SPECIALIZED URBAN TRANSPORT FOR INDEPENDENTLY LIVING ELDERLY IN GREATER VANCOUVER

by

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ABSTRACT

Adequate and appropriate means of mobility are essential for the psychological and physical well-being of elderly persons. Elderly persons who live in urban regions encounter barriers to their mobility which are unique to them as group. Physical, psychological, and financial factors interact with urban form and the organization of public transportation to constrain access to usual private and public modes of transportation. As a result, many of the urban elderly cannot walk, drive, ride as a passenger, or ride on public transportation to important destinations.

The demand for transportation by the urban elderly will be influenced by the following trends:

- the aging of urban populations,
- the growth of the frail elderly (persons over 75 years of age),
- de-institutionalization,
- suburbanization,
- improving health and income status of elderly persons.

The continuation of these trends will challenge planners to design transportation systems which are effective and efficient, and at the same time satisfactory to the elderly.

There are three types of possible solutions to the mobility problems of an increasing number of urban elderly persons:

- land-use planning,
- the design traffic systems to accommodate elderly drivers,
- the design of public transportation systems.

Planners do not have the necessary instruments to implement effective land use solutions. Accommodating an increase in the number of elderly drivers conflicts with social goals to increase public transportation use by all age groups. The thesis argues the most effective solutions for overcoming elderly mobility problems are based on the design of public transportation systems. There are two public transportation solutions for assisting elderly
persons with mobility problems. The first is making conventional public transportation more accessible. The second is expanding specialized transportation which is the focus of this thesis.

Three policy issues have dominated the history of specialized transportation in North America. The first policy issue is whether public resources for assisting the transportation handicapped should be allocated to accessible conventional public transportation, or allocated to expanding specialized transportation. This is a debate as to which public transportation solution is the most effective for overcoming elderly mobility problems.

The other two policy issues relate specifically to the design of specialized transportation. The second policy issue is what level of centralization provides the most effective and satisfactory service. The third policy issue is what are the appropriate roles of the public, non-profit, and for-profit sectors in the management and delivery of service.

A particular specialized transportation system can be described by how the three policy issues have been resolved in the urban region this system serves. A specialized transportation system can be evaluated by indicators of efficiency, effectiveness, and elderly satisfaction.

These descriptive and evaluative indicators are used to examine and compare specialized transportation in Greater Vancouver, Metropolitan Toronto, and the City of Edmonton. Four recommendations, based on the comparative examination, are made as to how specialized transportation in Greater Vancouver can be made more effective, efficient, and satisfactory to the elderly. These recommendations are:

- further allocations of public resources to assist the transportation handicapped should be directed at specialized transportation;

- greater use of telecommunications and computer technology to increase the effectiveness of scheduling and dispatching trips;

- implement a block grant program to assist in the establishment of community based transportation alternatives;

- implement a user side subsidy program as soon as possible;
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DEFINITIONS

Community based transportation alternative: A transportation system funded and supported by government grants, private donations, and local volunteers to serve the transportation needs of a specific group or community. Usually the delivery and management of service are controlled by the community and not by an overarching regional public transportation agency. A type of specialized transportation.

Conventional mass transportation: Public transportation designed for the "average" user. Defined by high capacity vehicles, and fixed routes and schedules. Includes regular bus service and rail rapid transit.

Demand responsive transportation: Dial-a-bus and taxi, this type of public transportation goes where and when the user wants. Contrasts to fixed route and schedule public transportation.

Dial-a-bus: Low capacity public transportation typified by flexible routing and scheduling. Trip requests are requested by phone in advance, and vehicles are dispatched to the most efficient and effective schedules and routes possible.

Independently living elderly: A person over the age of 65 who is not dependent on other people or institutions to meet most daily needs.

Kneeling buses: Buses which have an air suspension system that allows the bus operator to lower the right front of the bus to curb level. This assists persons who have difficulty climbing stairs to board the bus.

Market segmentation: Dividing aggregate demand into components based on need or location, and dividing supply to match each of the different demands. In the case of specialized transportation this means matching demand from different groups - the elderly, handicapped, and special needs children - to appropriate and adequate carriers.

Paratransit: transportation modes which combine the public nature of mass transit and the flexibility of the private automobile. Includes shared ride taxi, car/van pooling, jitneys, dial-a-bus, and community based volunteer efforts.

Specialized transportation: Public transportation designed to meet the needs of particular group. Includes dial-a-bus, subsidized taxi, and community based alternatives. Contrasts to conventional mass transportation. Also referred to as 'custom transit'.

Supply side subsidy: Government support to for-profit firms and non-profit societies who deliver and manage specialized transportation service.

Transportation handicapped: A person who cannot use or has difficulty using usual private and public modes of transportation. Also referred to as 'mobility disadvantaged'.

User side subsidy: Government support which allows a person to buy into a market that is otherwise financially closed to this person. Usually script or vouchers which discounts a percentage of the good or service purchased. In terms of specialized transportation this is script which discounts taxi fares. Also referred to a 'demand side' subsidies. Contrasts to supply side subsidies.
ABBREVIATIONS

ECMT, European Conference of Ministers of Transport

GVRD, Greater Vancouver Regional District

OECD, Organization for Economic Cooperation and Development

RPD, Richmond Planning Department

RTAC, Roads and Transportation Association of Canada

SPARC of BC, Social Planning and Research Council of British Columbia

TRB, Transportation Research Board

TTC, Toronto Transit Commission

UMTA, Urban Mass Transportation Administration
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1. INTRODUCTION

1.1 Purpose of Thesis

This thesis examines specialized transportation delivery to urban elderly who are transportation handicapped and living independently. Specialized transportation refers to demand responsive modes which are oriented to the needs of a specific group such as the elderly or handicapped. Independently living elderly are persons over the age of 65 not living in an institution or extended care facility. Transportation handicapped are persons who cannot use, or have difficulty using, usual public and private modes of transportation.

The delivery of services in Greater Vancouver and two other urban regions in Canada are described and evaluated. The purpose is to recommend how specialized transportation in Greater Vancouver can be made more satisfactory to transportation handicapped elderly. How service delivery can made more efficient and effective is also considered. The recommendations are developed by comparing service delivery in Greater Vancouver with Metropolitan Toronto and the City of Edmonton.

Greater Vancouver refers to the Greater Vancouver Regional District (GVRD). The GVRD is a regional government whose jurisdiction is slightly smaller than the Vancouver Census Metropolitan Area (CMA). The Vancouver CMA is an area defined by Statistics Canada for census enumeration.

1.2 Problem Statement

In 1986 there were 2.7 million Canadians over the age of 65 who represented 10.7% of the population (Stone and Frenken 1989:17). By 2000 this share is expected to rise to 12.2%, and to 18.8% by 2025 (MacDonald 1989:3). Urbanization is occurring at the same time as population aging. Between 1981 and 1986 the population of Canada grew by 4.2%, the combined population of cities over 50,000 grew by 5.1%, and the population in rural areas grew by 0.7% (Census of Canada 1981 and 1986).
As the elderly's population share increases, and as urbanization continues, public service delivery to the urban elderly will have to become an important focus for all types of planning - land-use, transportation, social, and economic development. Transportation planners will have to understand the constraints on mobility which prevent the elderly from meeting life-sustaining and life-enhancing needs. Public transportation delivery will have to be designed to overcome these constraints.

Most urban elderly do not depend on public transportation for mobility. Many are still financially and physically able to drive. Some live in a high density inner-city environment, or close to a major activity centre, so most of their needs can be met by walking. Some can depend on a spouse or family member to drive them. Others can afford to make extensive use of taxis. However, because of physical, psychological, financial, and environmental, constraints on mobility, approximately 20% of Canada's elderly have difficulties meeting their needs (Suen et. al. 1989:2, Wade 1983:11). These individuals have to depend on public transportation, but in terms of meeting their needs, the organization and operation of public transportation in many Canadian cities is inadequate and inappropriate.

There are social, political and legal imperatives to provide the elderly with the same level of transportation service as the rest of the population. First, according to principles of equity, public transportation should be accessible to all citizens, regardless of cost:

A number of policies bearing on specialized transportation are rooted in the principle of normalization. This principle holds that any disabled or disadvantaged person should be assisted to maintain a pattern or living and a lifestyle roughly approximating the norm within a given society (Bell and Ashford 1986:4; see also Rosenbloom and Altshuler 1979:136, ECMT 1980:49-52, Wolch and Dear 1987:211).

Second, politicians who ignore the interests of a voting block which will represent almost 20% of the population in thirty five years, risk political costs:

... the rapid increase in the number of elderly might lead to a strong voting block. Seniors will argue in the future, as they do now, that they have right to these services, for they have contributed their share to development
of the country. It is time they receive a return on their investments of taxes and employment. Politicians responsive to this constituency will look to planners for guidance on how their needs can be met (Segalowitz 1984:18, see also Wachs 1979:6-7).

Third, adequate public transportation for the elderly is mandated by provincial and federal statutes (Province of Ontario 1987:4-6).

These imperatives conflict with economic imperatives. To make public transportation fit the needs of the elderly, either by altering conventional mass transportation or by expanding specialized transportation, is costly and makes demands on public resources the rest of society may not be willing to meet (Atkinson 1985:52). Since the labour force is shrinking relative to the non-working elderly, the tax-base to pay for social services for the elderly is shrinking (Segalowitz 1984:3-4, Denton et. al. 1986:21). The decrease of available resources will be greater if governments continue to restrain spending, and if the costs of public service delivery continue to escalate (Bell and Revis 1983:40-41, Callahan and McNiven 1988, Wachs 1979:221-222).

Urban transportation planners have to design service which is satisfactory to an expanding group of elderly when the ability to pay for public transportation is diminishing (Atkinson and Suen 1987:4). The problem is how to deliver public transportation to the urban elderly in a manner which is effective and efficient, and yet appropriate to their needs.

1.3 Scope

This thesis examines specialized transportation delivery to elderly who reside in large urban regions, are living independently, and are transportation handicapped. The focus is Greater Vancouver, and comparisons are made with Metropolitan Toronto and the City of Edmonton.

Specialized transportation is defined by flexible routing and scheduling, low capacity vehicles, and an orientation to the needs of a specific group such as the elderly or handicapped (Bovy and Krayenbuhl 1978:145-146). This contrasts with conventional
mass transportation which is defined by fixed routes and schedules, high capacity vehicles, and an orientation to demand from the "average" commuter (OECD 1979:48-56, OECD 1987:11, Heraty 1988:106, Warrington et. al. 1988:2). The three prevalent modes of specialized transportation are dial-a-ride bus or van, subsidized taxi, and vehicles operated by community based networks. These modes are demand responsive in that they provide service from origin to destination upon request (Jones 1979:22, Kirby 1974:14-21).

Living independently is not being dependent on institutions or other people to meet most daily needs "... not living in a nursing home, home for the aged, chronic care unit in a general hospital or chronic care hospital, special care facility or mental health facility ..." (Straka 1989:7). This refers to elderly living in detached houses, strata title units, apartments, or social housing for seniors. The last type of residence includes seniors co-ops and rent subsidized apartments for seniors, but not group homes for service dependent elderly (Straka 1989:75).

Transportation handicapped elderly cannot use, or have difficulty using, usual private and public modes of transportation. This category includes elderly persons who poor, elderly persons who are handicapped, and elderly persons who are poor and handicapped (TRB 1979a:9). Also included are elderly persons who are not poor, nor legally handicapped, but nevertheless face constraints on their mobility. These constraints are created by the interaction of physical, financial, and psychological factors which are unique to the elderly, with urban form and the organization of urban transportation systems (SPARC of BC 1976:1, TRB 1983:chapter 2). For example:

- ambulatory elderly persons who cannot afford to own and maintain a car, have difficulty walking long distances, and have difficulty boarding a bus and maintaining balance while the bus is running;

- elderly who live in a low density suburban environment, not well served by conventional transit, but are afraid to drive because of failing eyesight.

Many elderly persons who cannot use private modes of transportation for financial and physical reasons, are also ineligible to use specialized transportation. Conventional public transportation is not an effective alternative because routing and scheduling are not
compatible with their activity patterns. As a result, these persons are in danger of becoming socially isolated due to a lack of adequate and appropriate alternatives (TTC 1987:6).

1.4 Methodology

Recommendations regarding specialized transportation in Greater Vancouver are based on comparisons with Metropolitan Toronto and the City of Edmonton. The specialized transportation systems in these urban regions are described according to:

- how public resources are allocated between different alternatives for improving the mobility of transportation handicapped persons;
- degree of centralization and coordination;
- the roles of the public, non-profit and for-profit sectors in the administration, management and delivery of service.

Evaluation of these systems is according to the following indicators:

- cost-efficiency, measured as cost per hour;
- cost-effectiveness, measured as cost per trip;
- service effectiveness, measured as trips per hour;
- social effectiveness, measured by penetration of the elderly market, distribution of types of trips, and percentage of rejected bookings;
- satisfaction, ascertained from surveys of elderly persons and statements of representatives of the elderly.

The last two indicators are direct measures of how the organization and delivery of service affects elderly persons who depend on specialized transportation for all or some of their mobility. The other three are indirect but necessary for evaluation (Lewis 1988). A satisfactory but inefficient system is vulnerable to government spending cuts, or to a reorganization which would lessen satisfaction. Conversely, increasing the cost-effectiveness of a specialized transportation system means more service can be delivered to more persons.

Information for description and evaluation comes from transportation agency reports, data provided by representative of these agencies, and previous surveys of elderly
persons from the three urban regions. Due to lack of information, and to organization, not all indicators can be applied in all cases. For instance, some of the operating contracts tendered in the Edmonton system are based on a flat rate per trip. Service hours are not kept for these contracts, so cost per hour and trips per hour cannot be calculated for the whole system.

Metropolitan Toronto and the City of Edmonton were selected for comparison with Greater Vancouver for the following reasons. First, both urban regions are in the same class as Greater Vancouver in that both have populations in excess of 500,000. Second, data was more available from these regions than from other regions such as Calgary or Montreal. Third, the organization of the specialized systems in Toronto and Edmonton were different enough from each other, and from the system in Vancouver, to offer a good basis for comparison.

1.5 Organization

The first three sections of Chapter Two discuss how constraints on mobility can affect the well-being and quality of life of the elderly. The fourth section examine trends which will influence the urban elderly’s demand for transportation. These sections define the problem: the present elderly face numerous barriers to meeting their needs, as urban populations age there will be increasing pressure on transportation planners to design solutions to overcome these barriers. The final section discusses three possible solutions for overcoming the mobility constraints of an increasing number of elderly persons:

- land use solutions,
- solutions based on accommodating elderly drivers,
- public transportation solutions.

The thesis argues the first two types of solutions are ineffective in terms of overcoming constraints on the mobility of the urban elderly. The costs of extensive implementation of these types of solutions would far outweigh the benefits.
The third chapter is a brief history of specialized transportation and a discussion of three salient policy issues:

- whether public resources for assisting persons who are transportation handicapped should be allocated to conventional public transportation or allocated to specialized transportation;

- degree of centralization and coordination;

- the roles of the public, non-profit and for-profit sectors in the administration, management and delivery of service.

Discussion of the first policy issue presents the problem of allocating resources between two public transportation solutions. The other two policy issues relate specifically to the design of specialized transportation. How politicians, administrators, and planners resolve these policy issues determines the size, structure and market area of a specialized transportation system.

Chapter four describes and evaluates three specialized transportation solutions to elderly mobility problems. These solutions are the specialized transportation systems in Greater Vancouver, Metropolitan Toronto, and the City of Edmonton. Description is in terms of policy issue resolution and evaluation is in terms of performance indicators. The final section of chapter four discusses the results of the descriptions and evaluations, and compares the three specialized transportation systems.

Chapter five draws conclusions from the four previous chapters, and makes recommendations regarding the delivery of specialized transportation in Greater Vancouver.
2. TRANSPORTATION AND THE NEEDS OF THE ELDERLY

2.1 Mobility and Needs

Mobility is a major concern of the elderly. Elderly persons in the United States have identified transportation, income, and health as the three major constraints on well-being and quality of life (Carp 1988:2). A third of the respondents in a study of Richmond residents over the age of 60 named transportation as the most serious barrier to a satisfactory lifestyle (Straka 1989:21). A 1971 Manitoba study found the most significant unmet need of the elderly in that province was for resources to be more accessible (RPD 1982:16). In White Rock, 42.7% of the agencies which serve the elderly stated inadequate transportation was a major barrier to service delivery (Hodge and Milstien 1989:80).

These concerns by the elderly, and the agencies which serve them, reflects the importance adequate and appropriate means of transportation have regarding the well-being of the elderly.

Mobility links life sustaining and life enhancing needs with locations in the urban environment where these needs are met. Life sustaining needs are met by going to the grocery store, doctor, pharmacy, or bank. Life-enhancing needs are met by visiting friends and relatives, a community centre, or place of worship (Carp 1988:4, Koutsopoulos 1980:67, Segalowitz 1984:8). Mobility is thus essential for the physical and psychological well-being of the elderly:

Social and emotional well-being is defined by the presence of such variables as positive self-esteem, feeling of usefulness, and happiness and the absence of loneliness, anxiety, and depression. Well-being depends on the individual’s success in meeting his or her own needs, and this is largely determined by the degree of congruence, or fit, between needs and community resources (Carp 1988:1, see also Straka 1989:17-18, TRB 1988:14, Wachs 1979:1, Rosenbloom 1988a:21, Gonda 1982:67-71).

Problems with mobility can lead to social isolation or institutionalization (Wolch and Dear 1987:227), both have an adverse effect on well-being. Social isolation caused by a lack of transportation alternatives has been linked to declining life satisfaction (Straka 1989:18,
Institutionalization has been linked with increased mortality and morbidity rates (Wiseman 1978:24).

Adequate public transportation thus becomes critical for elderly who cannot depend on walking, automobiles, and taxis for all or some of their mobility. Not only inadequacy, but the way service is delivered can detract from quality of life. For example, a particular specialized transportation system may require a day or more notice to book a trip. This makes for effective dispatching (Jackson 1982:535), but the ability to make spontaneous trip decisions is taken away from the elderly person who depends on the system (Rosenbloom 1988a:53, Gonda 1982).

2.2 Travel Patterns of the Elderly

The temporal and spatial patterns of elderly trip making differ from younger age groups. Retirement and aging mean health, personal business, and social trips become increasingly important (Straka 1989:26). Trip making becomes less frequent, more restricted in range, and more likely to occur during non-peak day-time hours (Golant 1986:259). The one aspect of elderly activity which is common to other age groups is a large majority of the elderly are dependent on the automobile.

Health, personal business and social trips take on an increasing importance with aging (Wade 1983:43, Straka 1989:26). A study done by Revis in the mid-seventies concluded important trips for the elderly were to health, social service, social and recreational, and shopping destinations (Revis 1976:350). This is supported by Carp’s study of elderly San Antonions which found important trips were for religious, health, shopping, and personal business reasons (Carp 1977:275). A study of Ontario seniors concluded the most important trips were to shopping, medical, and social destinations (Province of Ontario 1985:2-3).

While medical and health related trips are important, they are a small share of total trips taken by the elderly, and they occur at a lower frequency than other types of important trips. A study of Miami seniors found trips to shopping/personal business and
relaxation/enjoyment destinations had the highest share of all trips, while medical trips had one of lowest shares (Wade 1983:43). Straka's study of Richmond seniors found trips with the highest frequency were to the grocery store, seniors centre, restaurant, and to visit friends and family. For most of the respondents, these trips were taken once or twice a week. Trips to medical destinations were taken once or twice a month (Straka 1989:85).

The elderly make fewer trips than younger age groups (Carp 1988:2, Wachs 1986:4, Atkinson 1987:2, Wiseman 1978:8). A 1978 study found Montreal elderly made 0.98 per capita trips per day, compared to 2.36 for ages 20 to 24, 2.22 for ages 25 to 54, and 1.38 for ages 55 to 65 (Bussiere 1984:239). These decreases in trips frequency are due to the elimination of work trips, voluntary social disengagement, and constraints specific to the elderly (Golant 1986:259-260, Wiseman 1978:7-9, Rosenbloom 1988a:36, Schmitt 1979:128, Wachs 1985:2). In the U.S., one third of all trips and 40% of all vehicle mileage are due to work (Carp 1988:2). Wachs has attributed the fact that American couples in their seventies make half as many social trips as couples in their thirties to a process of social disengagement which accompanies aging (Wachs 1986:4). However, decreases in trip frequency have also been linked to involuntary constraints on mobility. This can be demonstrated by a study of elderly and handicapped persons in north Chicago which found significant unmet demand for various types of trips; 40% of the respondents wished to make more trips to see a movie, 38% wished they could make more social trips, and 32% wished they could make more trips to a ballgame (TRB 1983:21). It is significant that only 4% of the respondents wished they could make more health related trips.
Figure 1
Trips per Capita
of Different Age Groups in Montreal

Data from Bussiere 1984:239

Figure 2:
Destinations of White Rock Elderly
Within White Rock

Destination in White Rock
- Doctor's Office
- Drug Store
- Grocery Store
- Senior's Centre
- Church
- Recreation

Data from Hodge and Milstien 1989:69
Figure 3:
Chicago Elderly and Handicapped Wishing to Participate More Often in Activities

Type of Activity
- Out to eat
- Movie
- Social visits
- Grocery shopping
- Ballgame
- Public meeting
- Doctor or dentist

Percent

Respondents

Data from TRB 1983:21
Trip destinations become more circumscribed with aging (Straka 1989:26, Schmitt 1979:128, Golant 1986:259, Wiseman 1978:27). A majority of trips by Richmond seniors were within the same municipality. Trips to the grocery store for over half the respondents were within the immediate neighbourhood. One third of the respondents made trips to a seniors centre in the same neighbourhood (Straka 1989:85). Respondents from the White Rock survey made most of their important trips within this small municipality: 56.9% went to a doctor’s office in White Rock, 67.6% to a drugstore, 55.2% to a grocery store, 86.7% to a senior’s centre, 56.6% to a church, and 54.7% for recreation. For 80-85% of these seniors, seven of the ten most common destinations were in White Rock (Hodge and Milstien 1989:69).

It is not clear how much decreases in frequency and range are due to voluntary disengagement or to involuntary constraints (Wiseman 1978:27-30, TRB 1983:19-23). On the one hand, aging is associated with a decreasing desire to travel outside home (Golant 1986:259). On the other hand, physical and financial constraints cause some elderly limit their trip making involuntarily. Also, urban form and public transportation organization which are compatible with elderly activity patterns can increase the frequency and range of elderly trips (see Carp 1980, 1988).

Thus the decreases in elderly trip making result from a combination of voluntary and involuntary constraints. The assumption cannot be made that unmet demand by transportation handicapped elderly for more trips is simply the gap between their trip making and the trip making of the general population. Several U.S. studies found that if transportation handicapped persons could make all of the trips they wanted, their trip making rate would still be below that of the general population (see TRB 1983:Chapter 3). Gauging unmet demand depends on whether the need to travel is being met and not on the number of trips made:

A person’s mobility should be judged by the extent to which his or her need to travel is being met, and not by how much he or she travels in comparison to others. ... The critical question is not how much elderly people travel, but whether or
Figure 4:
Mode Choice of U.S. Elderly

Data from TRB 1988:29

Figure 5:
Mode Choice of Richmond Elderly

Data from Straka 1989:79
not mobility limitations restrict freedom of choice and hence quality of life (Wachs 1986:2).

In terms of temporal patterns, most elderly trips take place in the day time during non-peak hours (Wiseman 1978:27). Richmond seniors made most of their daily business trips between 9:00 a.m. and 4:00 p.m. Trips to the restaurant and to visit friends were made after 6:00 p.m. (Straka 1989:84). Of the respondents who rode the bus regularly, 77.8% made their trips between 9:00 a.m. and 4:00 p.m. (Straka 1989:98).

In terms of mode choice, a majority of North American elderly use the automobile for most of their trips. Aggregate data from 1977 to 1983 found 84.7% of trips made by U.S. seniors were in automobiles either as drivers or passengers, 2.4% on public transportation, 0.2% in taxis, and 8.9% by walking (TRB 1988:29). The Richmond study found 58.8% of the seniors drove for most trips, 11.8% rode with someone else, 16.5% used conventional transit, 1.2% depended on specialized transit, and 10.6% walked (Straka 1989:79). Of the elderly respondents from the White Rock study, 76% drove regularly (Hodge and Milstien 1989:64).

2.3 Constraints on Mobility

Physical, psychological, financial, urban design, and organizational constraints affect driving, riding as a car passenger, use of taxis, use of conventional public transportation, and use of specialized public transportation.

2.3.1 Physical Constraints: Physical processes associated with aging effect driving, walking, and conventional transit use.

Aging is associated with physical decline. Visual decline is marked by loss of ability to discriminate background objects, contraction of the visual field, dimming of vision, and loss of night vision. An American study found hearing impairments rose from 2% for individuals under 17 years of age, to 24% for individuals between 65 to 75, to 39% over 75 (TRB 1988: 58). Motor skills are effected by slowing of reflexes and the onset of chronic conditions such as arthritis. Attentiveness and information processing, which
effect the ability to make quick decisions, also decline with age (TRB 1988:58-59, Straka 1989:14-19).

Elderly drivers travel less than younger drivers, but are more vulnerable to death or serious injury in crashes. In terms of mileage driven, crash fatality rates for elderly drivers is second only to drivers under 25 (TRB 1988:38-40, Rosenbloom 1988a:40, Winter 1984:138). The elderly are involved in 7% of all automobile crashes in the U.S., but account for 12% of accident fatalities (Wachs 1986:24).

Awareness of increasing physical vulnerability means some elderly stop driving altogether, others limit driving to daytime and fair weather (Straka 1989:30, Rosenbloom 1988:40). Seventeen percent of White Rock seniors who drove regularly restricted their driving because of difficulties in bad weather, at night, and on freeways (Hodge and Milstien 1989:65). A 1973 U.S. survey found elderly widows limited their driving for the following reasons; only recently learned how to drive, afraid to drive on freeways, afraid to drive at night, and have visual problems which interfere with driving (Winter 1984:137). Circumstances when Richmond elderly would rather take a bus than drive were:

- in evenings; husband won’t drive unless he has to
- when it’s really slippery from the rain
- in winter (bad weather)
- night travel out of the community
- in the rush hours when there is heavy traffic (Straka 1989:Appendix D Table 2).

Physical frailty can contribute to make walking dangerous for the elderly. In 1982, the elderly accounted for about 10% of Canada’s population but 26% of pedestrian deaths (Tufts 1984:33). In 1982, in the United States, persons over 65 years of age accounted for one out of three pedestrian deaths and had the highest fatality rate of all age groups (TRB 1988:47, Winter 1984:139). Elderly pedestrians often cannot respond to bad drivers as quickly as younger pedestrians:
Older people generally know the right thing to do. But their ability to cope with the unexpected - especially if their minds are on something else - is reduced by their inability to take quick evasive action (Australian Office of Road Safety, cited in Rosenbloom 1988a:44, see also TRB 1988:48).

Physical frailty also affects public transit use. An elderly person, though ambulatory, may still have difficulty walking to a bus-stop or rapid transit station. High steps on buses and steep stairways to rapid transit stations are often barriers to using conventional public transportation (Wachs 1986:11, Straka 1989:40-42). Elderly persons are vulnerable to crime while walking to and from transit stops. A 1985 Los Angeles study found 29% of regular transit users over the age of 65 were victimized, compared to 8% under the age of 30 (Wachs 1986:12, see also Rosenbloom 1988a:46).

2.3.2 Psychological Constraints: Psychological factors limit riding in an automobile as a passenger and the use of specialized transportation.

A dependency on automobile rides from friends or family can create feelings of dependency and obligation which detract from a sense of self-control:

In a world which becomes increasingly constrained due to events often beyond one’s personal control (i.e. widowhood, retirement) it is conceivable that events that offer a viable opportunity for self-direction (both in the figurative and literal sense) may take on a greater importance in later life simply because there are relatively fewer events left that allow to feel in control (Gonda 1982:65, see also Straka 1989:31).

Feelings of dependency may inhibit an elderly person asking for rides for necessary trips.

Specialized transportation is unacceptable to some elderly because they do not want to be treated as belonging to a special group, distinct from the rest of society:

... one individual reported, "we have too many things already labeled 'only for the elderly'; I like to see young people around too, not always the old" (Straka 1989:116).


2.3.3 Financial Constraints: Lack of income limits automobile and taxi use.

Retirement usually means a drop in annual income. In 1981, 25% of Canada’s elderly had incomes below the poverty line. Of families headed by persons over 65, 11.7%
were poor, and 57.7% of unattached elderly were poor (Gardner 1988:3). In 1988, 23% of White Rock seniors lived below the poverty line (Hodge and Milstien 1989:3). A 1981 GVRD survey found the cost of automobile maintenance was a constant worry for many elderly automobile owners. Two of the respondents stated:

I have an old car which I use very seldom. I just can't afford to drive it with expenses of gas and insurance so high ...

I have a car which I may have to give up soon. The insurance and service charges are just getting too expensive (Auger 1982:29).

The White Rock survey found 84.6% of the seniors making over $20,000 a year drove regularly, as compared to 60.0% with incomes under $10,000 (Hodge and Milstien 1989:64). This is supported by an 1971 New York study which found 83.7% of the elderly who made less than $3,000 a year had zero automobile availability, compared to 20.6% of those who made more than $10,000 (Wachs 1979:19). Extensive use of taxis is not an alternative for low-income seniors who lack access to an automobile (Straka 1989:33, Rosenbloom et. al. 1980:11, Wachs 1979:211).

2.3.4 Urban Design Constraints: Some constraints on the mobility urban elderly in North America are a result of a lack of coordination between transportation systems, social services, and land-uses. The causes of this lack of coordination have been rising real incomes and the decentralization of activities (Wolch and Gabriel 1985:60-61, Meyer and Gomez-Ibanez 1980:chapter 2, Kellas 1984:2, RTAC 1976:67).

Rising incomes in the post-war era caused urban households to substitute automobiles in place of public transportation and homes in low-density suburbs in place of dwellings in high density central cities. The automobile is superior to public transit in terms of convenience, and flexibility (Owen 1976:6). Automobile use overcame the 'friction of distance' and enabled households to access cheaper and more attractive housing in the suburbs (Wachs 1986:1). Advances in telecommunications and trucking meant central city firms could seek out less costly locations on the urban fringe (Meyer and Gomez-Ibanez 1981:15-20). The suburbanization and decentralization of homes and employment were
not planned comprehensively, but were left to market forces. This meant decisions regarding land-uses and transportation systems were made in an incremental and uncoordinated manner (Webber 1971:133). Metropolitan sprawl reinforced automobile dependency:

... the spatial arrangements of the city have been developed on the assumption that everyone drives. Stores are remote from housing, housing remote from jobs, and in large areas of the metropolis almost every requirement of daily living depends on having a car. For those who do not drive, therefore, many of the opportunities for work and for enjoying the benefits supposedly made available by urban living are foreclosed (Owen 1976:7, see also Schmitt 1978:132, RTAC 1976:65, Wachs 1985:1).

Accommodating the automobile and facilitating the journey to work became the main focuses of urban transportation planning (Meyer and Gomez-Ibanez 1981:4-9).

Aggravating the lack of coordination between land uses, transportation systems, and social services is the fragmentation of planning functions. Different types of planning are executed by different agencies and by different levels of government. In Greater Vancouver, municipalities have the power to determine land-uses. Transportation planning for the region is done by two provincial agencies, the Ministry of Transportation and Highways (MOTH) and BC Transit (Kellas 1984:2). BC Transit is responsible for public transportation, and MOTH is responsible for the region’s major highways. Planning for different social services is the responsibility of distinct federal and provincial agencies (McNiven and Callahan 1988).

Weak regional governments exacerbates the fragmentation of planning in North American urban regions. This makes coordination of land uses, transportation systems, and social services difficult to achieve:

The gross inadequacies of social service coordination, interjurisdictional cooperation and physical/social planning integration suggest a vital need to explore the political and technical dimensions of the planning problem facing the human-services (Wolch and Dear 1987:252).

Dispersal of urban activities and a lack of planning integration can have adverse implications for some of Greater Vancouver’s independently living elderly, especially if they live in low density suburbs. Some of these persons cannot drive to distant services
and facilities, cannot depend on conventional public transportation, are ineligible to use specialized public transportation, and cannot find affordable and appropriate housing close to the services and facilities (Hodge and Milstien 1989:9).

A 1980 comparison of European and North American cities demonstrated the interaction between urban form and the mobility of the elderly. In American cities, 10.3% of the elderly walked for shopping trips, and 63.2% went in a car either as a driver or passenger. For health related trips 4.3% walked and 63.9% went in a car. For leisure trips 7.1% walked and 68.5% went in a car. In more compact and better planned European cities (OECD 1979:48), 63% of the elderly walked to shop and 14% went in a car either as a driver or passenger. For leisure trips 47% walked and 37% went by car. To visit friends and relatives 69% walked and 20% went by car (ECMT 1980:70-71).

A comparison between San Francisco and San Antonio further illustrates the relationships between urban form and elderly activity. The comparison demonstrated interactions between urban form, mode choice of the elderly, and the frequency of certain types of trips. San Francisco is an older compact city, San Antonio is newer and sprawled. Elderly San Franciscans had a lower rate of automobile use, walked more, and made greater use of public transit than elderly San Antonions. Homes and services are closer together, and public transit is more accessible in San Francisco. In San Francisco, 57% of the elderly respondents used walking for trip making on a daily basis, and 80% walked at least several times a week. Less than 25% of the San Antonions went somewhere by foot daily, and only 44% several times a week. Forty-eight percent of elderly San Franciscans used public transit several times a week, and only 13% never used it. Thirteen percent of elderly San Antonions used public transit several times a week, and 51% never used it. Of elderly San Franciscans, 55% went out for entertainment or recreation at least once a week, compared to only 3% of elderly San Antonions. Of these social trips 38% in San Francisco were by transit and 20% by foot. In San Antonio 2% used public transit for entertainment trips, and 7% walked (Carp 1980, 1988).
Figure 6: Modes Used by Urban Elderly for Different Types of Trips - United States

<table>
<thead>
<tr>
<th>Type of Trip</th>
<th>Shopping</th>
<th>Health</th>
<th>Leisure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of Elderly</td>
<td>30-40</td>
<td>50-60</td>
<td>70-80</td>
</tr>
</tbody>
</table>

Data from ECMT 1980:70-71

Figure 7: Mode Used by Urban Elderly for Different Types of Trips - Europe

<table>
<thead>
<tr>
<th>Type of Trip</th>
<th>Shopping</th>
<th>Leisure</th>
<th>Social Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of Elderly</td>
<td>20-30</td>
<td>40-50</td>
<td>60-70</td>
</tr>
</tbody>
</table>

Data from ECMT 1980:70-71
Figure 8: Frequency of Walking Trips by Elderly in San Antonio and San Francisco

Data from Carp 1980:146

Figure 9: Public Transit Use by Elderly in San Francisco and San Antonio

Data from Carp 1980:146
Figure 10:
Modes Used by Elderly for Entertainment Trips - San Francisco and San Antonio

Data from Carp 1980:149-150
These studies suggest an urban form which facilitates greater use of walking and public transit can alleviate some unmet demand by the elderly for social and recreational trips (Carp 1980). Walking is preferred mode for some elderly because it is inexpensive and is used as a "... therapy, hobby, and fitness workout ... " (RPD 1982:77). However, the use of walking to meet daily needs depends on distances and ease of access to destinations (see Straka 1989:32, ECMT 1980:114-115). Public transportation is also preferred by many elderly because it is a safe mode (Straka 1989:41-42).

Land use patterns in many North American urban regions create barriers to elderly mobility. At the same time traffic systems are designed for mass demand from commuters, and not demand from elderly drivers. For elderly drivers who are aware of declining skills:

Less frequent road use leads to a loss of functions, thus leading to an extra loss of functions and routine. The feeling of the elderly that they are no longer able to function in traffic which is tailored to the "average" road user, and fear of their own vulnerability, have the effect that old people become even less frequent road users. A vicious circle supervenes (Rosenbloom 1988a:41, quoting a Dutch study).

High capacity and high speed corridors, and a shortage of dedicated left turn lanes can make driving a threatening experience for elderly car owners (TRB 1988:4-6, Carp 1977:270-271). Land use patterns make walking and public transit unavailable modes for some elderly, also some elderly find driving unsafe. Thus some of the dependency elderly persons have on the automobile may not be due to preference but due to a lack of alternatives.

Other aspects of road and traffic design, such as walk signal timing cycles and lack of sidewalks beside busy streets, contribute to make walking unsafe for some elderly (Rosenbloom 1988a:46, RPD 1982:65).

2.3.5 Organizational Constraints: One of the goals which has been specified for public transportation by planners and politicians is to facilitate mobility for persons who cannot depend on usual private modes. However, for many elderly the organization of public transportation is a barrier to mobility.
Scheduling and routing of conventional public transportation are not compatible with elderly activity patterns. Conventional transportation is oriented toward work trips. Supply is spatially focused on high capacity corridors leading downtown, and temporally focused at rush hours. Retirement means important trips are made outside of peak hours, away from employment centres. Bus frequencies outside peak hours may mean waits which are long and inconvenient (Wiseman 1978:3). Destinations are often inappropriate. Bus stops and rapid transit stations may be situated beyond walking distance. To get to a destination may mean one or more transfers and long waits between transfers.

Complaints regarding conventional transit from the seniors in the Richmond study were:

- having to transfer too often
- walking to the nearest bus stop
- infrequent service
- long waits and poor connections
- have to stand and wait in cold weather (Straka 1989:Appendix D, Table III).

Complaints from the White Rock study were:

- need a better local bus service
- need closer bus stops
- need a shuttle bus to shopping
- need a small bus for short local trips with door to door service (Hodge and Milstien 1989:71).

Some of the responses by elderly users of specialized transportation in Vancouver as to why they were not interested in using conventional transit were:

- Too far to bus stop
- Bus wouldn’t go where I want to go
- Too crowded/Can’t get a seat
- Too difficult getting on and off (BC Transit 1988:30).

The routing and scheduling of conventional public transportation are based on mass demand, not the needs of specific groups (OECD 1979:45-56). If the subsidy per trip on a route in Toronto is five times the average subsidy per trip for the whole system, the route is discontinued by the Toronto Transit Commission (TTC). The Downtown [27] was discontinued for this reason. This route duplicated a portion of the Yonge Subway line and was used extensively by elderly persons who had difficulties using the subway (TTC 1989a:30-31).

TTC planners and administrators have no intention of changing service guidelines, routing, or scheduling to make conventional mass transportation fit the needs of the elderly (TTC 1989a:93). The following example from Calgary shows this orientation typical of Canadian public transportation agencies:

Calgary Transit is often approached by requests by seniors for bus revisions, the provision or relocation of bus shelters and revisions or scheduling changes for specific bus routes. Frequently, major revisions of bus routes are requested. Although such changes would assist the seniors, they may be a disbenefit to the larger community in terms of service (City of Calgary 1990:3).

Many elderly are restricted from using specialized transportation because these systems give priority to handicapped trips. Only 30% of Canada’s elderly are handicapped (Suen et. al 1989:2), and 1% are wheel-chair bound (Straka 1989:35). To use specialized transit, ambulatory seniors face stringent, and often demeaning, eligibility restrictions (means test) (Province of Ontario 1987:6). Trips have to be booked a day or more in advance, and priority is given to medical, employment, and educational trips. Many of these trips are to destinations for younger handicapped persons. Hours of service are often restricted to week-days and work hours (Rosenbloom 1988a:62, TRB 1983:58). The reason for these restrictions is specialized transportation agencies do not have the resources to meet demand. An administrator for Handy-DART told Straka:

We don’t advertise because we’re just meeting demand now. With more vehicles ... and more hours allocated for drivers ... we’d be better able to
satisfy more demand, and therefore, we could afford to be less picky where customers are concerned (Straka 1989:65).

Handy-DART is the name of the specialized public transportation system in Greater Vancouver. Restrictions are used by transportation agencies to control demand because of high costs, and because governments are unwilling to allocate the resources needed to meet demand (Bloomfield et. al. 1981:27, Lewis 1989:160).

Public transportation is often an inadequate alternative for elderly persons who have difficulty walking or driving to important destinations. Schmitt provides an example from Baltimore showing how land uses, the organization of public transportation, and physical and financial constraints interact to adversely affect the mobility of the elderly:

Trips by the elderly to grocery stores in northeast Baltimore illustrate the problem. As in most American cities, low densities of urban development, segregation of land uses, and mass marketing have placed grocery stores beyond a short walking distance for the majority of the area’s population. Many of the local elderly go to the first supermarket that can be reached on the nearest bus route to home without making a transfer. The store reached is not always the best in the area with respect to price, selection, and quality of goods, but is the only store accessible. Because bags of groceries are unwieldy on a bus, the added expense of a taxicab is often incurred for the return trip home. What may appear as irrational behavior of elderly shoppers often simply reflects their lack of opportunities to choose among destinations and modes of travel (Schmitt 1978:128).

An environment which sustains independent living for seniors must have housing, health care services, and transportation working together (Hodge and Milstien 1989:10). As the examples in the previous sections have shown this is not the case in many North American urban regions. There is no indication that either the dispersed form of these urban regions, their lack of integrated planning, or the orientation of their public transportation systems will change in the near future. As urban populations age the result will be a greater number of elderly whose mobility will be constrained by urban form and the organization of public transportation systems.
2.4 Factors Influencing Future Transportation Demand

Five trends will influence elderly demand for transportation - increasing numbers of elderly, increasing numbers of frail elderly, suburbanization, government restraint policy, and changes in health and income status.

In 1946 the elderly were 7.2% of Canada’s population, in 1986 they were 10.7% (Stone and Frenken 1989:17). By 2025 the share is expected to be 18.8% (MacDonald 1989:3). The elderly are expected to increase from 12.1% of metropolitan Vancouver’s population in 1986 to 13.6% by 2011 (GVRD 1989a:20). In Toronto an increase from 12.0% in 1988, to 14.6% by 2000 is expected (TTC 1989b:Exhibit 2-7).

The reasons for population aging are declining mortality and fertility rates (Denton et. al. 1986:20-22). More people are living longer and less children, relative to the population, are being born. In Canada, between 1971 and 1986, the number of children born per number of women in the child-bearing cohorts dropped from 2.2 to 1.6. At the same time mortality rates have been declining which means more people are living longer (Stone and Fletcher 1989:sections 2.2 and 3.1). The mortality rate for persons between 65 to 69 in the Vancouver CMA decreased from 26.01 person thousand in 1971 to 19.91 in 1986; for persons between 70 to 74 the decrease was from 37.61 to 29.11; for persons over 75 the decrease was from 93.43 to 81.24 (GVRD 1989b:12). Continuation of these fertility and mortality trends means the elderly will increase their share of the general population (GVRD 1989b:44-47).

At the same time the elderly are increasing their share of the population, the frail elderly are increasing their share of all elderly. Frail elderly are persons over the age of 75. Between 1976 and 1986 the frail elderly in Canada increased from 37.3% of persons over 65 to 38.8% (Stone and Frenken 1989:25). In the Vancouver C.M.A. the frail elderly will increase from 39.8% of all elderly in 1986 to 44.4% by 2011 (GVRD 1989:20). Generally, 75 is marked by an acceleration of hearing, visual, and motor disabilities (Straka 1989:14, Wade 1983:52). It is expected that many people over this age no longer
drive, cannot walk long distances or for long periods of time, and have difficulty using conventional public transportation. An increase in the number of frail elderly means an increase in demand for specialized transportation (Bell and Revis 1983:30).

An increasing number of urban elderly in North America are living in suburbs (Bell and Revis 1983:35-36, Rosebloom 1988a:27) The central city share of CMA elderly dropped by 10% in the Vancouver, Toronto, and Edmonton CMAs. In Vancouver the central city share went from 48.3% to 38.8% between 1976 and 1986, in Toronto from 32.5% to 22.2%, and in Edmonton from 92.1% to 82.4% (Census of Canada 1976 to 1986).

The elderly are increasing at a faster rate in the suburbs than in the central city. From 1966 and 1986 the elderly went from 13% to 15% of the City of Vancouver's population. For the rest of the CMA the elderly share went from 8.0% to 10.7%. In the fast growing suburb of Richmond the share has risen from 4.8% to 9.1% (Census of Canada 1966 to 1986). This reflects the central city share of CMA elderly declining faster than the central city share of the total CMA population. The City's share of metropolitan elderly dropped from 58.9% in 1966 to 38.8% in 1986. During the same period the City's share of the total CMA population dropped from 46.0% to 31.2% (Census of Canada 1966 to 1986).

One reason for the growth of suburban elderly is the 'aging in place' of individuals who moved to the suburbs in the post war era (Rosenbloom 1988:26). Another reason is the growth of major activity centres outside the CBD (polycentrism) which attract some central city retirees. These persons are free to relocate because residence is no longer tied to work (Straka 1989:11-14). A third reason is many elderly perceive the suburbs as cleaner, less crime ridden and less congested than the central city (TRB 1988:28). A fourth reason is gentrification of inner city areas has displaced some elderly renters (Wolch and Gabrial 1985:53). Finally, for elderly home owners, gentrification can mean selling a home in the central city and moving to cheaper housing in the suburbs.
Figure 11:
Historical and Projected Growth of Elderly in Vancouver C.M.A.

Percent of CMA Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Persons over 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td></td>
</tr>
<tr>
<td>1971</td>
<td></td>
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<tr>
<td>1976</td>
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<tr>
<td>2006</td>
<td></td>
</tr>
<tr>
<td>2011</td>
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</tr>
</tbody>
</table>

Data from GVRD 1989a:20 and Census of Canada 1966 to 1981

Figure 12:
Growth of Persons over 75 as a Share of All Elderly - Vancouver C.M.A.

Percent of All Elderly

<table>
<thead>
<tr>
<th>Year</th>
<th>Persons over 75</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
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<tr>
<td>2006</td>
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<tr>
<td>2011</td>
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</tbody>
</table>

Data from GVRD 1989:20, and Census of Canada 1966 to 1986
Figure 13:
Central City Elderly
as Percent of CMA Elderly

Data from Census of Canada -
1976, 1981, and 1986
Figure 14:
Elderly Share of Population -
City of Vancouver and Suburbs

Data from Census of Canada 1966 to 1986

Figure 15:
City of Vancouver - Share of C.M.A.
Population and Share of C.M.A. Elderly

Data from Census of Canada 1966 to 1986
The trend toward living in low density suburbs will reinforce the future elderly’s dependence on the automobile (Roberts 1986:3-4). At the same time demand for specialized transportation will increase from suburban elderly who lose the ability to drive. These persons will not be able to count on conventional public transportation for mobility. Destinations which are dispersed and far away discount walking as a mode. There is the possibility of these persons will become socially isolated if they have no adequate public alternatives (Wade 1983:28, Straka 1989:1-3, Wachs 1986:23).

Since the mid-seventies governments in North America have used de-institutionalization as an instrument of restraint policy (Wolch and Dear 1987:196-294, Gardner 1988:5). Various programs have been implemented to assist seniors by bringing services to their homes, or by taking seniors to services (see Gardner 1988, Hodge and Milstien 1989). Savings have been considerable. In Canada, community based alternatives are 11% to 14% the cost of institutional care (Gardner 1988:20). However, spending withdrawn from institutions has often not been reallocated to alternatives:

... expenditures on institutional care have been reduced in the name of providing community-based alternatives without allocating resources to expanding the latter. The result has not been more for less in the name of efficiency, but rather less for less and the elderly have suffered .... The disastrous impact of de-institutionalization without adequate community alternatives can be clearly seen in the many homeless ex-mental patients in major American cities (Gardner 1988:20-21, see also Callahan and McNiven 1988, Wolch and Dear 1987).

Adequate transportation is critical to the elderly’s ability to live independently within a community of choice (Straka 1989:4). De-institutionalization will increase demand for specialized transportation as many formerly institutionally dependent persons will not be able to use conventional public transportation. If de-institutionalization is used as an instrument for restraint, without compensating expenditures on alternatives, the supply of specialized transportation will not be able to meet demand (Atkinson 1987:4). As the following example from Portland (Oregon) shows this is a concern of transportation planners in many North American urban regions:
The Portland system is currently strained by a number of factors. The social service agencies are experiencing increases in demand for transportation services because the frail elderly population is growing and more DD clients are being placed in community programs rather than the state hospital. Meanwhile social service transportation funds are not growing as rapidly as demand (Dueker and Davis 1988:82).

Countering projections that more elderly will be dependent on public transportation are projections that the future elderly will be better off in terms of income and health (Bell and Revis 1983:31-32, Wachs and Blanchard 1975:2-5). In 1967 the average income of U.S. elderly was 50% that of the working population, it is expected to rise to between 83% to 90% by 2000 (UMTA 1982a:68). Improved income and health mean an increased ability to drive and maintain an automobile (Wachs and Blanchard 1975:9-11).

Furthermore, a greater percentage of the future elderly will have drivers licenses because of social reasons. A 1980 U.S. study found 33% of the women, and 70% of the men, over the age of 70 were licensed to drive (Wachs 1986:6). Many of these elderly never had a license, having grown up in times when car ownership was not common. Among people in their thirties, forties, and fifties at this time, 90% had drivers licenses and the percentage of women drivers was nearly equal to male drivers (Wachs 1986:6). This trend can be indicated with data from the U.S. In 1980, 84.7% of elderly trips were taken in an automobile as compared to 83.8% in 1970 (TRB 1988:29).

2.5 Possible Solutions to Elderly Mobility Problems

Present trends indicate an increase:

- of elderly,
- of the share frail elderly will have of all elderly,
- of elderly living in low density suburbs,
- of elderly living outside institutions,
- in automobile use by the elderly due to improved financial and health status.
Possible responses to increases in elderly demand for adequate and appropriate transportation fall into three classes (see TRB 1983:31, Province of Ontario 1983:2, Wade 1983:51-53):

- land use solutions,
- solutions to accommodate elderly drivers,
- public transportation solutions.

Solutions from all three classes can be implemented by planners when opportunities arise. However, given the form of urban regions in Canada, and given the instruments and resources presently available to planners, public transportation solutions are the most effective and realistic for overcoming barriers to the mobility of the elderly (Urban Institute 1985:1-5, Schmitt 1978:132, TRB 1983:88-90).

In regard to land use planning, bringing the origins and destinations of the elderly closer together is an ideal solution to their mobility problems (Schmitt 1978:132). Straka’s study found Richmond seniors living close to public transit routes and major activity centres reported the least problems going where they wanted (Straka 1989:131-132). These type of solutions are based on integration of housing, transportation, facilities, and social services. For example, building subsidized seniors coops close to major activity centres and transit transfer points, and siting health and social services for seniors close to residential concentrations of elderly (Schmitt 1978:132, Straka 1989:51-52, Wolch and Dear 1987:257, Province of Ontario 1983:25-29).

There are four problems with land use solutions. First they do not help elderly who already live in areas with transportation access problems (City of Calgary 1990:9). Second, not all elderly would want to move to planned seniors housing (Wiseman 1978:9, Straka 1989:51-52). The third problem is uncoordinated planning. The following is an example from Toronto:

When the subway was extended into suburban areas, often the local bus service along the parallel arterial road was eliminated. Increasingly, senior citizen apartments and senior citizen homes are being constructed near subway stations but due
On July 23, West Vancouver city council, to a man, voted down a proposed senior citizens' housing co-op. The well-heeled residents of the British Properties successfully lobbied against seniors' housing in their back yards.

Self-interest has been allowed to triumph over justice. Unless the council is prepared to provide an alternative site at a comparable price, West Vancouver's 7,000 seniors should avail themselves of the opportunity in this fall's municipal elections to replace the existing mayor and council with those who are concerned about affordable housing.

Craig Vance

BURNABY
to the high cost of land near stations are located in the intervening areas in between stations .... Due to the difficulty experienced by ambulatory disabled and elderly persons in walking long distances and in climbing stairs within rapid transit stations, the availability of local bus service in between stations is important to the mobility needs of a growing segment of Metro's population (TTC 1989a:169).

The fourth problem is the zoning powers of municipalities. Municipal planners and politicians can inhibit the construction of social housing for the elderly, the conversion of existing housing stock into shared accommodation, mixed use developments oriented to the elderly, and the siting of social services for the elderly (Wolch 1982:28, Province of Ontario 1983:9, Tufts 1984:36). There are no statutory planning instruments to integrate housing, transportation, social services, and activity centres to fit the needs of the elderly (see Kellas 1983, Wolch and Dear 1987:253, RTAC 1976:64).

Re-designing traffic systems and automobiles are solutions based on accommodating elderly drivers. These solutions include larger lettering on traffic signs, better maintenance of road markings, dedicated left turn lanes and signals, and mandating slower speeds for highways and roads (TRB 1988:4-6, Wachs 1979:252-254, Tufts 1984:31). Two major goals of urban transportation policy in North American have been to decrease the pollution and congestion costs caused by automobile dependency, and to assist the transportation handicapped achieve an adequate level of mobility (Kirby et. al. 1979:27). Solutions to elderly mobility problems which are based on accommodating more elderly drivers creates a conflict with the first goal. On the other hand, increasing public transportation use by all age groups serves both goals.

The two public transportation solutions are making conventional transit more accessible to the elderly, and expanding specialized transportation. Instruments to make conventional transit more accessible includes fare subsidies, station and stop design, and vehicle design. The focus of this thesis is assisting the transportation handicapped elderly by the design and expansion of specialized transportation. In the next chapter arguments are developed to support the expansion and design of specialized transportation as the main instrument for overcoming elderly mobility problems.
## Figure 17
Possible Solutions to Elderly Mobility Problems

<table>
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<th>Type of Solutions</th>
<th>Instruments</th>
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</thead>
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<td>(1) Land-Use Solutions</td>
<td>Zoning for Conversion to Shared Accommodation, Social Housing for Seniors, and Co-ops for Seniors</td>
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<td></td>
<td>Siting Housing for Seniors near Major Activity Centres and Transit Transfer Points</td>
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<td>Siting Services for Seniors near Residential Concentrations of Elderly</td>
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<td>(2) Solutions to Accommodate Elderly Drivers</td>
<td>Automobile Design for the Safety of Elderly Drivers</td>
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<td>Traffic System Design such as Left Hand Turn Signals</td>
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<td>(3) Public Transportation Solutions</td>
<td>Conventional Public Transit Instruments such as Targeted Fare Subsidies, Wheel-Chair Lifts on Buses, Kneeling Buses, Elevators at Rapid Transit Stations, and Shelters and Benches at Bus Stops</td>
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<td></td>
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3. SPECIALIZED TRANSPORTATION AND THE ELDERLY

3.1 History of Specialized Transportation

The development of specialized transportation in North America was a response to two trends, suburban growth and citizen advocacy:

The rebirth of paratransit in the middle-60s ... was originally an almost exclusively North American "innovation". The concept of paratransit is rooted in the protest against the political and Technological "Establishment", the quest for fairer solutions to the problems of mobility for various social groups and for "captive" transport users (i.e. considerations of equity) and the concern to make better use of the considerable infrastructure and vehicle capacity available (i.e. on grounds of efficiency). However, the interest focussed on paratransit in the United States and Canada is essentially due to the topography of their cities and to the very low density of urban development which is one of their outstanding features. While conventional transport is suitable for high-frequency services in densely populated busy districts, bus lines cannot hope to cater satisfactorily for all conceivable intra-city travel requirements. The cost of maintaining bus services in low-density urban areas, or acceptable frequencies outside peak hours, is found to be prohibitive (Bovy and Krayenbuhl 1978:32-34, see also Kirby 1974:30, Atkinson 1985:49, Atkinson 1986:20, UMTA 1982b:1).

During the sixties, automobile dependency was creating unacceptable pollution and congestion costs in North American urban regions. Governments responded by subsidizing the extension of mass transportation into the suburbs. This strategy proved to be ineffective and inefficient. The supply of conventional public transportation is indivisible, and demand in the suburbs is dispersed due to a scattered pattern of origins and destinations (OECD 1979:19). Implementing fixed routes, fixed schedules, and high capacity vehicles in areas defined by low residential densities and uncoordinated land-uses resulted in low ridership, poor service, and large operating deficits (Atkinson 1985:49, OECD 1979:12-16, UMTA 1982b:1-2). Only during rush hours, on high capacity corridors focussed on downtown, was enough demand generated to make conventional transit effective in the suburbs.

Planners began to examine more flexible modes to find ways to capture the suburban commuting market conventional transportation could not penetrate (UMTA 1982b:2-5). During the mid-sixties, research was carried out at M.I.T. and General
Motors on dial-a-bus. Dial-a-bus is low capacity demand responsive transportation, similar to taxi. Dial-a-bus and taxi go where the user wants, at the time the user wants (Jones 1979:22). Demonstration projects were carried out at Haddonfield N.J. and Santa Clara County (California) in the early seventies. A 1974 UMTA study used the term 'paratransit' to describe dial-a-bus and other modes such as shared ride taxi and van pooling (see Kirby 1974). Paratransit refers to:

"... a series of transport modes, organisational procedures and services falling broadly midway between two pre-eminent types of conventional transport .... "Paratransit" thus encompasses a hazy assortment of hybrid forms of transport, of "custom built" systems where the variety of solutions adopted and of experiments, whether successful or not, is inevitably large ..." (Bovy and Krayenbuhl 1978:9-10).

In the early 1980s there were about two hundred general paratransit systems in the United States, by the late 1980s many had been discontinued.

In Canada, the Regina Telebus began in 1971. Buses in the 18 to 30 passenger range were dispatched by radio, users could telephone a trip in advance (Atkinson 1985:3). Transport Canada became involved in paratransit research and helped finance demonstration projects in Peterborough and Edmonton (Atkinson 1985:2, Bovy and Krayenbuhl 1978:32-35). At the end of the 1970s there were eighteen general demand responsive systems in Canada, by 1985 only three remained (Atkinson 1985:3).

One reason general demand responsive systems were discontinued in North American urban regions was the high costs resulting from low productivity. Many of these systems cannot exceed five passengers per vehicle hour (UMTA 1982b:35). Because routes and schedules are not fixed, effective scheduling and routing is a problem. A second set of reasons were challenges from transit unions and private taxi companies. Non-union labour was used on many of these systems in an attempt to reduce operating costs and to expand managerial control (Atkinson 1985:7-15). Owners of taxi companies had concerns about paratransit systems taking away some of the taxi market (UMTA 1982b:26-27). A third reason for the decline of general paratransit was successful systems were replaced by conventional transit. For example, the ridership on the Regina Telebus became high...
enough to be replaced by fixed route and schedule buses (Atkinson 1985:3). At a high level of ridership conventional transit becomes more cost effective than paratransit. The lack of community support was a fourth reason for the decline of general paratransit. Service levels were not high enough to convince a significant number of suburban commuters to shift from automobiles to paratransit (UMTA 1982b:31).

Many of the systems that failed in the commuting market were re-directed at the handicapped and elderly markets (Atkinson 1985:3, Nutley 1988:344, UMTA 1982b:31).

An article written by David W. Jones in 1979 stated:

If there is a trend in demand-responsive transportation, it is away from service to the general public and toward service to groups who have special needs. These groups include the elderly, the handicapped, and (sometimes) youthful nondrivers and low-income persons (Jones 1979:23).

Other general demand responsive systems were replaced by alternatives such as shared ride taxi, and car/van pooling (UMTA 1982b:45).

At the same time suburbanization was accelerating in North America urban regions, marginalized groups - the poor, ethnic minorities, elderly, and handicapped - began to seek integration into the larger society. Many of their demands have been written into human rights legislation.

The U.S. Urban Mass Transportation Act was amended in 1970. Section 16 states:

... the national policy that elderly and handicapped persons have the same right as other persons to utilize mass transportation facilities and services (cited in Wachs and Blanchard 1975:1).

Section 504 of the 1973 Rehabilitation Act states:

No otherwise handicapped individual in the United States shall, solely by reason of his handicap, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance (cited in Lewis 1982:3).

The National Mass Transportation Assistance Act of 1974 states public transportation agencies must make 'special efforts' to assist the elderly and handicapped as a condition
for federal operating and capital subsidies (UMTA 1982a:p.2). The language of these acts is derived from the Civil Rights Act of 1964 (Lewis 1982:3, Urban Institute 1985:II-1).

In Canada, funding for urban transit is provided by provincial governments. Provincial human rights codes, derived from the Charter of Rights, provide a legal basis for accessible transportation. The Federal government Canadian Human Rights Act states:

> It is a discriminatory practice in the provision of goods, services, facilities or accommodation customarily available to the general public ... a) to deny, or to deny access to, any such good, service, facility or accommodation to any individual, ... (R.S.C. H-6.5)

Discrimination based on age or disability are two of the prohibited grounds of discrimination (R.S.C. H-6.3). Part 1, section 3 of the B.C. Human Rights Act states:

> No person shall ... a) deny to a person or class of persons any accommodation, service or facility customarily available to the public, ... because of the race, colour, ancestry, place of origin, religion, marital status, physical or mental disability or sex of that person or class of persons ... (R.S.B.C. chap.22).

Section 1, Part 1 of the Ontario Human Rights Code states:

> Every person has a right to equal treatment with respect to services, goods and facilities, without discrimination because of race, ancestry, place of origin, colour, ethnic origin, citizenship, creed, sex, age, marital status, family status or handicap (cited in Ontario Study 1987:1, see also Atkinson 1986:22).

To comply with these statutes, and to meet increasing demand from the elderly and handicapped for adequate and appropriate transportation, planners began to examine demand responsive modes. The expertise and experience gained from the application of these modes in the commuting market were redirected at the handicapped and elderly markets. The first U.S. systems were implemented in Portland, Cleveland, Denver, and Minneapolis during the mid-seventies. The first demand responsive systems for the elderly and handicapped in Canada began operation during the mid-seventies and early eighties. By 1985 there were 330 specialized transportation systems in Canada (Atkinson 1986:3).
3.2 Policy Issues

Three issues have dominated the history of specialized transportation in North America:

- whether public resources for assisting persons who are transportation handicapped should be allocated to conventional public transportation or allocated to specialized transportation;

- degree of centralization and coordination;

- the roles of the public, non-profit and for-profit sectors in the administration, management and delivery of service.

The first policy issue is a debate between different public transportation solutions to assist transportation handicapped persons. The second and third policy issues relate specifically to the design of specialized transportation. How these issues are resolved determines the structure, size, and market area of a specialized transportation system.

3.2.1 Accessibility or Parallel Service: "The Great Debate": In 1979, the U.S. Department of Transportation issued regulations mandating full accessibility for conventional mass transportation. Lifts on buses and elevators in rapid transit stations had to be installed as a condition for federal capital and operating subsidies (Lewis 1982:4). Concerns about costs resulted in urban transit agencies challenging the rules in court (Rosenbloom 1982:338-339) In 1981 the regulations were rescinded. Agencies could choose either accessible conventional transit or specialized transportation as instruments to assist the elderly and handicapped. This did not stop legal challenges to jurisdictions that did not have fully accessible public transportation. In 1986, a Maine superior court judgment held the City of South Portland in violation of the state's Human Rights Act for purchasing inaccessible buses (Province of Ontario 1987:102-103).

Unlike the U.S., the federal government in Canada does not have a large role in subsidizing urban public transportation. The Transportation Development Centre (TDC) assists Canadian urban transportation agencies through research and demonstration projects. The TDC is a branch of the Transport Canada. However, provincial governments fund and control public transportation in Canadian urban regions. Provincial
governments have supported the design and expansion specialized transportation as the main instrument for assisting the transportation handicapped (Atkinson 1986:22-24, TTC 1989a:67-70). Light Rail Transit systems in Vancouver, Calgary, and Edmonton are wheelchair accessible, rail and bus systems in other cities are partially accessible, but only in Vancouver are there plans to make the conventional bus system fully accessible.

Many public transit agencies are opposed to fully accessible conventional transportation for the following reasons.

First, transportation planners argue that transportation is a link between demand and the meeting of demand. As such transportation is a derived demand which has no value in itself:

... all transportation facilities and services have value only insofar as they contribute, instrumentally, to the accomplishment of nontransportation purposes. So conceived transportation services and travel can be only inputs into the operations of the systems they serve; they are never outputs (Webber 1971:138).

From this perspective public transportation for the elderly and handicapped is a means to integrate these groups into the activities of the larger society, not an end in itself (TTC 1989a:75-77). Since public transportation is perceived as a means to achieve social goals, transportation planners select modes that will assist the most transportation handicapped persons at the least cost. Public transportation agencies have supported the expansion of specialized transportation for this reason (Fielding 1982:271, TRB 1983:90).

The second argument is lift installation can impede the functioning of conventional public transportation. Lifts lower bus efficiency and effectiveness by reducing seating capacity and slowing boarding times at stops (Wachs 1986:18). There are also problems with the reliability and maintenance of lifts (TTC 1989a:66). The extra time to load and unload disabled passengers on lift equipped buses may make public transportation less attractive for potential non-handicapped users, and thus interfere with the goal of creating a modal split favourable to public transit (TRB 1979:20).
The third argument is lift and elevator installation have cross sector costs, resources expended on lifts and elevators are taken away from more effective solutions (see Lewis 1988). The lift equipped systems in Los Angeles, New York, and Washington carry only 50 to 100 wheelchair passengers per day (Wachs 1986:18, TTC 1989a:64, UMTA 1989a:59-61). The lift equipped system in Seattle, the most cost-effective in North America, only carries 0.4 passengers per bus per day (TTC 1989a:131). A high percentage of boardings on lift equipped buses are the result of intensive use by a few younger handicapped persons (Urban Institute 1985:IV-8). In St. Louis 92% of the boardings made in the first year of lift service were made by 40 wheelchair users. These individuals represented 2% of the 1,983 wheelchair users living within a quarter of a mile of accessible routes. Furthermore, only 13 of these 40 wheelchair users utilized lift equipped buses more than ten times during this period (Middendorf et. al. 1984:53, Wachs 1986:18).

Elevators in rapid transit stations are not used often. Skytrain in Vancouver is fully accessible with the exception of one downtown station (see Hunter 1986). However, trips which combine the specialized system with rapid transit account for only 25 trips a day (TTC 1989a:69). Furthermore, accessible rapid transit is not extensively used by the elderly. A 1987 survey showed persons over 60 accounted for only 8.3% of Vancouver's rapid transit ridership, but accounted for 16.2% of the ridership on the transit system as whole including rapid transit (BC Transit 1987).

One reason for low usage of lifts and kneeling buses is that they are conspicuous. Many elderly and handicapped persons will not use lifts because of the embarrassment resulting from delays caused by lift operation (ECMT 1980:116, Wachs 1986:18). With regard to kneeling buses, tests by the Toronto Transit Commission found:

... despite being an important safety feature, the audible warning device indicating the bus was about to kneel singled out disabled riders as being in need of special assistance. Many ambulatory and elderly persons requested the feature only once due to the stigma associated with the warning device ... (TTC 1989:163).
Figure 18: Rapid Transit Ridership and Ridership for Total Transit System - Vancouver

Rapid Transit Riders

- 15 or less: 4.4%
- 16 to 40: 67.1%
- 40 to 60: 20.2%
- Over 60: 8.3%

All Transit Riders

- 15 or less: 9.8%
- 16 to 40: 58.2%
- 40 to 60: 16.8%
- Over 60: 15.2%

Data from BC Transit 1987:3
Another reason for low usage is many handicapped and elderly persons prefer the higher quality door-to-door service provided by specialized transportation (TTC 1989a:134).

Finally, bus stops and stations on accessible routes can be reached only with great difficulty by many handicapped and elderly. It is for these reasons that not all handicapped persons prefer a fully accessible conventional system. In 1980, wheelchair users known to the Eire County Council on Transportation for the Elderly and Handicapped unanimously opposed lift equipped buses as an option for mobility (Urban Institute 1985:III-6).

Low usage of elevators and lifts make for high costs per trip. Costs for a handicapped trip on a lift equipped bus in the U.S. are usually between $200 and $500. Seattle is an exception with a cost of $25 per trip (TTC 1989a:66). In 1983 the cost per lift equipped trip in a sample of U.S. cities ranged between $16 and $1,293. The cost per trip on a sample of specialized systems went from $1.40 to $16.95 (TRB 1983:71-73). The average cost per trip for specialized transportation systems in Canada in 1985 was $13.00 (Atkinson 1986:3). Lifts and elevators are thus socially ineffective because more mobility can be provided for more transportation handicapped persons by expanding specialized transportation (ECMT 1980:116-117, UMTA 1989a:59, Lewis 1982:7-8).

A fourth argument against full accessibility is lift installation is inequitable. Public transportation agencies in Canada have consistently refused to alter the routing and scheduling of conventional transit to fit the activity patterns of the elderly. The argument is the high social cost of altering routing and scheduling for the benefit of a segment of society would be a disbenefit for the rest of society. The same argument can made against full accessibility because lifts assist only a few handicapped persons at a high social cost, and do not assist other segments of society.

Proponents of full accessibility argue on the basis of human rights. From this perspective issues of efficiency and cost-effectiveness are irrelevant:

It is an issue that ultimately cannot be decided on the basis of cost-effectiveness, inflation, time, ease of operation, local option, or managerial
pragmatism. It is a Constitutional and legal issue - indeed, it is a human rights issue (Lewis 1982:10, citing representative of the handicapped, see also Province of Ontario 1987:100-114).

These proponents also argue separate transportation services for the handicapped and elderly maintain barriers to full social integration (TTC 1989a:76, Bovy and Krayenbuhl 1978:156). Specialized transportation has the implication of "separate but equal" treatment, and thus contributes to maintaining a social ghetto, created by institutional dependency, for the handicapped (ECMT 1980:101). Representative of handicapped organizations argue accessible transportation will increase the interaction of non-handicapped and handicapped persons and will facilitate social acceptance of the handicapped:

... handicapped groups refused to accept equality of opportunity through demand responsive transit systems: they insist on equality of outcome, the right to ride on the same bus, train, and streetcar ... Use of the same facilities compels "normal" people to interact with them. Their objective has been to enhance social interaction rather than solve mobility problems (Fielding 1982:271, see also Wachs 1985).

This view is eloquently expressed by Ontario representatives of the elderly and handicapped:

We wish to see transportation services improved by enabling all systems to provide access to, and use of transportation by all persons in a dignified manner. To accomplish this we envision a transportation system that will have many components but in which every component will be fully accessible to as many people as is technologically possible. This will mean, among other things, that disabled people will be able to travel with dignity in the same vehicle with their families, friends and attendants. They will not experience the indignity of having to ask others to change their plans to accommodate the scheduling of specialised transportation (Province of Ontario 1987:6-7).

The case for full accessibly is supported by three arguments.

First, the possibility reported costs of lifts have been inflated by transit agencies opposed to installation. Also, specialized service accounting often does not consider public subsidies, private donations, and volunteer labour, so reported costs may be underestimates (Rosenbloom 1982:342, Cutler 1979:53, Jackson 1982).
Second, accessible conventional transportation allows for greater spontaneity in trip making decisions than does specialized transportation (BC Transit 1988b:13).

Third, the costs of accessible bus are more elastic in terms of ridership than specialized transportation costs. At a high level of ridership the cost per trip on an accessible system will fall below that of a specialized system. The use of low capacity vehicles makes the supply of specialized transportation more divisible than the supply of conventional transportation. Specialized transportations supply can adjust to different levels of demand, so costs per trip will not rise or fall much as ridership increases or decreases. Costs fall much more rapidly on high capacity fixed route buses because as unused capacity is filled by increased ridership, fixed costs will be spread among increasing output (BC Transit 1989a:20). Some planners have argued that a firm commitment by a transit agency to accessibility can make a lift equipped bus fleet as cost effective as specialized transportation. These planners point out the successes of the Seattle system (Rosenbloom 1982:343).

However these arguments cannot change the fact that routing, scheduling, and efficiency guidelines have more effect on accessibility than bus or station design. Lifts, kneeling buses, and elevators in rapid transit stations are still inaccessible if stops are too far away, long frequencies make waiting uncomfortable, and buses do not go where the elderly want when they want (Middendorf et. al. 1984:63, TRB 1983:22). Urban transportation planners orient conventional bus and rail transit to mass demand, and are unwilling to implement routing and scheduling changes which would make conventional transit better fit the needs of a specific group such as the elderly (TTC 1989a:93).

In terms of spontaneity of trip making, advances in applying computers to specialized transportation scheduling promise to shorten times between trip requests and meeting requests (see Transvision Consultants 1987).
Figure 19:
Theoretical Behavior of Total Cost and Cost per Trip of Accessible Fixed Route Transit and Specialized Transit

A. Total Cost

B. Cost Per Trip

Source: Transportation for Disabled Persons in Ontario: Towards a Strategy for the 1990s; James F. Hickling Management Consultants Ltd.
In terms of operating costs, 20% of the demand for specialized transportation in Vancouver would have to be diverted to accessible bus for cost per trip to equal the specialized system. However, BC Transit admits that a 20% diversion is optimistic, and could be as low as 7% (BC Transit 1989b:16-19). Furthermore, models of accessible bus operation which show declining cost per trip with increasing ridership do not include costs for extra buses. Delays, resulting from high demand for lifts, will create a need for additional capacity (BC Transit 1989a:20).

Given the trend of more elderly living independently in low density suburbs, the design and expansion of specialized transportation is the most effective solution to elderly mobility problems (Wachs 1986:25-26). This does not preempt implementation of less expensive alterations for elderly who want to use conventional transit. For example targeted fare subsidies, lower steps on buses, more handrails to hold on to, bus driver sensitivity training, larger lettering on destination signs, and more stops with benches and shelters (Straka 1989:117-118).

3.2.2 Coordination and Centralization: Coordination occurs when organizations, who formerly made decisions separately from each other, begin taking each other into account in their decision making (Transvision Consultants 1987:2). Simple coordination is when agencies share vehicle purchase and maintenance. Informal agreements between agencies to share information and to carry each other customers is a more complex form (Rosenbloom 1981:34, Cutler 1979:54). Centralized coordination is creating a common pool of vehicles or users under the direction of one agency. Previously these vehicles would have operated separately, or the user groups would have had their trips booked, scheduled, and dispatched separately (TRB 1979b:23).

High levels of coordination imply centralization. Centralization can be according to service delivery or service management. Centralization of service delivery is when one organization provides the vehicles and drivers to carry persons registered to use an specific system (Fielding et. al. 1980:18). Decentralization is when many organizations
provide vehicles and drivers to carry persons registered to use specific system.

Centralization of service management is the integration of the registration, scheduling, and trip dispatching for all the users in an urban region. Decentralized service management is when these operations for different user groups are distinct and carried out without consideration of each other.

These two dimensions of centralization do not necessarily coincide. The Edmonton brokerage is highly centralized in terms of service management. All specialized transportation users in the City form a common pool for registration, scheduling, and trip dispatching. These functions are done at a central location. On the other hand, service delivery is decentralized because a number of for-profit and non-profit organizations are under contract to carry the system’s users. These organizations provide their own vehicles and drivers.

Attempts to coordinate and centralize specialized transportation originate in the mid-seventies as a result of concerns about costs and quality of service (UMTA 1982a:43-44, Rosenbloom 1981:33). In many urban regions service was delivered by an array of social service agencies, volunteer networks, and non-profit societies. In most cases these efforts operated separately from each other. Different groups of transportation disadvantaged were carried to similar locations along the same route in different vehicles. The vehicles of some agencies were only used during certain times of the day, remaining idle for the rest. In some cases an individual had to depend on different services to get to different destinations. Sometimes a user would be dropped off at a destination and was not picked up. Some users did not have enough service, others had more than they could use (UMTA 1982a:30-40, Rosenbloom 1981:34).

Coordination was an attempt to improve efficiency, effectiveness, and user satisfaction by reducing route redundancy, unused capacity, duplication of administrative tasks, and the multiplicity of funding efforts:

An often documented benefit of consolidation has been the reduction in the duplication and overlap of transportation services provided to the elderly
and handicapped. This means reducing the number of individual service providers that render services to the same social service agencies, or by reducing parallel service such as that which occurs with several independent carriers providing service to different social service organizations but transporting their clients to the same facilities (Noel and Chadda 1986:136).

The theory underlying coordination attempts is scale economies are realized if more trips are carried in the same number of vehicles or less, and if administrative tasks and funding are rationalized. Cost per trip and cost per hour decrease, leading to increases in social effectiveness. Regular users can take more trips, and more transportation handicapped persons can use the service (Cutler 1979:52, Noel and Chadda 1986:137).


A second argument is the adverse impacts coordination can have on cost-effectiveness and service quality (Rosenbloom 1980:44). Carrying different user groups, such as the elderly and handicapped, in the same vehicles increases the number of destinations and may create longer vehicle runs in terms of time and distance. This can lead to less trips per hour which means increased costs per hour and per trip. Losses in efficiency and cost effectiveness may be greater than gains resulting from reductions in administrative duplication and service redundancy.

Coordination of vehicles and user groups can also result in a perceived loss of service quality. Service to groups with different needs, and from different areas, may not be sensitive to a specific locally based group:

... many agencies (desire) to serve similar groups of the elderly - those from a cohesive ethnic or religious group or from a given neighbourhood. There was real resistance to forcing the elderly to ride with children and strong resistance to mixing the elderly with the retarded or the severely handicapped. ... It may be possible to significantly lower the per-trip cost of transporting an elderly person to a doctor’s appointment, for example, if a coordinated system has the capacity to group several comparable trips from or to the same geographic location. The elderly rider, however, would incur some - perhaps significant - increases in waiting time and might also have to cope with an unfamiliar driver and ride with strangers and people unlike
himself or herself (Rosenbloom 1981:38, see also Rosenbloom 1988b:42, Warrington et. al. 1988:5).

There are arguments that decentralization, not coordination, results in cost savings and higher quality service (OECD 1987:chapter 2). First, decentralization according to geographic zones means shorter trip lengths, less service kilometers, greater productivity, and lower cost per trip (UMTA 1982a:28, TRB 1983:71). Second, delivery by community based non-profit societies, or for-profit firms, can result in higher quality, more responsive, less costly, and more varied service (OECD 1987:34). Senior citizens in an East Detroit neighbourhood organized their own transportation because the specialized service offered by the regional public transportation authority was not responsive to their needs. The community based service, administered and operated by senior citizens, and funded from various government sources, has proven to be responsive to the needs of the local elderly, and cost-effective at the same time (Fondriest 1986, McKelvey et. al. 1988).

The question as to what level a public agency should coordinate various specialized transportation efforts is linked to issues of appropriate scale (TRB 1979b:47). First, at what level of coordination and centralization can cost savings be maximized without sacrificing responsiveness. There are arguments to support either centralization or decentralization. Second, what level of coordination and centralization can balance responsiveness, and integration into the larger society. Decentralization may provide responsive service to the elderly, but responsive service can contribute to maintaining the social ghetto in which many elderly find themselves:

Associations setting up and operating specialized transport services are thus quite apt to maintain elderly and disabled persons in a closed environment. This kind of organisation would in fact seem all the less able to help such individuals fit into normal community life, as the bodies responsible for specialised transportation are very likely to have particular interests conflicting with other, even more important social objectives. For example, they naturally first will want to fill the specialised assistance facilities they manage and thus to prefer transport schemes which fail to give the elderly and disabled enough access to the outside world (ECMT 1980:105-106).
To be effective coordination must be at a level where costs are minimized without losing responsiveness to user needs, and where responsiveness is balanced with integration into the larger society (Dueker and Davis 1988:84).

3.2.3 The Roles of the Public, Non-profit, and For-profit Sectors: Before the roles of the public and private sectors are discussed, a distinction must be made between lead and operating agencies. Lead agencies fund, plan, and administer service, operating agencies manage and deliver (Walther 1982:148). Lead and operating functions can be carried out either by a social service, public transit, non-profit, and for-profit organization (UMTA 1982a:31, Walther 1982:151). With highly centralized specialized transportation systems, the lead and operating agencies are the same. One trend, which began in the mid-seventies and early eighties, is public lead agencies extending their control over the funding, planning, and administration of specialized transportation. A second trend, which began in the mid-eighties, has been for public lead agencies to contract out service delivery to private firms and non-profit societies.

Provision of specialized transportation was traditionally carried out by social service agencies and volunteer groups. During the seventies, public transit agencies in many large Canadian and U.S. urban centres consolidated these efforts (UMTA 1982b:15-20, Atkinson 1985:17). By the mid-eighties concerns about rising costs, and a policy environment oriented to dismantling the Welfare State, resulted in these agencies relinquishing some control over service delivery to private non-profit and for-profit carriers (Barnekov et. al. 1989:124-133, OECD 1987).

One reason public agencies extended their control over specialized transportation was to ensure service quality and standards. Some analysts argue certain services are best managed and delivered by the public sector because they are instruments of social goals, not private profit (Bailey 1987:141-143). It is in the interest of society as whole for public agencies to have some way to ensure such services are meeting these goals.
Public transportation agencies also consolidated specialized transportation delivery and management to save costs. However, in many cases consolidation did not improve efficiency and effectiveness, and in some cases consolidation meant greater inefficiency and ineffectiveness. By the early eighties, public transportation agencies began to rely more on private sector operators to improve the efficiency and effectiveness of service delivery.

There are two ways public lead agencies employ private sector operating agencies - purchase of service and vouchers. Purchase of service is contracting out service delivery and management to private firms. Vouchers, or user-side subsidies, increase a person's ability to buy into a particular transportation market. A user side subsidy is usually script or coupons which enables the user to discount taxi fares (OECD 1987:50-56).

Proponents of privatization claim contracting out service delivery to private for-profit firms will lower costs and increase service quality:

The thread that runs through these concepts is the idea that the inherent inefficiencies of government can be relieved by subjecting goods or services, traditionally provided by government, to the disciplines of the marketplace. Competition among firms, freedom from red tape and other procedural constraints, and flexibility in hiring, firing, and compensation practices, it is believed, create pressures for efficiency and cost savings that cannot be achieved in the public sector (Barnekov et. al. 1989:125, see Orski 1982:313-314).

These proponents also argue relying on the non-profit sector returns government service delivery back to traditional volunteer networks based on family and community (OECD 1987:chapter 3). The increasing use of non-profit societies and for-profit firms by public agencies to deliver specialized transportation service fits the goals of government restraint policy.

Two arguments are made against contracting out.

First, contracting out can save costs while maintaining quality when a service is defined by narrow objectives, quantifiable outputs which allow for easy monitoring, and a number of willing and able suppliers (Bendick 1984:166). Examples are waste collection and data processing. Privatizing services which have non-quantifiable outputs and goals has shown poor results (Bendick 1984, OECD 1987:50). For example, attempts to
contract out education in the U.S. did not improve quality. The contractors lost money, none of the participating school districts renewed the contracts, and relation between the school boards and contractors closed on a acrimonious note (Bendick 1984:158-159).

The objective of specialized transportation is cost-effective and satisfactory service to the transportation handicapped. This objective is to meet broad social goals of integrating the elderly and handicapped into society, and to provide these groups with an adequate level of mobility. Privatizing specialized transportation may increase the cost effectiveness of service delivery, but in some cases this may be at the costs of user satisfaction and appropriateness (Barnekov et. al. 1989:127, Rosenbloom 1988b:42).

A second argument against contracting out is private provision of service is not inherently effective and efficient. In a sample of U.S specialized transportation systems, the cost per trip of private providers ranged from $4.30 to $27.10, the range of public providers was $3.80 to $31.40. The study found service organization and contract terms had more influence on costs than the type of organization which delivered service. It was found that non-competitive contracts and private monopolies could make service delivery as inefficient and ineffective as delivery by some public systems (Rosenbloom 1988b:43). Also, the initial cost savings of some contracting out efforts are due to lower labour costs, not necessarily more efficient management or production:

Some of the current cost advantages enjoyed by private providers are simply a result of lower labor costs and not more efficient management or production; over time, labor costs will rise in any industry which is non-competitive, particularly one heavily engaged in public-sector contracting (Rosenbloom 1988b:44, see also Lauritzen 1988:8).

Long term efficiency and effectiveness gains in the operation of specialized transportation depend more on advances in information management. How call takers, schedulers, and dispatchers handle and control information has a large impact on efficiency and cost-effectiveness (Bender and Sutherland 1989:6, see also Transvision Consultants 1987:1). A study of shifting service delivery from a public agency to taxis in six Texas
cities concluded that better utilization of equipment and labour by the taxi companies were more responsible for costs savings than were lower labour costs (Rosenbloom 1980:44).

In terms of user side subsidies, the following arguments have been used for subsidizing fares to allow the elderly and handicapped to make more use of taxis. The public agency is saved the cost of buying, replacing and maintaining capital equipment. Shifting service delivery to existing taxi firms can lead to savings in administrative costs. The transportation agency does not pay for unused capacity, but only pays for actual demand, thus the amount of subsidy can be adjusted to the level of demand (TRB 1983:34). There can be savings in operating costs because transportation is provided by a competitive taxi market. Taxis can respond to trip requests quickly, users can make more spontaneous trip making decisions than they can with dial-a-bus services. Finally, vouchers allow the user to freely chose a carrier that best suites her or his needs instead of using a carrier imposed by an agency (OECD 1987:55-56).

There are three problems with vouchers.

First, convincing taxi companies to participate in voucher schemes. Many taxi companies do not have drivers trained to deal with elderly passengers and are hesitant to enter a market where they have little or no experience (Rosenbloom 1980:44). Participating in a user side subsidy program might entail capital investment for new cabs or for altering existing ones (Atkinson 1985:27-28, Transvision Consultants 1987:67, BC Transit 1989a:9).

The second problem is low rates of utilization by eligible and registered users (Middendorf et. al. 1984:56-61). One reason for low utilization are preference for other modes. Many eligible users may have access to other modes, and will register for a user side subsidy program in case the preferred mode becomes unavailable (TRB 1983:60). Another reason for low use is the script discount may not be high enough. Low income elderly may not be in the financial position to make extensive use of taxis even with a 50% discount on fares (Middendorf et. al. 1984:67, TRB 1983:61).
A third problem with user-side subsidy programs is they are vulnerable to fraud. Fraud was discovered in user-side subsidy programs in Dallas and Milwaukee. In both cities vouchers and trip charges were submitted by taxi drivers for trips not taken (Rosenbloom 1988b:44, Kendall 1980:47). In some cases this type fraud means collusion between users and taxi drivers. An explanation for the actions of lower income users may be they are finding ways to convert a transportation subsidy to pay for other necessities such as food or housing (Bendick 1984:161).

The goal of redesigning specialized transportation is to increase the quality and quantity of mobility for transportation handicapped persons. Privatization is one instrument to achieve this goal. Extending public agency control is another instrument. To oppose or promote privatization, or the extension of public sector control, for ideological reasons means other goals are being substituted in place of removing barriers for the transportation handicapped (ECMT 1980:112). Privatization is a policy instrument which in some cases can increase quantity and quality of service. Service delivery by private taxi companies and non-profit societies can save costs while maintaining or improving quality (Rosenbloom 1980, 1985, 1988). On the other hand delivery of specialized transportation is labour intensive, requiring a high level of skill from drivers and scheduling staff. The gains in costs and service quality from retaining highly paid, but highly skilled, public sector employees may outweigh any savings in labour costs resulting from contracting out (Rosenbloom 1980:44).

3.3 Organization, and Performance Indicators

The policy issues discussed in the previous section are resolved in the context of demands and constraints which originate from many sources (Lewis 1982:1-2). How these issues are resolved will effect the public transportation options available to the elderly.

Transportation planners propose solutions based on standards of efficiency and effectiveness, in other words to provide the most service for the most people per unit cost (Wachs 1985:3). Organizations representing the growing number of urban elderly demand
solutions which overcome barriers in a way which is satisfactory to their members' needs (Wachs 1986:2). In most urban regions the two types of solutions diverge so that specialized public transportation will be efficient and effective and yet at the same time unsatisfactory to the elderly.

Besides the imperatives of transportation planners and demands from the elderly, demands from various interest groups also impinge on policy issue resolution. There are demands from handicap advocacy groups for appropriate and adequate transportation which may compete with elderly demands (Wachs 1986:17). Transit unions leaders have a mandate to protect their member's job security and may view increasing use of taxis for service delivery with suspicion. Taxi companies have to be convinced of the benefits from entering specialized transportation markets. Local politicians need visible projects to appease various interest groups and to maintain credibility. Politicians from senior levels of government put pressure on local government to implement restraint policies. Constraints such as the distribution of power between different levels of government, and the organization of the conventional public transportation system will impact on decision making. Added to these are geographical constraints such as climate, terrain, and population density and distribution (Sinha et. al. 1980:21-22, RTAC 1976:63, TRB 1979:49-54). Sometimes these pressures will force a solution which is neither effective and efficient from the perspective of the transportation planner, nor satisfactory to the elderly. The installation of lifts on conventional buses for example.

How important specialized transportation policy issues are resolved in a particular urban region depends on the relative weights of all the above pressures, demands, and constraints (Lewis 1982:1-2). Policy issue resolution in turn will have an impact on the size, structure and market area of a specialized transportation system. A particular specialized transportation system can be described according to:

- how public resources are allocated between different alternatives for improving the mobility of transportation handicapped persons;

- degree of centralization and coordination;
- the roles of the public, non-profit and for-profit sectors in the administration, management and delivery of service.

A specialized transportation system can be evaluated in terms of **efficiency**, **effectiveness** and **satisfaction** (Chan 1987). **Efficiency** refers to how productively an agency utilizes service inputs. An **efficient** agency produces a level of output with minimum input, or maximum output from any given level of input. In terms of specialized transportation this means minimizing costs per service hour. **Effectiveness** is how an agency utilizes outputs to meet agency goals and user group needs. An **effective** agency meets a level of demand with minimum cost or output:

Efficiency and effectiveness are concerned with produced and consumed output respectively. ... Efficiency is concerned with how well a transit firm utilizes its available labour and capital resources; effectiveness is concerned with how well a transit firm meets its goals which have been set for it ... Efficiency measures reflect resource usage; effectiveness measures rate the degree to which the transit service achieves the rider’s and the community’s needs (Tally 1986:201, see also Tally and Anderson 1981:431, Fielding et. al. 1978:366, Chan 1987:281, Fielding 1987:60).

**Satisfaction** refers to how well specialized transportation fits the activity patterns and needs of the elderly. This depends on how much adjustment to personal plans and living habits have to made to use (consume) specialized transportation, and whether specialized transportation allows needs to be met in an appropriate and adequate way (Chan 1987:291).

The three dimensions of transportation service are input, output and consumption. How these dimensions are related to each other specifies the following performance indicators (Fielding 1987:60-62):

- **cost efficiency**, the relation between service input and output, measured in cost per hour.

- **cost effectiveness**, the relationship between service input and consumption, measured in cost per trip.

- **service effectiveness**, the relationship between service output and consumption in terms of agency goals, measured in trips per hour.

- **social effectiveness**, also the relationship between service output and consumption, but in terms of user group needs; measured by market
penetration, percentage of rejected bookings, and distribution of types of trips.

- **satisfaction**, elderly satisfaction with service delivery as a whole; a qualitative measure which can be ascertained from surveys of elderly persons, and from statements of representatives of the elderly (these indicators come from Chan 1987, and Fielding 1987).

The first three indicators relate to transit agency management goals, which are to provide as much service to as many people as possible with the least output and cost. The last two indicators relate to elderly goals, which are to maintain quality of life and well-being by meeting life sustaining and life enhancing needs. Public transportation which is appropriate and adequate to the elderly and at the same time effective and efficient has to be designed to balance both perspectives (Wachs 1985:23-24, Rosenbloom and Warren 1981:14-15, RTAC 1976:145-146, TRB 1979b:41-42).

However, this balance is often difficult to achieve because of scarce resources. For example, some specialized transportation systems require users to book trips one or more days in advance. Advance booking allows trips to be scheduled, grouped, and dispatched more effectively than on-demand service. Trips per hour can be maximized and ultimately this means lower costs per trip and per hour. Because of cost savings, more service can be provided for more people. On the other hand advance booking means users cannot make spontaneous trip making decisions. To offer on-demand service means less effective scheduling and dispatching. Cost per trip will increase due to decreases trips per hour. The result is less service to less people, a high number of rejected bookings, and the necessity to control demand by eligibility restrictions and trip prioritization (Lewis 1989:160). Given a fixed level of funding, the trade-off is between unsatisfactory service for many or a satisfactory service for a few.

The next chapter examines specialized transportation in Greater Vancouver, Metropolitan Toronto, and the City of Edmonton. The discussion is on how the different systems have evolved from policy issue resolution, and if these systems meet the mobility requirements of the elderly in cost-effective and efficient way. In the case of Vancouver
there is some discussion of how other demands and constraints have influenced the design of specialized transportation. The discussion on Vancouver is more extensive than Toronto and Edmonton because the focus of this thesis is Vancouver, and because of availability of information.
4. SERVICE IN VANCOUVER AND TWO OTHER URBAN REGIONS

4.1 Service Delivery in Vancouver

4.1.1 History, and Description of Service Area: Public transportation for the elderly and handicapped in Greater Vancouver is provided by Handy-DART. Handy-DART was formed in 1980 when BC Transit consolidated twenty operators of specialized transportation. BC Transit is the agency responsible for public transportation in Greater Vancouver. Consolidation was a response to intense political pressure from opposition politicians, seniors organizations, and handicapped advocacy groups (Vancouver Sun:July 17, 1980). Previously, services were funded and supported by various social service agencies, non-profit societies and private donations. These efforts were underfunded and distinct from each other. Service delivery was ineffective, and there were many complaints regarding unmet demand and quality of service. Also, many elderly and handicapped paid the transit levy on their power bills but were not receiving the same level of service as provided to the general population by conventional public transportation (Vancouver Sun:July 17 1980). In response to these complaints and inequities, BC Transit consolidated funding, administration, and service delivery (Stone and Geehan 1986:785). Presently, Handy-DART is a department of BC Transit, administered separately from conventional public transportation.

The Handy-DART service area is the Greater Vancouver Regional District (GVRD) which encompasses 2,473.25 square kilometers and had a 1986 population of 1.34 million, gross density is approximately 549 persons per square kilometer. In 1990 there were 15,772 persons registered to use Handy-DART (BC Transit 1988:35). Users pay the regular public transit fare and Handy-DART fare tickets and receipts can be used to transfer to the conventional system. Fares recovery is approximately 10% of operating costs, local taxes pay for another 26%, and the Province pays the remaining 64% (Chown 1988:2-3).
Figure 20:
Handy-DART Service Area
4.1.2 Allocation of Resources: Policy for the transportation handicapped in metropolitan Vancouver has focussed on projected increases in demand for Handy-DART service:

The Handy-DART system in the Vancouver region now carries nearly 500,000 passenger trips annually. ... The service is being used to capacity and some trips that disabled people wish to make cannot be accommodated. It has been estimated that these unmet trip requests account for about 15 percent of the number carried, or another 75,000 trips (BC Transit 1989b:16).

Demand for trips is expected to rise from 600,000 in 1989 to 1,570,00 in 2005, a 150% increase (BC Transit 1989a:Figure1). The regular bus fleet will be fully accessible by 2005 which is projected to divert 10-20% of Handy-DART demand to conventional transit (BC Transit 1989b:16). There are no plans to retrofit existing buses, as all new buses bought after 1990 will have lifts. BC Transit plans to divert a further 15% of projected Handy-DART demand to taxis by implementing a user side subsidy program (BC Transit 1989a:8).

The three instruments chosen to realize the goals of improving the mobility of the transportation handicapped in Greater Vancouver are lift installation, expansion of Handy-DART, and implementation of user side subsidies (BC Transit 1989a). According to studies by BC Transit's own technical staff this is not the most effective alternative for assisting the transportation handicapped. Rather the studies concluded the most effective alternative was expansion of Handy-DART in conjunction with implementation of user side subsidies without installing lifts on buses (BC Transit 1989a:Figures 11 and 12, Chown 1988:7).

The conclusion was based on considerations of costs and the needs of regular Handy-DART users.

Calculations of annual cost for various options found expansion of Handy-DART with the implementation of user side subsidies would cost 5.9 million dollars a year whereas expansion of Handy-DART with lift installation will cost 7.1 million a year (BC Transit 1989a:Figure 11).
Figure 21: Comparative Annual Costs of Service Options for Vancouver

Options

- Handy-DART
- Handy-DART - Scrip
- Handy-DART - Lifts

Millions of Dollars

Service Costs

Data from BC Transit 1989a:Figure 11

Figure 22: Handy-DART Users Responses on Use of Lift Equipped Buses

Response

- All Users
- Under 65
- Over 65
- Vancouver
- Richmond/Delta

Percent of Users

Would Use  Would Not Use

Data from BC Transit 1988:29
Figure 23:
Preferred Modes of Handy-DART Users
Over 65 and Under 65

Data from BC Transit 1988:34
Figure 24:
Preferred Modes of Handy-DART Users
City of Vancouver and Richmond/Delta

Data from BC Transit 1988:34
In terms of user group needs, a 1987 survey of Handy-DART users found only 35.9% of the respondents stated they would use lift-equipped buses, 49.4% stated they would not, and 13.2% didn't know. Of elderly users, 32.3% stated they would use accessible buses, and 52.3% stated they would not. For users under 65, the response was 45.3% yes and 44.8% no. In terms of location, 41.6% of City of Vancouver users said they would use accessible buses and 43.9% said no. This reflects a fairly accessible conventional system in the City made possible by a dense grid of trolley bus routes. In the low density suburbs of Richmond and Delta the responses were 26.8% yes and 62.5% no (BC Transit 1988:29). Conventional public transportation service in these areas is oriented to radial routes focussed on Downtown Vancouver (see Straka 1989:93-99).

Handy-DART was the preferred mode of 54.7% of the registrants and 8.2% preferred lift equipped bus. Of elderly users Handy-DART was preferred by 54.4% and bus by 7.0%. Of users younger than 65 54.2% preferred Handy-DART and 9.0% bus. Of Vancouver users 65.6% preferred Handy-DART and 7.7% preferred bus, in Richmond/Delta the numbers were 46.4% and 5.4%. While Vancouver users preferred Handy-DART and bus more than Richmond/Delta users, 32.1% of the latter preferred being driven by a friend or relative compared to 11.3% of the former (BC Transit 1988:34).

The discrepancy between the responses to questions on accessible bus use and preferred mode reflects the findings of an earlier UMTA study from the U.S. which found some persons who stated they would use accessible buses in fact would not be able to because of barriers to use (TRB 1983:22). Accessible buses would increase the number of trips made by transportation handicapped persons by 6.8% if the number of persons who stated they would use them were counted. If the number of persons who could actually use accessible buses were counted then trips would increase by only 3.2% (TRB 1983:22). Another possible reason for the discrepancy is most persons stating they would use
accessible buses would still depend on Handy-DART for most trips and use accessible buses only for some trips.

The survey recognized the difficulty of shifting demand from Handy-DART to accessible buses. One of the conclusions was:

The concept of providing specially equipped buses with lifts and securing devices for wheelchairs does not meet the transportation requirements of most handyDART users (BC Transit 1988:H-4).

The strong negative response from suburban users to lift equipped buses indicates a conventional transportation system which does not fit their mobility patterns. Many of suburban users show a strong preference for the automobile. This fits the findings of the White Rock and Richmond studies, 70.6% of the Richmond seniors and 76% from White Rock drove for most of their trips (Straka 1989:79, Hodge and Milstien 1989:64).

Inadequate conventional service in the suburbs, increasing suburbanization of the elderly, and continuing decentralization of employment and activities means the effectiveness of lift equipped buses for overcoming the mobility problems of Greater Vancouver elderly will decrease with time.

The decision to install lifts on Vancouver buses was the result of a 1988 Task Force on transportation for the elderly and handicapped. The Task Force was established by BC Transit Board of Directors and was chaired by the Mayor of the City of Vancouver (BC Transit 1989b:1). A well organized campaign by disabled advocates succeeded in convincing the Task Force to recommend lift installation (Atkinson 1989:2). These advocates based their case on human rights and argued inaccessible public mass transportation was discriminatory. During one of the public meetings held by the Task Force Jill Weiss of the Committee to Promote Accessible Conventional Transit stated:

It (the installation of lifts) makes sense. It doesn’t cost very much money and it says disabled people are being treated like all other citizens. To have a publicly funded transportation system that excludes a class of people is clearly discriminatory and people are seeing that it’s time to end that (quoted in Vancouver Sun:March 17 1989).
Clearly the decision to make buses accessible followed mainly from political concerns and pressures, not from more technical concerns of cost-effectiveness and efficiency, nor the needs of most users of specialized transportation (see Wachs 1985:14-17, Wachs 1986:16-23, Fielding 1982). As the experience from U.S. cities indicates ridership on accessible buses is due to intensive use by small number of handicapped persons (see Middendorf et. al. 1984:48-53, TRB 1983:47-52). In Greater Vancouver, resources are being allocated to an option which will assist a few wheelchair users, and which will make a powerful symbolic statement about the need to integrate handicapped persons into the larger society (TTC 1989a:76). At the same time these resources are being taken away from options which can increase the mobility of a greater number of persons from a wider variety of groups. Specialized transportation - Handy-DART, subsidized taxi use, and community based service - assists not only wheelchair bound persons, but persons with other physical handicaps, the mentally handicapped, the elderly, and special needs children (see Wachs 1986:18).

The resources that will be expended on lift installation could have been used to expand Handy-DART service. Presently, Handy-DART service is severely constrained because of current levels of funding and pressure from excess demand. Hours cannot be maximized to meet demand because each Handy-DART service area is allocated a certain number of hours by BC Transit. To meet demand trips per hour and trips per vehicle must be maximized, but an insufficient number of vehicles and the present level scheduling and dispatching effectiveness make maximization difficult if not impossible. Thus demand has to be rationed by eligibility restrictions, trip prioritization, and advance booking (Straka 1989:65, Urban Institute 1985:1-9, Lewis 1989:160).

One restriction is elderly persons are not eligible for Handy-DART service because of their age. There must be evidence of a physical impairment which makes the use of regular transit and private modes difficult or impossible. For example chronic physical conditions such as arthritis or multiple sclerosis, visual impairments, heart or respiratory
problems, or easily confused or disoriented. Medical, work, and educational trips receive the highest priority, trips for leisure or shopping the lowest. Non-subscription trips require between two and seven days advance notice.

4.1.3 Degree of Centralization and Coordination: The structure of Handy-DART is moderately centralized in terms of service delivery, and decentralized in terms of service management. In terms of service delivery, BC Transit administers Handy-DART, and owns and maintain the Handy-DART vehicles. Service is delivered by eight contractors. The vehicle drivers are employees of the contractors. In terms of service management, each contractor manages trip requests and delivers service within a specific geographic zone. All users do not form a common pool for scheduling and dispatching, but are divided according to service zone.

There is no formal coordination of vehicles and users between zones. Operators have informal agreements to carry each other’s users for subscription trips. For example an elderly person from Richmond may go to a rehabilitation centre in Vancouver on a certain day of the week. An agreement is made so Richmond Handy-DART, contractor for the Richmond zone, takes this person to the centre. Pacific Transit Cooperative, the contractor for the City of Vancouver, then takes this person home to Richmond.

Consultants have recommended greater use of computers to make coordination between zones more effective and efficient (Stone and Geehan 1986). Presently, computers are used to schedule and dispatch trips within zones, but are not being used to coordinate cross zone trips.

Decentralization in Vancouver is more responsive and better fits the more circumscribed activity patterns of the elderly as compared to more centralized service delivery (see McKelvey et. al. 1988:16, Rosenbloom and Warren 1981:9). Decentralization also allows for more community input into service delivery. The North Vancouver Custom Transit Advisory Committee consists of representatives of local elderly and handicapped. This committee works with BC Transit and the Handy-DART contractor for the North
Shore zone to deal with local concerns about service delivery (United Way 1989:2).

Finally, decentralization has implications for efficiency and effectiveness. Trip lengths are shorter which means less service kilometers, greater productivity, and lower cost per trip (UMTA 1982a:28, TRB 1983:71). This consideration is important for a low density urban region like Vancouver which has natural barriers such as bodies of water and uneven topography (Sinha et. al. 1980:22).

4.1.4 The Role of the Public and Non-Profit and For-Profit Sectors: The lead agency for the provision of specialized transportation in Greater Vancouver is BC Transit, a Crown Corporation empowered by the provincial government to provide public transportation to the communities and cities of British Columbia. BC Transit funds Handy-DART, does the long range planning, owns and maintain the vehicles, sets the service hours, and tenders the operating contracts. BC Transit owns and maintains the Handy-DART vans to ensure standards are maintained (Bruce Chown:personal communication) In terms of service delivery, BC Transit plays a mainly regulatory role. Service is delivered by seven non-profit societies and one for-profit firm, all under contract to BC Transit. The drivers for the vans and the trip scheduling staff are employees of the contractors. Contracts for each service zone are tendered every five years and put up for competitive bids.

Some trips are allocated to taxis by dispatchers during peak periods when Handy-DART is operating to capacity, and during low demand periods when use of Handy-DART would involve high costs due to unused capacity (BC Transit 1989a:3). The user pays the regular fare, and BC Transit reimburses the taxi company for the difference between paid and meter fares. In 1987/88 taxi trips accounted for approximately 6% of the total regional Handy-DART trips (BC Transit 1989a:7). BC Transit plans to increase this share to 15% when the user side subsidy program is implemented.
Figure 25: Handy-DART Operating Zones
Figure 26: The Organization of Public Transportation for Communities in British Columbia

Minister Responsible for Transit
Cabinet Committee on Transit

Board of Directors, BC Transit
Appointed by the Lieutenant-Governor in Council
Locally-elected municipal officials and private sector representatives from throughout the Province

Vancouver Regional Transit Commission
Locally-elected municipal officials

Victoria Regional Transit Commission
Locally-elected municipal officials

Small Community Systems Program
Locally-elected Councils/Boards

BCT
Custom
WVMT
BCRTC

BC Transit Staff, Vancouver

BC Transit Staff, Victoria

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4.1.5 Evaluation: From 1984/85 to 1989/90 cost efficiency went from $25.15 to $29.14 per hour, cost effectiveness from $11.32 per trip to $12.74 (gross cost per trip), and service effectiveness went from 2.22 trips per hour to 2.35. Gross cost means total costs without subtracting fare recovery. This contrasts with net cost which is total costs minus fare recovery. These compare favourably with Canadian averages. In 1985 the average productivity for all systems in Canada was 2.3 trips per hour, the average cost per trip was $13.00 (Atkinson 1985:3).

In terms of market penetration, 58% of the respondents of a 1987 Handy-DART user survey were over the age of 65 (BC Transit 1988:H-6). If this percentage is still the same now then these individuals are 5.6% of the 1986 Greater Vancouver elderly.

The other indicators of social effectiveness are rejected bookings, and distribution of types of trips.

Distribution of different types of trips for elderly users are 76.5% for medical purposes, 0.4% for work, 3.9% to visit friends, 4.6% for recreation, and 5.8% for shopping (BC Transit 1988:6). This fits findings from the Richmond and White Rock studies. Richmond respondents used Handy-DART mainly for medical treatment or doctors’ appointments (Straka 1989:App.D Table VI). The respondents in the White Rock study used Handy-DART mainly for medical purposes (Hodge and Milstien 1989:67). Medical and health related trips are important to the elderly, but infrequent. Richmond seniors travelled to the doctor’s office only once or twice a month. High frequency trips were for shopping, to the seniors centre, to the restaurant, and visits to friends which occurred once or twice a week (Straka 1989:80-84). Medical trips can be booked, grouped, and dispatched effectively because they are often subscription trips or appointments made in advance. On the other hand social and recreational trips tend to more spontaneous and unplanned. The present state of scheduling and dispatching technology, and the present level of funding, are such that these types of trips cannot be accommodated effectively.
Figure 27: Handy-DART Cost Efficiency

Data from Helen Cook, BC Transit

Figure 28: Handy-DART Cost Effectiveness

Gross Cost per Trip

Data from Helen Cook, BC Transit
Figure 29: Handy-DART Service Effectiveness

Trips Per Hour

Data from Helen Cook, BC Transit
Some elderly may use Handy-DART exclusively for medical and health related trips and use more preferred modes for other types of trips. For these elderly there is no problems with unmet demand. However a majority of elderly users prefer Handy-DART which means some demand for higher frequency non-medical trips is not being met because of trip priortization restrictions.

Data on rejected bookings can be used to support this last point. Only 58.9% of elderly users were able to book as many trips as they wanted, 21.4% could not, and 19.6% didn't know (BC Transit 1988:17). For all Handy-DART users, most of the rejected trips were to taken with other modes, but 18.1% of the rejected medical trips, 47.1% shopping, 31.3% social, and 43.8% recreation were not taken at all (BC Transit 1988:84). Many of these rejected trips are most likely being taken with less preferred modes, and demand others is not being met at all. Problems with trips rejection means some eligible persons will not bother to use Handy-DART. Two reasons why some registrants did not use Handy-DART were:

- Don't know anything about it
- Tried to use handyDART but service was never available when needed (BC Transit 1988:4).

Also, in 1988 trip rejection was approximately 15% of all trip requests (BC Transit 1989b:16).

Regarding satisfaction, most elderly users rated Handy-DART service highly, 75.4% rated the service as excellent, only 1.4% gave the service a poor rating (BC Transit 1988:16). Most Handy-DART users are satisfied with the service but want to make more trips than can be accommodated by the present structure (BC Transit 1989b:15).

Complaints about service mainly have to do with hours of service, the need for more service, and advance booking. Elderly respondents from the White Rock study stated:

- expanded HandiDart service required,
- HandiDart service - too rough a ride,
Figure 30:
Distribution of Handy-DART Trips
Over 65 and Under 65

Data from BC Transit 1988:8
Figure 31:
Frequency of Shopping and Medical Trips
Richmond Elderly

Data from Straka 1989: App. C, Table 12
Figure 32: Handy-DART Users Met and Demand for Trips

All Requests Met 59%
Don't Know 19.6%
All Requests Not Met 21.4%

Data from BC Transit 1988:17

Figure 33: Rejected Handy-DART Trips Not Taken By Other Modes

Type of Trip
- Medical
- Shopping
- Social
- Recreation

Percent

0 10 20 30 40 50

Percent of Trips

Data from BC Transit 1988:84
- rude drivers, trips too long, and drivers won't help people to bus (Hodge and Milstien 1989:71).

Two responses from Straka's study of Richmond seniors stated:

- we need more Handy-DART service,
- if there were more vehicles available, one could make more use of it (Handy-DART) (Straka 1989:App.D Table VI).

Three complaints from North Vancouver were:

- Trips to Vancouver are on a shared ride system with pick-up starting at 8:00 a.m. and returns starting at 11:30 a.m..
- Sunday service is from 11 a.m. to 7 p.m. restricting church service.
- Hours of service, bookings requirements, and ease of reaching Dispatcher by phone vary; i.e. cannot book past 3 p.m. or on weekends (United Way 1989:2).

Many transportation handicapped elderly are ineligible for Handy-DART service. Eligible elderly find restrictions on their use of Handy-DART, social and recreational trips are given low priority, and hours of operation are limited. In response to problems with user satisfaction the B.C. Task Force on Aging has recommended:

the Province of British Columbia expands the current handyDART service, in order to increase availability of the service to seniors and enable them to make more use of it for attending social and recreational events (Province of British Columbia 1990:36).

4.2 Service Delivery in Toronto and Edmonton

4.2.1 Toronto: Transportation for the handicapped and elderly of Metropolitan Toronto is provided by Wheel-Trans. Wheel-Trans was initiated by the Toronto Transit Commission (TTC) in 1975. Seven converted vans carried 46 registered users to work destinations. In 1977 the system was expanded so trips for any purpose could be accommodated. Between 1977 and 1983 private contractors delivered and managed service. In 1983 TTC staff took over administration, reservations, and scheduling. Operation came under one contractor in 1984. Concerns about service quality and complaints from users resulted in the TTC taking over bus service operation (TTC
The drivers for 102 Orion II buses, and booking and dispatching staff are now employees of the TTC (TTC 1989b:1).

The Wheel-Trans service area covers the Municipality of Metropolitan Toronto. Metropolitan Toronto has an area of 1618 square kilometers and a population of 2.2 million (1988), gross density is 1,355 persons per square kilometer. In 1989, 14,175 persons were registered to use Wheel-Trans (Frank Ahlin, personal communication). Four per-cent of Wheel-Trans operating costs are recovered from fares, 50% of the deficit is paid by the Province, and Metropolitan Toronto pays 50% (TTC 1989b:5). Metro pays 55% of Wheel-Trans operating costs from fares and taxes, the Province covers 45%.

Specialized transportation policy in Toronto has focused on making the conventional system as accessible as possible but not installing lifts, and improving Wheel-Trans service quality (Atkinson 1989:3).

A commitment has been made to have buses purchased after January 1990 with the kneeling feature (TTC 1989a:165-166). Also, twenty key rapid stations will be retrofitted with elevators and other accessible features, new rapid transit stations will have elevators built with them. All new rapid transit vehicles will have one wheelchair position, and by 2000 all existing vehicles will be retrofitted with at least one wheelchair position (TTC 1989a:178-179). There are no plans to make the bus fleet fully accessible because of costs related to lift installation, maintenance and operation, and because harsh winters would make lifts ineffective for a large part of the year (TTC 1989a:181, Middendorf et. al. 1984:66).

To improve cost-effectiveness the TTC plans to increase the share dedicated station wagons and non-dedicated taxis have of Wheel-Trans service. To improve service quality new computer applications will be used to shorten times between trip requests and responses, hours of operation will be expanded to match conventional bus and rail, and attempts will be made to reduce the number of rejected bookings (TTC 1989a:181-185).
Figure 34: Wheel-Trans Service Area

LEGEND

METROPOLITAN TORONTO

- Municipality of Metropolitan Toronto
- Municipality

CITY OF NORTH YORK
CITY OF YORK
BOROUGH OF EAST YORK
CITY OF TORONTO

CITY OF SCARBOROUGH
CITY OF ETOBICOKE

LAKE ONTARIO
High operating costs, and the level of funding, constrains Wheel-Trans service. The TTC has the freedom to expand eligibility criteria, but the Province will only provide subsidies for persons unable to board conventional transit (TTC 1987:6). Three types of trips are provided - subscription, advance registration, and demand responsive. Subscription trips are regular work and educational trips, these trips are paid monthly. Advance reservation trips are booked at least four days in advance. Demand-responsive trips are made the same day, these trips are met only if there is room due to cancellations. To be eligible to use Wheel-Trans, a person must have a physical disability which prevents boarding of conventional public transportation. Age in itself does not make a person eligible. In 1991 the Province plans to broaden eligibility guidelines to include persons unable to walk 175 metres or climb a flight of stairs (TTC 1989a:43).

The structure of Wheel-Trans is centralized in terms of service delivery and management. Administrators, trip scheduling, and bus drivers are TTC employees. In regard to service management, trip booking, scheduling, and dispatching for all users in the service area are integrated at a central location and most trips are dispatched to a common pool of TTC owned vehicles (TTC 1989b:3).

The lead agency for specialized transportation in Toronto is the TTC which is a semi-independent board responsible for public transportation in Metropolitan Toronto. The TTC funds, plans, and administers service. Vehicles owned and operated by the TTC carry a majority of Wheel-Trans trips. Some service delivery is contracted out to dedicated station wagon service provided by for-profit firms, and to taxi companies which provide non-dedicated service. The TTC owns and operates 102 Orion buses, some contract service is provided by 39 dedicated station wagons and approximately 75 non-dedicated vehicles from taxi firms (TTC 1989b:3).

From 1984 to 1989, net cost per hour went from $33.63 to $54.19, gross cost per hour would be higher than this number. Net cost per trip went from $16.34 to $28.95,
which means a gross cost per trip of approximately $30.00 in 1989. Between 1984 and 1989 service effectiveness went from 1.54 to 1.87 trips per hour (TTC 1989b:Appendix 1).

One possible reason for high costs and low productivity is the high level of congestion in Toronto which can lower vehicle speeds and increase trip times (Colquhoun and Bolger 1984:8, TTC 1987a:7). Another reason could be the inflexible centralized structure of Wheel-Trans does not allow for extensive segmentation of demand and supply. Persons from different user groups such are carried in the same vehicles at the same times:

Systems with many travelers who are difficult to group, such as severely handicapped riders making individual trips from highly variable origins and destinations and sometimes requiring significant time to board and deboard, always have low productivity (Rosenbloom 1988b:42).

As shown before, grouping transportation handicapped persons with different needs in the same vehicle for the same run can be ineffective and inefficient (Rosenbloom 1988b:42).

In 1987, 58% of the Wheel-Trans registrants were elderly. Using the number of registrants in 1989, and the number of elderly in Metropolitan Toronto in 1988, this would represent a penetration of approximately 3% of the elderly market. Between 1984 and 1988 rejected bookings went from 45,900 to 88,900, or from 9.8% of all bookings to 11.9% (TTC 1989a:Exhibit 3-8).

Rigid restrictions on demand, and a high rate of trip rejection have adversely impacted user satisfaction with Wheel-Trans service:

From a consumer perspective, major improvements are necessary to improve the quality of Wheel-Trans service. The most contentious issues among riders are the high percentage of rejected bookings and the four-day call-in period for advance reservation trips. A 10 to 12 percent rejection for all trip requests means that the travel plans of disabled consumers are being frustrated on a regular basis. Equally frustrating is the requirement to book trips in advance. Other consumer concerns include the quality and reliability of contract services (such as taxis), the impact of broader eligibility criteria on existing users and the fact that Wheel-Trans service is not available for the same time periods as the conventional transit system (TTC 1989a:45).
Figure 35:  
Wheel-Trans Cost Effectiveness  
Net Cost Per Trip

Data from TTC 1989b, Appendix 1

Figure 36:  
Wheel Trans Service Effectiveness

Data from TTC 1989b, Appendix 1
Figure 37:
Wheel-Trans - Rejected Bookings
Percent of All Trip Bookings

Data from TTC 1989a, Exhibit 3-8
4.2.2 Brokerage in Edmonton: Public transportation for the elderly and handicapped in Edmonton is provided by DATS (Disabled Adult Transportation System). DATS began in 1975 as a demonstration project jointly funded by the federal government and the City of Edmonton. In 1976 DATS served 3,800 registrants and provided 250 trips per day (Langille 1990:2). Until 1985 the structure of DATS was highly decentralized, service delivery was provided by private carriers working under contract to the City. The management of requests, scheduling, and dispatching, was done by the contractors’ personnel. The Transportation Department did not take an active role in service delivery or management, but rather played a more passive regulatory role (City of Edmonton 1987:10). In 1985 the Transportation Department restructured DATS.

The service area for DATS is the City of Edmonton which had a population of 573,980 in 1986, and covers 321.6 square kilometers, gross density is 1784.5 persons per square kilometer. The share the elderly have of the City’s population is 8.2% (Census of Canada 1986). DATS is administered as a branch of the City of Edmonton Transportation Department. Hours of service are the same as conventional public transportation. Users can use transit tickets to transfer to DATS, but not monthly passes. Eighty-six percent of DATS operating costs comes from a City of Edmonton tax levy, 8% from fare recovery, and 6% from the Province. In December 1989, 8,892 persons were registered to use DATS.

Policy regarding the transportation handicapped in Edmonton has been focussed on expanding DATS, and there are no plans to make the conventional system fully accessible. The stations for Edmonton’s LRT are wheelchair accessible, but there are no plans to install lifts on buses. Instead the policy has been to make DATS operation as comparable as possible to conventional transit. The Transportation Department hopes to avoid consumer criticism of discrimination in service to transportation handicapped persons and thus avoid pressure to install lifts (Langille 1990:5, see Rosebloom and Warren 1980:15 for other examples).
Figure 38: DATS Service Area
One of the reasons for restructuring DATS was pressure by organizations representing the elderly to expand eligibility restrictions, DATS at this time was primarily for use by handicapped persons (City of Edmonton 1987:3). Other reasons were the Transportation Department’s lack of control over standards and performance, and inability to effectively deal with complaints by users (Langille 1990:2). During 1982 and 1983 a series of studies concluded that the decentralized structure was not appropriate for projected increases of demand and other pressures for expanded use (City of Edmonton 1987:2-3). In 1985 the decision was made to restructure DATS as a centralized brokerage.

A transportation brokerage schedules and dispatches service but is not necessarily the vehicle operator. According to economic theory a broker is not involved in the supply, nor is the broker part of demand (Atkinson and Suen 1987:10), rather a broker has an intermediate role by matching demand with an appropriate supplier:

... the term brokerage refers to an intermediate market function that serves to remove the barriers to the exchange of goods and services between suppliers and consumers. ... brokerage is defined as an approach characterized by an orientation toward understanding and accommodating the actual demand for transportation services as identified by and through specific target populations (Schreffler 1986:47 and 51-52, see also Rosenbloom and Warren 1980:8, Forestall 1983:371-372).

A specialized transportation brokerage does not just passively regulate service delivery, nor does the brokerage take an active role in delivery. Rather the role of the broker is to regulate service delivery to maintain standards, but at the same time to mobilize community resources to meet demand (TRB 1979b:38). The role of the public sector managers of DATS is somewhere between the regulatory role of Handy-DART and the active role of Wheel-Trans.

The effectiveness of DATS, and user satisfaction, have been improved by market segmentation. Demand is segmented according to user group needs and type of trip. Supply is segmented by type of vehicle and type of contract. In this way a specific demand can be matched with the appropriate and cost effective vehicle. Many trips by the
ambulatory elderly and handicapped can be carried in taxis. Using taxis to deliver specialized transportation service is more cost-effective than dial-a-ride vans and buses (Colquhoun and Bolger 1984, Rosenbloom 1988b, Atkinson and Suen 1987). By shifting some demand to taxis, capacity in vans and buses can be freed up for severely handicapped persons, subscription trips, and group trips to one location (many to one). The last two types of trips can be scheduled, dispatched, and grouped to maximize van and bus productivity:

The greater cost-effectiveness of subscription trips comes from the higher vehicle productivities that can be achieved with this type of service. Subscription services usually handle only habitual or regularly scheduled trips that can be grouped into one or a few vehicles (TRB 1983:71).

The cost-effectiveness of subscription services is a result of higher vehicle productivities which are achieved with this type of service. Subscription services usually handle only habitual or regularly scheduled trips that can be grouped into one or a few vehicles (TRB 1983:71).

Vehicle effectiveness is also increased by tendering different types of contracts for different times. Hourly DATS contracts are for service between 6:00 a.m and 6:00 p.m., during this time productivity can be maximized and the most effective use can be made of vehicles. Once capacity provided by the hourly contracts is filled, runs are assigned to flat rate contractors. Flat rate contractors are also used exclusively in the evening hours when demand is low (Langille 1990:3).

The structure of DATS facilitates market segmentation. Service management - trip booking, scheduling and dispatching - is centralized so that all DATS registrants form a common pool of users. Service delivery on the other hand is highly decentralized, various private contractors and taxi companies are under different contracts to carry DATS registrants. By centralizing scheduling and dispatching, and by using a diverse set of carriers for delivery, the dispatching staff can match and group trip requests with the most appropriate carrier effectively and in a manner which is satisfactory to the user.
Figure 39: DATS Brokerage Structure

City of Edmonton
Transportation Department
Services Branch

- Consumer Advisory Board
- DATS Brokerage Centre Manager
- City-Owned Maintainence Centre
- Consulting Firm: Consulting Services and Staffing
- Scheduling and Dispatch Staff
  Brokerage Supervisor
- Bus Company: Operation of City Lift-Equipped Vehicles
- Taxi Company #1
  Hourly rates for subscription trips
- Taxi Company #2
  Flat rate van trips for groups
- Several Taxi Companies
  Flat rate sedan trips (reservations)
The lead agency for specialized transportation in the City of Edmonton is the Transportation Department which funds DATS and does the long range planning. Service is delivered by six taxi firms, and a fleet of City owned lift equipped vans which are operated by private contractors (Atkinson and Suen 1989:11). Staff from the Transportation Department manage the brokerage centre, schedule and dispatch trips, handle the registration files, deal with complaint investigations, and carry out statistical analysis (Atkinson and Suen 1987:12).

From 1985 to 1990 cost effectiveness for DATS has gone from a net cost of $11.93 per trip to $9.05. Gross cost per trip in 1989 was $11.38. During the same period ridership has almost doubled from 257,000 in 1984 to an estimated 500,000 projected for 1990 (Langille 1990:4).

In terms of market penetration, 67% of the 8,892 DATS registrants were over 65. These individuals were 12.6% of the elderly in the City of Edmonton in 1986. Of these elderly registrants 2,967 were non-ambulatory and 2,997 ambulatory. Ambulatory elderly were 33% of DATS registrants.

Restructuring as brokerage has changed the operation of DATS in ways that make service delivery more satisfactory to elderly persons. On-demand service, no restrictions on trip purpose, and no ceilings on number of trips are now offered by DATS (Langille 1990:5-6). These are changes which representatives of the elderly in Toronto and Vancouver have been suggesting for the systems in their respective cities. However, there are still some restrictions on use. On-demand service can only be provided if space is available, and reservation trips can only be accommodated on off peak hours. There seems to be some unmet demand as Edmonton seniors organizations have recommended expansion of DATS service:

That, in the allocation of funds for the transportation of seniors, higher priority be given to DATS (City of Edmonton 1990:41).
Figure 40: DATS Cost Effectiveness
Net Cost per Trip

Data from Langille 1990:4

Figure 41: DATS Trip Assignment by Contract Type

Data from Langille 1990:3
4.3 Discussion

In Greater Vancouver, Metropolitan Toronto, and the City of Edmonton specialized transportation demand and costs have increased rapidly within the last decade. A large part of the increase in demand is from ambulatory elderly persons for adequate and appropriate public transportation (Chown 1988:6, TTC 1989a:16, City of Edmonton 1987:2). This demand will continue to increase as urban populations age, as de-institutionalization continues to be used as an instrument of restraint policy, and as suburbanization and decentralization of urban activities accelerates. This means pressure on social resources for an expensive mode of public transportation at a time when governments have been restraining public spending.

Attempts to restructure specialized transportation have been responses to these pressures. The restructuring efforts in Greater Vancouver, Metropolitan Toronto, and the City of Edmonton can be understood in the context of how important specialized transportation policy issues have been resolved. In all three urban regions:

- the benefits and costs of full accessibility have been debated;
- public transportation agencies have coordinated service delivery and management;
- public transportation agencies have extended their control over funding, planning, and administration of specialized transportation, while at the same time private sector delivery of service has expanded.

In Vancouver pressure from handicap advocacy groups forced the allocation of some resources for improving the mobility of transportation handicapped persons to a fully accessible conventional bus system. In terms of structure, Handy-DART service delivery is partially centralized, and service management is decentralized. BC Transit own the vehicles and eight contractors deliver and manage service according to geographic zones. BC Transit is the lead agency, and seven non-profit societies and a for-profit firm deliver service. Greater use of the private sector is planned for the future when the user side subsidy program is implemented.
Figure 42:  
Satisfied Demand - 
Vancouver, Toronto, and Edmonton

Data from Helen Cook, personal communication; TTC 1989b, Appendix 1; and Langille 1990:4

Figure 43:  
The Costs of Specialized Transportation 
in Toronto and Vancouver

Data from Helen Cook, personal communication; TTC 1989b, Appendix 1
In Toronto, the TTC has decided to implement partial accessibility for conventional bus and rail transit, but has no plans to install lifts for reasons of costs and weather. The TTC has recently centralized service management and delivery in an attempt to control service standards. Most service is delivered and managed by the lead agency which is the TTC. There are plans to improve Wheel-Trans cost-effectiveness by expanding the use of private contractors and taxi companies for service delivery.

In Edmonton the decision has been made not to install lifts on buses. Instead transportation planners are attempting to "normalize" DATS by making service comparable to conventional service. DATS is highly centralized in terms of service management and decentralized in terms of service delivery. The reasons DATS was restructured as a centralized brokerage were to increase service quality and cost-effectiveness. These improvements were responses to current complaints about service, and projected rapid increases of demand for service. The City of Edmonton Transportation Department is the lead agency for DATS. The Transportation Department administers the system and manages service, while the actual delivery of service is done by private contractors.

DATS is the most cost-effective of the three services, in 1989 gross cost per trip was $11.38. In the same year cost per trip in Vancouver was $12.73, and approximately $30.00 in Toronto. Productivity was 2.35 trips per hour in Vancouver and 1.87 in Toronto. In 1989, the total cost per hour (costs without subtracting fare recovery) in Vancouver was $29.14, in Toronto deficit per hour (total cost minus fare recovery) was $54.19. Cost per hour and trips per hour cannot be calculated for Edmonton because the Transportation Department does not keep account of service hours.

DATS has captured a greater share of the elderly market in the urban region it serves than is the case with Handy-DART and Wheel-Trans. The market penetration by DATS is 12.6% of Edmonton’s elderly. Market penetration by Handy-DART is 5.6% of Greater Vancouver's elderly, and market penetration by Wheel-Trans is 3% of
Metropolitan Toronto's elderly. In Vancouver and Toronto 58% of the specialized transportation registrants are elderly, in Edmonton 67% are elderly. In 1988 rejected bookings were approximately 15% of all Handy-DART requests and 11.9% all Wheel-Trans requests. Although figures on trip rejection are not available, the policy of DATS has been to accommodate as many trips as possible (Langille 1990:4-5).

DATS in Edmonton is more cost-effective than Handy-DART and Wheel-Trans and has penetrated the elderly market to a greater extent than the other two systems. DATS also has on-demand booking, no restriction on number of trips, and no trip prioritization. Wheel-Trans on the other hand has low productivity, high costs, and a shallow penetration of the elderly market. At the same Wheel-Trans has rigid restrictions to use in terms of eligibility and type of trip.

The three salient points of the descriptions and comparisons in this chapter are:

- Political interests can force an allocation of resources to public transportation alternatives which are neither efficient, effective, or satisfactory to the elderly.

- A high degree of centralization is associated with low productivity, high costs, and a lack of effectiveness. On the other hand extreme decentralization, as was the case in all three urban regions before specialized transportation was restructured, is associated with a lack of user satisfaction.

- Extension of transportation agency control is associated with high costs and a lack of effectiveness. However, a lack of public agency control is associated with user dissatisfaction. Expansion of private sector delivery in conjunction with some public sector control is associated with high levels of effectiveness and user satisfaction.

The next chapter will draw conclusions from these points, and points made in the other chapters, and will make recommendations based on the conclusions. These recommendations will be directed at how the delivery and management of specialized transportation in Greater Vancouver can be made more adequate and appropriate for transportation handicapped elderly.
Figure 44:
Table of Indicators;
GVRD, Metro Toronto, and City of Edmonton

<table>
<thead>
<tr>
<th></th>
<th>GVRD</th>
<th>Metro Toronto</th>
<th>City of Edmonton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area - sq. kms.</td>
<td>2433.25</td>
<td>1617.92</td>
<td>321.65</td>
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<tr>
<td>Density (sq. kms.)</td>
<td>549</td>
<td>1372</td>
<td>1748</td>
</tr>
<tr>
<td>Percent Elderly</td>
<td>12.2%</td>
<td>12.0%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Elderly Users</td>
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<td>5958</td>
</tr>
<tr>
<td>Percent Elderly Users</td>
<td>58%</td>
<td>58%</td>
<td>67%</td>
</tr>
<tr>
<td>Market Penetration</td>
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<td>3.0%</td>
<td>12.6%</td>
</tr>
<tr>
<td>Cost per Hour</td>
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<td>N/A</td>
</tr>
<tr>
<td>Trips per Hour</td>
<td>2.35 (1989)</td>
<td>1.87 (1989)</td>
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</tr>
</tbody>
</table>
5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary and Conclusions

Chapter one stated the central problem of this thesis:

**How to design public transportation for an increasing number of elderly when resources to pay for public services for the elderly are diminishing.**

Given an increasing number of elderly, the high costs of public transportation, and government restraint policies, the challenge for transportation planners is to provide public transportation which is efficient and effective, and at the same time satisfactory to the elderly.

Chapter two began by stressing the importance of adequate and appropriate means of mobility for the physical and psychological well-being of the elderly. Next, a review of Canadian and U.S. studies concluded the activity patterns of the elderly differ significantly from younger age groups in terms of important destinations, range, frequency, and time of day. The third section explained how physical, financial, psychological, urban design, and organizational constraints create barriers to elderly persons trying to access usual private and public modes of transportation. The discussion focussed on how these constraints made walking, driving, riding as a passenger, conventional public transportation, and specialized public transportation difficult if not impossible to use.

The conclusion to be drawn from these sections is elderly activity patterns do not fit the structure and functioning of most North American urban regions. Decentralized and uncoordinated land uses, traffic networks which accommodate the automobile at the expense of other modes, and public transportation systems oriented to peak hours are not compatible with short trips to non-work and non-educational destinations made during off-peak hours. Furthermore, these aspects of urban form and function aggravate existing physical, financial, and psychological barriers to elderly mobility.

The fourth section of chapter two discussed trends which will increase elderly demand for adequate and appropriate transportation; an increasing share of urban populations, a greater percentage of persons over 75, suburbanization, de-
institutionalization, and improved health and income status. The fifth section examined possible solutions to accommodating the mobility needs of an increasing number of elderly persons. These solutions are based on land-use planning, the design of automobiles and traffic systems to accommodate a greater number of elderly drivers, and the design of public transportation systems.

A conclusion to be drawn from these sections is given the aging of the population, and given further uncoordinated decentralization of urban activities, the most effective solutions for overcoming present and future elderly mobility problems are those based on the design of public transportation systems. Planners do not have the instruments to implement land use solutions on a large scale. Accommodating an increasing number of elderly drivers conflicts with goals to increase public transportation use by all age groups.

The first section of chapter three reviewed the history of specialized transportation in North America. The second section discussed three policy issues which have dominated this history.

The discussion of the first policy issue concluded that specialized transportation design and expansion is a less costly and more effective solution to elderly mobility problems than the re-design of conventional public transportation. The flexible routing and scheduling of specialized transportation are more compatible with elderly activity patterns than the fixed routes and schedules of conventional public transportation. Also, expanding specialized transportation is less costly than altering the routing, scheduling, or vehicle design of conventional public transportation.

The discussion of the other two policy issues related to the design of specialized transportation.

Discussion of the second policy issue concluded the degree of centralization of a specialized transportation system should be at a level which provides efficient and effective service without sacrificing user satisfaction. This is often difficult to balance because efficiency, effectiveness, and user satisfaction are often achieved at the expense of each another.

Discussion of the third policy issue concluded the extension of public agency control of specialized transportation, and the expansion of private sector service delivery, are instruments for assisting the transportation handicapped and not instruments for ideological goals. Extension of public agency control ensures service standards and quality are maintained. Expansion of private sector delivery can improve cost effectiveness and user satisfaction.
Chapter four described specialized transportation systems in Greater Vancouver, Metropolitan Toronto, and the City of Edmonton. The description was in terms of how the three policy issues were resolved. These systems were evaluated in terms of efficiency, effectiveness, and elderly satisfaction.

A conclusion to be drawn from chapter four is specialized transportation systems are unable to meet demand from elderly persons for more social and recreational trips. The high costs of service expansion, and an inability to effectively schedule on-demand trips to social and recreational destinations, means restricting demand by eligibility rules, advance booking, and trip prioritization. Transportation planners are faced with the problem of designing specialized transportation to provide service for more elderly persons, and to meet demand for more social and recreational trips.

Two other conclusions follow from the previous conclusion. First, resources to assist transportation handicapped persons are more effective if they are directed at specialized transportation instead of conventional public transportation. Second, coordination, public sector control, and private sector delivery have to be at levels which can meet demand from the elderly in an efficient, effective, and satisfactory manner. These levels can vary according to the nature of a particular urban region.

5.2 Recommendations

Many elderly in Greater Vancouver have problems meeting their needs because of barriers to their mobility. Population aging, further dispersion and surbanization of residences and activities, a conventional public transportation system oriented to peak hour demand, a specialized transportation system which cannot meet elderly demand, and government restraint policies will combine to make the mobility problems of Greater Vancouver's elderly much more visible than they are now.

The following recommendations are directed at how specialized transportation in Greater Vancouver can be made more efficient and effective, and at the same time more satisfactory to the elderly. The recommendations are made in terms of the policy issues mentioned before; allocation of resources, centralization and coordination, and the roles of the private and public sectors.
5.2.1 Allocation of Resources: BC Transit has already made the commitment to make the conventional bus fleet wheelchair accessible by 2005, despite evidence that lifts help only a few transportation handicapped persons at a high cost.

It is recommended that any future allocation of resources to assist the transportation handicapped go to specialized transportation, and not to major adjustments to conventional public transportation vehicles and systems.

This does not discount minor alterations for elderly persons who use conventional transit. Benches and shelters at bus stops, destination signs which are easy to read, and driver sensitivity programs can be easily implemented, and are less costly than vehicle re-design or routing adjustments.

5.2.2 Coordination of Service Delivery and Management: The cost effectiveness and service effectiveness of Handy-DART can be improved by utilizing telecommunication and computer technologies. By linking the micro-computers used by the different contractors through modems and relevant software, information about cross zone trips can be transferred to back and forth between dispatching staffs. For example the staff for the Richmond contractor can send the times and destinations of trips being dispatched to the City of Vancouver to the contractor for the City. The Vancouver staff can then group the return trips for these individuals with trips being dispatched from Vancouver to Richmond. In this way cross zone trips can be scheduled, grouped, and dispatched more effectively and efficiently than the informal method being used now. The productivity of cross zone trips would be increased, leading to improved cost effectiveness for the whole Handy-DART system. This type of system means more centralization of service management, but inter-zone trips would still be the exclusive responsibility of the zone contractor. This system does not reach the full centralization of service management such as Wheel-Trans and DATS.

It is recommended greater use be made of micro-computer hardware and software in order to increase the scheduling and dispatching effectiveness of cross zone trips.
Expanding the role of community based transportation alternatives would further
decentralize service delivery, counteracting increased centralization of service
management. Current examples of community based transportation services in Greater
Vancouver are Richmond Leisure Services and Capilano Seniors' Hub Drivers (Straka
group leisure trips for elderly and special needs groups. The Hub assists seniors on the
North Shore with limited resources when Handy-DART, family or friends cannot help.
Both services are cost effective and responsive because drivers are volunteers and live in
the community. Similar systems in other parts of North America show the same
characteristics. One of the reasons the community based system in east Detroit is popular
with local seniors is because the drivers and users know each other (Fondriest 1986,
McKelvey et. al. 1988).

An instrument governments can use to assist the establishment of community
based transportation alternatives is the unconditional block grant. The Province of Alberta
provides block grants for locally based groups of seniors and handicapped persons to
establish their own transportation systems. The only requirement is the communities and
groups report on expenditures (Atkinson 1985:21).

It is recommended the Provincial government set up a fund, to be
distributed by BC Transit, for the establishment of community based
alternatives.

To put funding under a provincial Crown Corporation might cause some resistance from
groups and municipalities presently supporting these efforts (see Rosenbloom 1981).
However, community based alternatives would operate parallel to Handy-DART, and the
management and delivery of service would be under the control of seniors organizing the
service. Community based transportation systems can meet demand for group social and
recreational outings, and for trips Handy-DART cannot accommodate.

5.2.3 Implementation of User Side Subsidies: Implementation of user side subsidies
means relying more on for-profit carriers for service delivery. However, since the market
segment that benefits from user side subsidies is different than the market segment which is dependent on dial-a-bus, the role of the non-profit societies which deliver Handy-DART service will not be threatened.

Shifting demand for dial-a-bus to taxis has proven to be a cost effective and appropriate strategy. In Greater Vancouver taxi services for transportation handicapped persons are currently under purchase of service agreements. In 1987/88 a trip dispatched to taxi by Handy-DART dispatchers cost $8.50, while a trip in a Handy-DART van cost $11.50 (BC Transit 1989a:6). In Edmonton taxis firms provide specialized transportation service under formal contracts. The increased use of taxis in Edmonton since 1985 has been associated with a decline in net cost per trip (Langille 1990). In urban regions where user side subsidies have been implemented, cost per trip for specialized transportation has dropped (Colquon and Bolger 1984:13, Rosenbloom 1980:44-45).

User side subsidies improve service effectiveness in two ways. First lower costs mean more trips can be provided to more people. Second, by shifting some demand for Handy-DART to taxis, capacity in Handy-DART vans can be freed for more productive subscription, advance notice, and group trips (many to one). Capacity would be also be freed for severely handicapped persons.

In terms of social effectiveness subsidized taxi fares have proven quite compatible with the ambulatory elderly market segment. The most frequent users of successful programs in the U.S. have been low income ambulatory elderly persons (TRB 1983:74). In Calgary the user side subsidy program received a very favorable response from the ambulatory elderly persons (Colquhoun and Bolger 1984:13).

In terms of user satisfaction, using more effective taxi dispatchers means lower response times to trip requests. On-demand requests can be met, and more spontaneous trip making decisions can be made by users. Effective dispatching, when combined with cost-effectiveness, means restrictions on use, type of trip, and advance notice can be
loosened. More service can be offered to more people, and demand for more social and recreational trips can be met.

However, some user side subsidy programs have been marked by low utilization, and low participation by eligible elderly persons. Many elderly prefer other modes which are more accessible than taxi. For low income elderly the discount may not be high enough to make extensive use practical (Middendorf et. al. 1984:67, TRB 1983:58-61). In Greater Vancouver, taxi was the preferred mode of only 6% of elderly Handy-DART users (BC Transit 1988:34).

However, successful marketing, combined with a high discount, may persuade some elderly Handy-DART users to shift to taxis. Other markets besides elderly users of Handy-DART can also be accessed. For example, elderly drivers who do not want to drive at night or in bad weather, or elderly persons who use conventional bus for most trips but might need another mode when bus use becomes inconvenient:

It is recommended BC Transit implement the user side subsidy as soon as possible, consider increasing the subsidy per trip to more than 50%, and market the program to as many transportation handicapped elderly persons as possible.
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