

UMTA/TSC Transit Dependent Transportation Series

Incidence Rates And Travel Characteristics Of The Transportation Handicapped In Portland, Oregon

April 1977

Service and Methods Demonstration Program



**U.S. DEPARTMENT OF TRANSPORTATION
Transportation Systems Center**

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16. Abstract This report presents incidence rates, characteristics, and travel patterns of transportation handicapped and able-bodied elderly (65 and over) persons. A functional definition of handicap is used based on a person's ability to perform eight activities often required in traveling. Those identified as transportation handicapped are further classified as moderately or severely handicapped. Tables and discussion are presented on demographics, health problems, use of mobility aids, and trip rates, purposes and modes, and origin/destination patterns. A section is devoted to functional problems in using public transportation vs. handicap classification, health problem and use of mechanical aid. Respondents are evaluated in their ability to use six different transit modes ranging from a fixed-route regular bus to a door-to-door bus with a lift. Wheel-chair/walker users are analyzed separately. Data for this report was derived from a 6,000 household survey conducted in Portland. The survey design, questionnaires and field procedures are described.					
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PREFACE

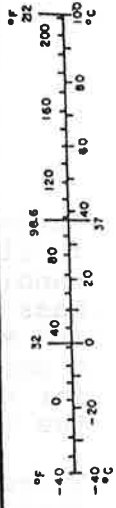
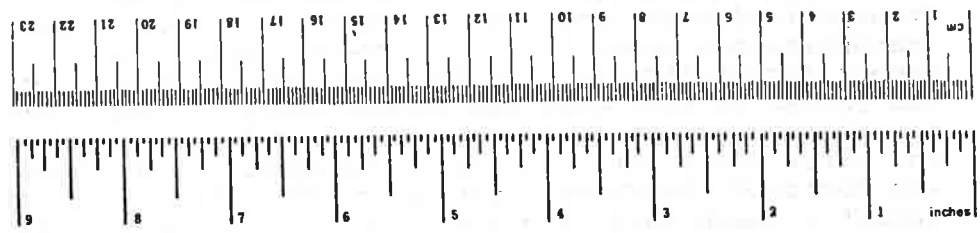
Current Federal regulations require that mass transportation facilities and services be designed to benefit elderly and handicapped persons. As part of this emphasis, the Urban Mass Transportation Administration is sponsoring a Service and Methods Demonstration project in Portland, Oregon to test a particular system designed to provide door-to-door service for handicapped persons. The project is being conducted by the Tri-County Metropolitan Transportation District.

To assist in the planning and evaluation of this project, a "before" survey was conducted of approximately 6,000 Portland households. The results of the survey are described herein.

This report was prepared by Crain and Associates for the Transportation Systems Center (TSC) of the U.S. Department of Transportation under Contract DOT-TSC-1081. The TSC staff member responsible for the Portland demonstration evaluation and review of this work was Donald Kendall. The authors wish to acknowledge the following Crain and Associates staff members for their contributions: Peter Fitzgerald and Sydwell Flynn, who designed the survey operations (Ms. Flynn also edited the report); Susan Kemp, who acted as research assistant; and Barton Weitz, who performed the computer programming.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures		Approximate Conversions from Metric Measures	
When You Know	Multiply by	When You Know	Multiply by
LENGTH		LENGTH	
inches	2.5	millimeters	0.04
feet	30	centimeters	0.4
yards	0.9	meters	3.3
miles	1.6	kilometers	1.1
			0.6
AREA		AREA	
square inches	6.5	square centimeters	0.16
square feet	0.09	square meters	1.2
square yards	0.8	square kilometers	0.4
square miles	2.6	hectares (10,000 m ²)	2.5
acres	0.4		
MASS (weight)		MASS (weight)	
ounces	28	grams	0.035
pounds	0.45	kilograms	2.2
short tons (2000 lb)	0.9	tonnes (1000 kg)	1.1
VOLUME		VOLUME	
teaspoons	5	milliliters	0.03
tablespoons	15	liters	2.1
fluid ounces	30	quarts	1.06
cups	0.24	liters	0.26
pints	0.47	cubic meters	35
quarts	0.95	cubic meters	1.3
gallons	3.8		
cubic feet	0.03		
cubic yards	0.76		
TEMPERATURE (exact)		TEMPERATURE (exact)	
Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	9/5 (then add 32)



CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	ix
<u>Section</u>	
1. INTRODUCTION	1
1.1 Background.	1
1.2 The Demonstration Project	2
1.3 Site Description.	2
2. SURVEY DESIGN.	3
2.1 Overview.	3
2.2 The Definition of Transportation Handicap	4
2.3 The Screening and Interviewing Questionnaire.	6
2.4 The Sample.	7
2.5 Field Procedures.	9
2.6 Representativeness of the Sample.	10
2.7 Reliability of the Screening Device	12
3. SURVEY RESULTS	16
3.1 Incidence Rates	16
3.1.1 Incidence, Correction Factors and Data Presentations.	16
3.1.2 By Handicap Classification	17
3.1.3 By Age and Sex	18
3.2 Characteristics of the Transportation Handicapped	20
3.2.1 Demographics	20
3.2.2 Health Problems.	24
3.2.3 Duration of Primary Health Problem	25
3.2.4 Use of Mechanical Aids	26
3.3 Travel Patterns	27
3.3.1 The Trip Data.	27
3.3.2 Trip Rates	27

CONTENTS (cont.)

<u>Section</u>	<u>Page</u>
3.3.3 Trip Purposes	30
3.3.4 Trip Modes	30
3.3.5 Purpose Vs. Mode	31
3.3.6 Mode Vs. Income.	32
3.3.7 Trip Length Vs. Classification.	34
3.3.8 Origin/Destination Patterns.	35
3.3.9 Trip Patterns Vs. Time . . .	37
3.4 Functional Problems in Using Public Transportation.	39
3.4.1 Transit Function Difficulty Vs. Classification.	39
3.4.2 Transit Function Factor Analysis.	40
3.4.3 Health Problems and Functional Capabilities .	42
3.4.4 Use of Aids and Difficulty with Transit Functions. .	45
3.4.5 Capability to Use Transpor- tation Modes.	45
3.4.6 Aid Use and Ability to Use Different Modes	49
3.4.7 Problems Using Fixed Route Bus Service	51
3.4.8 Mass Transit Problems Vs. Sex and Age	54
3.5 Special Analysis of Wheelchair/ Walker Users	54
3.5.1 Demographics	54
3.5.2 Health Problems.	54
3.5.3 Trip Patterns.	56
3.5.4 Difficulty with Transit Functions	56
3.5.5 Capability to Use Modes. . .	58
3.5.6 Problems with Existing Service	58
4. Applicability and Transferability of Findings.	61
APPENDIX A - Screening Form and Questionnaire . .	A-1
APPENDIX B - Computation of Incidence	B-1
APPENDIX C - Report of Inventions	C-1

ILLUSTRATIONS

<u>Figure</u>	<u>Page</u>
2-1 Portland Handicapped and Elderly Household Survey	8
3-1 Analysis Zones, Superzones - Portland "Before" Survey.	36
3-2 Profile of Functional Capability.	39

TABLES

<u>Table</u>	<u>Page</u>
2-1 AGE & SEX DISTRIBUTION OF SAMPLE.	11
2-2 SAMPLE HOUSEHOLD INCOME	11
2-3 SHIFTS IN TARGET GROUP CLASSIFICATION	13
2-4 INTERVIEW RESPONSES OF PERSONS WHO INDICATED "NO DIFFICULTY" WHEN SCREENED.	14
3-1 TRANSPORTATION HANDICAPPED INCIDENCE IN PORTLAND.	17
3-2 TRANSPORTATION HANDICAPPED INCIDENCE BY AGE AND SEX	19
3-3 DEMOGRAPHICS OF ELDERLY AND HANDICAPPED	21/22
3-4 DISTRIBUTION OF HEALTH PROBLEMS	23
3-5 MOST PREVALENT HEALTH PROBLEMS VS. AGE.	24
3-6 DURATION OF HEALTH PROBLEMS	25
3-7 AIDS USED BY HANDICAPPED AND ELDERLY.	26
3-8 TRIP RATES VERSUS DEMOGRAPHIC VARIABLES	29
3-9 TRIP PURPOSES	30
3-10 TRAVEL MODES.	31
3-11 RELATIONSHIPS BETWEEN INCOME & MODE CHOICE.	33

TABLES (cont.)

<u>Table</u>	<u>Page</u>
3-12 TRIP LENGTHS.	34
3-13 SUPERZONE TRIP TABLE (% OF TRIPS)	35
3-14 TRIP DESTINATION BY FREQUENCY	38
3-15 TRANSIT FUNCTION DIFFICULTY BY HANDICAP CLASSIFICATION	41
3-16 TRANSIT FUNCTION FACTOR ANALYSIS.	40
3-17 HEALTH PROBLEMS VS. DIFFICULTY WITH TRANSIT FUNCTIONS.	44
3-18 USE OF AIDS VS. DIFFICULTY WITH TRANSIT FUNCTIONS.	46
3-19 ABILITY TO USE MODE BY HANDICAP CLASSIFICATION	47
3-20 AID USE VS. ABILITY TO USE MODES.	50
3-21 BUS PROBLEMS BY HANDICAP CLASSIFICATION	53
3-22 PRIMARY HEALTH PROBLEMS OF SEVERELY HANDI- CAPPED AND WHEELCHAIR/WALKER PERSONS	55
3-23 TRIP PURPOSES OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS.	57
3-24 TRAVEL MODES OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS.	57
3-25 INABILITY OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS TO PERFORM TRANSIT FUNCTIONS.	57
3-26 ABILITY OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS TO USE VARIOUS MODES.	59
3-27 BUS PROBLEMS OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS.	60

EXECUTIVE SUMMARY

A Service and Methods demonstration project is planned in Portland, Oregon that will test some special transportation services for handicapped persons. A comprehensive household survey was conducted to measure the incidence of transportation handicapped (TH) persons and something of their existing travel behavior and problems. Over 13,000 persons were screened; 777 were interviewed. The major results of the survey are reported here.

1. Using a functional definition of handicapped it was found that 5.75% of Portland citizens are transportation handicapped. This number is divided between those who are severely handicapped (3.2%) and those who are moderately handicapped (2.55%).
2. Handicap incidence increases dramatically by age; the incidence among persons 65 and over is 27.5%. The incidence of transportation handicaps between males and females is generally comparable except in the over-65 age bracket where females exhibit a much higher incidence rate.
3. About 67% of the severely transportation handicapped are elderly, 67% are female, 60% have annual household incomes less than \$5,000, 25% live alone, 50% live in households with one or more cars, 25% are licensed to drive, 55% always or usually have automobile transportation available, 7% work and another 2% are seeking a job.
4. The rank order of the most prevalent health problems of those classified as transportation handicapped are arthritis, orthopedic, visual impairment, heart

ailment, and stroke. (Problems that had not existed for at least three months were termed temporary and not included.) About 50% used one or more aids (support canes, help of another person, walker, wheelchair, crutches, in that order of prevalence.)

5. There is a weak correlation between functional capability to use transit and health problems. Functions related to mobility correlate better than information/dexterity capabilities, but the relationship is still cloudy. There is a stronger correlation with use of aids.
6. It was found that able-bodied elderly persons make 1.4 one-way, non-walking trips per day. The moderately handicapped make 1.2 trips per day, and the severely handicapped make 0.8 trips. (The national average is 2.2 trips per day for the general public.) Age, income, and auto availability also influence trip rates with those who are older, poorer and with less accessibility to cars making fewer trips.
7. The most prevalent trip purposes of the transportation handicapped population are shopping - about 30%, recreational/social - about 30%, personal business - 16%, medical dental - 9%, and work - 7%.
8. The automobile is used for over 75% of all trips, with the handicapped person being either the driver or passenger. The severely handicapped more frequently ride as passengers (51%) than do the moderately handicapped (32%). About 20% of the moderately handicapped and 10% of the severely handicapped say they use the present bus service. There is a disproportionate use of buses and taxis by those in lower income groups.
9. About half of the trips are short--less than 10 minutes in length. The origin-destination patterns are such

that most trips are within sections of the city suggesting a zonal demand-responsive service might be effective.

10. The rank order of problems that handicapped persons (both users and non-users) have with the present Portland bus service are: jerkiness of bus, seat availability, lack of shelter at bus stop, distance to bus stop, and number and placement of handrails. Almost all able-bodied elderly and 90% of the moderately handicapped say they could use the present Portland bus service, but only 30% of the severely handicapped say they can. About 50% claim they can use the bus if special features are added to the bus design, about 70% if it makes door-to-door deliveries, and about 90% if both changes are made.

Thus the key to improving service for the transportation handicapped appears to be door-to-door service; fixed route service is a problem for many regardless of additional features, including lifts/ramps. Taxi service appears to be as acceptable as a door-to-door bus which has special features, including a ramp or lift for wheelchairs.

11. About 11% of the handicapped group use wheelchairs or walkers, implying they need a vehicle which has a lift or ramp. (However, most feel they can use taxis.) This group has more problems as a whole than the severely handicapped group, particularly in relation to bus use. They also have a lower trip making rate (0.5 vs. 0.8) and make fewer "optional" trips, i.e., social/recreational.

These data and conclusions are in general usable by planners in other urban areas. The incidence of transportationally handicapped will vary with the fraction of the persons who are .

elderly and the fraction who are work disabled, as indicated by census data. The specific problems with using a fixed route, fixed schedule bus service will vary between cities according to weather conditions and level of service offered.

1. INTRODUCTION

1.1 BACKGROUND

An UMTA sponsored Service and Methods Demonstration project is being conducted in Portland by the Tri-County Metropolitan Transportation District (Tri-Met) to test a particular system of providing special transportation services to handicapped and elderly persons. As part of this project a survey was conducted by Tri-Met to gather "before" data for planning and evaluation purposes. The survey was to measure the incidence of transportation handicapped persons, their pre-demonstration travel behavior, and the travel problems of both handicapped and elderly persons.* The results of this survey represent one of the more comprehensive sets of data in existence on this subject covering functional capabilities, health problems, demographic descriptions and attitudinal information.

These survey results are of interest to other regions because U.S. DOT UMTA regulations now state that after September 30, 1976, project approvals will only be granted to transportation improvement programs which contain project or project elements which are designed to benefit elderly and handicapped persons. Thus, planning data on this topic are greatly in demand at this time.

Because of the aforementioned comprehensiveness of the data and the pressing national need for such data, it was determined by UMTA and Transportation Systems Center (TSC) that the survey results should be published as a special interim report.

* The planned system is designed for handicapped persons of all ages who cannot use public transportation; survey results show that approximately three-fourths of the handicapped are elderly (65 and over).

1.2 THE DEMONSTRATION PROJECT

The Portland project is an exemplary demonstration within UMTA's Services and Methods Demonstration Program (SMD) and pertains specifically to the SMD objective of improving transportation services for transit dependent persons. The project will provide a city-wide specialized, door-to-door transportation service to certified elderly and other handicapped persons of all ages who cannot use the regular bus service. It will also evaluate an automated fare collection system, previously tested in Naugatuck Valley, Connecticut, which will allow monthly billing to the individual and/or to a social agency mandated to pay for the trip in question. Thus, it will be a major test of a transit operator's ability to provide special service to a special group and coordinate this service with the social agencies that are involved. Operations are to commence in December, 1976 and will continue for two years.

1.3 SITE DESCRIPTION

The City of Portland, Oregon, is the demonstration project service area. Portland, the largest city in the state, is located on the Oregon-Washington border, across the Columbia River from Vancouver. The city, according to the census data, has an uncommonly high percentage of its population who are over 65 years of age -- 14.7%. (Nationally about 10% of the population is 65 or over.) The fraction who are work-disabled is comparable to other cities -- 7%.

The city was recently identified as providing the best quality of urban life of an American city. Notwithstanding this, it is still a big city with big city problems--poverty, crime, urban decay, etc.

The city has a good bus system for its size and location. Tri-Met operates over 400 buses on 49 lines at good service levels and moderately low (35¢) fares.

2. SURVEY DESIGN

2.1 OVERVIEW

A household survey was conducted to search out transportation handicapped persons and interview them. The specific objectives were:

1. to measure the incidence of transportation handicapped persons,
2. to measure their current travel behavior, and
3. to measure their attitudes, perceptions and problems relative to traveling within Portland.

The plan was to identify a random sample of households and screen the inhabitants relative to some definition of handicapped. By screening all members of a known fraction of Portland households, the handicapped incidence could be estimated.

It was concluded that a door-to-door canvassing would be better than a telephone survey. This would allow the definition of transportation handicapped to be presented to household members in written form, to assure communication of what was meant by the term so that the screening and counting process would be as accurate as possible.

A random process was used to select 130 houses, each of which was to be the starting point of a cluster of approximately 50 houses that would be approached. To properly represent the complete population, interviews were also taken of persons living in institutions.

The survey was conducted in two phases. In the first phase, basic demographic information was taken on all household members and all members were screened for possible transportation handicaps (see Screening Form, Appendix A). In the second phase, those persons who had been identified as transportation handicapped were interviewed in depth (see Interview Question-

naire, Appendix A). The procedure for institutions was slightly different. For the screening phase, directors of 30 selected institutions (certain types, such as prisons, were excluded) were asked to assess the capabilities of their residents. From this large pool a representative number of residents was randomly chosen for full interviews.

In addition to those identified as transportation handicapped, a fraction of the able-bodied elderly (ABE) persons who were not screened as handicapped were also interviewed. There were two reasons for this. First, although the demonstration system is being designed for handicapped persons, there is a concern in Portland and by UMTA, for all elderly people. Second, this allowed a checking of the screening accuracy, to see if those who were screened as able-bodied would also be rated as able-bodied based on the complete interview.

2.2 THE DEFINITION OF TRANSPORTATION HANDICAP

The UMTA regulations applicable to this subject¹ define elderly and handicapped persons as those who "are unable without special facilities or special planning or design to utilize mass transportation facilities and services as effectively as persons who are not so affected." Based on this definition, the concern is not the medical reason for a person's incapacities, but whether he/she can or cannot use conventional public transportation. Thus, a functional rather than a medical definition of handicapped was employed. Eight specific activities were defined that are often required when a person attempts to use conventional, fixed route, fixed schedule mass transit. These activities are:

1. Get on or off a public transit bus
2. Go (walk) more than 2 or 3 blocks

¹U.S. DOT, "Transportation for Elderly and Handicapped Persons," Federal Register, Vol. 41, No. 85, April 30, 1976.

3. Wait, standing for more than 10 minutes
4. Keep balance while standing on a moving transit vehicle
5. Move in crowds
6. Read information signs (not including foreign language problems)
7. Grasp coins, tickets or handles
8. Understand and follow transit directions (not including foreign language problems)

During the door-to-door canvassing or screening, when a contact was made, a card was presented listing these eight activities. A household member contacted was asked to look over the list and identify whether any household member "has any problem using public transportation because their condition makes it difficult to perform any of these activities." Persons identified as transportation handicapped through this process (and a portion of the able-bodied elderly) were interviewed in depth. During the interview they were asked whether they could perform each of these activities easily, with some difficulty, with great difficulty, or not at all. The list of activities is a modified version of a list employed in work done by Abt Associates.²

Although the list of activities was prepared with Portland's fixed route bus system in mind, the idea was to develop a standard list which could be used in surveys in other cities as well. The list might need to be modified when used in another area if that city wishes to broaden or narrow the definition of handicapped and/or has a different type of public transportation system, e.g., a rail rapid transit facility. Also in analyzing the survey results, a more stringent set of criteria of who is handicapped can be used, e.g., only those people who report they can perform one of the eight functions "with great difficulty" or "not at all." Thus, the severity

²Abt Associates, Inc., TRANSPORTATION NEEDS OF THE HANDICAPPED: TRAVEL BARRIERS, prepared for U.S. DOT, Contract No. T8-304, August, 1969, p. 16.

and consequently the incidence, can be scaled up or down to fit local objectives.

In this Portland survey, the following criteria were used. As stated earlier, the interviewee was asked to respond to the eight functions in terms of whether each could be done "easily," "with some difficulty," "with great difficulty" or "could not be done at all." The respondents were classified as follows:

1. Able-bodied - Those who claimed "some difficulty" on no more than one function, saying all the rest could be done "easily."
2. Moderately Handicapped - Those who claimed "great difficulty" on no more than one function, saying that all the rest could be done "easily" or with "some difficulty."
3. Severely Handicapped - All the rest, i.e., those who claimed they "could not do" any function or had "great difficulty" with more than one.

This is an arbitrary procedure but allows some distinction between moderately and severely handicapped for readers of this report who are so interested. It also eliminates the slightly handicapped persons who have only minor trouble with one specific activity; many people have some trouble "keeping their balance on a moving transit vehicle."

2.3 THE SCREENING AND INTERVIEWING QUESTIONNAIRE

The screening and interviewing questionnaires are included in Appendix A and are self-explanatory. As stated earlier, the screening questionnaire is designed to identify the household members by age and sex and to determine if any members could possibly be transportation handicapped. The interview questionnaire is designed to solicit these basic groups of information:

1. Degree of functional handicap, based on the eight activities and the classification procedure developed above
2. Data on all trips by mode and purpose, for the last 48 hours
3. Perceived problems in using the existing bus service
4. Health problems, given in terms of primary, secondary and tertiary problems
5. Any aids used (e.g., wheelchairs, canes) in terms of single aid used, second, and third aid
6. The degree of difficulty the interviewees report they have with six different public transportation modes, including a door-to-door bus with a lift or ramp*
7. Demographic data

2.4 THE SAMPLE

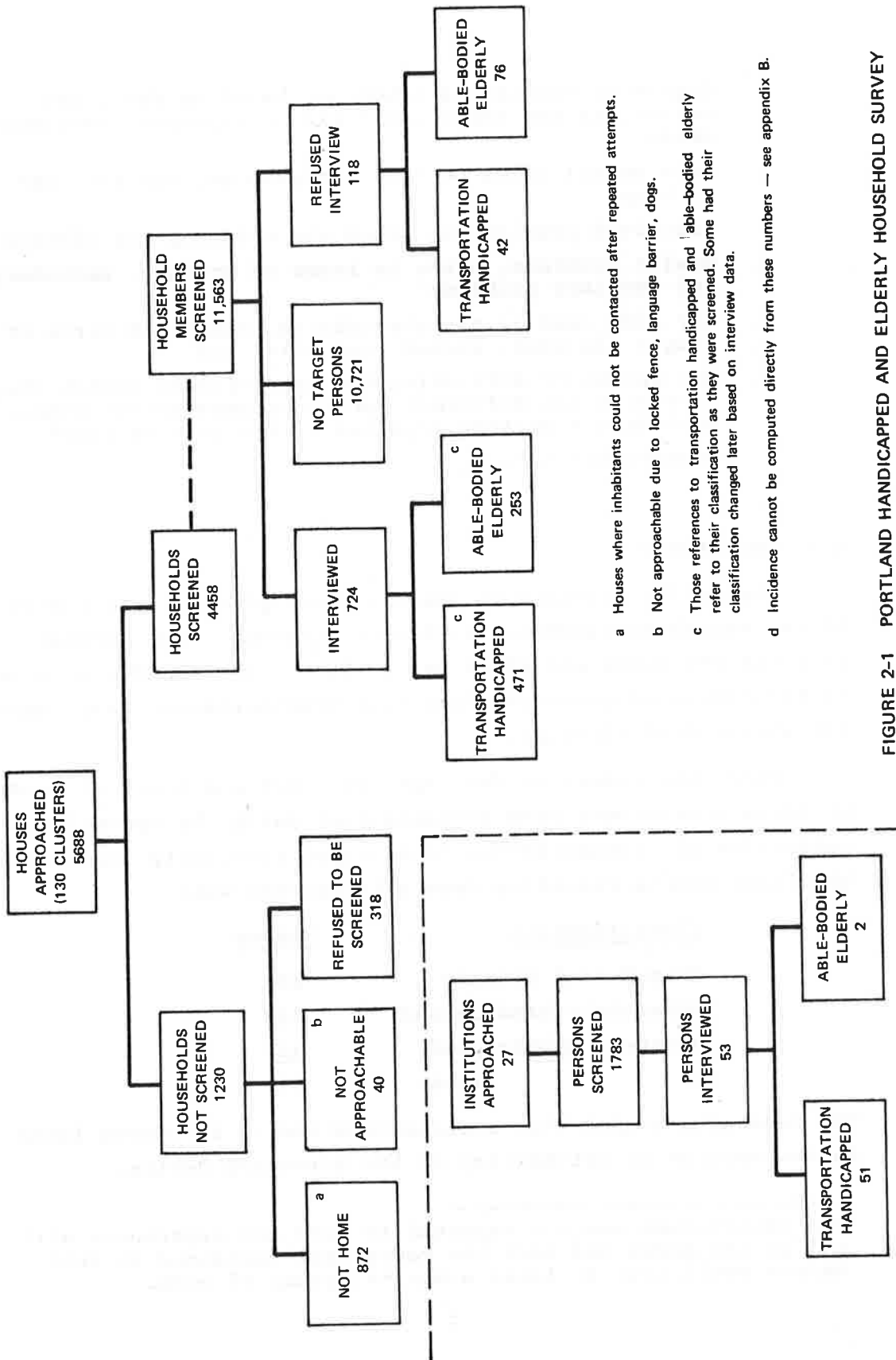
Figure 2-1 presents an overall description of the sample. Of the houses approached, 78.4% were screened. The refusal rate for the screening phase was 6.7%. The complete data set is 777 completed questionnaires (524 transportation handicapped, 255 able-bodied elderly).

After the interview data was processed and analyzed, some of those interviewed were re-classified using the operational definition of transportation handicapped previously discussed. The final sample resulting from this process was:

<u>Classification</u>	<u>Number</u>
Able-Bodied Elderly	271
Moderately Handicapped	189
Severely Handicapped	<u>317</u>
Total	777

The reasoning behind this reclassification is discussed later in the section on Reliability of the Screening Device.

*The interviewee was not expected to have had experience with all of the modes and thus the modes were explained so that he/she would have at least a minimal grasp of each.



- a Houses where inhabitants could not be contacted after repeated attempts.
- b Not approachable due to locked fence, language barrier, dogs.
- c Those references to transportation handicapped and able-bodied elderly refer to their classification as they were screened. Some had their classification changed later based on interview data.
- d Incidence cannot be computed directly from these numbers — see appendix B.

FIGURE 2-1 PORTLAND HANDICAPPED AND ELDERLY HOUSEHOLD SURVEY

2.5 FIELD PROCEDURES

The survey was started as a clustered random household survey. The questionnaires were pre-tested by interviewing a few handicapped and elderly persons. The data takers were university students trained by the survey supervisor. Canvassing took place between 6 and 9 PM Monday through Friday and between 9 AM and 1 PM on Saturday. An attempt was made to have each day of the week adequately represented since data on the past two days of travel were to be taken from each person who was interviewed. There was a calculated risk in attempting the house-to-house approach since much of the canvassing would be done after dark.

After the data takers had worked four evenings, it was determined that the incidence of elderly being interviewed was too low and that the fraction of households with no one at home was too high. Because of the darkness, apparently many persons, and particularly seniors, were not willing to answer their doors.

The survey was stopped and procedures redesigned. Several steps were taken:

1. The problems being encountered were publicized through the evening local TV news and newspapers.
2. All remaining clusters were leafleted, telling people of the story presented in the media coverage.
3. People who were not at home were left a message again referring to the media story and a "mail back" questionnaire.
4. Using a reverse telephone directory, the not-at-home houses were telephoned, either to solicit the mail-in questionnaire or to take the screening data and interview data on the phone.

5. Resumption of the survey was delayed until the change to daylight savings time to allow the work to be done before dark.

These procedures brought the not-at-home rate and refusal rates to the acceptable levels cited above.

The specific dates of the survey were:

<u>Time Period</u>	<u>Interviews</u>
First Week 2/29/76	191
Second, Third Weeks 4/25/76 and 5/2/76	428
Weekends 4/30/76, 5/7/76, and 7/14/76	105
Institutional	<u>53</u>
	777

The screening interview took about five minutes to complete and the full interview required about 30 minutes.

2.6 REPRESENTATIVENESS OF THE SAMPLE

Table 2-1 compares age and sex breakdowns of the sample with 1970 U.S. Census figures for Portland. The table is based on 10% of the full sample. From the table it appears that the elderly are underrepresented (12.2% vs. 14.8% in the Census). Concerned that this might significantly bias the results of the survey, we counted the elderly in the full sample. The result was 14.1%. Based on this we are confident that the sample accurately represents age distribution in Portland.

TABLE 2-1. AGE & SEX DISTRIBUTION OF SAMPLE*
(%)

AGE	FEMALES		MALES		ALL	
	SAMPLE	CENSUS	SAMPLE	CENSUS	SAMPLE	CENSUS
Under 10 yrs.	13.7	13.4	13.0	15.7	13.3	14.5
10-15 "	7.3	9.2	9.6	10.6	8.4	9.8
16-20 "	6.8	9.5	7.3	8.8	7.1	9.2
21-59 "	50.2	45.4	55.0	47.2	52.6	46.3
60-64 "	7.6	5.5	5.2	5.3	6.4	5.4
65+ "	14.4	17.0	9.9	12.4	12.2	14.8
All ages	100.0	100.0	100.0	100.0	100.0	100.0

*Sample percentages are based on an analysis of 10% of the screened population, i.e., on a randomly selected 1165 individuals (or 470 households) out of the 11,650 persons screened.

Income of the sample households is tabulated in Table 2-2. It is difficult to compare income data from the sample to Census income figures for two reasons. First a large fraction (24%)

TABLE 2-2. SAMPLE HOUSEHOLD INCOME*

INCOME	N	%
\$4,999 OR LESS	74	14.0
\$5,000 - \$9,999	79	14.9
\$10,000 - \$14,999	90	16.9
\$15,000 - \$24,999	82	15.5
\$25,000 OR MORE	34	6.4
REFUSALS	125	23.6
NOT ASKED	46	8.7
	530	100.0

*Sample percentage based on 10% of screened population, or 470 households.

of those surveyed declined to provide the requested information and it would probably be incorrect to assume that the incomes of these households would be distributed among the income categories in the same proportion as those who did answer the question. Second, while the survey income data are expressed in terms of "households", the Census figures are compiled for "families" and "unrelated individuals".

2.7 RELIABILITY OF THE SCREENING DEVICE

The objective of the screening step was to initially classify all the persons in a household as transportation handicapped, able-bodied elderly or other able-bodied, based on the responses given to the transit function question. Detailed interviews were conducted based on the person's classification as screened. During the interview, the transit function question was asked again. When the answers (and resulting classifications) given during the interview were compared to those supplied during the screening phase, inconsistencies were detected. Eight percent of those who were screened as transportation handicapped (TH) were reclassified as able-bodied elderly (ABE) as a result of different responses during the interview. Conversely, 10% of those who were initially thought to be ABE were changed to moderately transportation handicapped (MTH) or severely transportation handicapped (STH) after their interviews. The net shift is shown in Table 2-3 as well as the shift which would result if all able-bodied elderly persons had been interviewed.

TABLE 2-3. SHIFTS IN TARGET GROUP CLASSIFICATION

	Classification Based on Screening	Classification Based on Interview		
		ABE	MTH	STH
Actual Survey Results	TH - 522	42	167	313
	ABE - 255	229	22	4
	Total - 777	271	189	317
Results if all ABE persons were interviewed	TH - 522	42	167	313
	ABE* - 969	870	84	15
	Total - 1491	912	251	328

*expanded by 3.8

The lower half of Table 2-3 indicates that if all ABE had been interviewed, the net increase in TH between screening (522 TH) and interviewing (579 TH) would have been 57 persons. The data show that when the person responding to the screening questions was not the person who was later interviewed, the error rate was considerably higher.

While comparatively few (8 - 10%) people were reclassified because of the screen/interview conflict, answers given on any one question sometimes varied radically as shown in Table 2-4.

TABLE 2-4. INTERVIEW RESPONSES OF PERSONS WHO INDICATED
"NO DIFFICULTY" WHEN SCREENED

Activity	n	Difficulty with Activity (Interview)				
		Easy %	Some %	Great %	Can't Do %	Don't Know %
1. Get on/off Bus	637	54.6*	24.5	11.8	8.8	0.3
2. Walk 2-3 blocks	517	64.8	18.2	8.7	8.1	0.2
3. Wait (stand) 10 minutes	516	70.7	13.8	10.1	5.2	0.2
4. Balance in Moving Vehicle	592	52.4	20.3	16.4	10.3	0.7
5. Move in Crowds	709	59.1	17.3	14.2	7.9	1.4
6. Read Transit In- formation	479	81.2	9.8	4.4	4.4	0.2
7. Grasp Coins/Handles	478	86.8	7.3	2.1	3.6	0.2
8. Understand Transit Directions	756	82.7	8.7	5.0	3.6	0.0

*(Only) 54.6% of those who were screened as having "no difficulty" getting on/off transit vehicles said in the interview that it was "easy" for them to perform this function.

What are the possible reasons for such a disparity between screened and interview answers? First, the person answering the questions during the screening process was not always the person who was later interviewed. Giving answers for another person is bound to result in some error. Second, there is a difference between the screening and interview situations. Because the screening questions are asked at the door, the respondent might not deliberate as carefully about his/her answers. Some might even have the attitude of "answering these questions as quickly as possible so I can get on with what I'm doing." The interview, on the other hand, almost always took place with the data taker

and the interviewee seated within the house. The respondent had agreed to be interviewed, realizing it would take some time. Because this was a personalized interview (as opposed to screening questions dealing with all household members) the respondent might be motivated to consider his/her answers more carefully. Third, the element of pride might be an influence. A person might be less willing to acknowledge handicaps during a brief, at-the-door interview than during the lengthy, more personalized interview situation.

Thus the perfunctory nature of the screening process does cause errors. The net effect is that the screening device tends to understate the TH population. This affects the estimate of the TH incidence as discussed in the next section and in Appendix B.

3. SURVEY RESULTS

3.1 INCIDENCE RATES

3.1.1 Incidence, Correction Factors and Data Presentations

The computation of incidence of transportation handicapped persons in Portland is complex because of two problems. As previously stated, based on differences in screening and interview answers, some persons who were screened as TH were reclassified as ABE and vice versa. Additionally only about one-fourth of those persons screened as ABE were interviewed. If all had been interviewed, some would have been reclassified as TH. When the data is factored to account for the screening errors and lower sampling rate of the ABE, the transportation handicapped incidence in Portland is 5.5%. (A computation which accounts for these screening/interview problems is provided in Appendix B.)

The second problem is that an insufficient number of institutional interviews were obtained to accurately reflect Portland's ratio of institutional to household residents. Because of the disproportionately high number of TH persons living in institutions, a correction factor is in order.

To reflect the under-representation of the institutionalized in the sample, the incidence is corrected from 5.5% to 5.75% (see Appendix B for computation). Current estimates of transportation handicapped incidence in U.S. metropolitan areas range from 3.8% to 6.7% of the urban population.¹ The present study

¹U.S. Department of Transportation, Transportation Problems of the Transportation Handicapped, Volume 1 - The Transportation Handicapped Population, Definition and Counts, August, 1976. This report, edited by Crain & Associates, is a composite of findings obtained by three UMTA research contractors--Abt Associates, PMM/Survey Research Center and Grey Advertising. These studies and other studies that these three contractors used and referenced in their work are listed, along with the incidence value found, in the bibliography.

indicates that the Portland incidence is toward the high end of this range, probably due to Portland's relatively high concentration of elderly people.

These correction factors, in general, do not come into play in presentations of the data not concerning incidence. The single exception is where the TH and ABE data are combined, e.g., when the origin/destination pattern of all trips is shown. In these cases, the ABE data are expanded by a factor of 3.8 to reflect the lower sampling rate.

3.1.2 By Handicap Classification

Table 3-1 gives the incidence relative to the classification used in this analysis.

TABLE 3-1. TRANSPORTATION HANDICAPPED INCIDENCE
IN PORTLAND

	MTH	STH	ALL TH
%	2.55	3.20	5.75
Persons*	9,818	12,320	22,138

*Based on 1970 Portland population of 385,000

It should also be emphasized that this calculation of TH incidence is entirely based on the definitions of "moderately" and "severely transportation handicapped" that are used herein. Although the definitions used here are generally consistent with definitions used in other major studies, other definitions are possible and would produce quite different incidence rates from the same data.

Table 3-1 provides separate figures for the moderately and severely handicapped categories. This convention is followed in most of the rest of this report. This distinction proved to be important in this survey analysis since the moderately handicapped appear to be much more similar, in terms of current mobility, to the able-bodied elderly than to the

severely handicapped. This similarity to the able-bodied elderly is such that some readers of this report may conclude that the "real" TH problem involves only 3.2% of the Portland population instead of 5.75%.

We have also delineated a smaller and more intensely handicapped segment, the so-called "level entry" group (i.e., those who use wheelchairs or walkers). Analysis of this group is given at the end of this section on findings.

3.1.3 By Age and Sex

Table 3-2 shows how the incidence of transportation handicapped persons varies dramatically according to age group. For example, the severely handicapped rate is 13 times higher in the elderly (over 65) population than it is in the 21-59 age group. This dominance of the handicapped population by the elderly is crucial and should be borne in mind throughout the rest of the report, particularly when examining demographic characteristics, travel habits, etc.

Incidence of TH among females is generally comparable to that in males except in the over-65 bracket. There, as Table 3-2 shows, females exhibit much higher incidence rates. The reason for this is probably the difference in longevity between the sexes. Because females live longer than males, the average age of elderly females will be higher than the corresponding males. Thus, because TH incidence appears to increase markedly with age, elderly females may show higher TH incidence than their male counterparts because as a group they are "more elderly."

TABLE 3-2. TRANSPORTATION HANDICAPPED INCIDENCE BY AGE AND SEX

AGE	PERSONS CONTACTED ^a	FEMALES			MALES			COMBINED		
		MTH	STH	All TH	MTH	STH	All TH	MTH	STH	All TH
10-15	979	0.0 ^b	0.5 ^b	0.5	0.4	0.0	0.4	0.2	0.2	0.4
16-20	827	0.0	0.3	0.3	0.0	1.7	1.7	0.0	1.0	1.0
21-59	6127	0.8	1.8	2.6	0.5	0.9	1.4	0.6	1.3	1.9
60-64	746	3.0	3.3	6.3	3.1	3.1	6.2	3.0	3.2	6.2
65+	1421	12.8	19.5	32.3	7.2	12.9	20.1	10.6	16.9	27.5
All	10,100	2.5	4.0	6.5	1.2	2.1	3.3	1.8C	3.1C	4.9C

^aNumber of people in the sample over 10 years of age who were contacted and had the opportunity to be classified as TH. (Expanded from 10% sample).

^b0.0% of females 10-15 years of age were found to be moderately handicapped; 0.5% severely handicapped.

^cNote that this is the incidence of TH in the sample and does not account for under-representation of the institutionalized, screening errors, etc. See Appendix B for adjustments.

3.2 CHARACTERISTICS OF THE TRANSPORTATION HANDICAPPED

3.2.1 Demographics

Table 3-3 gives the demographic data for the groups of people interviewed. The essence of this data is that the TH group are about 2/3 female, 2/3 elderly, about 2/3 have household incomes under \$5,000 and about 1/3 have an automobile available and drive it.

TABLE 3-3. DEMOGRAPHICS OF ELDERLY AND HANDICAPPED

	ABE		MTH		STH	
	%	Std. Dev:	%	Std. Dev:	%	Std. Dev:
Female	61.7 ^a	3.0	69.1	3.4	67.4	2.6
Male	38.3	3.0	30.9	3.4	32.6	2.6
10-15 Years of Age	na	na	1.1 ^b	0.8	0.6 ^b	0.4
16-20 " " "	na	na	0.0	?	2.5	0.9
21-59 " " "	na	na	17.7	2.8	22.8	2.5
60-64 " " "	na	na	10.8	2.3	6.6	1.4
65+ " " "	100	?	70.4	3.3	67.4	2.6
\$0-\$4,999 Household Income	40.3	3.2	63.9 ^c	3.7	58.7	3.0
\$5,000-\$9,999 Household Income	36.1	3.1	21.3	3.1	19.9	2.4
\$10,000-\$14,999 " "	11.6	2.1	7.7	2.1	9.8	1.8
\$15,000-\$24,999 " "	7.7	1.7	3.6	1.4	8.7	1.7
\$25,000+ " "	4.3	1.3	3.6	1.4	2.9	1.0
1 Person in Household	33.3	2.9	54.0	3.6	27.8	2.5
2 Persons in Household	54.2	3.0	30.7	3.4	37.2	2.7
3 " " "	7.0	1.5	3.2	1.3	12.0	1.8
4 " " "	1.5	0.7	2.1	1.0	6.9	1.4
5+ " " "	1.1	0.6	1.6	0.9	2.2	0.8
Institutionalized Persons	2.6 ^d	1.0	7.4	1.9	12.3	1.9
Licensed to Drive	56.2	3.0	38.4	3.6	25.3	2.5
0 Autos in Household ^e	31.1	2.8	51.9	3.6	50.8	2.8
1 " " "	52.7	3.0	36.0	3.5	32.5	2.6
2 " " "	15.8	2.2	9.5	2.1	13.2	1.9
3 " " "	0.4	0.4	2.6	1.2	3.5	1.0
0 Drivers in Household ^f	30.8	2.8	51.3	3.6	50.2	2.8
1 " " "	41.4	3.0	33.9	3.4	29.7	2.6
2 " " "	26.4	2.7	13.2	2.5	14.8	2.0
3+ " " "	1.5	0.7	1.6	0.9	5.3	1.3
Auto Always Available ^g	57.4	3.0	37.1	3.5	36.2	2.7
Auto Usually Available	16.3	2.2	14.5	2.6	19.7	2.3
Auto Sometimes Available	13.3	2.0	25.3	3.2	25.2	2.5
Auto Never Available	13.0	2.0	23.1	3.3	18.8	2.2
Drive Daily ^h	41.0	3.9	34.2	5.3	27.6	4.5
Drive Frequently	36.0	3.8	35.2	5.4	33.7	4.7
Drive Weekly	5.6	1.8	3.8	2.2	6.1	2.4
Drive Occasionally	17.4	3.0	26.6	5.0	32.7	4.7

TABLE 3-3. DEMOGRAPHICS OF ELDERLY AND HANDICAPPED (cont.)

	ABE		MTH		STH	
	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.
Working Full Time	6.3	1.5	9.6	2.1	5.2	1.3
Working Part Time	9.6	1.8	3.7	1.4	1.6	0.7
Student	0.4	0.4	1.6	0.9	2.3	0.8
Keeping House	3.3	1.1	1.6	0.9	6.5	1.4
Retired--Not Looking	80.1	2.4	82.4	2.8	82.6	2.2
Unemployed--Looking	0.4	0.4	1.1	0.8	1.9	0.8
1 Year at Address	7.4	1.6	12.8	2.4	11.2	1.8
1-3 Years at Address	10.0	1.8	9.0	2.1	13.4	1.9
3-5 Years at Address	7.4	1.6	10.1	2.2	9.9	1.7
5-10 Years at Address	11.2	1.9	10.1	2.2	11.5	1.8
10-15 Years at Address	10.4	1.9	11.2	2.3	12.8	1.9
15+ Years at Address	53.5	3.0	46.8	3.6	40.9	2.8

^a61.7% of able-bodied elderly are female.

^bThis age distribution is from the 10% survey sample.

^c63.9% of moderately handicapped live in households having total incomes of less than \$5,000. Persons in institutions supplied their own personal income. Note that 14% of those interviewed refused to supply this information.

^d2.6% of able-bodied elderly live in "institutions" rather than "households."

^eIncludes persons living in institutions.

^fIncludes persons living in institutions.

^g"Auto available" means as a driver or as a passenger.

^gDrivers only.

TABLE 3-4. DISTRIBUTION OF HEALTH PROBLEMS
(1=Primary Health Problem, 2=Secondary Problem, 3=Tertiary Problem)

	(%)								
	ABE			MTH			STH		
	1	2	3	1	2	3	1	2	3
No Problem *	67.0	89.4	98.2	6.9	48.1	78.3	1.3	42.7	74.4
Arthritis **	9.2	2.5	0.4	35.4	9.5	1.6	18.3	11.7	1.3
Orthopedic	2.2	0.0	0.0	12.2	3.2	3.7	13.2	6.0	1.9
Visual Impairment	3.7	1.1	0.0	10.1	5.3	2.1	12.6	7.3	1.9
Heart Ailment	5.1	1.5	0.0	5.8	11.1	2.6	11.7	6.3	3.5
Stroke	0.7	0.4	0.0	1.1	0.5	0.0	6.9	0.9	0.3
Spinal Cord	0.0	0.0	0.0	3.2	0.5	0.5	2.5	0.6	1.3
Respiratory	0.7	0.8	0.0	3.2	3.2	1.1	2.2	1.6	1.3
Hearing Impairment	4.4	1.8	0.4	2.6	7.4	2.6	1.3	6.6	5.0
Amputee	0.0	0.0	0.0	1.1	0.5	0.0	1.9	0.3	0.3
Palsy	0.0	0.0	0.0	0.5	0.0	0.0	2.5	0.3	0.0
Multiple Sclerosis	0.0	0.0	0.4	1.1	0.0	0.5	1.6	0.0	0.3
Cancer	0.7	0.0	0.0	1.6	1.1	0.5	0.9	0.3	0.3
Epilepsy	0.4	0.0	0.0	0.5	0.0	0.0	0.6	0.3	0.3
Muscular Dystrophy	0.0	0.0	0.0	0.5	0.0	0.0	0.3	0.0	0.0
Renal Failure	0.4	0.4	0.0	0.5	0.5	0.5	0.3	1.6	0.0
Digestive Disorder	0.0	0.0	0.4	0.0	1.1	1.1	1.9	1.9	2.2
Polio	0.4	0.0	0.0	0.0	0.5	0.5	1.9	1.3	0.3
Cystic Fibrosis	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
Speech Impairment	0.0	0.0	0.4	0.0	0.0	0.0	0.0	1.3	0.6
Other	5.1	2.2	0.0	13.7	7.4	4.2	17.6	9.1	4.4
	n = 1037			n = 189			n = 317		

*67.0% of able-bodied elderly say they have no primary health problem; 89.4% have no secondary health problem; 98.2% have no tertiary health problem.

**9.2% of ABE listed arthritis as their primary health problem; 2.5% listed it as secondary; 0.4% listed it as tertiary.

3.2.2 Health Problems

Health problems which affect elderly and handicapped persons are listed in Table 3-4. They are ranked roughly according to the overall frequency with which they occur in the sample. Separate profiles are provided for able-bodied elderly, moderately handicapped and severely handicapped persons. Within each category, the percentage of the group reporting the condition as their first, second, or third most important health problem is given.

It can be seen from the table that handicapped persons are far more likely to have one or more health problems than are the able-bodied elderly. (Only 1.3% of the severely handicapped indicated that they had no health problem compared to 67% of the able-bodied elderly.)

Health problems of the elderly and handicapped differ somewhat according to age as shown in Table 3-5.

TABLE 3-5. MOST PREVALENT HEALTH PROBLEMS VS. AGE

RANK ORDER	ABE	MTH <65	MTH 65+	STH <65	STH 65+
1	NO Problem	Arthritis	Arthritis	Other	Arthritis
2	Other	Other	Orthopedic	Orthopedic	Other
3	Arthritis	Spinal	Other	Heart	Visual
4	Heart	Orthopedic	Visual	Visual	Heart
5	Hearing	Respiratory	NO Problem	Palsy	Orthopedic
6	Visual	NO Problem	Heart	Spinal	Stroke
7	Orthopedic	Visual	Hearing	Respiratory	Amputee

Particularly striking here is the total absence of arthritis as a major problem to the severely handicapped under 65 years of age. Also, any attempt to make a definitive statement about the health problem afflicting handicapped and elderly must be tempered by the consistently high ranking of "other" in all classifications. In other words, the TH reported a wide range of impairments - much wider than the list (See Table 3-4) from which they were allowed to choose.

3.2.3 Duration of Primary Health Problem

Interviewees were asked how long they had had their primary health problem. Problems that had existed 3 months or less were excluded. (Some long-term problems that were just starting could have been excluded by this process, but the probability of this is very small.)

Well over 90% of all persons interviewed who did report health problems that were not excluded by the three month criteria indicated that their primary problem had affected them for over one year. As Table 3-6 shows, there is no significant difference in the duration of the condition among able-bodied elderly or handicapped persons.

TABLE 3-6. DURATION OF HEALTH PROBLEMS

<u>Duration of Primary Health Problem</u>	<u>ABE (%)</u>	<u>MTH (%)</u>	<u>STH (%)</u>
0 - 3 Months	3.5	0.0*	0.0*
3 - 6 Months	1.2	2.3	2.9
6 - 9 Months	0.0	0.0	1.3
9 - 12 Months	1.2	1.1	3.5
12+ Months	94.1	96.6	92.3

*Short term (under 3 months) handicaps were not included in the survey.

3.2.4 Use of Mechanical Aids

Table 3-7 shows the striking relationship between the use of mechanical aids for moving about and classification as transportation handicapped.

TABLE 3-7. AIDS USED BY HANDICAPPED AND ELDERLY
(%)

	ABE				MTH				STH			
	No. of Aids Used				No. of Aids Used				No. of Aids Use			
	1	2	3	4	1	2	3	4	1	2	3	4
No Aid	96.3*	99.3	100.0	100.0	68.8	95.8	99.5	99.5	39.7	75.7	94.6	98.
Support Cane	1.8**	0.7**			21.7	1.1			24.6	5.4	0.6	
Other Person	0.4				2.6	0.5		0.5	7.3	6.6	2.2	0.
Walker					0.5				8.8	4.1	0.3	
Wheelchair-Coll									8.5	0.9		0.
Crutches	0.4				0.5	0.5			4.4	0.9	0.6	
Hearing Aid	0.7				3.7	1.1			0.9	1.9	0.9	
Blind Cane									1.9	0.6		
Back Brace					1.6				0.9	0.6		
Braces					0.5				1.3	1.3		
Car Controls	0.4					0.5				0.6		
Wheelchair-Non-Coll									0.6	0.3		
Wheelchair-Motor									0.6			
Art. Limb						0.5	0.5			0.3		
Van Lift										0.3		
House Elevator										0.3		
House Ramps											0.6	
Seeing Eye Dog												

* 96.3% of able-bodied elderly do not use a mechanical aid.

** 1.8% of the able-bodied elderly reported using a support cane as the "first" aid; 0.7% reported using it as their "second" aid.

3.3 TRAVEL PATTERNS

3.3.1 The Trip Data

Before discussing the trip data, some comments are necessary on the development of these data. Each person interviewed, whether they were screened as able-bodied elderly or as transportation handicapped, was asked about the trips they took during the last 48 hours. These data are then used to show the distribution of trips by origin/destination, purpose, etc. A problem arises, however, if one wishes to analyze all trips taken by able-bodied elderly and handicapped, since the former were sampled at a lower rate. For this aggregate analysis, we have expanded the ABE trips by an appropriate factor so that they would be correctly weighted with respect to the TH trips.

To guide the reader through the following tables, these are the numbers of trips taken by those sampled in each classification, over a 48 hour period.

<u>Classification</u>	<u>Persons</u>	<u>Trips</u>
ABE	271	768
ABE (expanded)*	1030	2918
Moderately TH	189	473
Severely TH	317	520

*The expansion factor is 3.8, i.e., if all ABE were interviewed, there would have been 1030 ABE completed questionnaires.

3.3.2 Trip Rates

The national average trip rate is 2.2 one-way trips per person per day.² Table 3-8 shows lower rates for all

²Alice Randall, Helen Greenhalgh, Elizabeth Samson, Nationwide Personal Transportation Study, Report No. 9, Mode of Transportation and Personal Characteristics of Tripmaker, U.S. DOT, FHWA, November 1973.

members of the sample with the rates declining with increasing level of handicap. A considerable portion of these lowered rates can probably be ascribed to the absence of work trips in this elderly-dominated sample. Nevertheless, it remains clear that the rate of tripmaking varies, in an overall sense at least, with the degree of handicap.

When tripmaking rates are broken down by categories such as age, income, etc. (Table 3-8), it becomes apparent that the handicap classifications are far from homogeneous. For example, young severely handicapped persons make trips approximately as frequently as the able-bodied elderly, and the highest rates of all are evidenced by the few upper income moderately handicapped persons in the sample.

TABLE 3-8. TRIP RATES VERSUS DEMOGRAPHIC VARIABLES

	ABE	MTH	STH
Overall			
Trips per Day	1.4	1.2	0.8
Total Trips, 48 Hours	768	463	520
Male	1.7	1.3	0.8
Female	1.2	1.2	0.9
10-15 Years of Age	N.A.		
16-20 " " "	N.A.	N.A.	1.3
21-59 " " "	N.A.	1.8	1.2
60-64 " " "	N.A.	1.3	0.8
65+ " " "	1.4	1.1	0.7
\$0-\$5,000 Income	0.9	1.0	0.7
\$5,000-\$10,000 Income	1.6	1.4	1.0
\$10,000-\$15,000 "	1.3	1.6	0.6
\$15,000-\$25,000 "	2.4	2.7	1.6
\$25,000 + Income	0.4	2.8	1.1
Driver's License	1.8	1.9	1.3
No Driver's License	0.9	0.8	0.7
Auto Always Available	1.8	1.9	1.1
Auto Usually Available	1.1	0.8	0.8
Auto Sometimes Available	0.8	0.8	0.7
Auto Never Available	0.7	0.9	0.4

3.3.3 Trip Purposes

In all classifications, between 40% - 45% of one-way trips were destined for "home," indicating that almost all round trips were from home to a single destination and return.

Table 3-9 shows the distribution of trip purposes after removing "home" trips from the sample. National figures³ for the general public are provided for perspective, but it should be remembered that the national data is for auto trips only while the Portland figures include all modes.

TABLE 3-9. TRIP PURPOSES

	PERCENT OF TRIPS			
	ABE	MTH	STH	NAT'L
SHOPPING	28.3	36.5	25.5	15.2
RECREATION/SOCIAL	29.3	29.6	30.1	22.4
PERSONAL BUSINESS	19.7	17.5	14.2	1.8
WORK	12.5	8.4	6.0	36.2
MEDICAL/DENTAL	4.4	3.6	14.9	1.8
CHURCH	5.1	2.2	8.2	9.3
SCHOOL	0.7	2.2	1.1	

3.3.4 Trip Modes

In all three classifications, approximately 80% of all trips are made by auto, shown in Table 3-10. As might be expected, the more handicapped a person is, however, the more likely it is that the person will be a passenger in the car rather than a driver. Severely handicapped persons are the largest taxi users, in spite of their generally lower incomes. This apparently reflects their lack of

³Ruth H. Asin, Nationwide Personal Transportation Study, Report No. 10, Purposes of Automobile Trips and Travel, U.S. DOT, FWA, May 1974.

access to other less expensive modes. National figures for the general public for incorporated areas are provided for comparison.⁴

TABLE 3-10. TRAVEL MODES

	PERCENT OF TRIPS			
	ABE	MTH	STH	NAT'L
AUTO DRIVER	60.6	44.8	33.0	53.4
AUTO PASSENGER W/ RELATIVE	17.7	22.5	36.7	—34.1
AUTO PASSENGER W/ FRIEND	5.8	9.0	10.9	
AUTO PASSENGER-AGENCY	0.3	0.2	3.3	
REGULAR BUS	14.1	22.1	10.5	5.1*
TAXI	0.5	0.4	2.9	0.3
OTHER	0.9	0.4	2.5	4.5
SCHOOL BUS	0.1	0.7	0.0	2.6

*Includes all public transit

3.3.5 Purpose Vs. Mode

Ignoring trips to home, the following may be said of the modes chosen for various trip purposes:

1. While the auto/driver mode dominated all destinations, its penetration ranges, for all TH persons, from 72.5% of all work trips to 40.7% of all medical/dental trips; typically, it accounts for 50-60% of the trips to any destination.
2. 11 of the reported taxi trips were for medical/dental trips; these comprised 8.8% of all medical/dental trips.

⁴Alice Randall, Helen Greenhalgh, Elizabeth Samson, Nation-wide Personal Transportation Study, Report No. 9, Mode of Transportation and Personal Characteristics of Tripmakers, U.S. DOT, FHWA, November 1973

3. The highest percentage of bus trips is for shopping (22.5%), followed by personal business (11.8%) and recreation/social (11.5%).
4. More agency-driver trips are to church than anywhere else, but these trips still only comprise 3.4% of all church trips.

3.3.6 Mode Vs. Income

Table 3-11 illustrates the relationships between income and mode choice. All trips, expanded ABE plus TH, are grouped together in this analysis. Recalling that taxis are primarily used for medical/dental trips, Table 3-11 additionally indicates that the taxi users are poor.

TABLE 3-11. RELATIONSHIPS BETWEEN INCOME & MODE CHOICE

	PERCENT OF TRIPS					n
	\$0-\$5K	\$5K-\$10K	\$10K-\$15K	\$15K-\$25K	\$25K+	
Auto Driver	23.8*	40.2	9.8	17.0	9.2	1765
	36.7**	59.8	49.5	70.2	81.1	
Auto Pass.--Friend	31.8	37.6	12.0	13.8	4.7	701
	19.5	22.2	24.2	22.7	16.5	
Auto Pass.--Relative	58.2	29.5	7.4	3.0	1.9	250
	12.7	6.2	5.3	1.8	2.4	
Auto Pass.--Agency	100.0	-0-	-0-	-0-	-0-	19
	1.6	-0-	-0-	-0-	-0-	
Regular Bus	57.1	27.6	13.2	2.1	-0-	498
	24.8	11.6	18.8	2.5	-0-	
School Bus	79.2	-0-	-0-	20.8	-0-	10
	0.7	-0-	-0-	0.5	-0-	
Taxi	84.2	5.5	10.4	-0-	-0-	37
	2.7	0.2	1.1	-0-	-0-	
Other	50.7	-0-	13.0	36.3	-0-	29
	1.3	-0-	1.1	2.5	-0-	

* 23.8% of auto driver trips are taken by those with less than \$5,000 incomes.

** 36.7% of trips taken by those with less than \$5,000 incomes are by auto driver mode.

3.3.7 Trip Length Vs. Classification

Table 3-12 shows the distribution of trip lengths in minutes for the three sample classification groups. National figures (for the general public) in miles for incorporated areas of 100,000 - 999,000 population are shown for comparison.⁵ The Portland trips have been converted to miles by assuming a 20 MPH average speed. Note that the national figures are for automobile trips only, while the Portland figures include all modes (with the automobile predominating, of course).

TABLE 3-12. TRIP LENGTHS

MINUTES	PERCENT OF TRIPS			PERCENT OF TRIPS				
	ABE	MTH	STH	ABE	MTH	STH	NAT'L	MILES
<5	26.2	31.7	17.3					
5-10	27.7	20.5	24.8	69.9	70.6	62.9	65.7	≤ 5
10-15	16.0	18.4	20.8					
15-20	13.7	11.7	16.2					
20-25	2.6	5.0	3.5	24.1	24.7	27.8	18.4	> 5 ≤ 10
25-30	7.8	8.0	8.1					
30-35	0.8	0.4	0.2					
35-40	0.5	0.0	0.6					
40-45	1.0	1.1	2.1	3.3	2.8	5.8	10.8	> 10 ≤ 20
45-50	0.0	0.4	0.6					
50-55	0.0	0.0	0.0					
55-60	1.0	0.9	2.3					
60+	2.6	1.9	3.7	2.6	1.9	3.7	5.1	20+
n =	2918	463	520					

⁵Ruth H. Asin, Nationwide Personal Transportation Study, Report No. 10, Purposes of Automobile Trips and Travel, U.S. DOT, FHWA, May 1974.

3.3.8 Origin/Destination Patterns

Trip origins and destinations were recorded in terms of 17 traffic zones, shown in Figure 3-1. The fine-grain was not accurate enough to present fully here, so it has been aggregated into six "superzones" (outlined on Figure 3-1) and presented in a small trip table, Table 3-13. These data have little relevance outside Portland, but are included here because they show that the greatest number of trips are intrazonal trips. Again, all trips, expanded ABE plus TH, are used in this analysis. These superzones have no relationship to any ultimate service plans, but are only meant to illustrate the general origin/destination pattern.

TABLE 3-13. SUPERZONE TRIP TABLE (% of Trips)

Superzones:	A	B	C	D	E	F
Small zones:	(1,2,10)	(3,4,5,6)	(7,8,9)	(11,12)	(13,14,15,16)	(17)
A	6.2* 7.5	3.8** 5.9***	4.0 3.3	3.8 4.2	3.6 3.5	2.1 2.2
B		4.8 3.5	1.4 1.7	1.4 1.3	2.1 1.5	3.2 2.9
C			14.0 10.4	2.5 6.6	2.8 1.8	1.6 0.8
D				10.4 11.9	5.4 4.7	2.1 3.2
E					16.9 14.0	4.8 5.2
F						0.4 1.0

TH	TH+
	ABE
983	3901

Total Trips****

* 6.2% of TH trips were made within superzone A.
 ** 3.8% of TH trips were made between zone A and B.
 *** 5.9% of all sample trips were made between zones A and B.
 **** About 3% of all trips were miscoded.

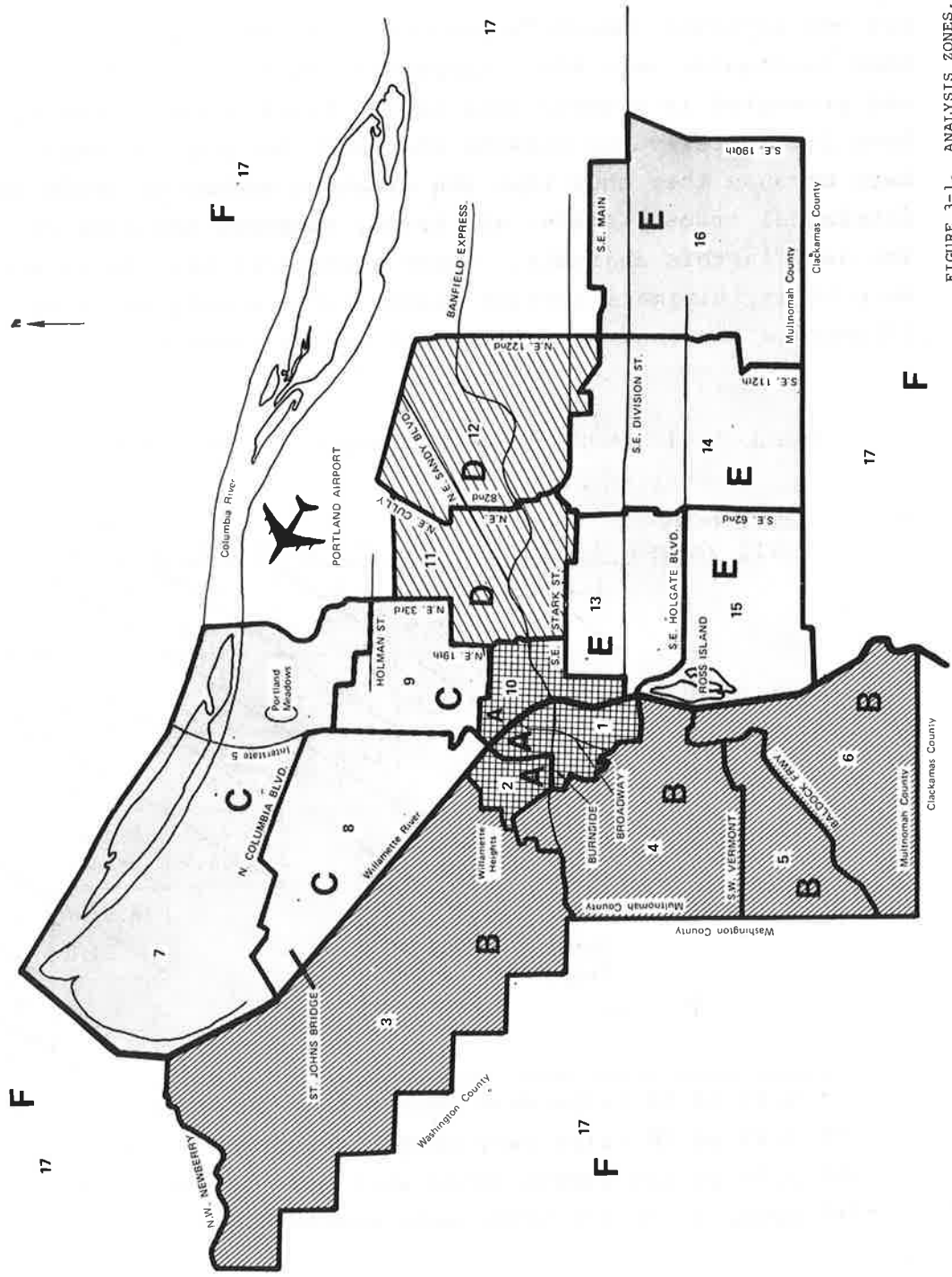


FIGURE 3-1. ANALYSIS ZONES, SUPERZONES - PORTLAND "BEFORE" SURVEY

48.2% of the total trips are intrazonal with three-fourths of these occurring within zones C, D and E. Looking at handicapped trips only, the intra-zonal percentage rises slightly to 52.7 with 41.3% of the trips contained in zones C, D and E. Examination of the 17 zone array reveals that even in the smaller zones, 39.7% of all trips are intrazonal; half of these are concentrated into zones 9, 11, and 13 and fully 10% of the total trips are within zone 11.

3.3.9 Trip Patterns Vs. Time

Table 3-14 shows that 47% of all sample trips are repeated weekly or more often. No significant differences in the trip-making regularity were found among the ABE or TH classifications. Similarly, the trips were scattered fairly evenly among the days of the week with 13-18% of the trips falling on any one day except for Friday and Saturday which accounted for 8.4% and 11.6% of the trips respectively. (The data were adjusted to reflect the differences in sample sizes by day-of-week.) Finally, 27.3% of the trips are repeated at the same time of day, e.g., when a specific trip occurs, it always occurs at 11 AM.

10.5% of the total trips are weekly journeys taken on the same day of the week; 90.1% of these trips are also taken at the same time of day. Adding these trips to the daily work trips (presuming they are also taken at the same time) produces a total of 12.8% of all trips which occur on a regularly scheduled basis.

68.2% of all trips are made during the 9:00 AM - 4:00 PM period. Shopping, Medical and Personal Business trips are particularly concentrated in this interval with percentages running over 80%. Work and School trips reach high levels (50.1% and 39.2%) in the 7:00 - 9:00 AM period, while

TABLE 3-14. TRIP DESTINATION BY FREQUENCY

	DAILY 5-7 times per week		FREQUENTLY 2-4 times per week		WEEKLY Once a week		OCCASIONALLY Less than once per week	
	%	STD. DEV.	%	STD. DEV.	%	STD. DEV.	%	STD. DEV.
WORK	57.8*	3.2	27.9	2.9	0.4	0.4	13.9	2.2
	31.8	2.2	9.1	1.1	0.2	0.2	1.7	0.3
SCHOOL	79.3	8.4	0	-	0	-	20.7	8.4
	4.3	2.2	0	-	0	-	0.2	0.1
SHOP	2.6	0.6	26.7	1.9	18.6	1.5	52.1	2.0
	3.8	0.9	23.2	1.7	19.3	1.6	16.6	0.8
MEDICAL/ DENTAL	0	-	6.8	2.1	8.0	2.3	85.2	2.9
	0	-	1.3	0.4	1.9	0.5	6.1	0.5
CHURCH	0.9	0.9	10.7	3.0	68.2	4.5	20.2	3.8
	0.2	0.2	1.6	0.5	12.1	1.3	1.1	0.2
PERSONAL BUSINESS	15.2	1.8	7.3	1.3	15.1	1.8	62.4	2.5
	13.5	1.6	3.8	0.7	9.5	1.1	12.0	0.7
RECREATION/ SOCIAL	2.7	0.6	16.8	1.5	16.1	1.4	64.4	1.9
	4.0	0.9	15.0	1.3	17.2	1.5	21.0	0.9
HOME	11.5	0.8	21.2	1.0	15.3	0.9	52.0	1.2
	42.4	2.4	46.1	1.9	39.8	2.0	41.4	1.1
TOTAL	11.4		19.4		16.2		53.0	

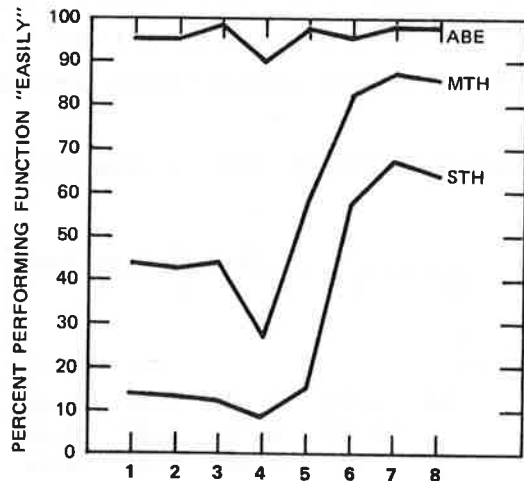
* 57.8% of work trips are made daily; 31.8% of daily trips are work trips.

Recreation/Social trips show the only real penetration of the evening hours with 18.8% of these trips occurring after 6:00 PM. These figures are for the entire sample, but are also representative of the handicapped trips taken alone.

3.4 FUNCTIONAL PROBLEMS IN USING PUBLIC TRANSPORTATION

3.4.1 Transit Function Difficulty Vs. Classification

Figure 3-2 provides a profile of able-bodied elderly, moderately handicapped and severely handicapped persons in terms of the transit functions which, during the interview, they indicated they could perform "easily."



- | | |
|-------------------------------|---------------------------|
| 1 = GET ON/OFF BUS | 5 = MOVE IN CROWDS |
| 2 = WALK 2-3 BLOCKS | 6 = READ TRANSIT INFO |
| 3 = WAIT (STAND) 10 MIN. | 7 = GRASP COINS/HANDLES |
| 4 = BALANCE IN MOVING VEHICLE | 8 = UNDERSTAND DIRECTIONS |

FIGURE 3-2. PROFILE OF FUNCTIONAL CAPABILITY

The profiles of the three groups are similar in shape showing that the transit functions compare consistently with each other in all groups. For example, "Balance in Moving Vehicle" is the most difficult function for all

classifications, while "Grasp Coins/Handles" is the easiest activity to perform regardless of handicap classification.

Greater detail on the degree of difficulty each classification experiences performing the transit functions is provided in Table 3-15 (next page).

3.4.2 Transit Function Factor Analysis

A factor analysis was performed studying the inter-correlations among degrees of difficulty reported on the eight transit functions. The responses for each function were scored as follows: if the respondent said he could perform the function "easily", a score of one was given; "with some difficulty" scored a two; "with great difficulty" scored a three; and could do it "not at all" scored a four. Table 3-16 gives the correlation coefficients among these scores.

TABLE 3-16. TRANSIT FUNCTION FACTOR ANALYSIS

Transit Functions	Transit Functions							
	1	2	3	4	5	6	7	8
1. Get on, off bus	1.00	0.62	0.67	0.64	0.60	0.04	0.35	0.09
2. Go 2, 3 blocks		1.00	0.74	0.57	0.58	0.04	0.28	0.09
3. Wait (stand) 10 mins.			1.00	0.64	0.64	0.05	0.31	0.12
4. Balance in Moving Vehicle				1.00	0.69	0.02	0.26	0.08
5. Move in crowds					1.00	0.13	0.33	0.21
6. Read transit information						1.00	0.37	0.67
7. Grasp coins, tickets, handles							1.00	0.47
8. Understand directions								1.00

This intercorrelation matrix produces no surprises. The first five functions are highly correlated and might be referred to as the "physical mobility" factor. Possibly two or three of these five functions could be deleted from the questionnaires with little affect on the overall results.

TABLE 3-15. TRANSIT FUNCTION DIFFICULTY BY HANDICAP CLASSIFICATION

(%)

	ABE				MTH				STH									
	Easy	Some	Great	Can't Do	Don't Know	Easy	Some	Great	Can't Do	Don't Know	Easy	Some	Great	Can't Do	Don't Know			
1. Get on/off Bus	95.2*	4.4	0	**	0	0.4	44.4	51.3	3.7	0	***	0	0.5	14.9	26.6	32.0	25.9	0.6
2. Walk 2/3 Blocks	95.2	4.4	0	0	0.4	41.3	51.3	7.4	0	0	0	0	0	13.0	17.4	36.7	32.9	0
3. Wait (Stand) 10 Min.	98.9	0.7	0	0	0.4	44.7	51.1	3.7	0	0	0.5	0	0	12.3	18.4	41.5	27.8	0
4. Balance While Moving	90.8	8.4	0	0	0.7	28.2	53.2	17.6	0	0	1.1	0	0	9.2	9.8	43.2	37.5	0.3
5. Move in Crowds	98.5	1.1	0	0	0.4	58.5	36.7	3.2	0	0	1.6	0	0	16.5	21.3	36.2	24.1	1.9
6. Read Transit Info.	96.3	3.7	0	0	0	81.9	9.0	8.5	0	0	0.5	0	0	58.7	14.6	13.3	12.7	0.6
7. Grasp Coins/Handles	98.9	1.1	0	0	0	88.8	9.6	1.6	0	0	0	0	0	67.5	16.9	7.0	8.3	0.3
8. Understand Directions	98.9	1.1	0	0	0	88.3	9.6	2.1	0	0	0	0	0	64.3	14.6	11.5	9.6	0

*95.2% of able-bodied elderly can get on or off a bus "easily."

**No able-bodied elderly have "great difficulty" getting on or off a bus.

***No moderately TH persons are unable to get on or off a bus.

Function 5 was added to relate to claustrophobia but apparently this was overshadowed by the purely physical aspects of moving in crowds. Functions 6 and 8 are logically related since they both require certain mental activities. Function 7 is not highly correlated with any of the other activities.

3.4.3 Health Problems and Functional Capabilities

Many elderly and handicapped people have multiple health problems, a situation which complicates any attempt to discern the relationship between single health conditions and difficulty with transit functions. For example, many people have arthritis in combination with other conditions. To examine the other conditions "separately" (i.e., all people with cancer, etc.) would be misleading because of the presence of the additional and perhaps contributory health condition, namely arthritis.

To simplify this situation, Table 3-17 was developed using only those persons who indicated they had no problem or a single health problem. The table shows a few things quite clearly:

1. People with no health problems generally have much less difficulty with transit functions than those who have any health problem.
2. Those functions which measure information/dexterity capabilities (numbers 6 - 8) are generally not well correlated with health problems. Exceptions to this are the visual impairment/read information combination and, less convincingly, stroke/grasp coins, and palsy with all three functions.

3. Epilepsy, visual and hearing problems do not appear to be related to the mobility functions (1 - 5) at all.
4. The relation between other conditions and the mobility functions is somewhat cloudy although fairly strong for stroke, spinal cord and orthopedic problems. The reason for this is probably that the degree of immobility which results from any of these conditions is largely a function of the severity of the problem (e.g., arthritis can be a nuisance or it can be crippling).

With respect to mobility functions (boarding, walking, balancing, etc.), aid use appears to be a more appropriate indirect indicator of difficulty than health problems. This is probably because a given aid implies a certain level of immobility, depending on the nature of the device.

TABLE 3-17. HEALTH PROBLEMS Vs. DIFFICULTY WITH TRANSIT FUNCTIONS

Health Problems	Transit Functions															
	1	2		3		4		5		6		7		8		
	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.
No Problem	0.4	0.2	0.7	0.3	0.4	0.2	0.7	0.3	0.6	0.3	0	(712)	0	(712)	0	(712)
Amputee	75.0	21.7	50.0	25.0	50.0	25.0	75.0	21.6	75.0	21.7	0	(4)	0	(4)	0	(4)
Arthritis	14.2*	3.2	12.3	3.0	17.4	3.4	23.3	3.9	9.2	2.6	0	(119)	2.5	1.4	0	(119)
Visual	2.4	2.4	0	(42)**	2.4	2.4	7.1	4.0	2.4	2.4	38.1	7.5	0	(42)	9.5	4.5
Palsy	60.0	21.9	60.0	21.9	60.0	21.9	80.0	17.9	80.0	17.9	40.0	21.9	60.0	21.9	40.0	21.9
Cancer	33.3	19.2	16.7	15.2	33.3	19.2	33.3	19.2	33.3	19.2	0	(6)	0	(6)	0	(6)
Hearing	0	(34)	2.9	2.7	0	(34)	5.8	4.0	2.9	2.9	0	(34)	0	(34)	2.9	2.9
Epilepsy	0	(4)	0	(4)	0	(4)	0	(4)	0	(4)	0	(4)	0	(4)	0	(4)
Heart	6.1	3.4	12.2	4.7	10.2	4.3	22.4	6.0	12.2	1.5	0	(49)	0	(49)	0	(49)
Mult. Scler.	50.0	25.0	75.0	21.7	50.0	25.0	50.0	25.0	25.0	21.7	0	(4)	0	(4)	0	(4)
Misc. Dyst.	0	(1)	100	(1)	0	(1)	100	(1)	0	(1)	0	(1)	0	(1)	0	(1)
Orthopedic	30.5	6.0	28.8	5.9	27.1	5.8	40.7	6.4	20.3	5.2	1.7	1.7	5.1	2.9	1.7	1.7
Polio	66.7	27.2	100	(3)	33.3	27.2	100	(3)	33.3	27.2	0	(3)	0	(3)	0	(3)
Respiratory	20.0	17.9	80.0	17.9	40.0	21.9	40.0	21.9	40.0	21.9	0	(5)	0	(5)	0	(5)
Spinal Cord	66.7	19.2	50.0	20.4	66.7	19.3	83.3	15.2	50.0	20.4	0	(6)	0	(6)	0	(6)
Stroke	54.5	15.0	54.5	15.0	63.6	14.5	63.6	14.5	54.5	15.0	8.3	8.0	36.4	14.5	8.3	3.4
Other	15.9	4.4	24.6	5.2	17.4	4.6	27.5	5.4	11.6	3.9	2.9	2.0	1.4	1.4	0.3	0.6

FUNCTIONS

- 1. Get On/Off Bus
- 2. Walk 2-3 Blocks
- 3. Wait (Stand) 10 Min.
- 4. Balance in Moving Bus
- 5. Move in Crowds
- 6. Read Transit Information
- 7. Grasp Coins/Handles
- 8. Understand Directions

* 14.2% of those whose single health problem was arthritis have great difficulty getting on or off a bus or cannot do it at all.

** Parenthesized figures are number of persons with health problems where standard deviation is indeterminate.

3.4.4 Use of Aids and Difficulty with Transit Functions

Table 3-18 shows the relationship between use of mechanical aids and difficulty in performing the transit functions. The survey findings indicated that many TH people use multiple aids when moving about. This situation makes it difficult to relate the use of any single aid with a transit activity. For example, 40% of those who use braces (at all) have great difficulty or cannot board a bus. However, when those who use braces only are examined, none of them has great difficulty performing this function.

In order to clarify the relationships between aids and difficulty with transit functions, only persons using a single aid are listed in Table 3-18. Within the constraints of the rather small populations associated with some of the aids, the following observations are made:

1. As would be expected, people who do not use aids have much less difficulty performing the transit functions than those who do (car controls excepted).
2. The first five transit functions are essentially measures of mobility. The more an aid implies immobility (e.g., wheelchairs versus hearing aids) the more difficulty persons using the aid will have in performing these functions.
3. Relationships between aids and the other functions are less clear (and probably do not exist) except for blind cane/Read information.

3.4.5 Capability to Use Transportation Modes

People were asked in the interview to evaluate six transit "modes" according to their own physical ability to use them. The modes were:

TABLE 3-18. USE OF AIDS Vs. DIFFICULTY WITH TRANSIT FUNCTIONS

Aid	Transit Functions														
	1	2	3	4	5	6	7	8							
%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.						
No Aid	3.8*	0.5	6.6	0.7	6.0	0.6	8.6	0.8	4.9	0.5	3.5	0.5	0.3	2.7	0.5
Wheelchair-Folding	100	(8)**	100	(8)	100	(8)	100	(8)	100	(8)	12.5	11.7	17.1	37.5	17.1
Wheelchair-Fixed	100	(1)	100	(1)	100	(1)	100	(1)	100	(1)	100	(1)	(1)	100	(1)
Wheelchair-Motor	100	(1)	100	(1)	100	(1)	100	(1)	100	(1)	0	(1)	(1)	0	(1)
Walker	100	(12)	100	(12)	91.7	8.0	100	(12)	91.7	8.0	16.7	10.8	8.3	8.0	0
Crutches	66.7	13.6	83.3	10.8	83.3	10.8	83.3	10.8	58.3	14.2	8.3	8.0	16.7	10.8	0
Support Cane	30.8	4.1	30.8	4.1	34.0	4.6	47.0	4.8	27.4	4.3	13.2	3.3	3.8	1.9	6.6
Blind Cane	20.0	17.9	0	(5)	0	(5)	20.0	17.9	0	(5)	100	(5)	20.0	17.9	20.0
Braces	0	(3)	66.7	27.2	66.7	27.2	66.7	27.2	0	(3)	0	(3)	0	(3)	0
Back Brace	0	(5)	20.0	17.9	20.0	17.9	40.0	21.9	20.0	17.9	20.0	17.9	20.0	17.9	20.0
Car Controls	0	(4)	0	(4)	0	(4)	0	(4)	0	(4)	0	(4)	0	(4)	0
Hearing Aid	6.7	6.5	6.7	6.5	13.3	8.8	13.3	8.8	6.7	6.5	6.7	6.5	6.7	6.5	6.7
Other Person	68.2	9.9	50.0	10.7	77.3	10.7	72.7	9.5	68.2	9.9	47.8	10.4	22.7	9.5	34.8

FUNCTIONS

- 1. Get On/Off Bus
- 2. Walk 2-3 Blocks
- 3. Wait (Stand) 10 Min.
- 4. Balance in Moving Bus
- 5. Move In Crowds
- 6. Read Transit Information
- 7. Grasp Coins/Handles
- 8. Understand Directions

* 3.8% of able-bodied elderly and transportation handicapped persons who do not use an aid experience great difficulty getting on/off a bus or cannot do it at all.

** Parenthesized figures are number of persons using aid where standard deviation is indeterminate.

1. Fixed route regular bus
2. Fixed route special bus having lower steps, wider doors, more handrails, better lighting and reserved seats - but with no lift or ramp
3. Fixed route bus with lift or ramp
4. Door-to-door bus service without lift or ramp
5. Door-to-door taxi service using standard 4-door automobile
6. Door-to-door bus service with lift or ramp

If the person being questioned did not appear to understand the difference between these alternatives, the interviewer offered further explanatory detail.

Table 3-19 summarizes the responses by handicap classification.

TABLE 3-19. ABILITY TO USE MODE BY HANDICAP CLASSIFICATION

	ABE		MTH		STH		All TH
	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%
Fixed Rt. Reg. Bus	97.5*	0.9	87.3	2.4	31.1	2.6	59.2**
Fixed Rt. Spec. Bus	97.8	0.9	93.5	1.8	52.4	2.8	73.0
Fixed Rt. Ramp Bus	97.0	1.0	90.2	2.2	51.6	2.8	70.9
Door-to-Door Reg. Bus	98.9	0.6	97.9	1.0	73.7	2.5	85.5
Door-to-Door Taxi	98.9	0.6	99.5	0.5	91.4	1.6	95.4
Door-to-Door Ramp Bus	97.7	0.9	97.8	1.1	90.8	1.6	94.3

* 97.5% of able-bodied elderly can use regularly fixed route bus service "easily" or with "some difficulty".

** Since, according to Appendix B, there are an equal number of MTH and STH, the fraction for all TH is an average of the MTH and STH fractions, i.e., $(87.3 + 31.1) \div 2$.

These results for "fixed route regular bus" are very consistent with those presented earlier in Table 3-15. Transit Difficulty by Handicap Classification, indicating that the functions accurately reflect the capabilities required to use existing "normal" transit.

The table shows that moderately handicapped persons are quite similar to the able-bodied elderly in their ability to use different modes; generally, more than 90% of the members of either group say they can use all modes "easily" or "with some difficulty." The difference between the two groups is that the percentage of "with some difficulty" responses is higher among the moderately handicapped than in the able-bodied elderly.

Severely handicapped persons, however, perceive themselves to be much more limited in the transit modes they can effectively use. Even in this group, however, door-to-door service with easy-entry vehicles can be utilized by more than 90% of the population.

The table also shows clearly that door-to-door service is more important to the handicapped than the special features of the vehicle. Simply "fixing up" existing buses (or buying new ones) raises the percentage of those who can use bus service by 14% (59.2% to 73.0%). However, providing door-to-door service raises the percentage by 27% (59.2% to 85.8%), almost doubling the number of handicapped who can now effectively use bus service. Another 9% (85.8% to 94.3%) are aided if the door-to-door bus includes a lift or ramp.

An important interpretation of the data, based on what would seem to be an internal consistency in the responses, relates to modes 2 and 3. Adding special features to the fixed route bus raises the percentage of users from 59.2% to 73.0%. Adding the lift/ramp to a fixed route bus raises the usage to 70.9%. We interpret this as follows: essentially, all the people who need a lift or ramp to get on a bus feel they couldn't

get over all the curbs and steps to get to the bus; it must come and get them. Those persons who reported they could use a fixed route ramp bus are therefore the same group who reported they could use a fixed route bus with special features. They are not people who need a lift or ramp to get on a bus, merely people who have trouble getting on/off and keeping their balance on buses and see the lift/ramp buses as ones with special features that they could use. Thus it is not really known the numbers of people who must use a lift or ramp to get on a bus who could use a fixed route ramp bus, but the implication is that the number is quite small.

Also pointed out by the data is the fact that none of the transit alternatives would enable all persons to use the service "easily" or even "with some difficulty." Among the severely handicapped, 5.2% feel they would experience "great difficulty" using door-to-door ramp buses and another 3.9% claim they would not be able to use them "at all."

3.4.6 Aid Use and Ability to Use Different Modes

In order to clarify the multiple aid problem (many people use more than one aid, making it difficult to isolate the contribution made by any one aid), Table 3-20 was developed by selecting only those (elderly and handicapped) people who use no aid or a single aid. The reduced sample causes the standard deviations to be somewhat higher than they would have been if multiple aid users had been included.

The table shows that any door-to-door service will allow use by more people than any fixed route service regardless of what types of vehicles are used. Combining door-to-door service with vehicles which are relatively easy to enter and exit (taxis and ramp or lift-equipped buses) results in the most usable transit system. Note also how closely taxis and door-to-door ramp buses compare with each other.

TABLE 3-20. AID USE vs. ABILITY TO USE MODES

	Fixed Reg.		Fixed Spec.		Fixed Ramp		DTD Reg.		DTD Taxi		DTD Ramp	
	%	S. D.	%	S. D.	%	S. D.	%	S. D.	%	S. D.	%	S. D.
No Aid	90.7*	1.6	94.0	1.3	99.0	0.5	97.9	0.8	93.0	1.4	97.7	0.8
Wheelchair-Folding	0	(8)**	0	(8)	25.0	15.3	12.4	11.7	62.5	15.7	75.0	15.3
Wheelchair-Fixed	0	(1)	0	(1)	0	(1)	0	(1)	0	(1)	0	(1)
Wheelchair-Motor	0	(1)	0	(1)	0	(1)	0	(1)	0	(1)	0	(1)
Walker	0	(12)	16.7	10.8	16.7	10.8	41.7	14.2	91.7	8.0	91.7	8.0
Crutches	25.0	12.5	66.7	13.6	58.3	14.2	75.0	12.5	83.3	10.8	100	12
Support Cane	56.1	2.3	78.1	4.0	72.7	4.5	88.7	3.1	96.3	1.8	96.0	2.0
Blind Cane	80.0	17.9	100	(5)	80.0	17.9	100	(5)	100	(5)	100	(5)
Braces	100	(3)	100	(3)	100	(3)	100	(3)	100	(3)	100	(3)
Back Brace	80	14.9	100	(5)	100	(5)	100	(5)	100	(5)	100	(5)
Car Controls	100	(4)	100	(4)	100	(4)	100	(4)	100	(4)	100	(4)
Hearing Aid	73.3	11.5	93.3	6.5	73.3	11.4	100	(15)	100	(15)	100	(15)
Other Person	21.7	8.6	43.5	10.3	47.8	10.4	65.2	9.9	91.3	5.9	82.6	7.9

* 90.7% of persons who use no aid can use regular fixed route buses "easily" or "with some difficulty".

** Parenthesized figures are number of persons who use aid where standard deviation is indeterminate.

3.4.7 Problems Using Fixed Route Bus Service

In the interview, persons were asked if they ever use the bus and how far they lived from the closest stop. Analysis of this information revealed:

1. More than 90% of the bus users live within four blocks of a stop; this holds regardless of handicap classification.
2. Fewer than 40% of the severely handicapped ever ride a bus regardless of how close they live to a stop.
3. The probability of ever using a bus is largely insensitive to the distance to the bus stop.

The last of these three statements seems contrary to the accepted wisdom of transit planning. The explanation is that we have asked whether you ever ride the bus. The dominant factor within the TH group is their physical capability and not the off-route distance.

Interviewees were asked, "If you ride or were to ride the bus, would any of the following be a problem for you?" For any items which were considered problems, the person was asked to indicate whether the problem was "moderate" or "severe". The list of items follows:

1. How frequently the buses run
2. No bus routes to places you need to go
3. Buses not running on schedule
4. Bus jerking while you are going to or leaving your seat
5. Number and placement of handrails
6. Availability of a seat on the bus
7. Lack of shelter at bus stop
8. Information about bus routes and schedules

9. Lack of driver courtesy
10. Cost of trip
11. Concern for personal safety
12. Distance from home to bus stop

Table 3-21 shows how able-bodied elderly, moderately handicapped and severely handicapped persons respectively responded to this question. Table 3-21 also ranks the five most severe problems for each handicap classification.

The rankings of the two handicapped groups are similar and show the predominance of physical difficulties. The able-bodied elderly, on the other hand, appear to have comparatively more difficulty with the service provided by the system (routes, frequency, etc.).

Handicapped people consistently report more difficulty using the existing bus system than do the able-bodied elderly, and the severely handicapped have more trouble than do the moderately handicapped. Even problems that seemingly are unrelated to handicaps (e.g., driver courtesy, buses being off schedule) are seen by handicapped persons as being more severe. However, these problems are quite real to a person who has trouble standing and waiting for an overdue bus or senses a driver frowning at someone who is slow in boarding.

Combining the "moderate" and "severe" categories, lack of shelter and bus jerking are consistently the most troublesome problems facing all groups while cost is uniformly ranked lowest. Personal safety climbs in the rankings of the more handicapped. Within any one problem area, the percentage of people ranking it as severe is much higher among the handicapped than in the able-bodied.

TABLE 3-21. BUS PROBLEMS BY HANDICAP CLASSIFICATION

	ABE				MTH				STH			
	Moderate		Severe		Moderate		Severe		Moderate		Severe	
	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.	%	Std. Dev.
Frequency	8.4*	1.7	3.7	1.1	20.7	3.0	6.9	1.8	14.8	2.1	13.2	1.9
Routes	12.1	2.0	4.0	1.2	14.9	2.6	8.5	2.0	14.2	2.1	15.8	2.1
Off Schedule	9.9	1.8	2.2	0.8	14.9	2.6	5.9	1.7	21.3	2.5	18.4	2.2
Jerking	20.9	2.5	2.2	0.8	37.2	3.5	19.1	2.9	14.6	2.1	62.1	2.8
Handrails	5.5	1.4	0.0	---	28.9	3.3	5.3	1.6	25.6	2.5	37.7	3.0
Seat Availability	12.5	2.0	0.7	0.5	21.9	3.0	17.1	2.7	13.6	1.9	54.1	2.8
Shelter	27.2	2.7	3.3	1.1	35.1	3.5	11.7	2.3	25.7	2.5	44.3	2.8
Information	5.1	1.3	1.8	0.8	11.2	2.3	5.9	1.7	13.0	1.9	14.9	2.0
Driver Courtesy	5.1	1.3	1.5	1.4	8.0	2.0	3.2	1.3	16.9	2.1	13.0	1.9
Cost	1.1	0.6	0.0	---	4.3	1.5	0.0	---	6.5	1.4	5.2	1.3
Personal Safety	2.9	1.0	1.5	1.4	15.0	2.6	2.7	1.2	18.2	2.2	25.6	2.5
Distance to Stop	5.9	1.4	1.5	1.4	15.1	2.6	8.6	2.0	15.8	2.1	42.4	2.8

RANKING OF MOST SEVERE PROBLEMS

<u>ABE</u>	<u>MTH</u>	<u>STH</u>
1. ROUTES	1. JERKING	1. JERKING
2. FREQUENCY	2. SEATS	2. SEATS
3. SHELTER	3. SHELTER	3. SHELTER
4. OFF SCHEDULE	4. DISTANCE	4. DISTANCE
5. JERKING	5. ROUTES	5. HANDRAILS

* 8.4% of able-bodied elderly say that bus frequency is a moderate problem for them.

3.4.8 Mass Transit Problems Vs. Sex and Age

Two additional analyses of the bus problem data were performed to determine if the problems reported differed with age or sex. No relationship was found between the genders and the problems they reported, nor were there significant differences among age groups.

3.5 SPECIAL ANALYSIS OF WHEELCHAIR/WALKER USERS

Because of their special needs, a special subgroup of those who require a lift/ramp vehicle was extracted from the survey results. These persons were assumed to be all persons who use wheelchairs or walkers for aids, regardless of whether these were listed as their first, second, third or fourth aids. Of the 506 transportation handicapped persons in the sample, 60, or 11.8%, were found to be members of the wheelchair/walker group.

3.5.1 Demographics

The wheelchair/walker group is generally quite similar to the severely handicapped in age (they are slightly younger), sex, income, auto availability, driving frequency and employment status. Not surprisingly, only 16.7% of this group possess driver's licenses compared to 25.3% of the severely handicapped.

3.5.2 Health Problems

As Table 3-22 shows, the wheelchair/walker group tends to have a more limited set of health problems than do the STH. In fact, nearly 50% of their problems are accounted for by three conditions: stroke, arthritis and orthopedic.

TABLE 3-22. PRIMARY HEALTH PROBLEMS OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS

	<u>STH</u>	<u>W/W</u>
	%	%
No Problem	1.3	1.7
Arthritis	18.3*	16.7
Orthopedic	13.2	15.0
Visual Impairment	12.6	3.3
Heart Ailment	11.7	5.0
Stroke	6.9	16.7
Spinal Cord	2.5	5.0
Respiratory	2.2	0
Hearing Impairment	1.3	0
Amputee	1.9	6.7
Palsy	2.5	6.7
Multiple Sclerosis	1.6	5.0
Cancer	0.9	0
Epilepsy	0.6	0
Muscular Dystrophy	0.3	1.7
Renal Failure	0.3	0
Digestive Disorder	1.9	1.7
Polio	1.9	1.7
Cystic Fibrosis	0.3	0
Speech Impairment	0	0
Other	13.7	13.3
	n = 317	n = 60

* 18.3 of the severely transportation handicapped have arthritis as their primary health problem.

3.5.3 Trip Patterns

The overall trip-making rate of wheelchair/walker users at 0.5 is significantly lower than the severely handicapped figure of 0.8. The trip rates of licensed drivers in both groups is comparable at 1.2 and 1.3 for W/W and STH respectively; the nondrivers, however, have significantly different rates (0.4 and .7). Thus, the disproportionate share of trips made by those who can drive is even greater in the wheelchair/walker group than it is for the severely handicapped.

Trip purposes and modes are compared in Tables 3-23 and 3-24. Wheelchair/walker users appear to make fewer "optional" trips such as shopping and recreation than the severely handicapped. While the automobile continues its dominance among the W/W users, the "submode" shifts are interesting. The very low percentage of bus trips is consonant with the extreme difficulty this group has using existing bus services.

About 90% of the trips of both groups are less than 30 minutes (the same is true for the able-bodied elderly and the moderately handicapped). However, the wheelchair/walker users make comparatively fewer very short trips; only 6.2% of their trips are less than five minutes long as opposed to 17.3% of the severely handicapped trips. Considering that the able-bodied elderly and moderately handicapped in turn made a higher percentage of short trips than the severely handicapped, a relationship may exist between a person's difficulty in traveling and the length of the trips that the person makes. For example, the W/W group make fewer shopping trips, which are shorter trips.

3.5.4 Difficulty with Transit Functions

Table 3-25 shows that persons using wheelchairs/walkers are roughly 2.5 times as likely to be unable to perform the transit mobility functions (Activities 1-5) as the severely handicapped.

TABLE 3-23. TRIP PURPOSES OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS

	<u>STH</u> %	<u>W/W</u> %
Work	3.4	6.2
School	0.6	1.5
Shop	14.2	7.7
Medical/Dental	8.3	9.2
Church	4.5	6.2
Personal Business	7.9	12.3
Recreation/Social	16.8	10.8
Home	44.3	46.2

TABLE 3-24. TRAVEL MODES OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS

	<u>STH</u> %	<u>W/W</u> %
Auto Driver	33.0	24.6
Auto Passenger-Relative	36.7	23.1
Auto Passenger-Friend	10.9	30.8
Auto Passenger-Agency	3.3	4.6
Regular Bus	10.5	1.5
Taxi	2.9	4.6
School Bus	0.0	0.0
Other	2.5	9.2

TABLE 3-25. INABILITY OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS TO PERFORM TRANSIT FUNCTIONS

	<u>STH</u> %	<u>W/W</u> %
1. Get on/off bus	25.9	70.0
2. Walk 2-3 blocks	32.9	75.0
3. Wait (stand) 10 mins.	27.8	66.7
4. Balance in moving vehicle	37.5	79.9
5. Move in crowds	24.1	59.3
6. Read transit information	12.7	15.5
7. Grasp coins/handles	8.3	22.4
8. Understand directions	9.6	15.5

3.5.5 Capability to Use Modes

Based on the preceding, it would be expected that the wheelchair/walker users would indicate great difficulty in using regular bus service and other modes which tax their limited mobility. Table 3-26 shows this to be the case; nearly 80% report they cannot use the regular bus system at all.

None of the mode choices brings the wheelchair/walker group nearly the same access to transit that the able-bodied elderly already have with the current fixed route bus system. Slightly more than half of the W/W population perceive the door-to-door ramp/lift buses as being easily used; 97.5% of the able-bodied elderly can use existing fixed route service easily.

3.5.6 Problems with Existing Service

Only 8.3% of the wheelchair/walker group ever use a bus (as compared to 30% of the severely handicapped). The difficulties the two groups have with the bus system are compared in Table 3-27.

The relative importance of problems (1) jerking, (2) seat availability, (3) shelter, (4) handrails is about the same for both groups. The percentage of people in the wheelchair/walker group who indicate that an item is a problem for them is moderately higher than for the severely handicapped. Problems are also uniformly termed severe by more of the W/W group.

TABLE 3-26. ABILITY OF SEVERELY HANDICAPPED AND WHEELCHAIR/WALKER PERSONS TO USE VARIOUS MODES

(%)

	EASILY		SOME DIFFICULTY		GREAT DIFFICULTY		UNABLE	
	STH	W/W	STH	W/W	STH	W/W	STH	W/W
FIXED ROUTE REGULAR BUS	7.9	1.7	23.2	6.7	28.6	11.7	40.3	78.3
FIXED ROUTE SPECIAL BUS	24.8	3.3	27.6	16.7	18.1	8.3	29.5	70.0
FIXED ROUTE RAMP BUS	28.6	16.7	23.0	13.3	22.0	23.3	26.3	43.3
DOOR-TO-DOOR REGULAR BUS	48.4	15.0	25.3	21.7	12.2	20.0	14.1	38.3
DOOR-TO-DOOR TAXI	73.0	40.0	18.4	33.3	5.4	13.3	3.2	10.0
DOOR-TO-DOOR RAMP BUS	77.0	55.0	13.8	23.3	5.2	11.7	3.9	6.7
	n=315	n=60						

TABLE 3-27. BUS PROBLEMS OF SEVERELY HANDICAPPED
AND WHEELCHAIR/WALKER PERSONS

(%)

	Moderate Problem		Severe Problem	
	STH	W/W	STH	W/W
Frequency	14.8	15.0	13.2	23.3
Routes	14.2	10.0	15.8	25.0
Off Schedule	21.3	18.3	18.4	48.3
Jerking	14.6	6.7	62.1	81.7
Handrails	25.6	15.0	37.7	61.7
Seat Availability	13.6	1.7	54.1	71.7
Shelter	25.7	11.7	44.3	61.7
Information	13.0	15.0	14.9	16.7
Driver Courtesy	16.9	23.3	13.0	25.0
Cost	6.5	8.3	5.2	8.3
Personal Safety	18.2	16.7	25.6	43.3
Distance to Stop	15.8	8.3	42.4	55.0
	n=310	n=60		

4. APPLICABILITY AND TRANSFERABILITY OF FINDINGS

Because of the current national concern for the mobility of elderly and handicapped persons and current Federal law and regulations which require regional and local planning to assure this mobility, it is important to understand the transferability of these Portland statistics to other areas. At this time, little is known concerning how elderly and handicapped mobility rates and patterns vary between regions. However, certain logical deductions are possible based on research in this field. These are offered here along with necessary qualifying remarks.

The transportation handicapped incidence of 5.75% measured in this survey reflects specific characteristics of Portland. The figure will be higher or lower in other urban areas and will be highly dependent on two factors--the elderly incidence and the work disabled incidence, as recorded in census data. The statistics for several selected cities are:

<u>SMSA</u>	<u>% > 65</u>	<u>% disabled (16-64)</u>
New York	10.5	5.3
Chicago	8.5	5.2
San Francisco- Oakland	9.1	5.9
Miami	13.4	6.6
Portland	10.2*	6.2

*Percentage for Portland SMSA is smaller than City of Portland (14.7%).

Thus, we suggest that a given area might expect its TH incidence to be higher or lower than Portland based on its value of these two demographic measures.

The distribution of health problems, use of health aids, and many of the demographic variables that are presented herein can probably be used in planning in other areas. These distributions may vary somewhat with the elderly incidence.

Similarly, much of the travel behavior data cited here is probably transferable. It would seem that data on trip rates versus handicap classification and income, the distributions of trips by purpose and mode, the data on trip regularity are all probably transferable. The origin/destination information may not be relevant to other areas because it is a function of land use patterns.

The data on attitudinal and functional problems of TH persons using public transportation are probably quite similar among areas, varying somewhat by weather conditions. Thus no knowledge of the stability of the fraction of the TH population that require level entry vehicles, i.e., the so-called wheelchair/walker group, was obtained.

Finally, the survey methodology - the process of screening households for TH persons and interviewing them, the functional definition and classification of individuals, the methods of organizing and presenting the data as shown herein, should be applicable to other urban areas concerned with improved transportation for their elderly and handicapped citizens.

APPENDIX A
SCREENING FORM AND QUESTIONNAIRE

PORTLAND HOUSEHOLD SURVEY SCREENING FORM

- 1. Interviewer's #: _____
- 2. Cluster #: _____
- 3. Household #: _____
- 4. Visit #: 1 2 3

Doorway Introduction:

Good evening. My name is _____. I'm calling on behalf of Tri-Met. Tri-Met is conducting a survey on the transportation needs of handicapped and elderly people and would like to get some information from you. The information I collect will help them plan a special transportation system for elderly citizens and handicapped people of all ages. Could you take 5 minutes now to answer some questions for our survey?

5. Household size:

How many people live in your household? This includes both people living with you and persons who are temporarily away from home. But it does not include college students or servicemen living away from home, or inmates of institutions or nursing homes.

_____ (10,11)
Household
size

6. Age, Sex:

I would like to know the age and sex of each household member. Is there anyone under 10 years of age? Is that person (are they) male or female? Etc.

	<u># Males</u>	<u># Females</u>	
Under 10	_____	_____	(12,13)
10 to 15 years	_____	_____	
16 to 20 years	_____	_____	
21 to 59 years	_____	_____	
60 to 64 years	_____	_____	
65 and over	_____	_____	(22,23)

7. Travel Functions:

(Give handout)

a. Please look at this list of activities that are often required in traveling. Excluding persons under 10 years of age, is there anyone in this household who has a problem using public transportation because their physical, mental, or other health condition makes it difficult to do any of these activities?

	Person		
	1	2	3
a. Get on or off a public transit bus.	___	___	___
b. Go (walk) more than 2 to 3 blocks.	___	___	___
c. Wait, standing, for more than 10 minutes.	___	___	___
d. Keep balance while standing in a moving transit vehicle.	___	___	___
e. Move in crowds.	___	___	___
f. Read information signs (not including foreign language problems).	___	___	___
g. Grasp coins, tickets, or handles.	___	___	___
h. Understand and follow transit directions (not including foreign language problems).	___	___	___
	(24-31)	(32-39)	(40-47)

(Interviewer: Check the appropriate spaces above for any response that approximates a "Yes".)

b. (If any of the above items are checked, ask):

	Person		
	1	2	3
What is the name or relationship of these persons to you?	_____	_____	_____
What are their ages?	_____	_____	_____

(If there were no transportationally handicapped persons identified in Question #7, go to INTERVIEWER INSTRUCTIONS on next page, following Question #9.)

8. Duration of Condition:

a. Is the difficulty described above caused by a permanent or a temporary condition?

	Person								
	1			2			3		
	T	P	DK	T	P	DK	T	P	DK
T = temporary									
P = permanent									
DK = don't know									

(Circle the correct letters.)

(48-50)

b. How long has this person had this condition(s)? Please respond in terms of the categories at the bottom of the card you are holding.

- 1 = less than 3 months
- 2 = 3 to 6 months
- 3 = 6 to 9 months
- 4 = 9 to 12 months
- 5 = one year or more

Person		
1	2	3

____ _ (48-50)

9. **Bedridden:**

Is this person confined to bed most of the time by a chronic condition?

Y = Yes N = No

Person		
1	2	3

Y N Y N Y N (51-53)

INTERVIEWER INSTRUCTIONS

At this point you must figure out exactly how many persons in this household should be interviewed. Interviewees fall into 2 categories:

1. A person is considered transportationally handicapped and should be interviewed if:
 - a. Any L or P is circled in Question #7a, and
 - b. The duration of the condition is 3 months or more (answers 2 - 5 in Question 8b), and
 - c. They are not bedridden (Question 9).
2. One-third of those persons who are 65 years of age or older AND not classified as transportationally handicapped will be interviewed.
 - a. Are there people 65 years of age or older designated in Question #6 who were not subsequently identified as handicapped?
 - b. Check these people off by sex in the right-hand columns of your control sheet.
 - c. If any of these people fall within the circles, they are part of the third to be interviewed.

Obtain each person's name who is to be interviewed and record it in the table following Question #11 on the next page.

Now indicate in the spaces below exactly how many people in this household are to be interviewed. (If none, put a zero.)

Number of transportationally handicapped to be interviewed: _____ (54)

Number of able-bodied persons, 65 or over, to be interviewed: _____ (55)

If no target person has been identified, skip to Question #12 on the last page.

10. If the above process has identified any target persons for interviewing, say:
 I would like to ask you (or the person identified as handicapped or the person you indicated as 65 years of age or over) some further questions about the trips you (he/she) made during the last two days and about your (his/her) ability to use different forms of transportation. These questions will take about 15 minutes. May I do this with you (or may I speak to that person) now?

11. If a target person has been identified but is unable to complete an interview at this time, say:

We would like to set up a time when we could conduct an interview by phone. Can you give me your phone number for this purpose? (Record below.)

Would it be convenient for us to call back this Friday or Saturday evening? (Record below.)

(If neither, ask):

When would it be more convenient for us to call? (Record below.)

I would like to leave this map for you (or the person we will be interviewing) because we will be referring to it for some of the questions. Could you keep it near the phone until we call back?

INTERVIEWER: Record outcome of above questions in spaces below:

	Transp. Handicapped Persons			Able-bodied 65 & Over	
	1	2	3	4	5
Name:					
C = interview completed R = interview refused Ph = phone interview					
Phone number: _____	XXX	XXX	XXX	XXX	XXX
When to call: F = Fri E = either S = Sat N = neither					
If "neither", day & time:					
Outcome of phone interview: C = completed 1st call: R = refusal 2nd call: NA = no answer 3rd call: CB = call back 4th call:					

12. If no interview is to take place at this time, say:

(Give out card)

Please look at this card and tell me which one of these categories includes the combined annual income of all members of your household before taxes are taken out. This information is for statistical purposes only and will be coded so that no one will be able to identify you or your income in the results.

1 ___ less than \$5,000

4 ___ \$15,000 to \$24,999

2 ___ \$5,000 to \$9,999

5 ___ \$25,000 and over

3 ___ \$10,000 to \$14,999

Income (56)

PORTLAND HOUSEHOLD SURVEY INTERVIEW QUESTIONNAIRE

- 1. Interviewer's #: _____
- 2. Cluster #: _____
- 3. Household #: _____
- 4. Person #: _____
- 5. Zone #: _____
- 6. Time of interview: _____

- 7. Is this a: 1 ___ home interview 2 ___ phone interview? _____
- 8. Target person is:
 - 1 ___ transportationally handicapped
 - 2 ___ able-bodied, 65 or over _____
- 9. Information supplied by:
 - 1 ___ person in question
 - 2 ___ another person _____
- 10. Is this information being supplied by the same person who gave screening information at the door?
___ Yes ___ No _____

Introduction:

(Re-explain purpose of survey if person whom you are interviewing is not the same person who gave the screening information.)

I would like to ask you some questions about the trips you made during the last two days. A trip is anytime you went from one place to another by motor vehicle or some form of public transportation. This does not include walking trips or bicycle trips. For example, going to work by automobile would be one trip; going to lunch by automobile would be a second trip; returning to work from lunch would be a third trip.

Let's begin by talking about the trips you made today.

TODAY'S TRIPS

1 1

11. Day of month: 1 _____
12. Day of week: 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____
 Sun Mon Tue Wed Thu Fri Sat
13. Did you make any trips today? Yes No

1 _____
 2 _____
 3 _____

TODAY - 1

- a. At what time did you begin your trip? a _____ : _____
- b. AM or PM? b _____
- c. In which of these zones did your trip begin? (Handout) c _____
- d. Where did you go on this trip? d _____
 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____
 Work School Shop Med/Dent Church PersBus RecSoc Home
- e. Was the activity you traveled to sponsored by a social service agency, church, club, or other organization? Yes No e _____
- f. In which zone did this trip end? f _____
- g. How long did it take you to get there--your travel time? g _____
- h. What method of transportation did you use for this trip? h _____
 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____
 Auto Auto Psgr Auto Psgr Auto Psgr Reg School Taxi Other
 Driver Relative Friend Agency Bus Bus
- i. Did you have to pay for this trip? Yes No i _____
- j. (If yes): How much? j \$ _____
- k. How often do you make this exact same trip? Please respond in terms of the categories printed at the top of this card. k _____
 1 _____ 2 _____ 3 _____ 4 _____
 Daily Frequently Weekly Occasionally
- l. Do you always make this trip at the same time of day? Yes No l _____
- m. (If K was "weekly"): Do you always make this trip on the same day of the week? Yes No m _____

TODAY - 2

- a. At what time did you begin your next trip? a _____ : _____
- b. AM or PM? b _____

(The form used in the survey continued in this manner, repeating questions a through m for Today-2, Today-3, etc., leaving room to record data on as many as six trips.)

YESTERDAY'S TRIPS

2 1

14. Day of the month: 14
15. Day of the week: 1 2 3 4 5 6 7 15
 Sun Mon Tue Wed Thu Fri Sat
16. Did you make any trips yesterday? Yes No 16

YESTERDAY - 1

- a. At what time did you begin your trip? a :
- b. AM or PM? b
- c. In which zone did your trip begin? c
- d. Where did you go on this trip? d
1 2 3 4 5 6 7 8
Work School Shop Med/Dent Church PersBus RecSoc Home
- e. Was the activity you traveled to sponsored by a social service agency, church, club, or other organization? Yes No e
- f. In which zone did this trip end? f
- g. How long did it take you to get there--your travel time? g
- h. What method of transportation did you use for this trip? h
1 2 3 4 5 6 7 8
Auto Auto Psgr Auto Psgr Auto Psgr Reg School Taxi Other
Driver Relative Friend Agency Bus Bus
- i. Did you have to pay for this trip? Yes No i
- j. (If yes): How much? j \$.
- k. How often do you make this exact same trip? Please respond in terms of the categories printed at the top of this card. k
1 2 3 4
Daily Frequently Weekly Occasionally
- l. Do you always make this trip at the same time of day? Yes No l
- m. (If K was "weekly"): Do you always make this trip on the same day of the week? Yes No m

YESTERDAY - 2

- a. At what time did you begin your next trip? a :
- b. AM or PM? b

(The form used in the survey continued in this manner, repeating questions a through m for Yesterday-2, Yesterday-3, etc., leaving room to record data on as many as six trips.)

TRIPS TWO DAYS AGO

3 1

17. Day of the month: 17 _____
18. Day of the week: 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____
 Sun Mon Tue Wed Thu Fri Sat 18 _____
19. Two nights ago, did you make any trips after 6PM? Yes No 19 _____

TWO DAYS AGO -- TRIP 1

- a. At what time did you begin your trip? a _____ : _____
- b. AM or PM? (Interviewer: Code "P" for night trip.) b _____
- c. In which zone did your trip begin? c _____
- d. Where did you go on this trip?
 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____
 Work School Shop Med/Dent Church PersBus RecSoc Home d _____
- e. Was the activity you traveled to sponsored by a social service agency, church, club, or other organization? Yes No e _____
- f. In which zone did this trip end? f _____
- g. How long did it take you to get there--your travel time? g _____
- h. What method of transportation did you use for this trip?
 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____
 Auto Auto Psgr Auto Psgr Auto Psgr Reg School Taxi Other h _____
 Driver Relative Friend Agency Bus Bus
- i. Did you have to pay for this trip? Yes No i _____
- j. (If yes): How much? j\$ _____
- k. How often do you make this exact same trip? Please respond in terms of the categories printed at the top of this card.
 1 _____ 2 _____ 3 _____ 4 _____ k _____
 Daily Frequently Weekly Occasionally
- l. Do you always make this trip at the same time of day? Yes No l _____
- m. (If K was "weekly"): Do you always make this trip on the same day of the week? Yes No m _____

TWO DAYS AGO -- TRIP 2

- a. At what time did you begin your next trip? a _____ : _____
- b. AM or PM? (Interviewer: Code "P" for night trip.) b _____

(The form used in the survey continued in this manner, repeating questions a through m for Two Days Ago-2, Two Days Ago-3, etc., leaving room to record data on as many as six trips.)

20. Do you use the bus for any of the trips you make? Yes No

21. If you ride or were to ride the bus, would any of the following be a problem for you?

(If the answer is "Yes", ask whether it is a severe or a moderate problem.)

	<u>Severe</u>	<u>Moderate</u>	<u>Not a Problem</u>	<u>Don't Know</u>	
a. How frequently the buses run.	1__	2__	3__	4__	a. ___
b. No bus routes to places you need to go.	1__	2__	3__	4__	b. ___
c. Buses not running on schedule.	1__	2__	3__	4__	c. ___
d. Bus jerking while you are going to or leaving your seat.	1__	2__	3__	4__	d. ___
e. Number and placement of handrails.	1__	2__	3__	4__	e. ___
f. Availability of a seat on the bus.	1__	2__	3__	4__	f. ___
g. Lack of shelter at bus stop.	1__	2__	3__	4__	g. ___
h. Information about bus routes and schedules.	1__	2__	3__	4__	h. ___
i. Lack of driver courtesy.	1__	2__	3__	4__	i. ___
j. Cost of trip.	1__	2__	3__	4__	j. ___
k. Concern for personal safety.	1__	2__	3__	4__	k. ___
l. Distance from home to bus stop.	1__	2__	3__	4__	l. ___

22. How many blocks is it from your home to the bus stop you use or might use? (If person responds "Don't know", leave blank.)

23. Please tell me if you are able to do the following activities. Please respond in terms of the choices on the card for Questions 13 and 17.

	<u>Easily</u>	<u>With some Difficulty</u>	<u>With great Difficulty</u>	<u>Not At All</u>	<u>Don't Know</u>	
a. Get on or off a public transit bus.	1__	2__	3__	4__	5__	a. ___
b. Go (walk) more than 2 to 3 blocks.	1__	2__	3__	4__	5__	b. ___
c. Wait, standing, for more than 10 minutes.	1__	2__	3__	4__	5__	c. ___
d. Keep balance while standing in a moving transit vehicle.	1__	2__	3__	4__	5__	d. ___
e. Move in crowds.	1__	2__	3__	4__	5__	e. ___

(This question is continued on next page.)

	<i>With some</i>	<i>With great</i>	<i>Not</i>	<i>Don't</i>		
	<i>Easily</i>	<i>Difficulty</i>	<i>Difficulty</i>	<i>At All</i>	<i>Know</i>	
f. Read information signs (not including foreign language problems).	1__	2__	3__	4__	5__	f. ____
g. Grasp coins, tickets, or handles.	1__	2__	3__	4__	5__	g. ____
h. Understand and follow transit directions (not including foreign language problems).	1__	2__	3__	4__	5__	h. ____

24. Please look at the list of health conditions on the card for Question #14 and tell me if you have any of the health problems listed.

(If none, code as "00".)

a. If so, please tell me what your primary health problem is.

b. Do you have a second health problem? Which one?

c. Do you have a third health problem? Which one?

- | | |
|-------------------------------------|-----------------------------|
| 00 = No health problems | 11 = Multiple Sclerosis |
| 01 = Amputee or Absence of Limb(s) | 12 = Muscular Dystrophy |
| 02 = Arthritis or Rheumatism | 13 = Orthopedic |
| 03 = Blindness or Visual Impairment | 14 = Polio |
| 04 = Cerebral Palsy | 15 = Renal (kidney) failure |
| 05 = Cystic Fibrosis | 16 = Respiratory Ailment |
| 06 = Cancer | 17 = Speech Impairment |
| 07 = Deafness or Hard of Hearing | 18 = Spinal Cord Injury |
| 08 = Digestive System Disorders | 19 = Stroke |
| 09 = Epilepsy | 20 = Other: |
| 10 = Heart Ailment | |

(e.g., obesity, pregnancy)

Interviewer: The following conditions are not listed on the hand-out and should be asked orally only when information is being supplied by a person other than the one in question, in appropriate cases:

- 21 = Drug Addiction/Alcoholism
- 22 = Emotionally Disturbed/Mentally Ill
- 23 = Mental Retardation

25. How long have you had your primary health problem (or refer to actual condition named in Question #14a)? Please respond in terms of the periods listed on the card for Question #15.

- | | |
|------------------------|----------------------|
| 1 = less than 3 months | 4 = 9 to 12 months |
| 2 = 3 to 6 months | 5 = One year or more |
| 3 = 6 to 9 months | |

26. Do you use any of the aids listed on the card for Question #26 when moving about or traveling? (Interviewer: Record code for all aids used. Stop after 4 aids.)

Wheelchair:

01 = collapsable	02 = non-collapsable	03 = motorized	
04 = Walker	11 = Car with special controls	Aid 1	___
05 = Crutches	12 = Van with lift or ramp	Aid 2	___
06 = Cane for support	13 = Seeing-eye dog	Aid 3	___
07 = Cane for blindness	14 = Hearing aid	Aid 4	___
08 = Leg braces	15 = Ramps in or around house		
09 = Back braces	16 = Elevator or lift in home		
10 = Artificial limb(s)	17 = Always aided by another person when traveling		

27. Several kinds of public transportation are now available or are being considered. I will describe some of them. For each one, please look at the possible answers on the card for Questions 13 and 17 and tell me whether you would be physically able to use it easily, with some difficulty, with great difficulty, or not at all.

1 = easily 2 = with some difficulty 3 = with great difficulty
4 = not at all

- a. Regular bus service on a fixed route. 1__2__3__4__ a. ___
- b. Fixed route bus service with all of these features: lower steps, wider doors, more handrails, better lighting and signs, and reserved seats--but with no lift or ramp.
1__2__3__4__ b. ___
- c. Door-to-door taxi service by standard 4-door cars with no lift or ramp. 1__2__3__4__ c. ___
- d. Door-to-door bus service but with no lift or ramp. 1__2__3__4__ d. ___
- e. Fixed route bus service with a lift or ramp. 1__2__3__4__ e. ___
- f. Door-to-door bus service with a lift or ramp. 1__2__3__4__ f. ___

28. If there were a door-to-door bus service whereby you could call in and a small bus would come to your door and take you directly where you wanted to go, would you: Y = Yes N = No D = Don't know

- a. ___ Use the new system instead of riding the regular bus? a. ___
- b. ___ Use the new system instead of any other means of transportation? b. ___
- c. ___ Make more trips? c. ___
- d. ___ Use this service at night? d. ___
- e. ___ Use this service on weekends? e. ___
- f. ___ Not use this new service? f. ___

29. (If the person would use the system at all, ask):

How much would you be willing to pay for this service for each one-way trip?

\$ _____

8

Duplicate cc 2-10

Now we would like to ask you a few questions for statistical purposes.

30. Sex (by observation): M = male F = female

31. Please stop me when I read the category that includes your age.

1 __ 10 - 15 years 3 __ 21 - 59 years 5 __ 65 and over

2 __ 16 - 20 years 4 __ 60 - 64 years

32. What is the number of persons in your household?

33. What is the number of autos in your household?

34. What is the number of drivers in your household?

35. Is an auto available to you as a driver or a passenger for trips you need to make: always, usually, sometimes, or never?

1 __ Always 2 __ Usually 3 __ Sometimes 4 __ Never

36. Do you have a driver's license? Y = yes N = no

37. How often do you drive? Please respond in terms of the categories listed at the top of the card.

1 __ Daily 2 __ Frequently 3 __ Weekly 4 __ Occasionally

38. What is your employment status?

1 __ Working full time 4 __ Keep house

2 __ Working part-time 5 __ Retired or not looking for work

3 __ Student 6 __ Unemployed--looking for work

39. How long have you lived at this address?

1 __ Less than 1 year 3 __ 3 - 5 years 5 __ 10 - 15 years

2 __ 1 - 3 years 4 __ 5 - 10 years 6 __ Over 15 years

40. Please look at the categories listed on the card for Question #40 and tell me which one of the categories includes the combined annual income of all members of your household before taxes are taken out.

1 __ Less than \$5,000 4 __ \$15,000 to \$24,999

2 __ \$5,000 to \$9,999 5 __ \$25,000 and over

3 __ \$10,000 to \$14,999

41. (Interviewer: Ask only if not a phone interview):

In case we need to contact you further, may we please have your telephone number? Phone #: _____

Within a couple of weeks one of my supervisors may call you in order to check that I interviewed you.

Thank you for your time.

APPENDIX B
COMPUTATION OF INCIDENCE

The screening/interviewing problems encountered in this survey caused the computation of the number of transportation handicapped persons in the sample to be less than completely straightforward. These problems were:

1. Insufficient institution interviews were obtained for the sample to be correctly apportioned between household and institution residents.
2. Only about one-fourth (the number is actually 1/3.8) of the people who were screened as able-bodied and who were elderly were asked for interviews. Some of these people refused to be interviewed.
3. Some of the people identified through the screening questions as transportation handicapped also refused to be interviewed.
4. Based on differences in screening and interview answers some persons who were screened as TH were reclassified after the interview as able-bodied elderly and vice versa.
5. Persons identified as TH who were under 10 years of age were not interviewed.
6. Because of the known error in the screening device, some of the people who were purposely not interviewed (i.e., the able-bodied, non-elderly) might have proven to be TH had they been interviewed.

The institutional portion of the sample was adjusted (for the calculation of incidence only) as follows:

Capacity of Mentally Retarded Institutions	152	
Capacity of Nursing Homes	+ 1873	
Capacity of Homes for the Aged	+ 862	
Portland Institution Capacity	2887	=
Portland Household Population	385,000 - 2887	
Household Sample Size	11,573	
Percent Institutionalized	x .0075	←
Adjusted Institution Sample Size	87	

The 0.75% institution population figure is substantiated by 1970 Census data for California and Oregon. Excluding mental health hospitals, the percentage of the population of these two states living in health-related institutions is 0.61% and 0.81% respectively.

TH incidence for institutionalized people was derived as follows:

Institution Population Screened	1783
Able-Bodied Elderly	- 128
Other Able-Bodied	- 30
Number TH	1625
TH Incidence	$\frac{1625}{1783} = .911$

The number of able-bodied elderly was estimated by the director of each institution. The number of other able-bodied was determined by taking the number of people in each institution who the director indicated had "no difficulty" performing the most difficult transit function (maintaining balance), above the institution's count of able-bodied elderly.

The number of TH from the institutional sample to be used in computing overall incidence then is:

Adjusted Institution Sample Size	87
Institution TH Incidence	x .911
	79

The remaining 8 institutionalized people are able-bodied elderly.

In order to compensate for the errors in the screening and for the able-bodied sampling rate, the screened data had to be factored. A factor of 0.92 was applied to the people who were screened as TH because it was found that 8% of them were reclassified as able-bodied elderly after the interview. A factor of 0.38 was applied to those persons screened as able-bodied elderly to account for the lower sampling rate (1/3.8) and the fact that 10% of these people were reclassified as transportation handicapped following the interview.

The fact that persons under 10 were excluded is not a source of error. We are estimating the fraction of the Portland population who are age 10 or above and who are TH. We are not interested in the TH people under 10, assuming they would be traveling with and under the care of an adult. However, had the under 10 group been included, we would expect, according to Table 3-2, their incidence to be about .1% or less. Consequently, this would have raised the overall incidence by about .1%.

The last of the six problems is not significant. Undoubtedly, if we had interviewed everyone who was screened as able-bodied non-elderly, we would have found a few more TH persons, but not many. The TH incidence for ages 10 through 64 is only about 1.5% (see Tables 2-1 and 3-2). If as few as 90% of these were caught in the screening process, the effect would be an error of .1% in the overall estimate of TH incidence.

The complete incidence computation is shown below.

	<u>As Screened</u>	<u>Factor</u>	<u>Resulting Sample TH</u>
Household TH Interviewed	471		
Household TH Refused	42		
Institution TH Interviewed	<u>79</u>		
	592	x .92	= 545
Household ABE Interviewed	253		
Household ABE Refused	76		
Household ABE Not Interviewed*	912		
Institution ABE Interviewed	<u>8</u>		
	1,249	x .10	= <u>125</u>
		Sample TH	<u>670</u> =
		Sample	11,650
		% Sample	5.75 ←

*From count of screening forms.

Computation of confidence limits for the estimate of TH incidence requires consideration of error in the screened incidence of TH, error in the institutional population estimate, and error in the estimate of the number of people screened as ABE who are really TH. Combination of all these factors gives 95% confidence limits of 5.0% and 6.6%. Much of the possible error is in the estimate of incorrectly classified ABE's; without this screening difficulty the error in estimated TH would be less than + .4%.

APPENDIX C
REPORT OF INVENTIONS

The contract, DOT-TSC-1081, Task Directive 1081-18, required a special report of the survey reported on herein. A number of innovative procedures were used in the design, execution and analysis of the survey. However, there was nothing in the nature of the work which should have or did lead to any inventions or improvements of inventions.

