1997

Public Transportation for the Elderly: A Neighborhood-Area Fixed-Route Alternative

Richard James Burke
Portland State University

THESIS APPROVAL

The abstract and thesis of Richard James Burke for the Master of Urban Studies were presented on July 1, 1997, and accepted by the thesis committee and the department.

COMMITTEE APPROVALS: [redacted]

William Rabiega, Chair

[redacted]

James Strathman

[redacted]

Maria Talbott
Representative of the Office of Graduate Studies

DEPARTMENT APPROVAL: [redacted]

Seymour Adler, Chair
Department of Urban Studies and Planning

****

ACCEPTED FOR PORTLAND STATE UNIVERSITY BY THE LIBRARY

by [redacted] on Sept. 23, 1997

ABSTRACT

An abstract of the thesis of Richard James Burke for the Master of Urban Studies presented July 1, 1997.

Title: Public Transportation for the Elderly: A Neighborhood-Area Fixed-Route Alternative

As the elderly population of the United States grows in coming decades, providing personal mobility will be increasingly challenging. The dispersed suburban residential pattern of most metropolitan areas ensures that the personal automobile will continue to be the dominant mode of transportation. Those who voluntarily or involuntarily stop driving will encounter serious constraints in meeting their transportation needs.

Conventional public transit in most cities is tailored to the needs of urban commuters, and is, at best, barely adequate for elderly riders. Supplemental demand-response or subscription "special-needs" services are often inconvenient, sometimes unreliable, and inefficient. Eligibility criteria restrict many non-disabled elderly people from using special-needs services.

A survey of a convenience sample of transit-dependent patrons of five senior

centers in Portland, Oregon revealed satisfaction, on average, with existing (conventional and special-needs) service.

A stated-preference survey of a subsample of respondents varied three service attributes--fare, proximity, and headways--in a hypothetical fixed-route neighborhood-area van service. ANOVA identified low fare, alone, to be the determining factor in transit-dependent seniors' choice of this mode. The stated-preference data suggest that farebox-recovery assumptions for "premium" scheduled local service might tend toward over-optimistic.

If the proportion of transit-dependent population to the general population were to remain at current levels in the Portland metropolitan area, then the current mix of transit services might be adequate. This assertion is based on the finding that the survey population reports overall satisfaction with the *status quo*, notwithstanding the genuine inconveniences reported by many. Given demographic projections, however, it is doubtful that the current mix of fixed-route and special-needs services could effectively meet the rising demand for local trips for groceries, other types of shopping, social and recreational activities, and medical necessities.

Efficient allocation of future transit resources, along with the success or failure of other service-delivery initiatives, will be contingent upon a thorough understanding of the travel needs and transportation preferences of the burgeoning elderly population. Stated-preference methodology, applied with attention to gerontological considerations, might serve this purpose effectively.

PUBLIC TRANSPORTATION FOR THE ELDERLY:

A NEIGHBORHOOD-AREA FIXED-ROUTE ALTERNATIVE

by

RICHARD JAMES BURKE

A thesis submitted in partial fulfillment of the
requirements for the degree of

MASTER OF URBAN STUDIES

Portland State University
1997

To Caroline Copeland Burke,
who always taught us
that there's a perfectly good
bus to get there.

ACKNOWLEDGEMENTS

I owe sincere thanks to Professor William A. Rabiega of Portland State University, for his inestimable assistance in preparing this document. This study would never have come into being without his expertise in applications of statistics to transportation research, among his many other talents. In addition, I am sincerely indebted to Bill for recommending me to the Master of Urban Studies program, all those Quarters ago.

Thanks also to Professor James G. Strathman, also of Portland State University, whose lectures on demographic trends sparked my initial interest in the transportation needs of the elderly. Jim was also the source of indispensable reference materials, as well as numerous personal insights regarding transportation issues.

My thanks and appreciation to all those on the faculty of the Departments of Urban Studies and Planning, Geography, and Public Administration at PSU, a first-class university, whose classes I have had the pleasure to attend.

Most of all, I owe heartfelt thanks (and years of babysitting) to my wife of ten years, Ellen Trygstad, whose Master of Arts in Speech Communication inspired me to pursue undergraduate and graduate study. Without her patience and constant support, an advanced degree would have remained but a dream.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Overview: Elderly America and Mobility

The first decades of the twenty-first century are rapidly approaching, and with them a profound change in the demographic makeup of the population. The age distribution will begin to move inexorably higher, as the first of the baby-boom generation enters the over-65 category, beginning in the year 2011.[1] This demographic change is by no means limited to North America; projections for the world's population show a marked tendency toward rapid growth of elderly cohorts early in the next century (Taeuber 1993, 2-17).

One of the many issues associated with the aging of the population is urban, suburban, and rural public transportation, particularly as an alternative for those whose independence is curtailed by loss of a driver's license, or other age-related impairment. Evidence shows that elderly citizens place high value upon personal independence and perhaps more importantly, participation in the larger society. Though the evidence is inconclusive, some researchers speculate that continuous engagement with society reaps health benefits and more satisfying lives, across the

---

[1] United States, Bureau of the Census, Current Population Reports, Special Studies, Sixty-Five Plus in America, by Cynthia M. Taeuber. (Washington: GPO, rev. 1993): 2-5

entire demographic spectrum of advanced age.[2] Mobility has become one prerequisite of participation in many important aspects of American life; since the social structure and the built environment are largely geared to the personal automobile, the limitations on participation of those who are unable to drive are obvious. Not only is the highway infrastructure designed for younger drivers,[3] but also most public transportation systems, especially in the suburbs, are configured to attract and serve urban commuters, rather than the types of local short-trip customers one might expect among the elderly population (Quinn 1989, 80).

An additional consideration at the state level is the growing challenge of highway safety *vis a vis* driver's-license renewal criteria, as more (and older) drivers go to great lengths to preserve their mobility and independence. An important corollary to personal mobility and participation in society is the need for safe highways, for young and old drivers alike. Some have argued that improvements in the traffic system may be able to mitigate the dangers and difficulties faced by older drivers, but the evidence is strong that the sheer numbers of elderly drivers in the future may defeat even the most optimistic predictions.

---

[2] Barbara Quinn, "Public Services in Aging America," American City and County 104 no.11 (November 1989): 79

[3] Patricia Waller, "The Older Driver," Human Factors 33, 5, (1991): 503

Purpose of the Study

The intention of this study is to examine the issue of public transportation with respect to the current and future elderly population of the Portland, Oregon metropolitan area. The existing public transportation system for senior citizens includes conventional bus and light-rail, along with contract demand-response and subscription service ("LIFT"), administered by the quasi-governmental Tri-County Metropolitan Service District (Tri-Met).

In order to plan effectively for anticipated increases in the number of non-drivers, it is essential to assess the quality of existing programs:

-Does Tri-Met meet the needs of transit-dependent seniors?

-Is the present system operationally efficient?

-What would the optimal configuration of services look like in the future?

The research hypothesis contends that Tri-Met service currently meets transit-dependent seniors' needs marginally, at best, and that demand-response and subscription services may not be up to the challenge of future demand. The research and null hypotheses may be stated as follows:

Research hypothesis: *Transit-dependent seniors find current public transit service inconvenient and difficult to use. Sufficient demand will exist in the future to warrant a scheduled fixed-route local van or small-bus service.*

Null hypothesis: *Transit-dependent seniors are satisfied with the current mix of transit modes for their local travel needs. Future increases in demand would be best met with expanded demand-response and subscription service.*

A written multiple-choice survey of 90 elderly clients of the Loaves and Fishes discounted-meal program was used to assess the current level of satisfaction or dissatisfaction with existing transit service.

A stated-preference survey of a sub-sample of this population was administered to measure existing (and, by inference, future) demand for a scheduled, fixed-route, local van or small bus service. This hypothetical service would be integrated with the commuter transit network, but specifically configured to provide affordable and convenient service between residential neighborhoods and those retail/service concentrations which most consistently attract local residents, particularly those whose travel is not related to employment, i.e. future retirees. The stated-preference survey varied parameters of convenience, frequency, and fare, as in previous transit studies.[4]

Based upon the analysis of survey results, recommendations for Portland-area transit service planning are presented. The findings of the research may suggest strategies for transportation planners in other locales, as the elderly population grows nationwide.

---

[4] 1. Jordan Louviere, Final Report on a Before and After Transit Innovation Study (University of Iowa, Center for Urban Transportation Studies, 1973)

2. Flannely et al., "Assessing Consumers' Interest in Using Alternative Transportation Modes of Commuting," Psychological Reports 67 (1990): 875-878

CHAPTER II

LITERATURE REVIEW

Within the broad range of disciplines that are brought to bear upon urban service planning for an aging population, there is a wealth of literature in both the academic and the popular press. However, on the more specific subject of transportation planning for the elderly, the scholarly literature is relatively sparse, and the popular literature sparser still.

The books, articles, and dissertations reviewed for this study are drawn from the fields of urban and regional planning, demography, gerontology, sociology, and geography. Works that are explicitly concerned with transportation services are discussed at some length. Other works call attention to the need for broad-based planning for an aging population. The latter are reviewed in order to help establish the demographic and economic context for the transportation system modifications suggested by this study. It should be noted that the literature and data cited here are from North American and Western European publications, and therefore address planning concerns in the developed world. This does not imply that planning for an aging population is any less urgent a concern in the world's developing nations.

(Indeed, rapid growth in the elderly population is projected worldwide.)[5]

In order to establish the contextual groundwork for this narrowly-focused and geographically limited study of public transportation service planning, five more general aspects of aging are examined, along with their implications for public policy. The five themes are as follows:

1. The demography of aging.

2. Intra-urban migration, spatial distribution, and living arrangements of the elderly

3. Travel demand characteristics and mode choices of the elderly.

4. Traffic safety, driving ability, and functional limitations of the oldest elderly.

5. Planning for public transportation needs of the elderly.

1. The Demography of Aging

Sixty-Five Plus in America, by Census Bureau analyst Cynthia M. Taeuber, is an excellent source for a comprehensive look at the trends in age distribution in the United States. Population projections derived from the 1990 Census and other surveys reveal somewhat startling statistics: for the U.S. as a whole, between 1990 and 2010 the number of those 65 and older is expected to increase by 26.0% (from 31.2 million to 39.4 million). For the oldest-old (85 years and older), the number is

---

[5] Taeuber 1993, Table 2-6. World population 65 years and older in 1991: 332 million; in 2000: 426 million.

expected to almost double (98.5%), from 3.1 million to 6.1 million (Taeuber 1993, table 5-4). Compared with the growth in the total U.S. population, this growth in absolute numbers of elderly from 1990 to 2010 is described as "undramatic" by Taeuber. However, she continues, "from 2010 to 2030...the elderly population would grow 76% while the population under age 65 would increase [only] 6.5 percent" (Taeuber 1993, v). This trend, of course, reflects the entry of the baby boom generation into the 65-plus age group. Taeuber observes that the comparatively slow growth in the elderly population between 1990 and 2011 is a period which "planners call...a 'window of opportunity,' a time to prepare and plan for the aging of the baby boom generation" (Taeuber 1993, 2-1).

To guide the allocation of public services (including transportation), the *proportions* of elderly cohorts to the total U.S. population are more important than their absolute numbers: In 1990, 12.5% of the population was 65 and older. By 2050 that proportion is projected to reach 20.6%. Further disaggregation reveals several significant peaks in the proportional growth of certain cohorts between 2000 and 2030. For example, the age 65-74 cohort was 7.3% of the total population in 1990; by 2030, their proportion is expected to increase to 11.0%. For the age 75-84 cohort (supposedly the majority of tomorrow's transportation-handicapped), from 1990 to 2030 their proportion will rise from 4.0% to 6.8%. Finally, for the oldest-old cohort, age 85 years and over, between 1990 and 2030 their proportion will rise from 1.2% to 2.4% (Taeuber 1993, figure 2-19).

Sixty-Five Plus in America also provides Census data and projections by

individual state. Since over half of Oregon's population lives in the Portland region, these data permit some extrapolation for urban studies purposes, with the *caveat* that aging-in-place in rural communities may invalidate comparisons between state and metropolitan cohort proportions.

Oregon's over-65 population in 1990 was 391,000 (13.8% of the total population). By 2010, the number is expected to increase to 412,000 (14.1% of the total population). For those 85 and over, the 1990 data and the 2010 projection are, respectively, 39,000 (1.1% of total population) and 72,000 (2.0% of total population), which represents a substantial increase in absolute numbers. These projections translate into a 5.4% increase in those 65 and over, and (more significantly) an 85.9% increase in those 85 and older in Oregon by 2010 (Taeuber 1993, table 5-4). Though these net increases seem modest, the entry of the first baby boom cohort (in 2011) into the ranks of the elderly is yet to happen. Taeuber does not offer projections by individual state beyond 2010.

The demography of aging once the baby boom cohort enters the ranks of elderly is discussed in "Lifecourse Migration and Redistribution of the Elderly Across U.S. Regions and Metropolitan Areas," by William H. Frey.[6] This article will be referred to in later sections, as it provides a excellent overview of migration, relocation, and aging-in-place as they impact the spatial distribution of the elderly population.

---

[6] William H.Frey, "Lifecourse Migration and Redistribution of the Elderly Across U.S. Regions and Metropolitan Areas," Economic Outlook USA, 2nd Quarter (1986)

Frey projects growth of the elderly population for Portland between 1980 and 2030, based upon two assumptions of lifecourse migration rates and choices of retirement locations (more about these distinctions in section 2 below): those observed between 1965-1970, and those observed between 1975-1980. Assuming the 1965-1970 rates, the absolute growth of Portland's elderly population will be +244.3%. Assuming the 1975-1980 rates, the figure is a slightly lower, but still impressive +238.8%. For the sake of comparison, Frey's data reveal that the only two cities expected to have greater net growth than Portland's in the over-65 age category between 1980-2030 are Phoenix and Seattle (Frey 1986, 16).

2. Intra-Urban Migration, Spatial Distribution and Living Arrangements of the Elderly

While it is useful to recognize the general trends in the over-65 population in the Portland metropolitan area, the spatial *concentration* of the transit-dependent population is more pertinent to this study. Therefore, current research into the spatial distribution of various age cohorts should be considered.

Public transportation, like other public services, operates most efficiently when its clientele is clearly established; its route and fare structure must correspond to demonstrated community needs. As the Portland area gains in numbers of retirees and pre-retirees, what patterns of spatial distribution will transportation planners observe? The best answer to this question may be that the geographic distribution of the elderly population, both in urban and suburban areas, is a function of home

ownership, migration, and aging-in-place.

Unlike previous generations of Americans, home ownership is widespread, and houses constitute the lion's share of older Americans' equity. According to Taeuber, "Three-fourths (76.2 percent) [of American householders aged 65 or older] were homeowners [in 1989]...71.1 percent [of] homes occupied by elderly householders were single-family homes" (Taeuber 1993, 4-18).

The single most valuable asset held by the average home owner in all age categories is the home itself. For those 65 and over, homes constituted 40.4 percent of total assets in 1988. For comparison, the next most valuable assets among this age group were interest-earning accounts at financial institutions (22.4 percent) (Taeuber 1993, table 4-7).

When combined with the well-documented preference for autonomy and independence, high rates of home ownership (and the importance of homes as equity) provide a strong incentive for aging-in-place, which is borne out in much empirical research (Bonnette, 1991; Schwartz et al., 1984; Sheiner and Weil, 1992). As long as health considerations do not precipitate decisions to move, for example to be closer to family or institutional supports, most home owners remain in the same house well into retirement.

As an illustration of the steady pace of suburbanization of the elderly, the median year of the construction of the dwellings occupied by today's elderly was 1956, certainly a busy year for the construction of the bedroom communities that have defined American cities ever since (Taeuber 1993, 4-18).

In a compilation titled Elderly Migration and Population Redistribution, edited by Andrei Rogers, several authors, including Frey, investigated the reasons for local and long-distance moves by the elderly, as well as their propensity for aging-in-place.[7] In his contributing essay, Frey, citing earlier work by Rogers and Woodward (1988), concludes that, "...elderly gains for most areas are attributable to 'aging-in-place' rather than net migration" (Rogers 1992, 124). Nonetheless, elderly migration, especially within locales, is an important consideration for transportation and other service planning. Why do a minority of elderly people move, while the majority choose to age-in-place? Rogers, citing Longino, observes: "...the reasons why most people do not move during late life throw light upon the minority of cases in which migrations occur." Social gerontologists identify an intangible but very real factor, the "meaning of home," as an important predictor of aging-in-place (Rogers 1992, 19). This suggests that the constraints of living independently in the single-family home must become fairly pronounced before most elderly people even contemplate moving.

Among the various reasons for changes of residence, proximity to family members, especially children of the elderly, rates quite high. Rogers cites Speare and McNally: "...using a sample of persons 74 or older, [the authors] find that, after moving, movers are more likely to live closer to their children than to live further away" (Rogers 1992, 59). An intriguing area for research might be to quantify

---

[7] Andrei Rogers, ed., Elderly Migration and Population Redistribution, (New York: Halsted Press, 1992)

moves by parents of baby boomers from other locales to Portland, given its reputation as a "boomer-magnet" city.

Frey also notes that migration decisions by the pre-elderly have a pronounced impact upon future spatial distribution of the elderly, and should not be neglected: "...it is important to focus on non-elderly, as well as elderly population shifts to understand evolving regional changes in elderly concentration" (Rogers 1992, 120). This may be the key to accurately predicting the future spatial concentration of the elderly in the Portland area. Even the most conservative projections point to steady growth in the regional economy, hence population. Insofar as the most rapid growth is occurring in the suburbs (such as Washington County, to the west), the Portland area seems to be conforming to Frey's second postulated growth-rate assumption in "Lifecourse Migration and Redistribution..." (Frey 1986). At 1970-1975 rates, nationally, central cities would theoretically lose pre-elderly migrants, while non-metropolitan areas would gain: "...only since 1970 do we find a strong tendency for pre-elderly lifecourse migration to lead to redistribution 'down the metropolitan hierarchy' as well as to 'peripheral' South and West regions" (Frey 1986, 12). Furthermore, as he writes in Rogers' compilation, "the importance of pre-elderly migration will have a particularly strong impact when the large baby boom cohorts begin to age-in-place in the year 2010" (Rogers 1992, 139). For Western, non-metropolitan areas, Frey projects that the net increases in elderly population attributable to baby boomers will range from +164.5% (1965-1970 rates) to +268.1% (1970-1975 rates) (Rogers 1992, 139).

In "Spatial and Social Dimensions of Interurban Elderly Migration," Robert Wiseman and M. Virden (1977) ask, "Are [the elderly] leaving older neighborhoods for those newly constructed on the periphery, or are they moving back toward the center of the city and areas whose environment is richer in terms of activity opportunities?"[8]

These authors utilized a discriminant analysis technique to reveal salient characteristics of those who move inward and outward in urban areas. Two distinct types were differentiated: a) movers-out (car owners, wealthy), and b) movers-in (socioeconomic diversity, smaller disposable income, most in need of social services). Their ultimate conclusion was that the suburban dispersion of the elderly population would continue apace, even as the less affluent (and less numerous) group chooses more central locations, with the following implications for policy makers:

> ...Service delivery systems for the aging, which now focus upon inner city areas, might have to redistribute their efforts toward suburban locations in the near future. This may be particularly true for transportation services, which presently are not a major need in these areas since levels of auto ownership are still relatively high (nearly twice that of those moving inward.) Later, however, many of these people will be required because of age to relinquish use of their automobiles. They will be in a particularly difficult position since suburban environments have lower densities of life support facilities such as grocery stores and medical facilities (Wiseman and Virden 1977, 11).

Wiseman and another co-author, Curtis Roseman, identified certain trends in

---

[8] Robert Wiseman and M. Virden, "Spatial and Social Dimensions of Interurban Elderly Migration," Economic Geography 58 (Jan. 1977)

elderly migration in their Economic Geography article, "A Typology of Elderly Migration Based on the Decision Making Process."[9] Having defined two varieties of "search space" (i.e. local and national), the authors turn their attention to motivations of those who migrate to and within urban areas. Those who move over greater distances (at the national scale) after retirement usually are seeking the climates and amenities of frequent vacation destinations, hence the growth of Florida, Arizona, California, and other Sunbelt states. Others are attracted to communities specifically marketed to retirees, while still others relocate to be near (typically younger) family members. Another category in the authors' typology is the "return migrant," whose sentimental attachment to the town of his or her birth or upbringing leads him or her "home" (Wiseman and Roseman 1979, 330).

Among movers within urban areas, the authors identify two main types: a) movers who are typically less affluent, and disproportionately affected by racial, income, or transportation constraints, and b) movers seeking "apartmentalization"--that is, moving from a single family home to an apartment or condominium, a decision which, the authors suggest, "may be influenced by accessibility to public transit and the availability of services and activities within the neighborhood" (Wiseman and Roseman 1979, 333).

Those movers within cities who are constrained by financial resources, racial discrimination, and transportation access are the subjects of R. Burkhauser's

---

[9] Robert Wiseman and Curtis Roseman, "A Typology of Elderly Migration Based on the Decision Making Process," Economic Geography 55, (1979)

Research on Aging essay, "Mobility Patterns of Older Homeowners: Are Older Homeowners Trapped in Distressed Neighborhoods?"[10] The author found that a high relative proportion of elderly home owners in distressed neighborhoods have little choice but to remain, due to income and other constraints: "[While] 65% of [all] persons moved between 1970 and 1980 [and] 23.4% moved within a neighborhood...among the elderly population, only 39% moved...however, 31.6% moved within a neighborhood" (Burkhaeuser 1995, 366). The author concludes:

> ...Unlike younger home owners, older home owners are less likely to exit from distressed neighborhoods than from secure neighborhoods...When older home owners do exit from distressed neighborhoods, they are more likely to move to another distressed neighborhood than are younger home owners (Burkhaeuser 1995, 381).

The implication of this finding for transportation planning is that transit-dependency will continue to concentrate disproportionately in more distressed parts of the inner cities, as the ranks of elderly who are aging-in-place, either voluntarily or involuntarily, continue to swell. Combined with the increasing dispersal of retail enterprises to suburban locations, this "mobility isolation" of elderly inner city home owners could create genuine hardships.

In summary, aging-in-place will constitute the biggest source of elderly concentration, both in the City of Portland and its suburbs. Pre-elderly migration will result in a steep upturn in the elderly population beginning in 2011. Limited

---

[10] R. Burkhauser,"Mobility Patterns of Older Homeowners: Are Older Homeowners Trapped in Distressed Neighborhoods?" Research on Aging 17 (4) (December 1995)

numbers of elderly people will seek "apartmentalization" amenities, while others will relocate to be near family members. It can be predicted that the numerical growth and the spatial distribution of the elderly population in the Portland area will resemble that of other Western cities. Transportation options for non-drivers, especially given the dispersed geography of the suburbs, will be challenging to provide.

3. Travel Demand Characteristics and Mode Choices of the Elderly

Increasing reliance upon the private automobile has predictably kept pace with the geographic dispersal of urban populations. Sandra Rosenbloom's Travel by the Elderly[11] is a compilation and analysis of Nationwide Personal Transportation Survey (NPTS) data, and reveals the extent of elderly citizens' dependence upon at least one household member's license and ability to drive.

The most immediate indicator of this increasing dependence upon the automobile is the growth in miles driven annually between 1983 and 1990: "Although the average elderly person took only 6% more trips in 1990 than in 1983, those trips were 19.4% longer; on average elderly individuals travelled almost 26% further in 1990 than they had in 1983" (Rosenbloom 1995, 3-19). Significantly, those over 70 drove 40% more miles in 1990 than in 1983

---

[11] Sandra Rosenbloom, Travel by the Elderly, United States, Department of Transportation, Federal Highway Administration, Office of Highway Information Management, Demographic Special Reports, (Washington: GPO, 1995)

(Rosenbloom 1995, 3-5). Not surprisingly, usage of automobiles is higher in rural than in urban areas, but "there is no cohort of the elderly who use the car for less than three-fourths of all their trips regardless of where they live" (Rosenbloom 1995, 3-17).

Shopping trips were consistently the most frequent trips, while "Combined Social" and "Family/Business" were close second and third (Rosenbloom 1995, 3-21). For most age cohorts, the increase in shopping trips was modest, but a dramatic increase can be noted in the 85-plus group (from 19.0% in 1983 to 36.6% in 1990) (Rosenbloom 1995, table 9). While some of these trips may have involved a younger driver offering his or her services to an older relative or acquaintance, these figures suggest that automobile shopping trips by drivers over 85 increased substantially. This fact is worth noting in the context of highway safety and licensing criteria.

It is readily apparent from the Nationwide Personal Transportation Survey data that transit has progressively lost "market share" among the elderly. Between 1983 and 1990, the only over-60 age cohort for whom transit usage increased was the 75-79 group. The author also notes that all elderly cohorts take a significantly higher percentage of trips on foot than by transit. This is especially true for the 85-plus cohort, who took 16.2% of all trips on foot, compared to 2.9% by transit and 76.5% by auto (Rosenbloom 1995, table 5). Another surprising statistic was that 6.8% of rural trips by the 85-plus cohort were on foot, compared with 3.4% transit and 86.3% auto (Rosenbloom 1995, table 6). The author speculates that the small

but noticeable gain in rural usage of transit by this older cohort may be attributable to improvements in service between 1983 and 1990 (Rosenbloom 1995, 3-17).

Travel by the Elderly raises important transportation policy questions, many of which are directly relevant to this study. Most importantly, the NPTS data corroborate the conclusions of other researchers into aging-in-place and spatial distribution of the elderly. Americans' preference for remaining in single-family homes at all costs contrasts with trends in, say, European countries: "In many other developed countries older people are very likely to move when they leave the workforce -- moving to communities that meet their new needs (including declining ability or willingness to drive or travel)" (Rosenbloom 1995, 3-46).

Among the policy recommendations set forth in Travel by the Elderly is a mandate for transit service providers, to "consider the needs of older travellers when they make route and service decisions" (Rosenbloom 1995, 3-46). The biggest obstacle to achieving that goal is that the transit needs of the elderly rarely coincide with those of urban commuters, for whom conventional transit is designed (by necessity). Demand-response and subscription service, while improving access for many, could never hope to meet the future needs implied by demographic projections. The author recommends that "communities...invest in different kinds of transit and paratransit options -- smaller, accessible buses routed to the places where older Americans like to go in a community, subsidized taxi voucher programs, organized non-work carpools, etc" (Rosenbloom 1995, 3-46).

4. Traffic Safety, Driving Ability and Functional Limitations

NPTS data reveal older Americans' indisputable preference for the automobile as primary transportation. The prospect of ever greater numbers of older drivers, particularly those over 85, has generated much research into implications for society. This is especially true for the issue of highway safety.

Several aspects of this dilemma are summarized in Juliet Bruce's Aging article, "To Drive or Not to Drive".[12]

First, the absolute numbers of older drivers is certain to increase. Perhaps most alarmingly, "...[licensed drivers] 85 and older...will more than double in number from 3.1 million in 1990 to 8.1 million in 2030" (Bruce 1994, 49).

The independence to which auto drivers have become accustomed is yielded only reluctantly, and sometimes resentfully. "Losing a license to drive can mean the end of independence to visit friends, to go grocery shopping, or to go to the doctor's office. Especially for some retired men...when men stop driving, they frequently return to their house and stop living" (Bruce 1994, 49). While this assertion might put too fine a point on the gender differences in the psychological effect of losing one's driver's license, the implication is clear: auto-mobility is seen by most as a prerequisite to engagement with society.

Bruce cites National Institute on Aging and National Highway Traffic Safety Administration research that found "while crash rates for all older drivers fell

---

[12] Juliet Bruce, "To Drive or Not to Drive," Aging 366 (September 1994)

significantly during the 1980's, the number of older drivers killed or injured in traffic accidents rose rapidly. What these data suggest is that older drivers are at greater risk [than the general population] when crashes do occur" (Bruce 1994, 49).

Among the contributing causes to accidents are "failing peripheral vision[;] a decrease in *selective attention capability*, which allows a person to observe things in the periphery while they are looking straight ahead at the road [;] and Alzheimer's disease" (Bruce 1994, 49).

Patricia Waller asserts, in "The Older Driver," "when crash risk per mile is considered, older drivers may constitute the most hazardous group of drivers in the population."[13] Waller raises important ethical considerations, such as the potential arbitrariness of denying licenses based upon chronological age (Waller 1991, 502). A creative suggestion proposed by Waller is to find "effective ways to coordinate licensing programs with alternative transportation for older citizens...so that as older people experience restriction or denial of licensure, they can be directed toward other resources and services in the community to meet their transportation needs" (Waller 1991, 504).

To the credit of older drivers as a group, research shows that people with diminishing driving skills frequently "self-select" to fewer trips, specific times (e.g. no night driving) and manageable routes. Benekohal et al. conducted a survey and focus groups with 664 older Illinois drivers, concluding that a majority of their

---

[13] Patricia F. Waller, "The Older Driver," Human Factors 33 (5) (1991): 500

study population "recognized significant changes in their driving capabilities. The responses to these changes can be categorized in three ways: compensatory behavior, self-imposed restrictions on driving, and increased anxiety levels."[14]

Findings by Campbell et al. illustrate the lengths to which older drivers will go to continue driving:

> Although six medical conditions -- macular degeneration, any activity limitation, syncope, Parkinson's disease, retinal hemorrhaging, and stroke sequelae -- were found to be significantly related to giving up driving, half of those who have these conditions continue to drive...Clearly, the decision to cede driving privileges is complex and not dependent solely on medical problems.[15]

5. Transportation Planning for the Elderly

In the literature, there is surprisingly little consensus on solutions to the problem of an aging, auto-dependent society. However, many parallel avenues of inquiry combine to provide suggestions, and a mix of possible solutions.

An online search of a dissertation abstracts index found several theses and dissertations that explicitly address future transportation needs of the elderly.

One thesis examined the Fresno/Clovis, California metropolitan area, arriving at the conclusion that "[here], as in other localities, no special planning has

---

[14] Rahim F. Benekohal et al., "Effects of Aging on Older Drivers' Travel Characteristics," Transportation Research Record 1438 (1994): 97

[15] Miriam K. Campbell et al., "Medical Conditions Associated with Driving Cessation in Community-Dwelling, Ambulatory Elders," Journal of Gerontology: Social Sciences Vol. 48, No.4 (1993): S233

gone into providing transportation specifically for the elderly...The characteristics of the elderly identified in the study require that transportation planners consider the elderly as a special group."[16]

In a Canadian study, another thesis researcher concludes:

> As local mobility decreases with age, the local environment becomes particularly important...Given the fact that older people prefer to continue aging within their own homes and in their own neighborhoods for as long as possible, community planners must anticipate this 'new' population who will be living in suburban areas that have been designed and developed for the young, auto-oriented family with children.[17]

While it may be obvious that alternatives to the personal automobile must be made available to the growing population of non-drivers, there exists no simple formula for effectively and efficiently meeting all travel needs of all seniors. High-density city centers might be best served by standard buses equipped with kneeling features, low-floor boarding designs, lifts, handholds and the like. Inner suburbs and outer suburbs may require unique approaches, perhaps integrating standard buses and rail with circuitously routed feeder buses or vans.

Advocates of adapting conventional transit to the needs of seniors should be attentive to the difficulties routinely encountered by this special population while using the system. In Technology Review, Marc Miller notes, "Most accidents on

---

[16] Oghenekome Joseph Ajise, "Transportation Planning for the Elderly: Problems and Issues in the Fresno/Clovis Metropolitan Area," MAI 32 (1993): Issue 2 (California State University, Fresno)

[17] Jacqueline East, "Community Planning for Neighborhood Change in an Aging Society," MAI 31 (1992): Issue 4 (University of Manitoba)

buses and subways are probably not reported as traffic accidents...Problems with balancing make elderly passengers very prone to falls when boarding or getting off...or while the bus is moving. One result may be that older people give up using public buses."[18]

In "Transportation Needs of the Elderly Population," Sandra Rosenbloom, citing a 1977 study, describes the dilemma facing advocates of a transit-based solution:

> Few elderly individuals explain their failure to use transit in terms of their health problems or disability, issues that transit systems might address through vehicle or system modifications. Only among those over age 80 are there a meaningful number of people not now using transit who say they would need help to become transit users. The striking fact about the data is that more people who *are* transit users report needing help than non-users! This suggests that nonusers are not being realistic about the transit problems that they would likely encounter because transit is not a serious enough option for them to consider its real ramifications.[19]

Rosenbloom refutes the argument that demand-response services could provide a viable alternative, due to their cumbersome operational limitations, costs, and eligibility requirements. This finding is especially relevant to this study: demand-response and subscription special-needs services are the backbone of Tri-Met's supplementary services in the Portland metropolitan area.

---

[18] Marc Miller, "Trends: Safety for Seniors," Technology Review vol. 89 no.7 (October 1986): 11

[19] Sandra Rosenbloom, "Transportation Needs of the Elderly Population," Clinics in Geriatric Medicine Vol. 9 No. 2 (May 1993): 303

Rosenbloom cites her own previous national studies that show:

> The average special service trip [is] approximately 10 miles...special paratransit services provide no more than *60 miles of travel per year* to the average elderly rider...Compare this with [the data] which show that most elderly drivers, even those over age 85, travel thousands of miles per year. Clearly special services cannot respond to many of the needs of the aging elderly [sic] population (Rosenbloom 1993, 306).

Eligibility requirements in most jurisdictions seriously curtail more general usage of special-needs services: "Being poor, sporadically disabled, or even lacking a car, without a serious physical disability, does not meet minimum eligibility criteria in many if not most cities" (Rosenbloom 1993, 307).

The quality of service leaves much to be desired: "The limited hours of service, advance reservation requirements,[20] and constrained service availability combine to reduce the usefulness of these systems to most people eligible for and genuinely in need of transportation assistance" (Rosenbloom 1993, 307).

Finally, Rosenbloom calls attention to the extremely high cost-per-ride of demand-response services: "In 1989, the [American Public Transit Association] reported that the average cost of a one-way special transit trip was $9.70." Even at low-end cost-per-ride estimates, which range between $4.00 and $7.00, one must agree with Rosenbloom that "special paratransit services offer the elderly traveller even less service than do traditional transit services" (Rosenbloom 1993, 307).

Anthony Rufolo, James Strathman, and Zohngren Peng conducted a study of fixed-route versus demand-response service (the latter available to all transit riders,

---

[20] At least 72 hours advance notice is required for Tri-Met LIFT.

as opposed to "eligible-only" riders) in a suburban locale near Portland, Oregon. The authors found that "customers do not have strong preferences for demand responsive over fixed-route services." They concluded that the cost of providing the service could therefore constitute the main criterion for evaluating the service.[21]

As this study will show, the transit-dependent elderly do have a measurable interest in neighborhood-area fixed-route service, notwithstanding overall satisfaction with the current mix of fixed-route regular transit and demand-response special-needs transit. From an operational point of view, the proposed supplementary service would have to be evaluated in terms of costs, subsidies, and farebox revenue, consistent with Rufolo et al.'s findings. In planning a system-wide supplementary service to meet the needs of future elderly residents of the Portland area, studies like that by Rufolo et al. might be combined with stated-preference modeling such as that employed in this study, to ascertain the feasibility of applying the LIFT fleet resources to a more efficient and effective purpose.

Stated-preference mode-choice modeling, the methodology of this study, is discussed extensively in recent transportation planning journals.

Kroes and Sheldon summarize an accepted definition of the method:

> What are stated-preference methods?...[They are] a family of techniques which use individual respondents' statements about their

---

[21] Anthony M. Rufolo, James G. Strathman, and Zohngren Peng, "Assessment of Demand Responsive Versus Fixed-Route Transit Service: Portland, Oregon Case Study," Transportation Northwest Regional Center (May 1996): 14

preferences in a set of transport options to estimate utility functions.[22]

The consensus seems to be that the stated-preference method of estimating modal splits has advantages over revealed-preference modeling. Kroes and Sheldon note the following distinctions:

> 1. Revealed preference methods cannot be used in a direct way to evaluate demand under conditions which do not yet exist.
> 2. [They] are normally restricted to primary service variables (such as journey time or cost)...and [rarely are used to estimate] the impact of secondary travel variables (such as seat design and station facilities) (Kroes and Sheldon 1988, 12-13).

As the stated-preference methodology is refined through various applications, Kroes and Sheldon report, its usefulness for understanding "choice processes" has become apparent (Kroes and Sheldon 1988, 12).

In the context of this study, direct observation of "choice processes" is the key: as three primary attributes of the hypothetical neighborhood transit service are varied, the respondent is expected to reveal the degree of increased or decreased likelihood of making the choice to ride, given certain service parameters. The ANOVA applied to stated-preference data should theoretically constitute a measurement of the effects of service attribute changes upon "choice processes."

---

[22] E.P. Kroes and R.J. Sheldon, "Stated Preference Methods," Journal of Transport Economics and Policy 22 (1988): 11

CHAPTER III

METHODOLOGY

Overview

The objectives of the primary data collection for this study were two-fold: first, to assess elderly peoples' perceptions of the usefulness of existing Tri-Met services, and second, to establish viable parameters of fare, distance and frequency in a proposed fixed-route supplement to the LIFT. Statistical analysis was applied to support or refute the research and null hypotheses.

For the first objective, a standard multiple-choice written questionnaire was used (Appendix A); for the second, a stated-preference written questionnaire (Appendix B). Supporting qualitative data was gathered in on-site personal interviews. A pre-test of the two questionnaires was administered prior to the official survey.

Originally, the two questionnaires were combined, with the intention of having all respondents participate in the stated-preference component. However, after consultations with supervisors at the five survey sites, it was decided that such a long form would very likely tax the abilities and patience of many seniors. Instead, virtually everyone (N=90) received the multiple-choice questionnaire, while

a small subsample of volunteers were given both components, with the stated-preference part conducted essentially one-on-one. The result was a considerably smaller number (N = 11) of completed, usable stated-preference survey respondents than had been hoped. Nonetheless, each completed stated-preference questionnaire provided a score for each of 27 service attribute combinations, yielding 297 "cases" for the ANOVA.

The two surveys were designed to complement each other. The multiple-choice component was intended to supply the demographic and current transit-usage data against which to interpret the stated-preference survey data.

Table 3-1

Beaverton	21
Gresham	20
Hollywood	15
Lents	15
Northeast	19
TOTAL	N = 90

The Survey Population

In selecting the survey population, the principal requirement was to identify a population of senior citizens for whom transportation options are limited. The rationale behind this is the central research hypothesis: that demand will increase in the future for scheduled, fixed-route service, in the place of demand-response or subscription service. The hypothesis assumes that Portland and other cities will house significantly higher proportions of non-drivers in coming decades. A survey of a "transportation-challenged" group should theoretically permit general inferences of future service needs. It is important to note that the objective in selecting a sample was not to achieve results generalizable to the entire elderly population of the Portland area, but instead to guide planning of transportation services for the transit-dependent, whose numbers are expected to increase substantially.

Three Loaves-and-Fishes congregate meal sites in the city of Portland, and one each in suburban Gresham and Beaverton, were chosen as survey sites. Loaves-and-Fishes is a non-profit, nonsectarian agency which also operates an extensive meals-on-wheels program throughout the Portland metropolitan area. For those who have access to transportation, Loaves and Fishes operates 19 congregate meal sites which serve lunch for a nominal fee.[23] Clients of the congregate meal sites (the survey population) are driven by family or friends, take the LIFT, or ride regular Tri-Met service. Some also drive their own cars. The centers provide social

---

[23] Brochure, Loaves and Fishes Centers, Inc., Portland Oregon

services, companionship, cultural activities, and home handcraft production (including superb basket making and quilts).

Initial inquiries with program directors and site supervisors confirmed a high degree of transit-dependency among clients. Indeed, the schedule of the day's activities at each site is arranged to conform to the requirements of the various transportation providers -- particularly the Tri-Met LIFT.[24]

In consideration for some elderly people's vision limitations, a large point-size font was used for instructions, examples, and the surveys themselves.

Surveys were distributed and collected on-site and in person. The visits were scheduled to be between 10:00 AM and noon, in order to not disrupt mealtime. The purpose of the survey was briefly described, and each willing respondent was provided the form(s) and a pencil. Respondents were encouraged to offer comments and suggestions. These coments did provide valuable insights, which were recorded verbatim or paraphrased, and became the basis for qualitative research data.

In all the centers except Beaverton, the short questionnaire was distributed to nearly 75 or 80 percent of the clientele present on the day of the survey. In Beaverton, an estimated 30 percent participated, due to a conflict with a concert in the room with the greatest number of lunch clients. Fortunately, the Beaverton center has many more clients than the other centers, so the number of responses was roughly the same.

---

[24] Personal conversation with Michaela Fogarty, director, Loaves and Fishes Centers, Inc.

Of the total, only seventeen clients agreed to try the stated-preference questionnaire, of which only eleven were acceptable for the purposes of statistical analysis. From the kinds of misunderstandings that rendered some questionnaires unusable, one can glean information that could be helpful to designers of future surveys.

In Chapter IV, specific statistical operations and their results are discussed in detail, including pertinent computer output as necessary. These results will be followed by analysis and conclusions.

The Multiple-Choice Questionnaire: Current Transportation Attributes

The short questionnaire, besides providing basic demographic information, was designed to determine the strength of association, if any, between transit-dependency and satisfaction with the existing Tri-Met system. Table 3-2 lists each of the variables of interest (excluding demographic variables) and a summary of the purpose of each.

Table 3-2. Variables and their purpose

SPSS Variable	Variable Name	Purpose
AUTOS	Number of Automobiles in Use by Household	Establish relative numbers of drivers, auto passengers, and exclusive users of transit.
BUSSTOP	Distance to Bus Stop	Correlate walking distance with transit usage; establish acceptable walk-distance parameters in proposed service.
CARHELP	Driven by Friends	Establish number who are dependent upon others' drivers licenses.
DRIVERS	Number of Drivers in Household	Establish number of licensed drivers available.
LIMITS	Limitations on Driving	Examine reasons, if any, for inability to drive.
SHOPPING	Adequacy of Tri-Met for Shopping	Measure older peoples' perceptions of convenience of current service for routine trips.
TRANSFER	Transfer Required for Shopping	Establish correlations, if any, between satisfaction with existing service, usage of same, and necessity of a transfer for a routine trip.
TRIMET	Usage of Tri-Met	Establish numbers of users of Tri-Met, by mode.
TRIMETOK	Usefulness of Tri-Met for Seniors	Measure older peoples' perceptions of convenience of current service for the elderly in general.

Table 3-3. Variable Type

Variable Name	Variable Type
AGE	Ordinal, 4 levels
AUTOS	Ordinal, 3 levels
BUSSTOP	Ordinal, 4 levels
CARHELP	Dichotomous
DRIVERS	Ordinal, 3 levels
GENDER	Dichotomous
INCOME	Ordinal, 6 levels
LIMITS	Dichotomous
SHOPPING	Ordinal, 5 levels
TRANSFER	Dichotomous (plus "don't know")
TRIMET	Dichotomous
TRIMET OK	Ordinal, 5 levels
TRACT	Nominal

The Stated-Preference Questionnaire: Measuring The Effects of Variations in Fixed-Route Service Attributes

The stated-preference questionnaire (Appendix B) was designed to measure the degree of interest among the sample population in various possible arrangements of fixed-route neighborhood service.

For the sake of simplicity and ease of comprehension, only three core

attributes -- fare, walking distance, and frequency (headways) -- were utilized. These attributes are by no means the only ones considered by choice riders of transit, as shown in other studies of the effects of service changes upon ridership.[25] As most of these studies have shown, choice ridership is far less sensitive to fare reductions than to service improvements. Or, conversely, marginal fare increases have minimal long-term impact upon ridership, when accompanied by better-than-marginal improvements in service.[26] It appears that the saying, "you get what you pay for" is borne out by empirical evidence.

Each of three parameters (fare, walking distance, and service frequency) was presented in three variations, which yielded 3 X 3 X 3 (27) permutations. A street map of the area (e.g. Gresham, Northeast Portland, etc.) was given out with each questionnaire. The maps illustrated examples of routings that might be expected under the three walking-distance parameters. (Appendix C)

Respondents were instructed to mark a linear scale, ranging from "Less Likely" to "More Likely", at a point that approximated the likelihood of their using the service in each of the 27 possible configurations. In order for the three service

---

[25] See Flannely et al. (1990); Louviere (1973). Other factors with demonstrated importance to choice riders are comfort, cleanliness, punctuality, and drivers' courtesy.

[26] Jose A. Gomez-Ibanez and John R. Meyer, Going Private (Washington D.C.:Brookings Institution, 1993) Patronage increased 180 percent in one British city when minibuses on more circuitous routings and shorter headways replaced large buses on exclusively trunk routings, even as fares were increased appreciably. (Gomez-Ibanez and Meyer 1993, p.50-53)

parameters to have equal weight, the order of their presentation was changed three times. In retrospect, this step may have been counterproductive, insofar as becoming comfortable with the format might have encouraged some of the partial-respondents to finish.

ANOVA was used to search for main and multiple-way interaction effects among the three service parameters. Theoretically, the ANOVA results would support or refute the research hypothesis, which assumes that elderly transit-dependent people would in fact use a fixed-route local service at a given maximum fare, provided it promised tangible service improvements. While the survey did not aspire to determine with scientific precision the actual fare and its associated service levels, it was hoped that it might suggest a valid format for such detailed studies in the future.

In the design of future similar questionnaires, it may be necessary to distill the ordered response categories into a form less challenging to respondents. Overall length might be reduced, and variations might be presented as discrete choices, rather than preferences expressed as percentages. The literature of survey research among the elderly has shown that declining cognitive ability presents unique challenges.[27] Cognitive limitations were apparent among a few respondents, but the success of this particular stated-preference survey seems to have been constrained

---

[27] See, for example, Jobe et al., "Cognitive Laboratory Approach to Designing Questionnaires for Surveys of the Elderly," Public Health Reports vol. 105, no. 5 (Sept/Oct 1990)

by other factors. Nonetheless, cognitive abilities should certainly be taken into consideration in future studies of elderly populations.

CHAPTER IV

SURVEY RESULTS AND ANALYSIS

Section A: Multiple-Choice Questionnaire Results

1. Frequencies

The survey sample size was 90 (Table 3-1, p. 28). Complete frequencies tables are presented in Appendix D. Demographic frequencies are summarized in Tables 4-1 through 4-3. The median age is 73.9 years. The mean approximate annual household income is under $10,000. Women respondents outnumbered men by 48 to 36.

Table 4-1

Age	Frequency	Percent
59 and Under	16	17.8
60-69	25	27.8
70-79	34	37.8
80 and Over	5	5.6

Other frequencies of particular interest are "Limitations on Driving" (50 out of 70 are unable to drive due to some type of limitation); "Distance to Bus Stop" (62 out of 90 have a bus stop between one and three blocks of home); and "Usage

of Tri-Met" (67 out of 90 use Tri-Met). These frequencies serve to illustrate the degree of transit-dependency of the sample.

Table 4-2.

Gender	Frequency	Percent
Male	36	40.0
Female	48	57.1

Table 4-3.

Income Category	Frequency	Percent
$5,000 or less	23	25.6
$5,000 to $9,999	15	16.7
$10,000 to $14,999	13	14.4
$15,000 to $24,999	9	10.0
$25,000 to $34,999	3	3.3
$35,000 or more	1	1.1

The concentration in the under-$10,000 annual income category suggests that the survey population is poorer, on the whole, than the general elderly population.[28]

Approximately equal numbers of completed questionnaires were obtained at all five senior centers, such that no single center is accorded undue weight in the analysis. As further analysis will show, clients of suburban and urban centers exhibit different transportation mode-choice characteristics, consistent with other research findings.

2. Comparisons of Means

Distinctions between the two suburban centers and the three urban centers were evident in group means compared against the population means for the variables Income, Usefulness of Tri-Met for [a typical trip such as] Shopping, and Usefulness of Tri-Met for Seniors. (Complete tables are presented in Appendix E). As shown in Table 4-4, incomes are generally higher in the suburbs. As expected, perceptions of the convenience of Tri-Met decline with lower residential density.

---

[28] Median income for age 65 and older in the U.S. in 1989: $14,183 for men, $8,044 for women (Taeuber 1993, 4-7).

Table 4-4.

Senior Center Location	Group Income Mean (Pop. Mean =2.33)	Group Mean: Usefulness of Tri-Met for Shopping (Pop. Mean =3.06)	Group Mean: Usefulness of Tri-Met for Seniors (Pop. Mean =3.15)
Beaverton (suburban)	2.57	2.07	2.37
Gresham (suburban)	3.14	2.86	3.00
Hollywood	1.50	3.80	3.93
Lents	2.00	3.86	3.78
Northeast	2.17	2.84	2.92

Income Scale Range: 1-6
"Usefulness" Variables' Scale Range: 1-5

The urban/suburban distinction in the survey data serves as an excellent illustration of the relative efficacy of transit in those disparate markets. Hollywood, for example, is arguably the "best connected" transit node in Portland. The senior center is served by four bus lines (two stop at the door, and two stop within two blocks). All four are routed to the nearby light-rail station, and three of the four operate seven days a week, including late evenings. The district has a long history as a retail center; nearby Providence Medical Center has grown into a sprawling complex of clinics, eldercare facilities, and specialists' offices. Given the combination of retail/service concentration and virtually ubiquitous transit, it is not

surprising to find higher group means in Hollywood for both "usefulness of Tri-Met" variables.

Similarly, Lents is served by frequent bus service, has clearly defined retail nodes, and reports better-than-satisfactory perceptions of existing transit service.

In contrast, both suburban groups score lower than the mean on "usefulness of Tri-Met". Although both Gresham and Beaverton have historic downtown retail and service districts (both enjoying a degree of revival in recent years), the dominant development pattern has been enormous malls, wide boulevards, and the usual litany of auto-oriented architecture.

In confirmation of the literature on spatial distribution of the elderly, and aging-in-place, the mean incomes for both suburban centers were well above those of the three urban centers. From on-site empirical observation in Beaverton, it was evident that most clients drove themselves, or were driven by friends or family members. Those who used Tri-Met were almost exclusively physically disabled, and used the LIFT. The other suburban group, Gresham, on the other hand, reported higher usage of all modes of Tri-Met service. The proximity of the light rail, and possibly lower average incomes, may be contributing factors.

In the Northeast center, the group means for the two "usefulness" variables are lower than the population means. The conventional bus service is as frequent and accessible in this neighborhood as in the other two "urban" sites. This result may raise the question whether or not the LIFT is providing as dependable service to this lower-income area as to other neighborhoods. A second possible explanation

may be that the clientele of the Northeast center is older, on average, than that of other centers, and therefore find usage of conventional transit to be more difficult. Yet another explanation may be simply insufficient sample size, or sampling error.

Table 4-4 also illustrates an important finding for the two "usefulness" variables: the population means center around "satisfactory," meaning that respondents rate current Tri-Met service as sufficient, on average. This is so in spite of the frustrations expressed by many in one-on-one interviews, especially with regard to the LIFT. This "averaging out," however, belies the importance of the finding that roughly half the respondents find current service to be less than satisfactory. In on-site interviews, the most often repeated complaints had to do with LIFT service -- schedule unreliability, the advance-reservation requirement, and lack of holiday and weekend service.

Surprisingly, very few interview subjects voiced dissatisfaction with regular bus and rail service. This suggests that the overall good state of health and agility of most non-disabled respondents permits routine usage of conventional transit modes.

3. Crosstabulations

A series of crosstabulations and chi-square tests were performed to identify the strength of association between transit usage, auto and driver availability, and limitations on driving (Table 4-5).

Observed values differed from expected values sufficiently to validate several conclusions with respect to the "captive" and the "choice" riders of transit

among the survey population. First, the "captive" riders (no car or driver available) were more numerous than expected -- nearly one-third of the total population. Second, the number of "choice" riders was approximately even with the number of non-users of transit who have access to one car (21and 19, respectively). Finally, slightly more "choice" riders with two or more available cars and drivers were observed than expected: 11 of 14 respondents ride Tri-Met despite access to two or more autos, and 14 of 19 ride Tri-Met despite access to two or more drivers.

One can conclude from the crosstabulations that current Tri-Met services are enjoying high rates of patronage from this age and socioeconomic group, irrespective of the availability of alternatives for many. One question that this finding provokes is whether these respondents (and, presumably their spouses or other aged relatives) are actively engaging in the self-selection process noted by Benekohal et al.: when a viable alternative to driving is available, and time in transit is a minor factor, transit may impose fewer demands than driving. It is important to note that the crosstabulations aggregate the responses from city and suburb alike, and that significant differences in modal split are inevitable, simply due to geography.

Table 4-5

AUTOS No. of Automobiles in Use by TRIMET Usage of Tri-Met

TRIMET Page 1 of 1

AUTOS	Count / Exp Val	No 0	Yes 1	Row Total
0 None		1 / 8.4	30 / 22.6	31 / 36.5%
1 One		19 / 10.8	21 / 29.2	40 / 47.1%
2 Two or More		3 / 3.8	11 / 10.2	14 / 16.5%
Column Total		23 / 27.1%	62 / 72.9%	85 / 100.0%

Chi-Square	Value	DF	Significance
Pearson	17.61454	2	.00015
Likelihood Ratio	20.51798	2	.00004
Mantel-Haenszel test for linear association	5.24292	1	.02204

Minimum Expected Frequency - 3.788
Cells with Expected Frequency < 5 - 1 OF 6 (16.7%)
Number of Missing Observations: 5

DRIVERS No. of Drivers in Home by TRIMET Usage of Tri-Met

TRIMET Page 1 of 1

DRIVERS	Count / Exp Val	No 0	Yes 1	Row Total
0 None		2 / 7.5	26 / 20.5	28 / 32.6%
1 One		16 / 10.4	23 / 28.6	39 / 45.3%
2 Two or More		5 / 5.1	14 / 13.9	19 / 22.1%
Column Total		23 / 26.7%	63 / 73.3%	86 / 100.0%

Chi-Square	Value	DF	Significance
Pearson	9.55297	2	.00843
Likelihood Ratio	10.76725	2	.00459
Mantel-Haenszel test for linear association	3.20222	1	.07354

(continued)

Minimum Expected Frequency - 5.081
Number of Missing Observations: 4

LIMITS Limitations on Driving by TRIMET Usage of Tri-Met

LIMITS	TRIMET No (0)	TRIMET Yes (1)	Row Total
0 Not Applicable	12 4.0	8 16.0	20 28.6%
1 Yes	2 10.0	48 40.0	50 71.4%
Column Total	14 20.0%	56 80.0%	70 100.0%

Chi-Square	Value	DF	Significance
Pearson	28.00000	1	.00000
Continuity Correction	24.60938	1	.00000
Likelihood Ratio	26.34146	1	.00000
Mantel-Haenszel test for linear association	27.60000	1	.00000
Fisher's Exact Test:			
One-Tail			.00000
Two-Tail			.00000

Minimum Expected Frequency - 4.000
Cells with Expected Frequency < 5 - 1 OF 4 (25.0%)
Number of Missing Observations: 20

The crosstabulation of Limitations on Driving and Usage of Tri-Met yielded significant differences between observed and expected values. More than half of those who reported no limitations also reported no usage of Tri-Met. Conversely, virtually everyone who reported limitations on driving reported usage of Tri-Met. Again, this helps to validate the assertion that this survey population contains high numbers of "captive" as well as choice riders of all transit modes.

Section B: Stated-Preference Survey Results

As noted above, the total *N* of usable stated-preference questionnaires was eleven. Certain characteristics of the survey methodology led many respondents to decline to answer the somewhat lengthy list of choices. Some misunderstood the written instructions, and simply placed a check mark next to an attribute (e.g. "Fare $1.50", or "Every 20 minutes") that seemed acceptable. Others seem to have noticed only one of the three displayed attributes, and placed their "votes" at the same mark on every line. Still others understood the design, but had difficulty differentiating between the incremental changes in order and values of attributes. Similar pitfalls could be avoided in future surveys, with appropriate attention to questionnaire length and format, and cognitive ability, when appropriate.

The score, "percent likelihood of choosing," for each respondent on each combination of attributes was obtained by applying a template calibrated in hundredths. The total number of scores was 11 (Respondents) X 27 (Attribute permutations) = 297. These 297 "cases" were the basis for a three-way, full factorial ANOVA, which sought main and interactive effects between fare, distance and frequency with respect to percentage likelihood of choosing to ride.

As shown in Table 4-6, the ANOVA found the combined main effects to be significant (F = 3.594, Sig. .002). The one-way effect of "Fare" was also significant (F = 7.747, Sig. .001). It should be noted that many disabled and elderly users of Tri-Met services ride at the discounted Honored Citizen fare of 50 cents. It was assumed, perhaps in error, that the respondents would recognize the implicit

association between the three graduated fares and service quality. In retrospect, it might have been more effective to differentiate this service from the present Tri-Met subsidy structure, and to contrast it with, say, taxi service. The potential for this type of proposed service to attract full-fare paying (i.e. non-elderly or otherwise specially subsidized) transit riders was beyond the immediate scope of this project, but it is perhaps the latter who would most readily perceive the association between higher fare and better service on the stated-preference questionnaire.

Table 4-6.

* * * A N A L Y S I S O F V A R I A N C E * * *

SCORE % Likelihood of Choosing
by DISTANCE Average Distance to Stops
FARE One-Way Fare
FREQ Frequency of Service (Headways)

UNIQUE sums of squares
All effects entered simultaneously

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	15404.791	6	2567.465	3.594	.002
DISTANCE	1533.756	2	766.878	1.073	.343
FARE	11069.761	2	5534.880	7.747	.001
FREQ	2717.291	2	1358.645	1.902	.151
2-Way Interactions	1766.994	12	147.249	.206	.998
DISTANCE FARE	412.686	4	103.171	.144	.965
DISTANCE FREQ	763.374	4	190.844	.267	.899
FARE FREQ	579.144	4	144.786	.203	.937
3-Way Interactions	700.360	8	87.545	.123	.998
DISTANCE FARE FREQ	700.360	8	87.545	.123	.998
Explained	18030.008	26	693.462	.971	.509
Residual	185036.845	259	714.428		
Total	203066.853	285	712.515		

297 cases were processed.
11 cases (3.7 pct) were missing.

Two and three-way interactions were detected, albeit without statistical significance (Table 4-6). The failure of the model to generate significant interactive effects may be a consequence of the small sample. With a larger sample, it is possible that more respondents would understand the implicit association between the three service parameters, and more would give consideration to "trading off" one acceptable attribute for another. Another possibility is that the somewhat daunting length and possibly confusing format of the questionnaire may have precluded some respondents (especially those of limited cognitive ability) from considering all three attributes' effects upon each other.[29]

As the stated-preference segment was administered, respondents were encouraged to ask questions or offer comments. Several made notations in the "fare"column that the fare ought to be round-trip. The questionnaire did not specify one-way or round-trip, again due to the implicit fare/service relationship. In selecting a range of fares, the near-impossibility of achieving two-block origin and destination proximity within neighborhoods, at current transit fares, was an important consideration. The broader issue of transit subsidies is tangential to this study, but would of course play an important role in administration of such a neighborhood fixed-route system.

---

[29] As suggested by Professor William Rabiega, Portland State University

Section C: Qualitative Data

At the conclusion of each site visit, personal comments of survey respondents and Loaves and Fishes staff were recorded (anonymously) as hand-written qualitative data. This record served to put a human face upon the quantitative data, especially those from the multiple-choice questionnaire.

Conversations with respondents as well as with program and site supervisors confirmed that transportation is an important consideration for elderly people. The director of Portland Loaves and Fishes stressed that transportation is a daily challenge for their clients -- indeed, a significant problem for many. She noted also that meal programs must be coordinated with any number of transportation schedules and constraints, to ensure that clients get their meals.[30]

The site director at the Lents location listed a catalog of transportation difficulties encountered daily by elderly clients:[31]

- The feeling of apprehension when waiting for the LIFT: Clients are expected to be looking out the front window during the approximated arrival time. The LIFT is frequently unpredictable. For seniors, the fear is very real that a momentary distraction may have caused one to miss one's ride. When missing a ride means missing lunch, it can be very distressing, especially for those on a limited income.

---

[30] Personal conversation with director, Portland Loaves and Fishes, Inc.

[31] Personal conversation with site director, Lents Loaves and Fishes

- Reorganization of LIFT service agency: Recently, Tri-Met Special Needs subcontractors underwent a major change of scheduling, dispatch, and driver assignments all at once. Elderly clients who had become accustomed to their service had to endure a lengthy period of confusion and readjustment, as the "learning curve" varied from employee to employee.

- Truncated shopping trips: Frequently, an hour-long shopping trip is reduced by half, due to a late pickup. Nonetheless, the client is still required to be at the front of the store at the originally scheduled time. When one is slow on one's feet to begin with, this type of shopping trip can be a real ordeal.

Eligibility constraints, inconsistencies, and outright errors were reported by several LIFT users. Several interviewees had been informed that they "weren't handicapped enough," despite serious mobility impediments (e.g. unreasonable walking distances to regular bus stops, along rural roads with no sidewalks). One Beaverton user's subscription service was abruptly cancelled, due to a case of mistaken identity. (Repeated failure to call with cancellations eventually results in termination of service; the wrong rider's service was terminated). One respondent reported that an acquaintance with virtually identical mobility restrictions was eligible, while the respondent was not, due to a seemingly arbitrary jurisdictional boundary. The interviews confirmed Rosenbloom's findings that inherent inefficiencies and operational limitations prevent demand-response service from

being applied optimally.

Several respondents and staff noted that discomfort, unsteadiness, and the inaccesibility of restroom facilities sharply curtail the travel that seniors would otherwise undertake. Time in transit is a definite factor, as is the lack of amenities at many destinations.

In these conversations, it became clear that service tailored to local (as opposed to commuter) trips has a certain attraction for many. In discussions about the type of vehicles being proposed for fixed-route neighborhood service, most agreed that the small, lift-equipped vans used by Tri-Met on some low-patronage routes are very practical for elderly passengers.

Finally, the interviews with clients and staff revealed a genuine interest in improving transportation for seniors. Some even joked that they might not live to see the needed changes, but that it is satisfying to participate in improving things for folks in the future.

CHAPTER V

CONCLUSION

This study established firm grounds for neither the research hypothesis nor the null hypothesis, restated herein:

Research hypothesis: *Transit-dependent seniors find current public transit service inconvenient and difficult to use. Sufficient demand will exist in the future to warrant a scheduled fixed-route local van or small-bus service.*

Null hypothesis: *Transit-dependent seniors are satisfied with the current mix of transit modes for their local travel needs. Future increases in demand would be best met with expanded demand-response and subscription service.*

The results of both the multiple-choice and the stated-preference surveys do, however, reaffirm the findings of other researchers with respect to transportation and the elderly.

The geography of metropolitan areas, especially in the dispersed suburbs, does not lend itself to ideal compromises between the transit needs of commuters and retirees. The former have an interest in the most direct and speedy routings to

employment locations, while the latter require transportation to meet basic needs: groceries, medical facilities, and social and recreational opportunities.

Before the baby boom enters the ranks of the elderly, society will be faced with difficult transportation planning choices. Either resources should be targeted at making vehicles and highways safer for older drivers, or viable alternatives should be offered. Simply to let events take their natural course is to invite frightening consequences, as growing numbers of the oldest-old go to great lengths to preserve the independence provided by the private car. All indicators point to increases in vehicular traffic, meaning that the driving environment will become still more daunting to the older driver. While every effort must be made to preserve personal independence, which may reap health and other tangible benefits, society must be made aware of the dangers that mentally or physically impaired drivers pose to themselves and others.

Some might argue from the land-use perspective that encouraging the development of more pedestrian-friendly neighborhoods would obviate the need for many older people to drive. Such proposals have much merit, but do not address the factor of aging-in-place. All indications are that, as a whole, older people will remain as long as possible in the homes that constitute so much of their capital investments, in neighborhoods that have been historically auto-oriented. Those with greater financial resources will have the option of relocating to communities with better transportation options, among other amenities, and will most likely remain engaged with the outer world. Those with limited means might, at worst, have to

accept decreasing mobility -- dependent upon others for transportation, or continuing to drive at increased personal risk.

This study has argued that demand-response and subscription special-needs services may not be capable of addressing demand on the order anticipated during the first decades of the twenty-first century. These services will no doubt continue to play a critical role for those whose travel needs absolutely require door-to-door subsidized service.

The question remains: what viable alternatives are feasible which could meet the travel needs for the still-active and ambulatory? The hypothetical service proposed in this study elicited, at best, "lukewarm," interest among the survey population. The absence of a ringing endorsement by this elderly, transit-dependent group is not necessarily grounds for abandoning the notion of a neighborhood-area fixed-route alternative. In urban and suburban settings where transit-based solutions have demonstrated success, such "hybrid" service could alleviate (for users) the constraints of demand-response and the incompatability of conventional commuter service. If routed, scheduled, and integrated with the commuter transit network in a creative manner, and tailored to the geography of each particular locale, such "hybrid" service could serve young and old equally well.

The demonstrated preference for walking, especially among those 85 and over, may suggest other alternatives for the distribution of goods and services. As difficult as it may be to achieve, multiple-use zoning, tax-abatement and other tools may succeed in encouraging small-scale retailing and services to assume their

historical neighborhood roles again.

It may not be too far-fetched to envision a network of mobile providers of goods and services. In many rural communities, there has been a long tradition of grocery deliveries to homebound citizens. As Meals-on-Wheels demonstrates in Portland, it is possible for a non-profit agency to provide basic nutrition to at least some of the neediest in a medium-size city. The phenomenal growth of the elderly population which is anticipated would most likely overwhelm the existing network of mobile providers of goods and services. Therefore, securing the means to expand these vital links will remain important in future policy debates.

Suggestions for Further Research

Stated-preference survey methodology of the type used in this study may have to be modified to be less challenging to respondents, elderly and non-elderly alike. Further refinement of stated-preference methods might achieve an effective synthesis between gerontology and transportation planning.

A very important aspect of older people's urban and suburban mobility is pedestrian safety. One avenue for research into public transportation options is walking safety, which would bring architecture and design into the process of accommodating transit to the needs of the elderly. Future studies could examine transit and paratransit routings as a function of safety of walking access.

A final suggestion for future research is the impact upon the extended family of having to provide transportation services for non-driving relatives. From

the public policy perspective, society's failure to provide viable alternatives to the private car for the elderly may have compound social effects. It would be interesting to quantify the productivity gains of the working sector, or the easing of family stress at home, if transit system design could enable the older generation to assert their independence for as long as they remain relatively healthy and ambulatory.

A SELECTED BIBLIOGRAPHY

Ajise, O. "Transportation Planning for the Elderly: Problems and Issues in the Fresno/Clovis Metropolitan Area." MAI 32 (1993): Issue 2 (California State University, Fresno).

Baglioni, A. "Residential Relocation and the Health of the Elderly." Aging, Stress and Health. Markides et al., eds. (1989).

Benekohal, R., et al. "Effects of Aging on Older Drivers' Travel Characteristics." Transportation Research Record 1438 (1994).

Bonnette, B. "Housing in Metropolitan Areas: Movers and Stayers." Statistical Brief, U.S. Department of the Census (1991).

Bruce, J. "To Drive or Not to Drive." Aging 366, 1994.

Burkhauser, R. "Mobility Patterns of Older Homeowners: Are Older Homeowners Trapped in Distressed Neighborhoods?" Research on Aging vol. 17 no.4, Dec. 1, 1995.

Campbell, M. et al. "Medical Conditions Associated With Driving Cessation in Community-Dwelling, Ambulatory Elders." Journal of Gerontology: Social Sciences vol. 48 no. 4, 1993.

East, J. "Community Planning for Neighborhood Change in an Aging Society." MAI 31 (1992): Issue 4 (University of Manitoba).

Flannely et al. "Assessing Consumers' Interest in Using Alternative Transportation Modes of Commuting." Psychological Reports 67 (1990) 875-878.

Frey, W. "Lifecourse Migration and Redistribution of the Elderly Across U.S. Regions and Metropolitan Areas." Economic Outlook USA, 2nd Qtr. (1986).

Gomez-Ibanez, J. and Meyer, J. Going Private. Brookings Institution, Washington D.C. (1993).

Graff, T. and Wiseman, R. "Changing Concentrations of Older Americans." The Geographical Review 68, 4 (1978).

Hensher, D. "Stated-Preference Analysis of Travel Choices: the State of the Practice." Transportation vol. 21 no. 2 (1994).

Jobe, J. and Mingay, D. " Cognitive Laboratory Approach to Designing Questionnaires for Surveys of the Elderly." Public Health Reports vol. 105 no. 5 (September 1990): 518-524.

Kline, D. "Vision, aging and driving." Journal of Gerontology vol. 47 no. 1 (1992).

Kroes, E. and Sheldon, R. "Stated Preference Methods." Journal of Transport Economics and Policy 22 (1988).

Litwak, E. and Longino, C. "Migration Patterns Among the Elderly: a Developmental Perspective." The Gerontologist 27, 3 (1987).

Louviere, J. Final Report on a Before and After Transit Innovation Study. University of Iowa, Center for Urban Transportation Studies (1973).

Meyer, J. and Speare, A. "Distinctly Elderly Mobility: Types and Determinants." Economic Geography 61, 1 (1985).

Miller, M. "Trends: Safety for Seniors." Technology Review vol.89 no.7 (Oct 1986): 10-11.

Odutala, A. "Services and Longevity of Paratransit Operation." Transportation Quarterly vol. 44 no. 1, January 1, 1990.

Quinn, B. "Public Services in Aging America." American City and County 104 no.11 (November 1989).

Rogers, A., ed. Elderly Migration and Population Redistribution. New York: Halsted Press (1992).

Rogers, A., ed. "The Suburbanization of the American Elderly." Elderly Migration and Population Redistribution, op. cit.

Rosenbloom, S. "Transportation Needs of the Elderly Population." Clinics in Geriatric Medicine Vol. 9 No. 2 (May 1993).

Rosenbloom, S. Travel by the Elderly. United States, Department of Transportation, Federal Highway Administration, Office of Highway Information Management, Demographic Special Reports (Washington: GPO, 1995).

Rufolo, T. et al., "Assessment of Demand-Responsive Versus Fixed-Route Transit Service: A Portland, Oregon Case Study." TransNow Regional Center (1996).

Schwartz, S. et al. "The choice of living arrangements by the elderly." Retirement and Economic Behavior. Brookings Institution, Washington, D.C. (1984).

Sheiner, L. and Weil, D. "The housing wealth of the aged." Working paper, National Board of Economic Research (1992).

Soldo, B. "The living arrangements of the elderly." Aging: Social Change. Keisler et. al., eds. New York: Academic Press (1981).

Stone, J. et al. "Paratransit Computer Dispatch and Scheduling: an Application of Advanced Public Transportation Systems." Transportation Quarterly (1994).

Taeuber, C. Sixty-Five Plus in America. U.S. Department of Commerce, Bureau of the Census. (Washington: GPO, rev. May 1993).

Waller, P. "The Older Driver." Human Factors 33, 5 (1991).

Wiseman, R.and Roseman, C. "A Typology of Elderly Migration Based on the Decision-Making Process." Economic Geography (1979).

Wiseman, R. and Virden, M. "Spatial and Social Dimensions of Intraurban Elderly Migration." Economic Geography (1977).

APPENDIX A:

MULTIPLE-CHOICE QUESTIONNAIRE

Survey: Neighborhood-Area Transportation for Senior Citizens

The following is a list of questions about transportation options for Senior Citizens in your community. The survey consists of questions to help guide Portland-area transportation planning.

The survey is part of a graduate thesis project at Portland State University's Department of Urban Studies and Planning. Your assistance will be greatly appreciated in this examination of ways to improve public transportation services for non-driving members of the community.

The questionnaire will require 15 or 20 minutes to complete. Most questions are multiple-choice. Please use a pencil with eraser, in case corrections are necessary.

If you would like to receive a report on the results of this study, a separate form is provided on the last page, and a report will be sent by mail in several months. Please be assured that all information you provide will be held in strict confidence, and utilized exclusively for the purposes of this academic study.
Again, thank you for your assistance in this research project.

Richard J. Burke, graduate student
Department of Urban Studies and Planning
Portland State University

****

1. How many licensed drivers live in your household?

___ NONE

___ ONE

___ TWO OR MORE

2. How many automobiles are used by your household on a regular basis?

___ NONE

___ ONE

___ TWO OR MORE

3. Do you, or any adult members of your household, require transportation by a family member, relative, friend, or community volunteer driver?

___ YES

___ NO

4. Please indicate any of the following reasons why you, or any adult family members, are unable to drive, or prefer not to drive.

___ (NOT APPLICABLE)

___ VISION LIMITATIONS

___ PHYSICAL LIMITATIONS

___ SAFETY CONSIDERATIONS

___ OTHER (Please describe briefly)_____

_____

_____

5. Do you, or any members of your household, use Tri-Met bus, MAX light rail, or "LIFT" van service?

BUS: ___ YES ___NO

MAX: ___ YES ___ NO

"LIFT": ___ YES ___ NO

6. Thinking for a moment about the travel needs of elderly relatives, friends, or neighbors who are unable to drive, or prefer public transportation, would you say that Portland's public transportation system is:

NOT ADEQUATE___/ BARELY ADEQUATE ___/

SATISFACTORY ___/ GOOD ___/ VERY GOOD ___

7. If you were to take a bus to a destination fairly close to home (for example, grocery shopping), would you say that Portland's public transportation system is:

NOT ADEQUATE___/ BARELY ADEQUATE___/

SATISFACTORY___/ GOOD ___/ VERY GOOD ___

8. How far from your house is the nearest bus or rail stop?

___ ONE TO THREE BLOCKS

___ FOUR TO SIX BLOCKS

___ SEVEN TO TEN BLOCKS

___ MORE THAN TEN BLOCKS

9. To use Tri-Met for a typical trip, such as shopping, would the trip require a transfer?

___ YES

___ NO

___ DON'T KNOW

****

The following questions are for statistical purposes only. Please be assured that the information you provide is confidential, anonymous, and used exclusively for the purpose of this academic study.

10. AGE: ____

11. SEX: ____ m ____ f

12. APPROXIMATE ANNUAL HOUSEHOLD INCOME:

__ $5,000 or less / __ $5,000 to $9,999/ __ $10,000 to $14,999/

__ $15,000 to $24,999/ __ $25,000 to $34,999/ __ $35,000 or more.

APPENDIX B:

STATED-PREFERENCE QUESTIONNAIRE

Stated-Preference Questionnaire

On the next page is a map of your community, with several possible small-bus / van routes illustrated.

The service would consist of 15 to 20-passenger vans or small buses, running on a regular schedule, which would serve local retail centers as well as Tri-Met stations and transfer points. The buses would be wheelchair lift-equipped. Assume that service will operate Monday through Saturday, between 7:00 AM and 10:00 PM.

After you have looked at the map, you will be asked to evaluate different possible arrangements of service.

Shown below are different possible arrangements for scheduled small bus/ van service to and from nearby shopping, professional services, and social and recreational activities.

For each combination, please mark the dotted line to indicate the likelihood that you would use this service.

EXAMPLE:

FARE	**DISTANCE TO STOP**	**FREQUENCY**
$2.00	4 blocks	every 20 minutes

Likelihood that you would use service:

less likely more likely

[. . . . . ^ . . . . .]

0% 50% 100%

In the example, this person has indicated about a 40 percent chance that he or she would find it useful to have access to a small bus or van every twenty minutes, four blocks' walk away, at a fare of $2.00.

DISTANCE TO STOP	FREQUENCY	FARE
6 blocks	every 10 minutes	$2.00
LESS LIKELY [. . . . . ^ . . . . .]		MORE LIKELY

6 blocks	every 20 minutes	$2.00
LESS LIKELY [. . . . . ^ . . . . .]		MORE LIKELY

6 blocks	every 30 minutes	$2.00
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . .]		

4 blocks	every 10 minutes	$2.00
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . .]		

4 blocks	every 20 minutes	$2.00
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . .]		

4 blocks	every 30 minutes	$2.00
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . .]		

2 blocks	every 10 minutes	$2.00
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . .]		

2 blocks	every 20 minutes	$2.00
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . .]		

2 blocks	every 30 minutes	$2.00
LESS LIKELY		MORE LIKELY
[. . . . . .^. . . . .]		

FARE	DISTANCE TO STOP	FREQUENCY
$1.50	6 blocks	every 10 minutes
LESS LIKELY		MORE LIKELY
[. . . . . .^ . . . . .]		

$1.50	6 blocks	every 20 minutes
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . .]		

$1.50	6 blocks	every 30 minutes
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . . .]		

$1.50	4 blocks	every 10 minutes
LESS LIKELY		MORE LIKELY
[. . . . . .^. . . . .]		

$1.50	4 blocks	every 20 minutes
LESS LIKELY		MORE LIKELY
[. . . . . .^. . . . .]		

$1.50	4 blocks	every 30 minutes
LESS LIKELY		MORE LIKELY
[. . . . . .^. . . . .]		

$1.50	2 blocks	every 10 minutes
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . .]		

$1.50	2 blocks	every 20 minutes
LESS LIKELY		MORE LIKELY
[. . . . . ^. . . . .]		

$1.50	2 blocks	every 30 minutes
LESS LIKELY		MORE LIKELY
[. . . . . ^ . . . . .]		

FREQUENCY	FARE	DISTANCE TO STOP
every 10 minutes	$2.50	6 blocks
LESS LIKELY [. . . . . ^ . . . . .]		MORE LIKELY

every 10 minutes	$2.50	4 blocks
LESS LIKELY [. . . . . ^ . . . . .]		MORE LIKELY

every 10 minutes	$2.50	2 blocks
LESS LIKELY [. . . . . ^ . . . . .]		MORE LIKELY

every 20 minutes	$2.50	6 blocks
LESS LIKELY [. . . . . ^ . . . . .]		MORE LIKELY

every 20 minutes	$2.50	4 blocks
LESS LIKELY [. . . . . ^ . . . . .]		MORE LIKELY

every 20 minutes	$2.50	2 blocks
LESS LIKELY		MORE LIKELY
[. . . . . .^ . . . . .]		

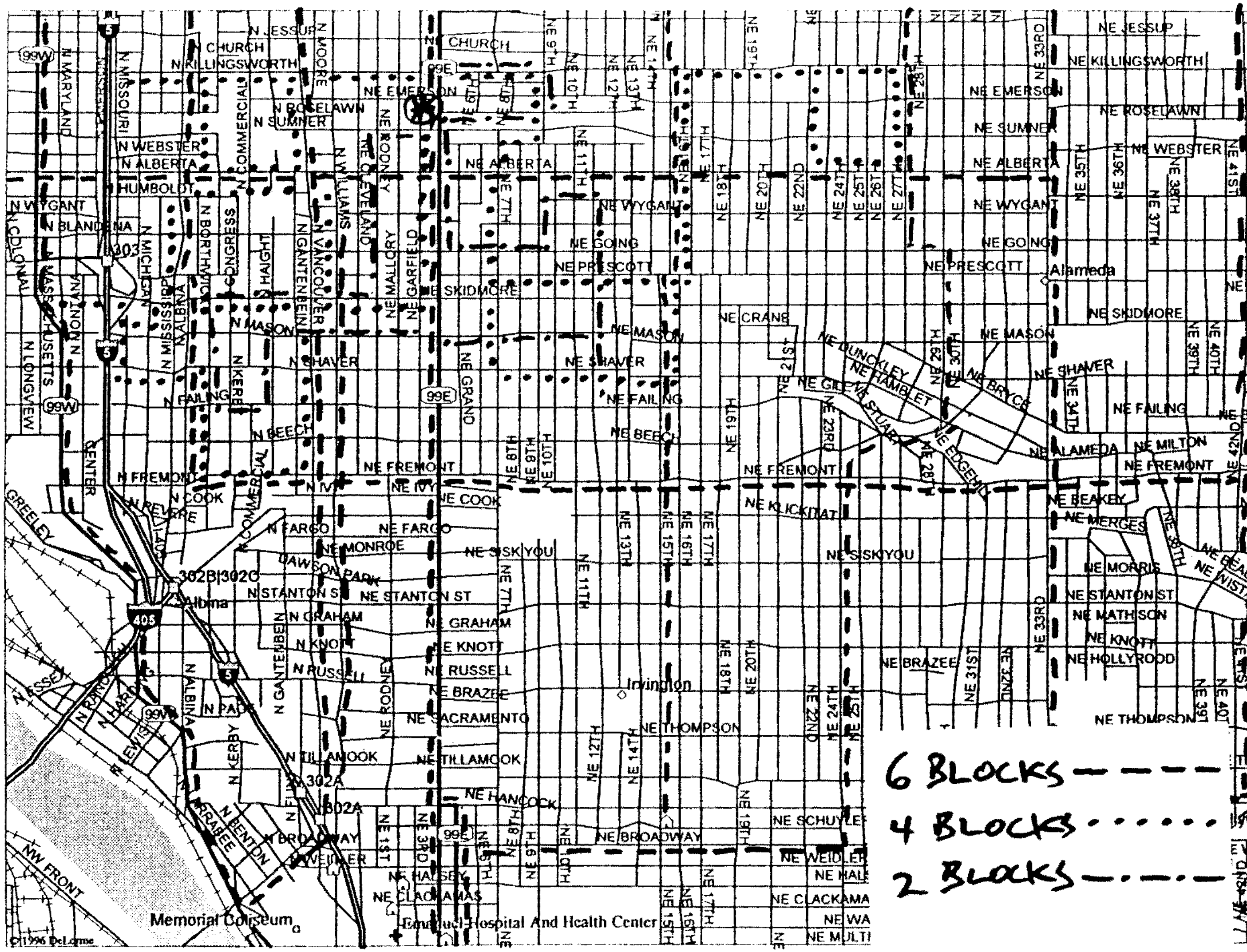
every 30 minutes	$2.50	6 blocks
LESS LIKELY		MORE LIKELY
[. . . . . .^ . . . . .]		

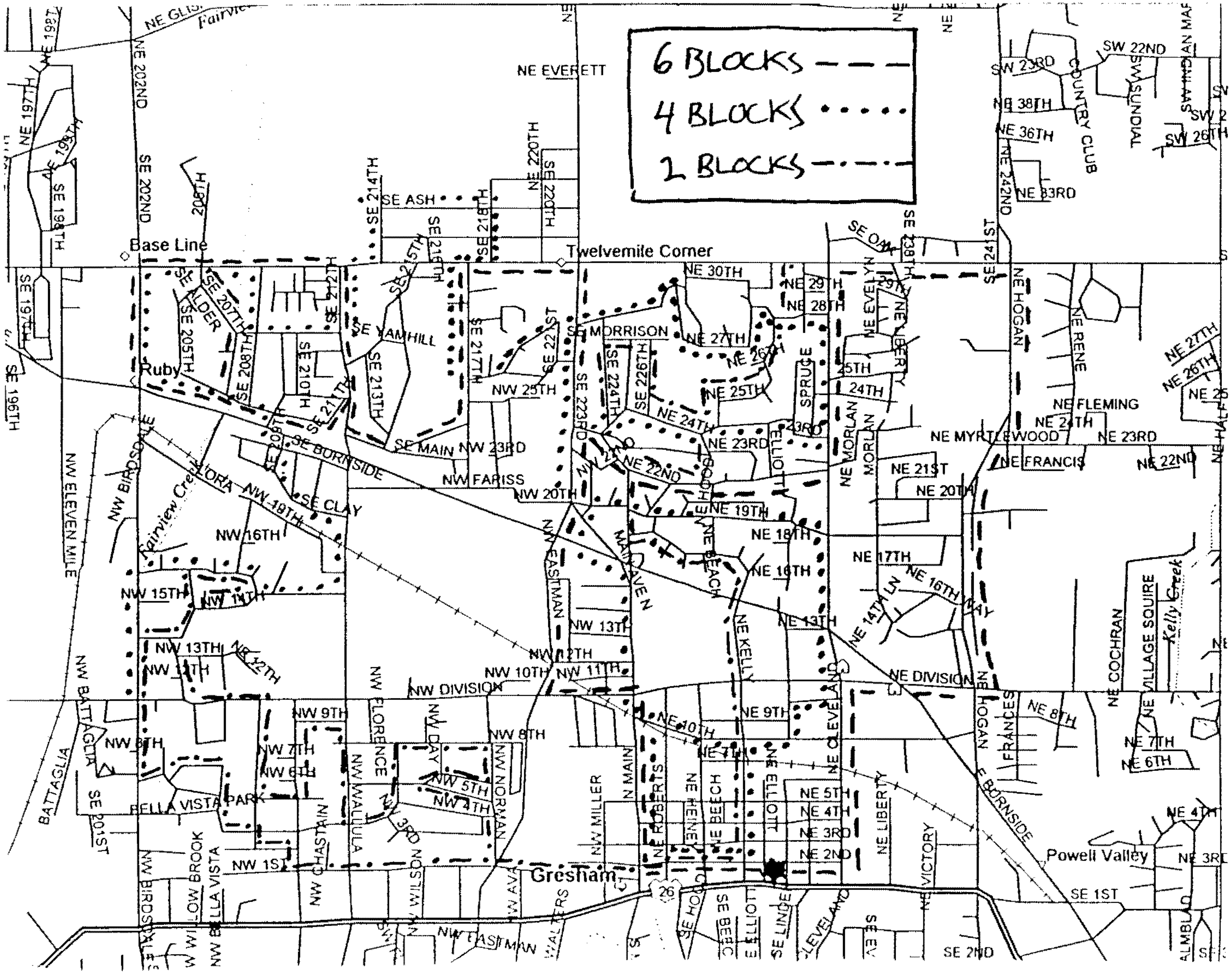
every 30 minutes	$2.50	4 blocks
LESS LIKELY		MORE LIKELY
[. . . . . .^ . . . . .]		

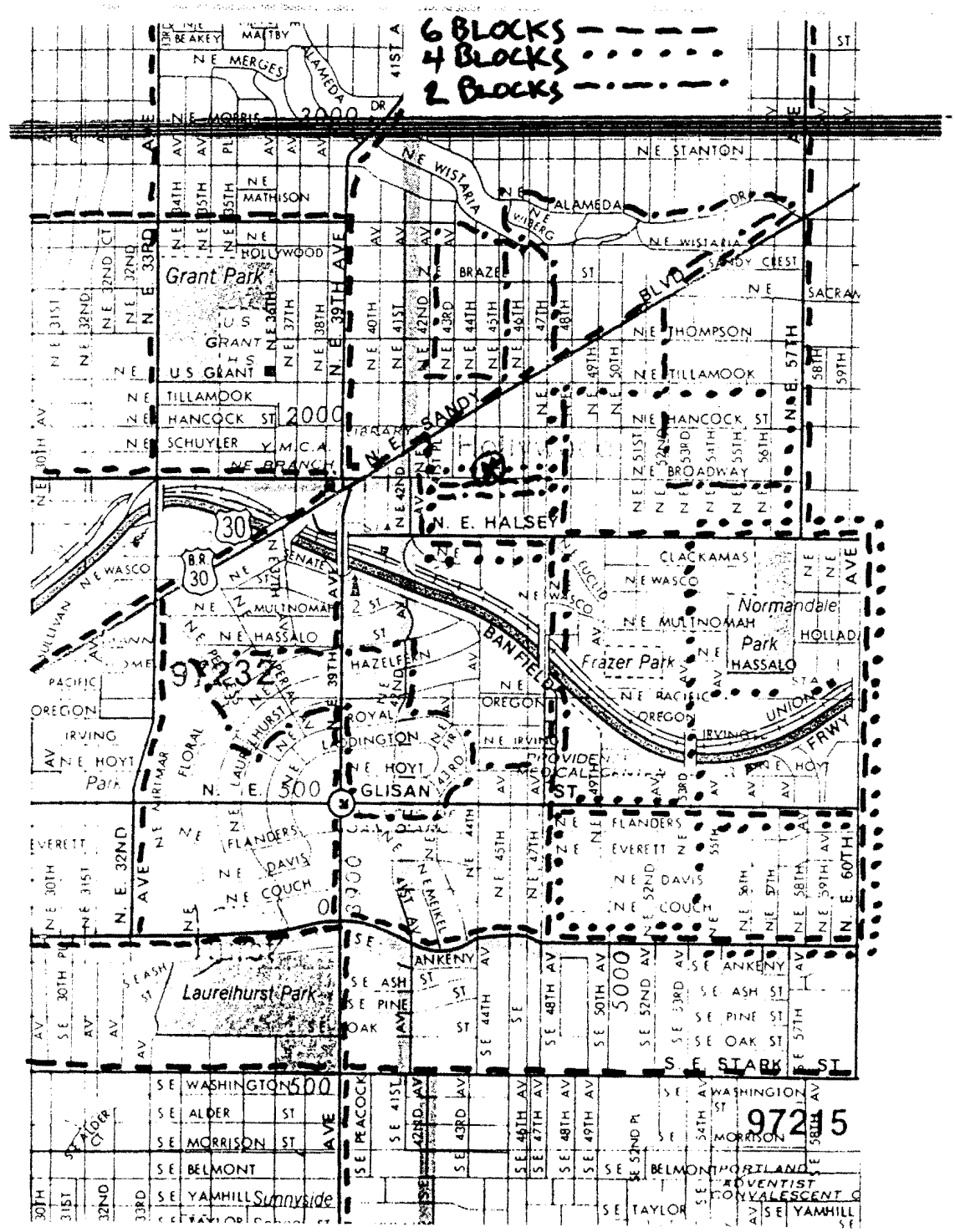
every 30 minutes	$2.50	2 blocks
LESS LIKELY		MORE LIKELY
[. . . . . .^ . . . . .]		

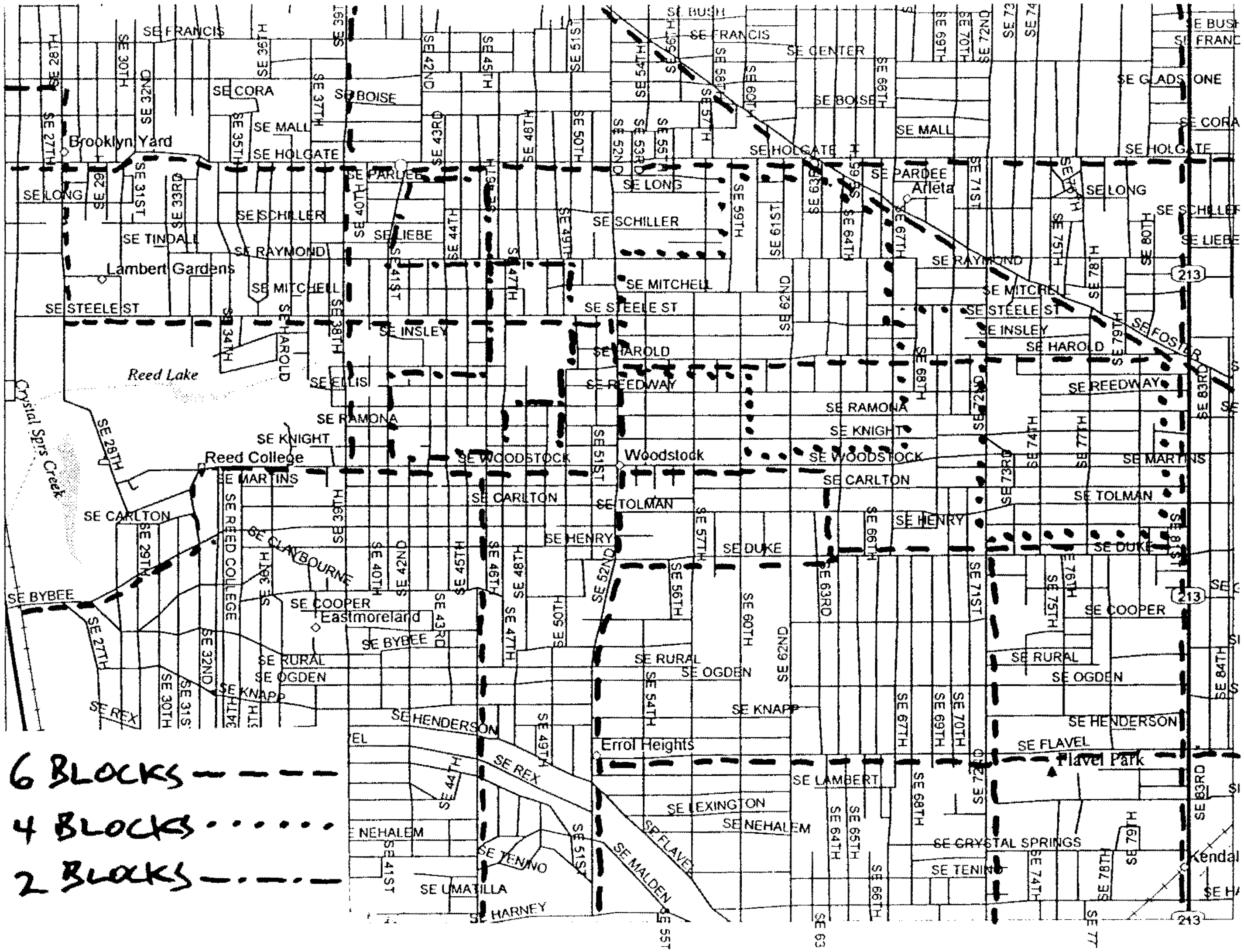
APPENDIX C:

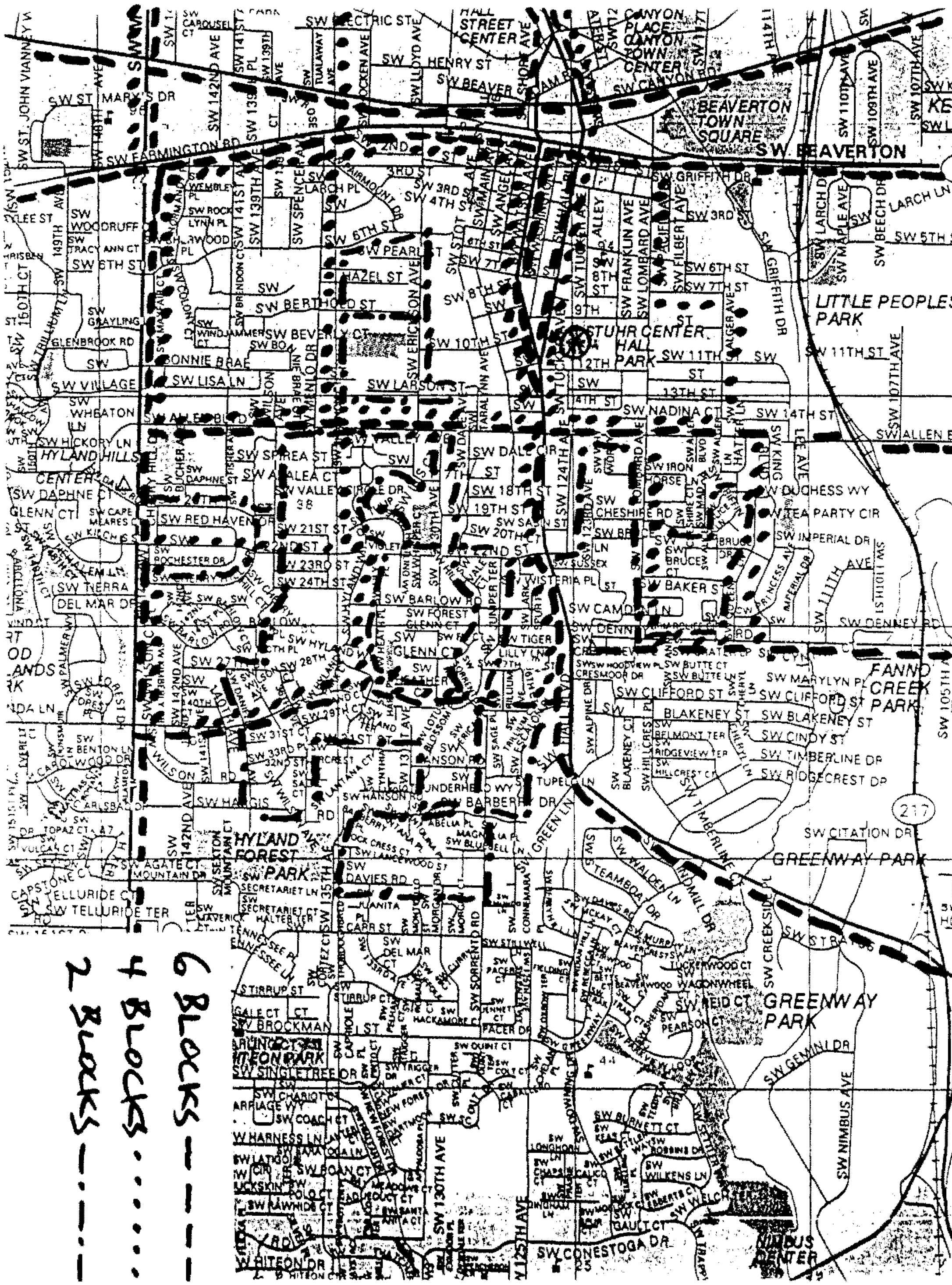
AREA STREET MAPS


6 BLOCKS
4 BLOCKS
2 BLOCKS
N JESSUP
N CHURCH
N KILLINGSWORTH
NE CHURCH
NE EMERSON
N ROSELAWN
N SUMNER
N WEBSTER
N ALBERTA
HUMBOLDT
N WYGANT
N BLANDENA
NE ALBERTA
NE WYGANT
NE GOING
NE PRESCOTT
NE SKIDMORE
N MASON
NE MASON
N SHAVER
NE SHAVER
N FAILING
NE FAILING
N BEECH
NE BEECH
N FREMONT
NE FREMONT
N COOK
NE COOK
N REVERE
N FARGO
NE FARGO
NE MONROE
DAWSON PARK
NE SISKIYOU
N STANTON ST
NE STANTON ST
N GRAHAM
NE GRAHAM
N KNOTT
NE KNOTT
N RUSSELL
NE RUSSELL
NE BRAZEE
NE SACRAMENTO
NE THOMPSON
N TILLAMOOK
NE TILLAMOOK
NE HANCOCK
N BROADWAY
NE BROADWAY
N WEIDLER
NE WEIDLER
NE HALSEY
NE CLACKAMAS
NE SCHUYLER
NE MULTI
NE JESSUP
NE KILLINGSWORTH
NE ROSELAWN
NE SUMNER
NE WEBSTER
Alameda
NE CRANE
NE DUNCKLEY
NE HAMBLET
NE GILE
NE STUART
NE BRYCE
NE EDGEHILL
NE ALAMEDA
NE MILTON
NE KLICKITAT
NE BEAKEY
NE MERGES
NE MORRIS
NE MATHISON
NE HOLLYROOD
N MARYLAND
N MISSOURI
N COMMERCIAL
N MOORE
N WILLIAMS
NE CLEVELAND
NE RODNEY
NE MALLORY
NE GARFIELD
N VANCOUVER
N GANTENBEIN
N CONGRESS
N HAIGHT
N MICHIGAN
N MISSISSIPPI
N ALBINA
N KERBY
N LONGVIEW
N MASSACHUSETTS
N MONTANA
N CENTER
N COLONIAL
N GREELEY
NE GRAND
NE 7TH
NE 8TH
NE 9TH
NE 10TH
NE 11TH
NE 12TH
NE 13TH
NE 14TH
NE 15TH
NE 16TH
NE 17TH
NE 18TH
NE 19TH
NE 20TH
NE 21ST
NE 22ND
NE 23RD
NE 24TH
NE 25TH
NE 26TH
NE 27TH
NE 28TH
NE 29TH
NE 30TH
NE 31ST
NE 32ND
NE 33RD
NE 34TH
NE 35TH
NE 36TH
NE 37TH
NE 38TH
NE 39TH
NE 40TH
NE 41ST
NE 42ND
Albina
Irvington
N INTERSTATE
N LEWIS
N RANDOLPH
N PAGE
N BENTON
N WHEELER
NW FRONT
Memorial Coliseum
Emanuel Hospital And Health Center
99W
99E
5
405
302A
302B
302C
303
© 1996 DeLorme


6 BLOCKS
4 BLOCKS
2 BLOCKS
NE EVERETT
Base Line
Twelvemile Corner
Ruby
Gresham
Powell Valley
Fairview Creek
Kelly Creek
SE ASH
SE 214TH
SE 215TH
SE 216TH
SE 218TH
NE 220TH
SE 22OTH
SE 202ND
NE 202ND
NE 197TH
NE 199TH
SE 198TH
SE 197TH
SE 196TH
SE ALDER
SE 205TH
SE 207TH
SE 208TH
SE 210TH
SE 212TH
SE 211TH
SE 213TH
SE 217TH
SE YAMHILL
SE 221ST
SE MORRISON
SE 223RD
SE 224TH
SE 226TH
SE MAIN
NW 23RD
NW 25TH
SE BURNSIDE
NW FARISS
NW 20TH
SE CLAY
NW 19TH
NW 16TH
NW 15TH
NW 14TH
NW 13TH
NW 12TH
NW 11TH
NW 10TH
NW DIVISION
NW 9TH
NW 8TH
NW 7TH
NW 6TH
NW 5TH
NW 4TH
NW 3RD
NW 1ST
NW BIRDSDALE
NW ELEVEN MILE
NW BATTAGLIA
BATTAGLIA
SE 201ST
BELLA VISTA PARK
NW WILLOW BROOK
NW BELLA VISTA
NW CHASTAIN
NW WALLULA
NW FLORENCE
NW DAY
NW NORMAN
NW WILSON
NW EASTMAN
NW MILLER
N MAIN
MAIN AVE N
NE 30TH
NE 29TH
NE 28TH
NE 27TH
NE 26TH
NE 25TH
NE 24TH
NE 23RD
NE 22ND
NE 21ST
NE 20TH
NE 19TH
NE 18TH
NE 17TH
NE 16TH
NE 13TH
NE 10TH
NE 9TH
NE 8TH
NE 7TH
NE 6TH
NE 5TH
NE 4TH
NE 3RD
NE 2ND
NE KELLY
NE BEACH
NE HOOD
NE ELLIOTT
NE ROBERTS
NE HEINEY
NE CLEVELAND
NE LIBERTY
NE VICTORY
NE MORLAN
NE EVELYN
NE HOGAN
NE RENE
NE FLEMING
NE MYRTLEWOOD
NE FRANCIS
NE FRANCES
NE DIVISION
NE COCHRAN
NE VILLAGE SQUIRE
NE 14TH LN
NE 16TH WAY
SPRUCE
SE 238TH
SE 241ST
SE OAK
SW 22ND
SW 23RD
SW SUNDIAL
COUNTRY CLUB
NE 38TH
NE 36TH
NE 33RD
NE 242ND
SW 26TH
E BURNSIDE
SE 1ST
SE 2ND
SE HOOD
SE BEECH
SE ELLIOTT
SE LINDEN
SE CLEVELAND
NW EASTMAN
WALTERS
26


6 BLOCKS
4 BLOCKS
2 BLOCKS
Grant Park
Laurelhurst Park
Sunnyside
Normandale Park
Frazer Park
N.E. HALSEY
N.E. SANDY BLVD
N.E. 39TH AVE
N.E. 57TH AVE
N.E. 32ND AVE
N.E. 60TH AVE
BANFIELD FWY
GLISAN ST
S.E. STARK ST
97232
97215


SE FRANCIS
SE BUSH
SE CENTER
SE GLADSTONE
SE CORA
SE BOISE
SE MALL
SE HOLGATE
Brooklyn Yard
SE PARDEE
SE LONG
Arleta
SE SCHILLER
SE TINDALL
SE LIEBE
SE RAYMOND
Lambert Gardens
SE MITCHELL
SE STEELE ST
SE INSLEY
SE HAROLD
SE FOSTER
Reed Lake
SE ELLIS
SE REEDWAY
SE RAMONA
SE KNIGHT
Reed College
Woodstock
SE WOODSTOCK
SE MARTINS
SE CARLTON
SE TOLMAN
SE HENRY
SE DUKE
Crystal Sprs Creek
SE CLAYBOURNE
SE BYBEE
SE COOPER
Eastmoreland
SE RURAL
SE OGDEN
SE KNAPP
SE REX
SE HENDERSON
SE FLAVEL
Errol Heights
Flavel Park
SE LAMBERT
SE LEXINGTON
SE NEHALEM
SE CRYSTAL SPRINGS
SE TENINO
SE UMATILLA
SE HARNEY
SE MALDEN
Kendal
SE REED COLLEGE
213
6 BLOCKS - - - -
4 BLOCKS · · · · · ·
2 BLOCKS - . - . -


6 BLOCKS — — —
4 BLOCKS • • • • •
2 BLOCKS — • — • —
SW BEAVERTON
BEAVERTON TOWN SQUARE
CANYON PLACE
CANYON TOWN CENTER
HALL STREET CENTER
SW FARMINGTON RD
SW CANYON RD
SW ALLEN BLVD
SW DENNEY RD
SW HALL BLVD
STUHR CENTER
LITTLE PEOPLES PARK
HYLAND HILLS CENTER
HYLAND FOREST PARK
FANNO CREEK PARK
GREENWAY PARK
SW NIMBUS AVE
NIMBUS CENTER
SW CONESTOGA DR
SW 130TH AVE
SW 125TH AVE
SW 142ND AVE
217

APPENDIX D:

FREQUENCIES

APPENDIX D: FREQUENCIES

AGE Age Group

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Age 59 and Under	1	16	17.8	20.0	20.0
Age 60 - 69	2	25	27.8	31.3	51.3
Age 70 - 79	3	34	37.8	42.5	93.8
Age 80 and Over	4	5	5.6	6.3	100.0
	.	10	11.1	Missing	
	Total	90	100.0	100.0	

Valid cases 80 Missing cases 10

- -

AUTOS No. of Automobiles in Use

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
None	0	32	35.6	36.4	36.4
One	1	41	45.6	46.6	83.0
Two or More	2	15	16.7	17.0	100.0
	.	2	2.2	Missing	
	Total	90	100.0	100.0	

Valid cases 88 Missing cases 2

- -

BUSSTOP Distance to Bus Stop

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
One to Three Blocks	1	62	68.9	72.9	72.9
Four to Six Blocks	2	12	13.3	14.1	87.1
Seven to Ten Blocks	3	4	4.4	4.7	91.8
More than Ten Blocks	4	7	7.8	8.2	100.0
	.	5	5.6	Missing	
	Total	90	100.0	100.0	

Valid cases 85 Missing cases 5

CARHELP Driven by Friends

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Yes	1	34	37.8	39.5	39.5
No	2	52	57.8	60.5	100.0
	.	4	4.4	Missing	
	Total	90	100.0	100.0	

Valid cases 86 Missing cases 4

- -

DRIVERS No. of Drivers in Home

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
None	0	29	32.2	32.6	32.6
One	1	40	44.4	44.9	77.5
Two or More	2	20	22.2	22.5	100.0
	.	1	1.1	Missing	
	Total	90	100.0	100.0	

Valid cases 89 Missing cases 1

- -

GENDER Gender of Respondent

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Male	1	36	40.0	42.9	42.9
Female	2	48	53.3	57.1	100.0
	.	6	6.7	Missing	
	Total	90	100.0	100.0	

Valid cases 84 Missing cases 6

INCOME Approx. Household Income

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
$5,000 or Less	1	23	25.6	35.9	35.9
$5,000 to $9,999	2	15	16.7	23.4	59.4
$10,000 to $14,999	3	13	14.4	20.3	79.7
$15,000 to $24,999	4	9	10.0	14.1	93.8
$25,000 to $34,999	5	3	3.3	4.7	98.4
$35,000 or more	6	1	1.1	1.6	100.0
	.	26	28.9	Missing	
	Total	90	100.0	100.0	

Valid cases 64 Missing cases 26

- -

LIMITS Limitations on Driving

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Not Applicable	0	20	22.2	28.6	28.6
Vision Limitations	1	5	5.6	7.1	35.7
Physical Limitations	2	13	14.4	18.6	54.3
Safety Consideration	3	4	4.4	5.7	60.0
Combination of Factors	4	10	11.1	14.3	74.3
Other	5	18	20.0	25.7	100.0
	.	20	22.2	Missing	
	Total	90	100.0	100.0	

Valid cases 70 Missing cases 20

SHOPPING Adequacy of Tri-Met for Shopping

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Not Adequate	1	16	17.8	20.8	20.8
Barely Adequate	2	10	11.1	13.0	33.8
Satisfactory	3	20	22.2	26.0	59.7
Good	4	15	16.7	19.5	79.2
Very Good	5	16	17.8	20.8	100.0
	.	13	14.4	Missing	
	Total	90	100.0	100.0	

Valid cases 77 Missing cases 13

- -

TRACT Senior Center Location

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Beaverton	B	21	23.3	23.3	23.3
Gresham	G	20	22.2	22.2	45.6
Hollywood	H	15	16.7	16.7	62.2
Lents	L	15	16.7	16.7	78.9
Northeast	N	19	21.1	21.1	100.0
	Total	90	100.0	100.0	

Valid cases 90 Missing cases 0

- -

TRANSFER Transfer Required for Shopping

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Yes	1	37	41.1	44.0	44.0
No	2	31	34.4	36.9	81.0
Don't Know	3	16	17.8	19.0	100.0
	.	6	6.7	Missing	
	Total	90	100.0	100.0	

Valid cases 84 Missing cases 6

TRIMET Usage of Tri-Met

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
None	0	23	25.6	26.4	26.4
Bus Only	1	16	17.8	18.4	44.8
Rail Only	2	5	5.6	5.7	50.6
LIFT Only	3	12	13.3	13.8	64.4
Bus and Rail	4	16	17.8	18.4	82.8
LIFT and Rail	5	2	2.2	2.3	85.1
Bus and LIFT	6	9	10.0	10.3	95.4
All Three	7	4	4.4	4.6	100.0
	.	3	3.3	Missing	
	Total	90	100.0	100.0	

Valid cases 87 Missing cases 3

- -

TRIMETOK Usefulness of Tri-Met for Seniors

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Not Adequate	1	10	11.1	12.8	12.8
Barely Adequate	2	14	15.6	17.9	30.8
Satisfactory	3	22	24.4	28.2	59.0
Good	4	18	20.0	23.1	82.1
Very Good	5	14	15.6	17.9	100.0
	.	12	13.3	Missing	
	Total	90	100.0	100.0	

Valid cases 78 Missing cases 12

APPENDIX E:

SELECTED MEANS
By SENIOR CENTER LOCATION

APPENDIX E: SELECTED MEANS BY SENIOR CENTER LOCATION

- - Description of Subpopulations - -

Summaries of INCOME Approx. Household Income
By levels of TRACT Senior Center Location

Variable	Value	Label	Mean	Std Dev	Cases
For Entire Population			2.3281	1.3100	64
TRACT	B	Beaverton	2.5714	1.2225	14
TRACT	G	Gresham	3.1429	1.5119	14
TRACT	H	Hollywood	1.5000	.7071	10
TRACT	L	Lents	2.0000	1.1094	14
TRACT	N	Northeast	2.1667	1.3371	12

Total Cases = 90
Missing Cases = 26 or 28.9 Pct

- - Description of Subpopulations - -

Summaries of SHOPPING Adequacy of Tri-Met for Shopping
By levels of TRACT Senior Center Location

Variable	Value	Label	Mean	Std Dev	Cases
For Entire Population			3.0649	1.4174	77
TRACT	B	Beaverton	2.0667	1.1629	15
TRACT	G	Gresham	2.8571	1.4064	14
TRACT	H	Hollywood	3.8000	1.4243	15
TRACT	L	Lents	3.8571	1.1673	14
TRACT	N	Northeast	2.8421	1.2589	19

Total Cases = 90
Missing Cases = 13 or 14.4 Pct

- - Description of Subpopulations - -

Summaries of TRIMETOK Usefulness of Tri-Met for Seniors
By levels of TRACT Senior Center Location

Variable	Value	Label	Mean	Std Dev	Cases
For Entire Population			3.1538	1.2800	78
TRACT	B	Beaverton	2.3684	1.0116	19
TRACT	G	Gresham	3.0000	1.1882	18
TRACT	H	Hollywood	3.9333	1.1629	15
TRACT	L	Lents	3.7857	.9750	14
TRACT	N	Northeast	2.9167	1.5050	12

Total Cases = 90
Missing Cases = 12 or 13.3 Pct