that the appropriate framework for paratransit implementation seems to be the community, the workplace, and the social service center (20) is applicable to the MTP in its current location. Using the same instructional techniques and the same labor practices, but now located at PI, mobility training currently costs approximately \$500 per person (recovered through a fee for service), nearly 28 percent less than the per capita cost of \$692 for training administered through SACoG.

Deployment of Direct Labor and Minimization of Costs

Despite the costs imposed because of institutional location, substantial cost savings were achieved in the hiring and deployment of direct labor because of low wages, variable hours, and training practices. Six part-time paraprofessionals performed all of the training as well as several administrative duties. Trainers were paid salaries and expenses but no benefits. Direct labor costs, \$5.42 per hour, were consequently low. Trainers contributed 63 percent of the total manhours for the MTP, but incurred only 37 percent of the total financial cost (Table 2).

If a professional training staff had been deployed at the MTP, total program costs would probably have been doubled without a commensurate increase in the number of clients trained. As more clients are mobility trained, the issues of risk or liability associated with the use of paraprofessional trainers may become increasingly important. It is important to note, however, that special edu-

cation professionals have endorsed the use of non-professional trainers as a way to substantially reduce training costs (11). Of course, the supervision of training by qualified persons is imperative.

The critical minimization of costs, however, was accomplished by the deployment of instructors on a part-time, variable basis. Training capacity, or manhours, corresponded directly to the availability of clients for training. Therefore, the direct costs of training varied according to daily, weekly, or even seasonal fluctuations in client intake (fewer referrals are received during holiday seasons; inclement weather disrupts training; no-shows occur because of illness).

Training Practices, Client Characteristics, and Costs

Although comparable data are not available from other programs, the MTP minimized instruction time because of the following practices: All training was conducted on the bus and at frequent intervals. Training required an average of 25 hr per client. An average of 12 one-way trips (at an average trip length of 5 miles) was taken by the client during training. Training was usually completed within a week to 10 days.

It has been asserted that group instruction at one site reduces the overall costs of training (22). However, unless the subjects of training are children in a classroom, or more severely handicapped adults who need extra instruction in pre-mobility skills, group training is believed to be redundant. Skills must be retaught when bus travel begins. Moreover, group instruction may encourage a commitment to more expensive strategies, such as hiring full-time professionals or purchasing equipment, as well as require a facility, which might offset the economies of scale attained by an enlarged instructor-to-pupil ratio.

Despite the likelihood of ultimate success, client characteristics, such as the severity of retardation or the presence of other handicaps, can and do influence the amount of effort required to train different clients. This may cause per capita costs of instruction to vary greatly within one program. For example, the cost of training paid by the Lanterman Regional Center in Los Angeles ranged from a minimum of \$140 to \$3,888 spent to train one person who was both blind and mentally retarded. Her training required over four times the mean cost of \$891 spent in training 24 other retarded clients in the program. Similarly, the MPT expended 120 hr to train one individual who was retarded and deaf.

It is noteworthy that multiply handicapped retarded persons can be mobility trained. And, even though the cost of training is substantially increased, it may be more cost-effective to train

these individuals than to continue supplying them with specialized transportation.

EVALUATING THE EFFECTIVENESS OF MOBILITY TRAINING

The ability of the individual to learn independent travel skills and his or her propensity to use fixed-route transit after the completion of training together represent the sum and substance of any mobility training endeavor. Accordingly, it is appropriate to address questions that social service agencies or special effort providers might have concerning the wisdom and financial risk of investing in mobility training for mentally retarded persons: What risks do clients incur during training and subsequent travel? How long are travel skills retained? What additional costs are required for further training, if it is necessary?

Risks and Benefits of Independent Travel

To date, one client of the MTP has been injured as a consequence of using public transit. After the completion of training and 8 months of continuous travel she was struck down and her leg broken when she ran in front of a car when hurrying to catch her bus. This accident is the only known incident of travel-related physical injuries sustained by a mentally retarded person who has been travel trained. Mobility training programs have excellent safety records to date, and no actuarial data are available that would suggest that mentally retarded public mass transit patrons are subject to greater risks than are users of normal intelligence.

The inherent risk does exist that mentally retarded persons who use public transportation modes to pursue normal activities in the community will be more vulnerable to accidents than if they remained in protective care and were transported on closed systems. Nonetheless, the risks are compensated by the benefits to the client of increased mobility that may open new employment and recreational opportunities, as well as the substantial gains in social competence, initiative, and self-confidence noted in the clients of the MTP.

Retention of Travel Skills

The travel behavior of clients trained at the MTP suggests that the risk that a retarded person will simply forget critical travel skills is low. A survey of clients conducted 3 months after the demonstration period ended in September 1982 showed that 85 of the 95 clients who completed training continued to use RT buses on a regular basis. In a very few instances trainers spent additional time with clients after independent travel had begun. However, this was done to allay the fears of parents, not because the clients actually needed to be retaught route skills. A client who withdrew from travel for a while might need some retraining. But it has been noted elsewhere that clients who did not travel after the successful completion of training retained their travel skills for at least a year (22).

However, 25 graduates of the MTP did have to be trained on new routes because RT rerouted its buses. For these 25 persons, all of whom were retarded, additional training required only 20 percent of the initial training time of 25 hr. Instead, these individuals needed an average of 5 hr of instruction that required two one-way trips (usually in a single day). This suggests that most of the initial train-

ing involves the learning of generic travel skills that the individual can later transfer to learning new routes. Through the addition of more routes to an individual's repertoire, his or her mobility can be significantly enhanced with a small incremental increase in overall cost.

Cost-Effectiveness of the MTP

Both the percentage of clients who are successfully trained and the percentage of clients who continue to use transit after training is completed constitute fundamental measures of mobility training performance. Both measures embody, to some extent, the relative cost-effectiveness of different training programs. The second measure, the posttraining use of transit, will be used here to compare the cost-effectiveness of mobility training and subsequent travel with alternative transit supply options that are available in the Sacramento public transit service area.

An incremental cost per trip has been calculated for mobility training so that the costs of other transit systems can be compared. It is assumed that the 85 clients who were using RT 3 months after the end of the demonstration period will continue to do so on a daily basis. Therefore, the trip rate for travel during training and for subsequent independent travel is postulated to be 504 one-way trips per year. Finally, the per capita cost to train of \$738 (the quotient of the full costs of training, \$65,700, divided by the 85 actual users) is amortized over the annual trip volume of 504 one-way trips yielding an incremental cost of training per trip of \$1.41.

Table 3 shows the full costs, the user costs, and the net transit subsidies of other transit options in relation to mobility training. Comparing the ratio of the combined full costs of both training at the MTP and travel on RT with the full costs of other transportation services reveals the opportunity costs to taxpayers of providing individuals with paratransit who instead could or should be mobility trained. For example, the opportunity cost ratio of the full cost of training and travel to the full cost of PI service is 2.75. This means that, for the cost of supplying one person with travel on PI, at least two persons could be diverted to RT. If all 85 clients continue to travel after the first year, the full cost becomes travel on RT, and the opportunity costs relative to specialized services increase correspondingly. The opportunity cost ratios of the full cost of services on the RT Special and on PI to the full cost of conventional bus service would then become 1.42 and 5.98, respectively.

The cost-effectiveness of mobility training is more striking when evaluated from the perspective of the regional transit agency, the Sacramento Rapid Transit district. Regional Transit donates the travel of both trainers and clients during training and sells handicapped users passes to clients who continue to travel. The net transit subsidy for the first year of training and travel on RT is \$0.92 per one-way trip, an incremental increase of only \$0.05 over the average subsidy of \$0.87 per trip for handicapped users (who do not require wheelchair lifts). Furthermore, the net transit subsidy to divert mentally retarded users is only 15 percent of the subsidy of \$6.47 per trip for PI. This implies that the opportunity costs of not training are significant for the Sacramento regional transit system: the foregone productivity of one passenger on PI is seven passengers who could be trained to use RT.

TABLE 3 Comparative Costs of Sacramento Rapid Transit District Supply Options

Mode	System	Full Cost		Price to User		Net Transit Subsidy	
		Per One-Way Trip (\$)	Total per Passenger per Year (\$)	Per One-Way Trip (\$)	Total per Passenger per Year (\$)	Per One-Way Trip (\$)	Per Passenger per Year (\$)
Conventional Transit							
Fixed-route bus	Regional transit	1.25	630	0.35	192	0.87	438
Specialized Transit Services							
Mobility training plus fixed-route bus	MTP and Regional Transit	2.71 ^a	1,366	1.76 ^b	902	0.92	464
Specialized fixed-route subscription bus	Regional Transit Special	1.77	892	0.50	240	1.27	652
Demand-responsive & subscription paratransit	Paratransit, Inc.	7.47	3,765	1.00	504	6.47	3,260

^a \$2.71 is the combined costs of \$1.25 per trip and the incremental cost (\$1.41) of mobility training. \$1.41 = \$738.00 (the full cost to train one person who continues to use transit)/504 one-way trips (the presumed base trip volume for one client during the year of training and travel).

^b \$1.79 = \$1.41 (incremental cost) + \$0.35 (user charge). Note that other costs in the price column are actual revenues generated by user fees that are charged on a monthly basis (e.g., Regional Transit sells a handicapped user pass for \$16.00 monthly).

Service-Effectiveness of Mobility Training

Despite the cost-effectiveness of training, the demand for training has been low. The Department of Developmental Services for the state of California reports that a total of 451 mentally retarded persons (including the clients of the MTP) have been trained out of a statewide caseload of 56,000 persons 16 years of age or older and living in the community (13).

Two factors reduce the demand for training. As data in Table 3 suggest, for social service agencies the relevant costs governing the decision of whether to mobility train clients may be the prices charged for alternative special transit services rather than the full costs of providing them. For example, social services in Sacramento must now pay for mobility training and for the user passes for RT; the cost for both exceeds the costs to the users of the other specialized transit services. Thus there may be little cost incentive to train clients if special efforts systems are effectively in competition with providers of mobility training.

More important, it has been noted that parents are likely to oppose the attempts of social service agencies and schools to teach their retarded offspring skills that prepare them for a normal life in the community (24). In keeping with this tendency, parents are especially prone to oppose mobility training; training programs often identify parental resistance as a major difficulty (15,16,18,23).

A significant amount of parental reluctance inevitably affects both the effectiveness of training and, indirectly, the costs by preventing qualified individuals from being trained, inducing an overly cautious approach to training that results in more hours of instruction than necessary to learn skills, and preventing successfully trained clients from continuing independent travel. At the MTP only one parent prevented her successfully trained daughter from subsequently traveling on RT. However, in Detroit 11 of the 48 clients who were successfully trained were not allowed by their parents to continue to travel on city buses despite the special care taken and the success achieved in ensuring the safe travel of the clients (16).

CONCLUSION

The MTP has demonstrated that mobility training can be an inexpensive auxiliary transportation service that promotes the use of fixed-route transit by handicapped persons who would otherwise patronize special efforts systems. Although strictly compar-

able data are either cryptically presented or omitted from the training literature, it does appear that the MTP successfully trained retarded persons in less time and at lower cost than did other programs, due in part to the training regimen and the labor policies applied to instructors.

So that various training results can be compared and more efficient training practices developed, providers of mobility training should more rigorously collect and report training data. It would be useful if variables related to client traits, transit mode service characteristics, and teaching methods were correlated with the rate of success and the amount of time and money required for training. Furthermore, the travel behavior of mentally retarded persons should be evaluated both before and after training, as well as be compared with the travel behavior of retarded persons who remain patrons of special transportation services, to determine the impact independent travel ability may have on mobility, on the substitution of fixed-route modes for paratransit, on induced tripmaking, and on the ability of the person to secure competitive employment and better living arrangements in the community.

This information would be particularly enlightening for federal and state transportation policy makers who are currently investigating cost-effective responses to the needs of the transportation handicapped. Careful and comprehensive reporting of mobility training will ensure that it is included in the body of recognized transit supply options and that the tripmaking needs and patterns of mentally retarded persons are distinguished from those exhibited by other subgroups of the transportation handicapped.

ACKNOWLEDGMENT

Several persons contributed information and clarity to this paper: Sandra Rosenbloom of the University of Texas at Austin; Herb Reindl, Chief of Program Development and Evaluation Branch, CalTrans; Betty Gralicker, Lanterman Regional Center in Los Angeles; Tadashi Mayeda; and Newell Starks, Jr. The views expressed herein are solely those of the authors.

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