USE OF THE LIGHT RAIL OR LIGHT RAPID TRANSIT
SYSTEMS BY
INDIVIDUALS WITH SEVERE VISUAL IMPAIRMENTS

by

KATHRYN JANE SVENDSEN

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Department of Educational Psychology / Special Ed.

The University of British Columbia
Vancouver, Canada

Date April 25, 1990

ABSTRACT

This study investigated the relationship between use of Light Rapid or Light Rail (LRT) by persons with severe visual impairments and independence in orientation and mobility. Use of the LRT poses special problems to blind users and requires skill in mobility. The premise of the study was that blind persons who felt confident in travelling independently were more likely to use the LRT than those who do not. The study also examined the difficulties blind persons experienced in LRT use.

The subjects were 63 persons between the ages of 19 and 65 who responded to a survey questionnaire. Thirty five of these individuals were male and 25 were female. All the subjects were registered as legally blind with the C.N.I.B. The range of visual loss included total blindness, light perception, tunnel vision, central vision loss and low vision.

The results indicated that orientation and mobility training on the LRT system would resolve many of the difficulties that users of the systems encountered. Modification of the systems by transit companies to make the systems more easily accessible to visually impaired travellers are suggested.

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DEDICATION

To the subjects, thesis committee members and my husband who assisted, encouraged and supported me through each stage of this project.

CHAPTER ONE

INTRODUCTION

In today's urban society, independence, among other things, means being able to work and maintain a social life without depending on other people in order to travel from one place to another. For the visually impaired person, this often means making use of public transportation. In the past ten years, the LRT (Light Rail or Light Rapid Transit) System has become an integral part of public transportation systems.

This thesis addresses the problems experienced by severely visually impaired persons in making use of Light Rail or Light Rapid Transit. This chapter will introduce the study, review the literature on orientation and mobility and describe the use of Light Rapid and Light Rail Transit Systems.

I. THE PROBLEM

Independence is important to visually impaired people. The ability to move about freely, safely and comfortably is a prerequisite to social and financial independence (Passini, Dupre and Langlois, 1986). Without the ability to move about in one's environment independently, access to gainful employment, recreation and medical services is severely restricted. Lack of independent mobility imposes severe limitations on all aspects of living and may even

cause health problems (Welsh and Blasch, 1980). Full integration into community life is not possible without it (Resnick, 1983).

Orientation and mobility instruction facilitates independence by giving the visually impaired person the skills he needs to go where he wants, when he wants, without needing to depend on others (Welsh, 1980). In the urban environment, orientation and mobility skills include making use of all forms of public transportation.

Public transit is important to people living in urban areas. Without public transit, it is not possible to travel within a city unless one can drive a car. Ability to travel alone on public transportation systems - including the Light Rail/Rapid Transit (LRT) is an important component of independence for visually impaired persons. Dependence on family and friends for transportation is not always possible or even feasible and does not allow the visually impaired person to be independent. Nor is it desirable to rely wholly on taxi service which is very expensive compared to public transit. Use of public transit has become an important factor in the independence of visually impaired individuals.

The development of LRT in the urban environment has made movement much faster. Travel from the outskirts of the city takes even less time than traveling the same distance by car (Edmonton Light Rail Transit pamphlet).

LRT systems are an integral part of the public transit system. Most bus routes connect with LRT systems. In cities where new sections of the LRT are being put into operation, the bus routes in the surrounding area have been changed so that the LRT system and the bus system merge into an integrated whole.

Learning to use public transit is part of orientation and mobility training. Orientation and mobility (O&M) is the ability to orient oneself to the environment and move freely, safely and efficiently within that environment (Hill and Ponder, 1976). Familiarization with public transportation systems such as buses and how they operate is an integral part of O&M training. In automated systems there is no driver and few attendants from whom to obtain assistance. Knowing the direction or destination of incoming trains sometimes presents problems. Lack of clear markings of the area between the cars has resulted in serious accidents. Miller (1983) indicated that subways (similar to LRT's because of stations etc.) can be dangerous for visually impaired persons. He noted three incidents where blind travelers have fallen onto the rail tracks by stepping into the space between the cars. Jackson, Peck and Bentzen (1983) discuss some of the difficulties that visually impaired people may experience while using public transportation such as LRTs.

In order for the visually impaired person to use the system safely, efficiently and comfortably, they must be

completely familiar with the layout of the platforms and where the cars stop, and direction of oncoming trains.

The hypothesis of this thesis is that use of the LRT is related to independent travel. Orientation and mobility training prepares the severely visually impaired individual for independent travel.

II. DEFINITION OF TERMS

The following terms relate to the visually impaired person, their travel techniques and the transit system.

Orientation and Mobility

MOBILITY - The capacity, the readiness and the facility to move. The ability to move within one's environment (Ponder and Hill, 1976).

ORIENTATION - The process of utilizing the remaining senses in establishing one's position and relationship to all other significant objects in one's environment. Collection and organization of information concerning the environment and one's relationship to it (Ponder and Hill, 1976).

ORIENTATION AND MOBILITY TRAINING - The training of a visually impaired person to use all his senses to orient himself and learn to move about in the environment freely, safely and efficiently, while knowing where he is in space.

CANE TECHNIQUE - Use of a white cane to detect obstacles and drop offs (such as curbs and stairs) in one's path.

WHITE CANE (long cane) - A lightweight cane of prescribed length which is an obstacle detector and environmental sensor for the blind pedestrian. They are typically white, with a six inch red stripe above the lower tip, and are longer than an orthopedic cane (Bentzen, Jackson and Peck, 1981).

DOG GUIDE - A dog which has been specially trained to guide a blind person through the environment. The dog is trained to stop at steps and curbs and guide the blind person around obstacles.

SONIC GUIDE - A head mounted device used for the detection of obstacles. The distance from the obstacle can be judged by the sound waves that generate from the device and bounce back from the object.

ROUTES - The path one travels to get from one place to another.

SIGHTED GUIDE TECHNIQUE - The use of a sighted person as an aid for travelling. The visually handicapped person grasps his guide's arm just above the elbow with a firm yet relaxed grip, and follows about a half step behind the guide. This allows sufficient time to

react to the guide's starting, stopping, turning or stepping up or down (Bentzen, Jackson and Peck, 1981).

Visual Impairments

BLINDNESS - An inability to see (Cassin and Solomon, 1984).

LEGAL BLINDNESS - A visual acuity of 20/200 or less in the better eye after best possible correction or 20 degrees or less remaining of one's visual field. 20/200 indicates that what a normally sighted person can see at 200 feet, the legally blind person can see at 20 feet with the same degree of clarity.

CENTRAL VISION - The detection of movement or objects in our direct line of vision. The central vision is the vision we use to see fine detail and for reading.

TUNNEL VISION - Loss of peripheral field with the retention of some degree of central field (Cassin and Solomon, 1984).

PERIPHERAL VISION - The detection of movement of objects not in the direct line of vision. Objects may not be seen with great clarity in the peripheral vision.

LIGHT PERCEPTION - The ability to detect the presence or absence of light.

LOW VISION - When impairment in the visual system interferes with normal daily functioning (Bentzen, Jackson and Peck, 1981). In this document, all the subjects with low vision are legally blind.

Transit

LRT - Light Rapid or Light Rail Transit - In Calgary the system is known as the C-Train, in Edmonton as the LRT and in Vancouver as the Skytrain.

INFORMATION SYSTEMS - Announcements, maps and signs used by transit systems to inform the public about the system's use.

SIGNAGE - All maps and signs in printed form.

III. ORIENTATION AND MOBILITY TRAINING

Orientation and mobility training is the instruction visually impaired people receive from a qualified orientation and mobility instructor to learn how to travel safely and efficiently through the environment. This training includes learning how to use one's remaining vision to look for clues and landmarks that indicate where one is in the environment. It may also include learning to use various mobility aids such as monoculars to enable the visually impaired person to see signs and traffic lights better. Use of the white cane may be taught so that the blind pedestrian can detect obstacles in his line of travel. The use of public transportation is taught so that the visually impaired person can make use of this system safely and confidently.

Many visually impaired people receive some type of orientation and mobility training. Blasch and Welsh (1980) indicate that the opportunity for formal orientation and mobility instruction should be available to all visually impaired persons.

Training Procedures

Formal instruction generally begins indoors. The need and depth of orientation and mobility training differs according to the degree of vision an individual has. The use of the "long" or "white" cane is taught to totally blind persons. The cane is used as an obstacle detector. Some individuals with limited vision may not require a cane and those with some vision are taught to use their vision to assist them in travel. Training for these individuals may also include use of a monocular indoors and outdoors, route training, use of public transportation and developing awareness of when assistance may be needed. Visual skills to be developed include looking for clues in the environment such as shapes and shadows which can help to identify stairs and curbs, where to locate street lights, walk/don't walk signals and traffic lights (Anna Bradfield, personal communication).

The sighted guide technique is usually the first stage of training for the totally blind person. This technique enables the visually impaired person to receive sighted assistance in a comfortable, safe manner. In many

environments such as up and down stairs, through doors, in elevators and narrow passages, sighted guide technique is used as an introduction to independent travel. The use of the cane begins with indoor mobility. It involves learning to use the touch and diagonal cane techniques. Blind persons learn how to navigate stairs, doors, elevators, escalators, and crowded environments. Outdoor training involves instruction with the cane to identify roadways, sidewalks, roads without sidewalks, and street crossings on both low and high traffic streets (Ponder and Hill, 1976). The sighted guide technique is sometimes taught concurrently with long cane. The sequence in which these skills are taught is determined by the needs of individual students.

The mobility skills that are easiest to acquire are introduced first; complex skills follow in order to allow the student to experience success. Mobility training is presented in an organized and logical manner (Crouse, 1980). Cane techniques are usually introduced and practiced until the mobility student is able to travel safely alone. The student becomes comfortable with cane technique before route training is introduced (Pete Wurzbarger, personal communication). Orientation and mobility skills or travel training involves practical skills and each skill and technique must be taught and practiced. By the time the mobility student is competent

in a particular skill, he will have also learned to be independent in at least one simple route.

Use of Public Transportation

Bus and LRT training are important components of travel training. Mobility students should be taught the location of bus stops, well-defined routes from their homes to the bus stop and a well-defined route from a bus stop to their destination.

Mobility training on Light Rail/Rapid Transit systems is complex. Chew and Manzer (1986) indicated that specific instruction on the use of the LRT is required in order to use the system efficiently, safely and comfortably. The individual must know the location of the station, and be familiar with it's layout. The directions in which trains are traveling and the location of the open doors are essential. For example, train doors do not open directly in front of blind persons as often happens with bus travel (Chew and Manzer, 1986). The ability to locate the desired stop and reorient oneself after getting off the LRT must also be taught (Jackson, Peck and Bentzen, 1983). Blind and visually impaired travelers should also know how to seek assistance if it is required, how to protect themselves from overzealous sighted helpers and how to reorient themselves if they should become lost (Ponder and Hill, 1976).

It is a sad fact that the majority of visually impaired adults have not received a complete course of mobility instruction.¹

School-aged children receive mobility instruction at school. Some school districts have teachers of the visually impaired, who also are certified orientation and mobility instructors. Other school districts contract with private instructors to provide students with mobility training.

There has been little research on independent LRT system use. It is hoped that the present study will contribute to the knowledge of the use of Light Rail/Rapid Transit by persons with severe visual impairments and an understanding of the problems they encounter. LRT systems need this information to make LRT travel easily accessible to these individuals.

IV. HISTORY OF THE LRT SYSTEM IN WESTERN CANADA

The LRT, formally known as Light Rail Transit (Alberta) or Light Rapid Transit (British Columbia) has been in operation in Western Canada since 1978. Planning for the system was underway for at least a decade.

¹In the Vancouver area, approximately 260 C.N.I.B. clients receive orientation and mobility instruction in a year. Many of these clients are repeat clients. Four mobility instructors carry out this instruction. There are approximately 5000 registered visually impaired people living in this area (Jay Wadsworth, personal communication).

The first system to go into operation was in Edmonton, which opened a 7.2 kilometre track in 1978. The system had three ground level stations and two underground stations. In 1981 a 2.2 kilometre extension was completed. This station was ground level. The third extension to be completed on this system was 0.9 kilometres long. Two downtown stations were built underground. Presently, the South LRT extension is being constructed, with the opening date of the first station in September of 1989 and the second station in August, 1992. This addition consists of an additional 2.5 kilometres of track, with both stations underground. Once these extensions are completed, Edmonton will have a total of 10 stations in service, 12.8 kilometres of track.

In Calgary, a long term project is planned with an LRT system eventually to consist of 6 lines. It is to be a radial system, which is centered at the downtown core. At present, three of these lines are in operation. In 1981 a 12.5 kilometre track was opened to service the southern portion of Calgary. All stations are at ground level. In 1985, the Northeast line was opened. This extension is 9.8 kilometres long. It runs from the northeast section of Calgary, to the downtown core. The third line to be completed was the Northwest line - 5.5 kilometres of track, from the University of Calgary, to the downtown core. To date, Calgary has 19 stations in service, a total of 27.8 kilometres of track.

While Alberta's LRT systems run at or below ground level, Vancouver, British Columbia's system is an elevated, automated system. Construction on this computer-driven system began in May, 1981 and the system was inaugurated in December, 1985 with 22 kilometres of track and 15 stations. This system operates from downtown Vancouver, through Burnaby and New Westminster. An additional 3.1 kilometres of track is due to be completed in 1990. This will give the Lower Mainland of B.C. a total of 17 stations, serving four different municipalities. Further extensions are being planned to connect Richmond and Coquitlam to Vancouver.

Both Alberta and B.C. have barrier free, proof-of-payment fare collection systems. Periodically a transit worker will request the presentation of the rider's bus ticket. Fines are given to violators. Passengers may purchase their tickets from ticket dispensers/validators located within the stations or carry a monthly pass.

The trains used in Edmonton's LRT system and Calgary's C-Train were made in Germany. They are powered by electricity which is accessed by overhead wires. They have a section of wall in the middle of the car which can bend like an accordian, allowing the car to move more easily around corners. They also have enclosed driver's cabs at both ends. Passengers gain access to the cars by pushing a button located to the side of the door. From the inside, the button is located on a pole in the center of the

doorway. The door button is located about five feet from the floor. Some of the poles have been adapted for wheelchair users by bending the pole below the door button so that the lower portion of the pole is located to one side of the doorway. The upper portion of the door pole remains in the centre of the doorway. There are 8 doors per car; four on each side of the car. All doors are individually operated, with a locking system controlled by the driver which eliminates the possibility of someone opening the door on the wrong side of the car.

Vancouver's system, called the Skytrain, is operated from a central computer center. There are no drivers on these vehicles. The power supply is located on the side of the vehicle, below platform level. These high voltage wires are kept as far away from the public as possible. Therefore, the lines are always found on the opposite side of the tracks, away from the platform.

Passengers gain access to Skytrain by pushing a button located in the centre of each set of double doors. These doors slide open. Inside, the buttons which open the doors are located at hand height, on each of four poles, beside the doors. Doors are located on both sides of the car, with a total of eight doors per two-car train. Only the doors on the platform side of the car will open. The others remain locked. Before doors close, there is a warning tone.

Different methods are used by the Light Rail/Rapid Transit systems to provide transit users with information about how to use the system. This information includes: directions of the incoming trains, route information, which station the train is arriving at and which platform to use. This information is provided in a number of ways. Some companies use auditory announcements and a variety of signs, well lit maps placed behind glass, illuminated signs and flashing Light Emitting Diode (LED) signs.

The present study will examine the relationship between use of LRT systems by severely visually impaired adults and independence in orientation and mobility. Chapter Two will describe the methodology employed and the subjects of the study.

CHAPTER TWO

METHODOLOGY AND RESEARCH DESIGN

This chapter explains the method that was used to conduct the study and how it was designed.

I. THE METHOD

A survey was conducted among visually impaired residents of Edmonton, Calgary and Vancouver. One hundred and fifty surveys were sent out to a random sample of fifty people in each city. Offices of the Canadian National Institute for the Blind in each city sent the author's survey questionnaire to registered, legally blind individuals, between the ages of 19 and 65 living in their jurisdictions. Sixty three responses were obtained. The researcher had no access to confidential records.

The sample was randomized by having the C.N.I.B. number their clients who were between the ages of 19 and 65. Then, 150 numbers (50 for each city) were chosen from a table of random numbers. The surveys were sent to those individuals whose numbers were chosen from the table.

The surveys were printed in large print, although some subject respondents would need assistance reading the print. The population consisted of braille readers, large print readers, and nonreaders. (Regular print readers presumably used vision aids.)

The survey instrument was developed and refined with the assistance of orientation and mobility instructors and blind adults. Three orientation and mobility instructors and one blind person assisted in the development of the final questionnaire. Participants were requested to complete the survey and return it in the enclosed, stamped envelope. The surveys were mailed in early to mid-December. A follow up letter was also sent (see Appendix II). No names were used and correspondence was handled by three jurisdictions of the Canadian National Institute for the Blind. None of the participants were known to the researcher.

II. THE SURVEY QUESTIONNAIRE

The questionnaire (see Appendix II) consisted of two sections, Section 1 - Research Data; Section 2 - Subject Data. There were nineteen questions in Section 1 and seven questions in Section 2. Subjects were asked to answer only those questions which pertained to them.

Section 1 consisted of three parts. Part 1 encompassed questions 1 to 9, dealing with method of travel - sighted guide, long cane, identification cane, dog guide as well as secondary travel aids such as a distance monocular or electronic travel aid. Questions regarding use of transportation - buses, taxis, transportation for the handicapped, the LRT and family and friends were included. Lastly, the subjects were asked if they had

formal orientation and mobility training and if they did, did it include specific instruction on the LRT.

Part 2 of the research section included questions 10-17. Only those individuals who used the LRT, no matter how infrequently, were asked to respond to this section. The questions examined whether the subjects used the LRT system alone, with assistance when needed or only with the assistance of a sighted person. The instances in which the subjects used the LRT and how comfortable they were using it, how comfortable they were in unfamiliar stations and in using new routes as well as the ease with which they could access the information systems - e.g. maps and signs, were examined. Questions were also provided in which the participants had the opportunity to state any difficulties they encountered, as well as what they liked about the LRT.

Part 3 of the research section consisted of two questions (18 and 19) which were to be answered by those individuals who did not use the LRT, in order to identify reasons for non-use such as lack of training, it did not go where they wanted, the system was too difficult to access or bad experiences in its use.

Section 2 - Subject Data, sought information about subjects age, the age of onset of their visual impairment, the medium they used to read, degree of visual impairment, additional handicaps and jurisdiction in which they resided.

III. THE SUBJECTS

A total of 143 questionnaires were distributed - 44.1 percent were returned (150 were sent, but 7 were not received). Nineteen of 46 (41.3 percent) surveys were returned from Calgary, 23 of 48 (47.9 percent) surveys were returned from Edmonton, and 21 of 49 (43.8 percent) surveys were returned from Vancouver. Table I shows the distribution and responses to the questionnaires in the three cities.

Table I: Distribution, Number and Percentage of Responses

City	Total Surveys Reaching Participants	Surveys Answered	Percent Males	Percent Females
Calgary	46	19	57.9	42.1
Edmonton	48	23	60.9	39.1
Vancouver	49	21	47.6	52.4
Total	143	63	55.6	44.4

Thirty five (55.6 percent) of the respondents were male and 28 (44.4 percent) of the respondents were female.

The 30-39 year age group was the largest age grouping, followed by the 60-65 year group and the 40-49 year age group. The fourth largest group was the 50-59 year group. The smallest age group represented in the sample was the 19-29 year group. The distribution of ages for the entire respondent group is presented in Graph I.

Graph 1
Numbers of Female and Male Subjects,
in the Response Group, Broken Down by Age and City

Types of Visual Impairments

Subjects indicated degree of visual impairment from 5 categories. These were: a) totally blind, b) light perception, c) tunnel vision, d) peripheral vision only and e) general low vision.

There were 9 totally blind subjects (14.5 percent), 3 subjects (4.8 percent) with light perception only, 16 subjects (25.4 percent) with tunnel vision, 7 subjects (11.1 percent) with a central vision loss and 27 subjects (43.5 percent) who classified their vision as low vision. The largest category was low vision; individuals with light perception only, comprised the smallest category. Table II indicates the number and percent of types of visual impairments of respondents.

Table II: Types of Visual Impairments of Subjects

Impairment	Calgary	Edmonton	Vancouver	Total	Percent
Totally Blind	3	1	5	9	14.5
Light Perception	2	0	1	3	4.8
Tunnel Vision	5	6	5	16	25.4
Peripheral Vision only	2	4	1	7	11.1
Low Vision	7	12	8	27	43.5
Totals:	19	23	20	62*	

*The number of subjects do not agree with the previous total of subjects, as one subject (1.6 percent) from the Vancouver area did not complete the question on his visual impairment.

Age of Onset

Twenty eight subjects or 44.4 percent were visually impaired at birth. Congenital blindness was the largest

category. Most adventitiously blinded subjects became visually impaired in adulthood. Twenty five subjects (39.7 percent) were blinded after the age of 19. Eight subjects (12.7 percent) were blinded between the ages of 6 and 18. The fewest number of subjects were blinded in early childhood (one to five years). Only 2 subjects lost their vision at this age. Of the three city centres, the Calgary group had the largest percentage of people with congenital visual impairments at birth. The Vancouver group had the largest percentage of age of onset in adulthood.

There was no particular pattern of types of visual impairments at particular ages of onset. Table III shows the types of visual impairment and age of onset data.

Table III: Visual Impairment Compared to Age of Onset

Age of Visual Impairment Onset	Degree of Visual Impairment	Number of Subjects	Percent
at birth	totally blind	4	14.2
	light perception	1	3.6
	tunnel vision	8	28.6
	peripheral vision only	1	3.6
	low vision	14	50.0
1 - 5 years	totally blind	1	50.0
	low vision	1	50.0
6 - 18 years	tunnel vision	2	25.0
	peripheral vision only	3	37.5
	low vision	3	37.5
adulthood	totally blind	3	12.0
	light perception	2	8.0
	tunnel vision	6	24.0
	peripheral vision only	3	12.0
	low vision	11	44.0

Additional Handicaps

Twenty two subjects (34.9 percent) indicated that they had other handicaps. These handicaps were divided into five categories: physical disability, speech impairment, hearing loss, reading disability and other. If the subject chose the category of "other", they were requested to indicate what the disability was.

Ten individuals reported having a physical disability in addition to being visually impaired. Two subjects had a speech impairment and six reported hearing loss. One of these individuals was profoundly deaf. Five subjects had reading disabilities and seven indicated disabilities in the "other" category. Of the 22 subjects with additional difficulties, 5 had 2 handicaps in addition to visual impairment, one had three additional handicaps and one individual had four additional handicaps.

Reading Media

It was important to know the reading media of subjects. Methods of reading were divided into five categories: braille, large print, regular print, audio tape (cassette) and other. Some subjects used a combination of these media to access information. Eleven subjects (17.5 percent) used braille, and 28 (44.4 percent) used large print. Twenty subjects or 31.7 percent used regular print, 17 (27.0 percent) used audio tapes and 10 subjects (15.9 percent) used other means. Seventeen subjects used a

combination of two reading media, and two subjects used 4 different media.² Four subjects (6.56 percent) indicated that they did not read. Table IV indicates the method of reading employed.

Table IV: Reading Media Used by Subjects

Reading Media	Calgary		Edmonton		Vancouver		Total	
	#	%	#	%	#	%	#	%
Braille	6	31.6	1	4.3	4	19.0	11	17.5
Large Print	9	47.4	11	47.8	8	38.1	28	44.4
Regular Print	7	36.8	8	34.8	5	23.8	20	31.7
Tape	7	36.8	4	17.4	6	28.6	17	27.0
Other (inapprop.)	1	5.3	2	8.7	3	14.3	6	9.5
Other (nonreader)	1	5.3	1	4.3	2	9.5	4	6.3

Other responses included under "other" was that subjects read with the aid of magnifiers, special glasses, glasses or indicated that they could not read small print. These respondents did not indicate whether they read regular print or large print.

Mobility Techniques

The travel aids the subjects used was examined. Six persons (9.5 percent) indicated that they used a sighted guide as their primary method of travel. Six (9.5 percent) used a white cane with touch technique. Ten (15.9 percent) used the cane for identification only. Four persons (6.4 percent) used a dog guide and 28 people (44.4 percent) indicated that they did not use an aid at all. Nine

²Six of the subjects that answered with the category of "other" chose this category inappropriately, or did not indicate what the other reading medium was.

respondents (14.3 percent) answered in the "other" category. Answers in this category were to be accompanied with their primary travel aid. Other responses indicated use of "handibus, family drives me, rides in cars". Table V shows the types of travel aids used in each of the 3 cities.

Table V: Primary Travel Aids Used By Subjects

Aid	Calgary	Edmonton	Vancouver	Total	Percent
Sighted Guide	3	1	2	6	9.5
White Cane	3	1	2	6	9.5
ID Cane	4	3	3	10	15.9
Dog Guide	1	1	2	4	6.4
No Aid	6	14	8	28	44.4
Other	2	3	4	9	14.3
Totals:	19	23	21	63	100.0

Of the 26 individuals who did use a travel aid, (category "other" was not included) 10 persons (38.5 percent) used only one aid. Four persons indicated that they used distance monoculars and one individual used an electronic travel aid. This individual used a sonic guide. Eleven respondents (42.3 percent) indicated that they used other secondary aids. Items that were included were triple bifocal glasses, identification cane, cane and sighted guide. Vancouver had the highest percentage (80.9) of people who used only one type of travel aid. Calgary had the highest percentage (33.3) of people who used more than one travel aid. Two individuals did not reply to this question.

Individuals who indicated they had other handicaps besides a vision loss used many types of travel aids such as cane, sighted guide, and identification cane. Personal assistance, rides in cars, friends and relations, scope and handibus were also listed as modes of travel. These forms of assistance indicate that those individuals are dependent on others.

IV. DATA ANALYSIS

A chi-square test was used to measure statistical significance. The critical value for chi was taken at the .05 level. The chi-square test was used in the comparison of the LRT and other methods of transportation, in the comparison of LRT use and prior orientation and mobility instruction, and to compare differences in comfort levels in LRT use between those subjects who had received orientation and mobility training and those who did not.

Descriptive data are presented on the subject's use of travel aids, frequency of LRT use, orientation and mobility training and reasons for using or not using the LRT. The results are presented in frequency tables.

CHAPTER THREE

RESULTS

This study demonstrated that independent travelers make use of public transportation, including the LRT. The data demonstrated significant relationships exist between:

1. LRT Use and Age of Subject
2. LRT Use and Bus Use.

I. LRT USE

Thirty eight subjects were LRT users: 6 (15.8 percent) used it 5 days per week, 6 (15.8 percent) used it 2 - 4 days per week, 2 persons used it at least 1 day per week and 24 (63.1 percent) used it less than one day per week. Twenty five subjects did not use LRT systems.

Twenty (52.6 percent) of the LRT-using subjects were in the 20-39 year age grouping. The remaining 18 (47.4 percent) were in the 40-65 year age range. This is in contrast to the non-users. Six (25 percent) of the nonusers were in the 20-39 year age group and 18 (75 percent) were in the 40-65 year age group.

Significantly more subjects in the 20-39 age range made use of the LRT. The age at which the subject acquired a visual loss was not significant, while age was a

significant factor in LRT use. Table VI compares the age of the subject with LRT use.

Table VI: LRT Use Compared to Age of Subject

		LRT Use		Chi-square	
		Yes	No		
Age:	20-39	20	6	4.69	<.05*
	40-65	18	18		

*Statistically significant at = .05 level.

In Calgary, 12 (63.2 percent) subjects used the LRT system infrequently - less than one day per week. Three subjects (15.8 percent) used the system at least one day per week or more; 4 persons (21.0 percent) did not use the system at all.

In Edmonton, 12 subjects used the system. Three subjects used the system at least once a week, 9 subjects used the system infrequently and almost half (47.8 percent or 11 persons) did not use the LRT system.

The situation was much the same in Vancouver as it was in Edmonton. Ten of twenty one respondents (47.6 percent) did not use Skytrain. Eight persons (38.1 percent) used the system a minimum of once a week and 3 persons used it less than once a week. Table VII shows the frequency distribution of LRT use for Calgary, Edmonton and Vancouver.

Table VII: Frequency of LRT Use

Frequency	Calgary	Edmonton	Vancouver	Totals	Percent
5 days/week	1	2	3	6	9.5
2-4 days/week	1	1	4	6	9.5
1 day/week	1	0	1	2	3.2
< 1 day/week	12	9	3	24	38.1
never	4	11	10	25	39.7
Totals:	19	23	21	63	100.0

Twenty one subjects (55.3 percent) reported that they used the system alone without assistance; 7 subjects (18.4 percent) used the system with assistance when needed; 3 people used the system only with the assistance of a sighted person. Seven respondents (18.4 percent) did not answer this question. The reasons why they did not answer are unknown. Table VIII shows the number of respondents who used the system independently and with assistance.

Table VIII: How Subjects Use the LRT

	Calgary	Edmonton	Vancouver	Total	Percent
no assist.	9	7	5	21	55.3
assist. when needed	2	2	3	7	18.4
only with assist.	1	0	2	3	7.9
no response	3	3	1	7	18.4
Totals:	15	12	11	38	100.0

II. USE OF OTHER TRANSPORTATION SYSTEMS

All LRT users made use of the bus system. The figures indicate that LRT use and bus use are related. No significant relationships were found between use of taxis, handicapped transportation, and family and friends.

Subjects were as likely to make use of these other methods of transportation whether or not they used the LRT.

Table IX compares LRT use to bus, taxi, handicapped transportation and family and friends (for transportation). The figures are reported in terms of LRT Users and LRT Nonusers and whether or not they used the other methods of transportation.

Table IX: LRT Users/Nonusers as Related to Bus, Taxi, Transportation for the Handicapped, and Family and Friends

		LRT Use		Chi-square	
		Yes	No		
Bus Use:	Yes	38	16	16.4	<.05*
	No	0	9		
Taxi Use:	Yes	25	14	.4	>.05
	No	13	10		
Handicapped Transport.:	Yes	9	7	.06	>.05
	No	27	18		
Family & Friends	Yes	31	21	.04	>.05
	No	7	4		

*Statistically significant at = .05 level.

The frequency distribution of the other methods of transportation can be found in Appendix III.

III. ORIENTATION AND MOBILITY TRAINING

Of sixty three respondents to the survey, 21 (33.3 percent) indicated that they had received orientation and mobility training. Forty two respondents (66.7 percent) indicated that they had not. Table X shows the number of respondents who received training.

Table X: Mobility Training of Subjects

City	Training Not Received	Training Received	Percentage Receiving Training
Calgary	14	5	26.3
Edmonton	15	8	39.1
Vancouver	13	8	38.1
Total:	42	21	33.3

No subject had received orientation and mobility training on the LRT. One individual indicated that he would be getting instruction soon.

Sixteen of 38 LRT users (42.1 percent) and 8 LRT nonusers had received prior orientation and mobility instruction.

IV. REASONS FOR USING THE LRT

Subjects used the LRT for many different reasons. Twenty one subjects gave two or more reasons for using the LRT. Five (13.1 percent) used it for going to work; 16 (42.1 percent) for shopping; 25 (65.8 percent) for recreation or visiting; 8 individuals (21.0 percent) indicated they used the LRT for doctor's appointments, university classes, going to church, bank or C.N.I.B. Table XI shows reasons for the use of LRT.

Subjects were requested to indicate what they liked about the LRT system in their city. (Comments are listed in Appendix IV.) The most common reply was that LRT systems are fast. Subjects also reported they liked the

Table XI: Subjects' Reasons for Using the LRT

Reason	Calgary	Edmonton	Vancouver	Total	Percent of 38
going to work	2	1	2	5	13.1
going shopping	9	2	5	16	42.1
recreation or visiting	8	8	9	25	65.8
other	5	2	1	8	21.0
Total:	24(n=15)	13(n=12)	17(n=11)	54(n=38)	

oral announcements at each station, courtesy of the personnel, frequent and reliable service, assistance that is available if required, and the LRT's accessibility.

V. DIFFICULTIES WITH THE LRT

Subjects were asked to state difficulties they experienced with the LRT systems. These difficulties were divided into 2 categories: station difficulties and train difficulties. Station difficulties included: knowing destinations of trains coming into the station, dim or no lighting for stairwells, inaccessibility of some stations, inability to read signs with flashing LED readouts, obstacles on the platforms, and station layout.

Difficulties related to the train included: wrong station announcements or lack of announcements, unclear announcements, finding train doors and door buttons, the train door opening where there was no platform, and difficulties with the post in the centre of the door (especially when the poles have been adapted for wheelchair access). Spaces between the cars can be mistaken for door

opening and the doors close too quickly. (See Appendix V for a complete list of anecdotal comments on subjects' difficulties with the LRT trains and stations.)

VI. COMFORT LEVELS AND INFORMATION ACCESS

The four remaining questions for LRT users in this section of the survey dealt with their comfort in using the LRT, their comfort in using unfamiliar stations, their comfort in using new routes involving the LRT and how easy the information systems were to access.

Thirty one subjects responded to the question regarding "comfort in using the LRT". Subjects were asked whether they felt comfortable using unfamiliar LRT stations or new routes involving the LRT. Sixteen subjects indicated that they were uncomfortable or very uncomfortable using unfamiliar stations and 15 subjects indicated that they were "uncomfortable" or "very uncomfortable" using new routes. Fifty percent of those who answered the question regarding the ease with which they could access information systems indicated that it was easy, while 50 percent indicated that it was difficult or very difficult. The responses to these questions can be seen in Table XII and XIII.

Table XII: Comfort in Using the LRT, Unfamiliar Stations and New Routes Involving the LRT

		Cal.	Edm.	Van.	Total	Percent
LRT Use:	very com.	3	6	3	12	38.7
	comfortable	6	1	5	12	38.7
	uncomfortable	2	2	2	6	19.4
	very uncom.	1	0	0	1	3.2
Unfamiliar Stations:	very com.	0	0	1	1	3.2
	comfortable	5	6	3	14	45.2
	uncomfortable	5	2	5	11	35.5
	very uncom.	3	1	1	5	16.1
New Routes:	very com.	1	0	1	2	6.9
	comfortable	5	6	1	12	41.4
	uncomfortable	4	2	7	13	44.8
	very uncom.	2	0	0	2	6.9

Table XIII: Ease of Accessing Information

	Calgary	Edmonton	Vancouver	Total	Percent
very easy	0	0	0	0	0.0
easy	6	4	4	14	50.0
difficult	4	2	3	9	32.1
very difficult	2	2	1	5	17.9
Totals*:	12	8	8	28	100.0

*Three responses were not received from Calgary, four from Edmonton and two from Vancouver. One person from Vancouver indicated that this question was not applicable to them.

There was no significant relationship between reported level of comfort with LRT use and prior orientation and mobility training.

VII. LRT NON-USE

Subjects who did not use the LRT were asked why they did not use it and if they had tried to use it. Thirteen of these subjects (52.0 percent) indicated that they did not use the LRT because it did not go where they wanted to

go. The remaining 12 people (48.0 percent) did not use the LRT because it was either too difficult to use or they had not received instruction on it's use. Other reasons included being driven by friends or relatives, they lived in a hospital, lack of need, or unavailability of the LRT in the area of the city where they lived.

Three subjects (12.0 percent) indicated that they found the LRT too difficult to use. They found the bus easier to use or they had a near-accident on the LRT. Reasons for non-use of the LRT can be found in Table XIV.

Table XIV: Why Subjects Were Not Using the LRT

Reason	Calgary	Edmonton	Vancouver	Total
too difficult	0	1	2	3
no instruction	2	0	0	2
bad experience	0	0	0	0
doesn't go where you want to go	1	8	4	13
other	1	2	4	7
Total	4	11	10	25

CHAPTER FOUR

DISCUSSION AND LIMITATIONS

I. DISCUSSION

LRT Use

The majority of subjects in this study used the LRT, however, most LRT users used the system infrequently. An interesting finding of the study was that the majority of LRT users were in the 19-39 age category. Subjects in this age range were more likely to have had access to orientation and mobility training as part of their education and been encouraged to develop an independent lifestyle. Orientation and mobility training has only been available to blind persons during the last 20 years. It has been increasingly recognized as an essential component of the education and rehabilitation of blind persons.

The age at which visual impairment occurred did not affect use of the LRT system. Just as many subjects who were blinded in childhood made use of the system as subjects who were blinded in adulthood.

Persons who become visually impaired in their teens or adulthood have visual memories of city streets and other concepts related to travel - for example, they can visualize an intersection. Adventitiously blinded people tend to find outdoor travel easier than individuals who were blind at birth or very early in life. The majority of

people who used the LRT had either low vision or tunnel vision.

Of the 5 blind LRT-using subjects, 4 had previous orientation and mobility training. Only 1 subject that did not receive training used the LRT.

Most LRT users traveled independently. They neither needed to be accompanied or required assistance while traveling. More than half, or 54.5 percent, of subjects with a secondary handicap also made use of the LRT. Seven of these subjects used the LRT infrequently (less than one day per week) while 5 subjects used it 2 or more days per week. Secondary handicaps represented in this study did not seem to affect independent travel.

Use of Other Transportation Methods

LRT users used other forms of public transportation such as city buses. All the LRT users in this sample rode the bus, suggesting that LRT users are independent. The reasons provided by respondents for LRT use indicate the independence of those respondents who used the LRT for going to work, shopping, recreation and other personal reasons.

Subjects who did not use either the LRT or the Transportation for the Handicapped relied on family and friends for travel. There were 5 subjects who did not make use of any mode of public transportation.

Ten subjects indicated that they used both the LRT and the Transportation for the Handicapped. Most of these subjects did not have additional handicaps. Further study is necessary to determine why they also used the Transportation for the Handicapped.

Difficulties with the LRT

Almost 50 percent of the LRT users reported some difficulties with the systems. The difficulties subjects reported concerned access to information regarding train destinations and station announcements. It is important for transit companies to consider other means of making information available, such as oral announcements of incoming trains. Information about train schedules and destinations of trains is available only in print at the present time.

Fifty percent of the subjects felt that the LRT systems provided sufficient information for convenient use, and 50 percent felt that information was not accessible. The subjects who considered that information was accessible were able to read print. Only one print reader found information difficult to access and this subject reads braille and uses audio tapes, suggesting a more severe visual impairment than the other print readers. Three of the individuals who were satisfied used braille or audio tape. One third of the unsatisfied could not access print.

In Calgary, three different lines make use of the same platform in the downtown area. Blind LRT patrons have no way of knowing which train pulling into the station will take them to their desired destination unless they ask someone. Station announcements of incoming trains could remedy this. In systems like Vancouver and Edmonton, where there is presently only one line, these announcements would be useful so that LRT users would know which direction the incoming train was going.

Vancouver's Skytrain uses LED signs to announce the arrival of trains into its stations. These are helpful to some individuals, but many subjects could not use them. These subjects found the signs too difficult to read because the words moved or the signs were too small. Audible announcements would make information more accessible.

II. LIMITATIONS

Due to the small sample, it is difficult to demonstrate how representative the sample population was. No target population demographics were available to the researcher, except for the approximate number of visually impaired persons registered with the C.N.I.B. in each city. Those persons who are registered with the C.N.I.B. are registered voluntarily. Not all legally blind people are registered with this agency. The author requested that subjects for this study be randomly chosen from those

registered visually impaired individuals by the method described in Chapter 2.

It would have been interesting to know the employment status of LRT users - as well as more specific information about the extent of their orientation and mobility training.

Some of the questionnaire terms may also have been misinterpreted. For example, in the question regarding the need for assistance, it is possible that some persons interpreted answer "b) alone (with sighted assistance at your request when needed)" to mean needing a sighted person to accompany them. This answer was intended to indicate that the subject only received assistance in order to obtain information about such things as the destination of the incoming train.

A final limitation was the small number of totally blind LRT users in the sample. Although 5 of the 9 totally blind subjects were LRT users, it is possible that they are not representative of the totally blind group in general. It will be interesting to see if LRT use will increase with more intensive orientation and mobility instruction in LRT use.

CHAPTER FIVE

SUMMARY AND RECOMMENDATIONS

I. SUMMARY

Visually impaired people are making use of the LRT systems. The majority of these people have some sight. Those who used the LRT were impressed with its frequent and reliable service, the on-board train announcements of the next station, the courtesy of the personnel and the LRT's accessibility. Reported difficulties included knowing which train was pulling into the station, the incorrect, absent or unclear announcements of upcoming stations, poles in the centre of the doorway (especially when adapted for wheelchair use), station layouts and mistaking the spaces between cars for doorways.

Many of the difficulties LRT-using subjects experienced were related to their not having received orientation and mobility training. Only a small percentage of visually impaired people who participated in this study indicated that they had received orientation and mobility instruction. None had received instruction on the LRT. Only one individual stated that he would be receiving this training.

Orientation and mobility instruction in LRT use, station and platform layout, car design, knowledge about available assistance, use of maps, and platform recovery

would enable the blind person to use the LRT system with fewer difficulties and frustrations. Appropriate orientation and mobility training will prevent deaths or injuries from falling onto the tracks between the cars. Modified cane techniques or solutions such as checking for the floor of the car before boarding must be taught. More travelers should probably employ canes if they have difficulty visually detecting the difference between the car doorway and the between-car space.

Orientation and mobility training can increase the comfort level of visually impaired LRT patrons by decreasing the number of difficulties that the LRT users had. Use of LRT systems should be included as part of orientation and mobility training - these systems are complex, noisy and present special problems to blind travelers.

Age of onset of blindness and degree of visual impairment were not determinant factors in LRT use in this study. However, the desire and ability to travel independently emerged as an important determinant of LRT use.

II. RECOMMENDATIONS

This section includes recommendations for both orientation and mobility instructors and transit companies.

Transit Companies

1. An alternate location for poles in the centre of train doorways should be found, especially for poles that have been adapted for wheelchair use.
2. Audible announcements should be made on station platforms should be made to indicate which train is coming into the station. Some systems provide LED displays, and all trains are marked, but many visually impaired people cannot make use of these media.
3. Ensure that all on-board train announcements are clear and correct.
4. Use signage in large, clear letters with high contrast colors, so more of the visually impaired population that access large print can make use of them. (see Bentzen, Jackson and Peck, 1981).

Orientation and Mobility Training

1. Visually impaired people require orientation and mobility training on the LRT to enable them to overcome some of the difficulties they are encountering on the system such as: figuring out the station, finding elevators and locating the buttons to open the LRT doors.

2. Adapted cane techniques should be taught to increase safety in LRT stations - to prevent them falling from platforms and other dangers.
3. Visually impaired people who might mistake the between car space for a train doorway should use a white cane and use it to check for the floor of the train before boarding.

APPENDIX I

GLOSSARY OF TERMS

ARC - The pattern that the cane tip makes when the touch technique is being used. (2)

BLINDNESS - An inability to see. (3)

CANE - see LONG CANE

CANE TECHNIQUE - Use of a white cane to detect obstacles and drop offs (such as curbs and stairs) in one's path.

CENTRAL VISION - The detection of movement or objects in our direct line of vision. Central vision is the vision we use to see fine detail and for reading.

CONGENITAL - Present at birth.

DOG GUIDE - A dog used by a blind person, for the purposes of mobility. The dog is trained to stop at stairs and curbs and guide the blind person around obstacles.

ELECTRONIC TRAVEL AID - An electronic device for the purpose of assisting the visually impaired person with mobility. These devices detect obstacles and/or drop offs (curbs).

INFORMATION SYSTEMS - Announcements, maps and signs used by Transit systems to inform the public about the system's use.

LEGAL BLINDNESS - A visual acuity of 20/200 or less in the better eye after best possible correction or 20 degrees or less remaining of one's visual field. 20/200 indicates that what a normally sighted person can see at 200 feet, the legally blind person can see at 20 feet with the same degree of clarity.

LIGHT PERCEPTION - The ability to detect the presence or absence of light.

LIGHT PROJECTION - Ability to determine the direction of a light source. Slightly better acuity than light perception. (3)

LONG CANE - A lightweight cane of prescribed length which is an obstacle detector and environmental sensor for the blind pedestrian. They are typically white, with a six inch red stripe above the lower tip, and are longer than an orthopedic cane. (1)

LOW VISION - When impairment in the visual system interferes with normal daily functioning. (1)

LRT - Light Rapid Transit or Light Rail Transit - In Calgary the system is known as the C-Train, in Edmonton as the LRT and in Vancouver as the Skytrain.

MOBILITY - The capacity, the readiness and the facility to move. The ability to move within one's environment. (2)

MOBILITY INSTRUCTOR - A person who has received specialized training in teaching the visually impaired orientation and mobility skills.

MONOCULAR - Distance viewing device similar to binoculars, but for use with one eye at a time.

ORIENTATION - The process of utilizing the remaining senses in establishing one's position and relationship to all other significant objects in one's environment. Collection and organization of information concerning the environment and one's relationship to it. (2)

ORIENTATION AND MOBILITY TRAINING - The training of a visually impaired person to use all his senses to orient himself and learn to move about in the environment freely, safely and efficiently, while knowing where he is in space.

PARTIALLY SIGHTED - Having a visual acuity of 20/70 or less in the better eye after best possible correction, and being able to use residual vision as the principal channel of learning. A person who is at least able to count fingers. (2)

PERIPHERAL VISION - The detection of movement or objects which are not in the direct line of vision. Objects may not be seen with great clarity in the peripheral vision.

RESIDUAL VISION - The remaining vision a visually impaired person has.

ROUTES - The path one travels to get from one place to another.

SIGHTED GUIDE TECHNIQUE - The use of a sighted person as an aid for travelling. The visually handicapped person grasps his guide's arm just above the elbow with a firm yet relaxed grip, and follows about a half step behind the guide. This allows sufficient time to react to the guide's starting, stopping, turning or stepping up or down. (1)

SIGNAGE - All maps and signs in printed form.

SONIC GUIDE - A head mounted device used for the detection of obstacles. The distance from the obstacle can be judged by the sound waves that generate from the device and bounce back from the object.

TUNNEL VISION - Loss of the peripheral visual fields with the retention of some degree of central field. (3)

VISUALLY IMPAIRED - One who has lost much or all of his vision.

Glossary terms have been taken from one of the sources below, or written specifically for this glossary. Those terms which have been taken from other sources are followed by a number corresponding to the text from which it was taken.

- (1) Bentzen, B. L., Jackson, R. M. and Peck, A. F. (August 1981) Solutions for Problems of Visually Impaired Users of Rail Rapid Transit. Vol. 1 of Improving communications with the Visually Impaired in Rail Rapid Transit Systems. Washington, D.C.: U.S. Department of Transportation, Urban Mass Transportation Administration.
- (2) Hill, Everett and Ponder, Purvis. Orientation and Mobility Techniques New York: American Foundation for the Blind, 1976.
- (3) Cassin, Barbara and Sheila Solomon. Dictionary of Eye Terminology. Gainesville, Florida: Triad Publishing Co., 1984.

APPENDIX II

LETTERS AND SURVEY

The letters and survey questionnaire were sent out in large print so that a greater number of the visually impaired population could read it without assistance. It was known that even though the questionnaire was sent in large print, some individuals would still require assistance to read it.

Dear Sir/Madam:

I am conducting a research project on transit and the visually impaired, entitled, "Use of the Light Rail or Light Rapid Transit Systems by Individuals with Severe Visual Impairments". Your assistance in completing this project is very important. This study is being conducted in Edmonton, Calgary and Vancouver. Information gleaned from this study will be forwarded to each of the transit companies where the study is being conducted, as they are interested in the results. With continuing expansion of these systems, your input may be beneficial for improving the new additions.

Very little information has been gathered on how useful the light rail/light rapid transit system (LRT, C-Train and Skytrain) is for the visually impaired. This research project will therefore answer the following questions:

1. Do the visually impaired use light rail/light rapid transit? Why or why not?
2. What level of orientation and mobility training was received by those individuals using the rapid rail system?

My qualifications for conducting this research are as follows: I am a certified teacher of the visually impaired and a certified orientation and mobility instructor. The results of this research will be reported in a thesis and given to the transit companies in Edmonton, Calgary and Vancouver.

USE OF THE LIGHT RAIL OR LIGHT RAPID TRANSIT
SYSTEMS BY
INDIVIDUALS WITH SEVERE VISUAL IMPAIRMENTS

Thank you very much for taking the time to complete this survey. Your assistance in completing this research is very important. If you wish to answer in some other format than print, (braille or tape), feel free to do so, but please return this survey form together with your answers. Your answers are anonymous. Again, thank you very much for your cooperation.

LIGHT RAIL/LIGHT RAPID TRANSIT SURVEY

DIRECTIONS: Please complete all of the following items or question by checking the appropriate response and/or writing in one or more words.

SECTION 1: RESEARCH DATA

1. What is your PRIMARY method of travel? (please mark only one)
☐ a) sighted guide
☐ b) white cane with touch technique
☐ c) identification cane only
☐ d) dog guide
☐ e) no aid used
☐ f) other (please specify) _____
2. In combination with the above travel methods, do you presently use:
☐ a) a distance monocular lens
☐ b) an electronic travel aid (please specify what type) _____
☐ c) other (please specify) _____
☐ d) no other aids used
3. How often do you use the buses:
☐ a) 5 days per week or more
☐ b) 2 to 4 days per week
☐ c) 1 day per week
☐ d) less than one day per week
☐ e) never
4. How often do you use the LRT:
☐ a) 5 days per week or more
☐ b) 2 to 4 days per week
☐ c) 1 day per week
☐ d) less than one day per week
☐ e) never
5. How often do you use taxi's:
☐ a) 5 days per week or more
☐ b) 2 to 4 days per week
☐ c) 1 day per week
☐ d) less than one day per week
☐ e) never
6. How often do you use transportation for the handicapped:
☐ a) 5 days per week or more
☐ b) 2 to 4 days per week
☐ c) 1 day per week
☐ d) less than one day per week
☐ e) never

7. How often do you rely on friends or family for transportation:
- ☐ a) 5 days per week or more
 - ☐ b) 2 to 4 days per week
 - ☐ c) 1 day per week
 - ☐ d) less than one day per week
 - ☐ e) never
8. Were you given formal training in orientation and mobility?
- ☐ a) yes
 - ☐ b) no

If you USE the LRT, please answer the questions 10 to 17.
If you DO NOT use the LRT, please answer questions 18 and 19.

10. Do you use the LRT:
- ☐ a) alone (with no sighted assistance)
 - ☐ b) alone (with sighted assistance at your request when needed)
 - ☐ c) only with the assistance of a sighted person
11. In what instances do you use the LRT? Check all that are appropriate.
- ☐ a) going to work
 - ☐ b) going shopping
 - ☐ c) for recreation
 - ☐ d) going visiting
 - ☐ e) other (please specify) _____
12. What do you like about using the LRT?
13. Have you every had any difficulties in using the LRT system in your city? If so, please describe the problem below.
14. How comfortable are you using the LRT?
- ☐ a) very comfortable
 - ☐ b) comfortable
 - ☐ c) uncomfortable
 - ☐ d) very uncomfortable
15. How comfortable are you using unfamiliar stations?
- ☐ a) very comfortable
 - ☐ b) comfortable
 - ☐ c) uncomfortable
 - ☐ d) very uncomfortable

16. How comfortable are you using new routes involving the LRT?

- ☐ a) very comfortable
- ☐ b) comfortable
- ☐ c) uncomfortable
- ☐ d) very uncomfortable

17. How easy are the information systems to access?

- ☐ a) very easy
- ☐ b) easy
- ☐ c) difficult
- ☐ d) very difficult

Please answer the questions in Section 2.

Please answer questions 18 and 19 if you DO NOT use the LRT.

18. If you do not use the LRT in your city, is it because:

- ☐ a) you find the system too difficult to use
- ☐ b) you have not received any instruction in how to use it
- ☐ c) you have had a bad experience on the LRT
- ☐ d) it does not go where you wish to go
- ☐ e) other (please specify) _____

19. If you answered (a) above, please describe the difficulties you have encountered.

Please answer the questions in Section 2.

SECTION 2: SUBJECT DATA

1. I live in:
☐ a) Calgary
☐ b) Edmonton
☐ c) Vancouver
2. I am:
☐ a) male
☐ b) female
3. At what age did your visual impairment occur:
☐ a) at birth
☐ b) 1 - 5 years
☐ c) 6 - 18 years
☐ d) in adulthood
4. Are you:
☐ a) a braille reader
☐ b) a large print reader
☐ c) a regular print reader
☐ d) a tape reader
☐ e) other (please specify) _____
5. To what degree are you visually impaired:
☐ a) totally blind
☐ b) perceiving light only
☐ c) tunnel vision
☐ d) peripheral vision only
☐ e) low vision
6. If you have any other additional handicaps, mark whichever ones describe you.
☐ a) physical disability
☐ b) speech impairment
☐ c) hearing loss
☐ d) reading disability
☐ e) other (please specify) _____
7. What age group do you fit in?
☐ a) 19 to 29 years
☐ b) 30 to 39 years
☐ c) 40 to 49 years
☐ d) 50 to 59 years
☐ e) 60 to 65 years

APPENDIX III

FREQUENCY DISTRIBUTION TABLES OF TRANSPORTATION METHODS

Bus Use Among LRT Users and Nonusers

Frequency	Calgary		Edmonton		Vancouver		Totals		
	U	N	U	N	U	N	U	N	C
5 days/week	5	2	7	4	8	3	20	9	29
2-4 days/week	4	0	1	1	2	1	7	2	9
1 day/week	2	0	0	0	1	1	3	1	4
< 1 day/week	4	0	4	3	0	1	8	4	12
never	0	2	0	3	0	4	0	9	9
Totals:	15	4	12	11	11	10	38	25	63

Frequency of LRT Use

Frequency	Calgary		Edmonton		Vancouver		Totals		
5 days/week	1		2		3		6		
2-4 days/week	1		1		4		6		
1 day/week	1		0		1		2		
< 1 day/week	12		9		3		24		
never	4		11		10		25		
Totals:	19		23		21		63		

Taxi Use Among LRT Users and Nonusers

Frequency	Calgary		Edmonton		Vancouver		Totals		
	U	N	U	N	U	N	U	N	C
5 days/week	0	1	0	1	0	0	0	2	2
2-4 days/week	3	1	0	1	0	0	3	2	5
1 day/week	1	0	0	1	3	0	4	1	5
< 1 day/week	6	1	8	5	4	3	18	9	27
never	5	1	4	3	4	6	13	10	23
Totals*:	15	4	12	11	11	9	38	24	62

*One respondent from Vancouver did not answer this question.

Use Of Handicapped Transportation Among LRT Users and Nonusers

Frequency	Calgary		Edmonton		Vancouver		Totals		C
	U	N	U	N	U	N	U	N	
5 days/week	1	2	0	0	0	0	1	2	3
2-4 days/week	0	0	0	0	1	1	1	1	2
1 day/week	1	0	1	0	0	0	1	1	2
< 1 day/week	1	0	2	1	3	2	6	3	9
never	12	2	9	9	6	7	27	18	45

Totals*: 15 4 12 10 10 10 36 25 61

* One respondent from Edmonton and one from Vancouver did not complete this question.

Use of Family/Friends For Transportation Among LRT Users and Nonusers

Frequency	Calgary		Edmonton		Vancouver		Totals		C
	U	N	U	N	U	N	U	N	
5 days/week	4	2	2	3	3	2	9	7	16
2-4 days/week	4	0	3	3	2	5	9	8	17
1 day/week	4	0	0	2	4	0	8	2	10
< 1 day/week	1	1	3	1	1	2	5	4	9
never	2	1	4	2	1	1	7	4	11
Totals:	15	4	12	11	11	10	28	25	63

APPENDIX IV

ANECDOTAL COMMENTS ABOUT WHAT SUBJECTS LIKED ABOUT THE LRT

This appendix contains the comments of the subjects in full, regarding the things they liked about the LRT.

Subject	Comment
#2	- quick
#3	- the intervals between trains are usually frequent - interiors are usually clean and maintained - usually a minimum amount of time to travel from N.E. to C.B.D.
#6	- fast - announcing stops
#8	- you can hear over the speaker where you are
#9	- quicker
#12	- faster than bus if available
#16	- convenience, courtesy of personnel - assistance
#17	- easy to use and the least expensive
#18	- it's very quick
#22	- accessability
#33	- fast, efficient, all stops are announced
#34	- cuts down on downtown traffic - more direct - faster
#36	- it is quick
#38	- it is frequent and reliable service - also it is within walking distance of our home
#39	- it is quick and it doesn't have too many stops
#40	- fast and convenient

- #43 - convenient - new experience
- #46 - the LRT is faster and more direct
- #48 - it's fast
- #53 - from here to there
- #54 - it is fast and safe
- #58 - it's quick
- #59 - it gets me there faster downtown
- #63 - it is fast
- #64 - it is quick transportation
- #66 - it is a very convenient way to travel a great distance in a quick format
- #67 - you get to places faster
- #68 - it's quick
- #69 - speed and frequency
- #70 - once I'm at the LRT station, transportation is quicker than using the bus

APPENDIX V

ANECDOTAL COMMENTS ABOUT DIFFICULTIES SUBJECTS HAD WITH THE LRT

This appendix contains the comments of the subjects in full, regarding the difficulties they have with the LRT.

Subject	Comment
#3	<ul style="list-style-type: none">- occasional difficulties with projecting railing which houses button to activate door. The rails (posts) were adapted for wheelchair access - but act as an encumbrance for the visually impaired (particularly totally blind).- lack of announcements on exterior of train at each station to announce direction of train.
#6	<ul style="list-style-type: none">- I caught my finger in the hinge of the door and lost the end off my finger and nail.
#7	<ul style="list-style-type: none">- I am fully aware of the system as it took it's current form and the lack of consideration to the physically handicapped in it's construction. The trains move at a very rapid speed, and are hardly conducive to the lesser mobile person. The ramps are dangerous enough not to be undertaken by the visually impaired unless a guide of some sort is present. The stations have more stairs which are time consuming and dangerous for us to handle!
#9	<ul style="list-style-type: none">- try to find the door from the outside.
#16	<ul style="list-style-type: none">- caught in doors twice - due to shoving of crowd. No injury.
#17	<ul style="list-style-type: none">- I get on the wrong train or miss the desired train sometimes.
#22	<ul style="list-style-type: none">- the pole in the center of door is a problem for me. I cannot see it very well and have walked into it on several occasions. Also spaces between the cars (outside where joined together) can be mistaken for a door opening. I have almost fallen (down onto tracks).
#24	<ul style="list-style-type: none">- Too hard to find the button to press and open the door (not well enough marked).- Wheelchair accessibility is an obstacle to the blind person.
#34	<ul style="list-style-type: none">- figuring out the station.- figuring out where elevators are.

- one doesn't have elevator Granville St. in Vancouver. It's center city inaccessible for disabled.
- #40 - sometimes override my destination, due to daydreaming.
- #46 - stairs descending into the station - they are terribly dim, with either no light or very little overhead lighting.
- small print on the time schedules, which I am unable to read.
- #48 - the Columbia Station in New Westminster is awkward to manage, having to go down a lot of stairs before reaching the elevator or escalator. As a matter of fact, most of the stations I have used are not designed very well.
- #51 - Eye coordination problems seem to become aggravated. The above problem has been with me about 40 years. The problem, it seems to me, became evident after an almost fatal car accident. The same problem grew worse after coma shock treatments and vast doses of tranquilizers.
- #56 - I find the bus easier to ride when I have to.
- I have double vision a lot so I have to be careful.
- #58 - only trouble is reading signs that have a broken digital readout (LED) instead of a straight line type.
- #59 - at first it was difficult knowing which direction the train was going, so I didn't know what side of the platform to stand on.
- #60 - Makes me very nervous.
- Nearly fell when it started to speed up.
- #64 - Yes. Just in the sense that I need someone to tell me which train it is. If no one is on the platform, I have no idea which train it is.
- #66 - doors close too quickly for me.
- do not announce stations very clearly.
- station stops have obstacles on them sometimes.
- #69 - find the door and the door button.
- knowing which one of the trains this one is.

- knowing which stop we have arrived at.
Sometimes the announcer gives the wrong station and do not announce.
- one time the door arrived at a place wheretherewas no platform. Driver notified him in time.
- one time didn't know which stop we have arrived at so had to hold the door open in order to get attention of the driver.

#70

- Yes. My difficulty is I never know what train I am on unless I ask someone on the platform.

APPENDIX VI

OTHER COMMENTS MADE BY SUBJECTS

This appendix contains comments made by the subjects, to the researcher which were not connected with any particular question. Comments have been edited so that the individual may not be identified.

Subject	Comment
#3	- city of Calgary has approached C.N.I.B. and HETCO (Handicapped and Elderly Transportation Committee) re. some adaptations for the visually impaired - but more adaptations could take place.
#5	- the running light signs are hard to read on buses (destination).
#7	- I am in a unique position, as I do not work outside my home, thus require the Transit System, in any form, for less than perhaps others in my visual impairment situations. I also have a husband who works shift work and most appointments I make (i.e. doctors etc.) can be accommodated according to his shifts. My husband has no physical impairment of any kind and has always been available to drive me. Most organizations I belong to also are aware of my visual impairment and usually share the responsibility of driving me about. I also have a sister and sister-in-law in town who are very good, under emergency circumstances, in helping me out. My children are only 13 and 10 years so are not drivers as yet. Personally I find the Transit system, whether bus or LRT very difficult, so I try to avoid use of either. Actually, I'd be very frightened of the LRT because of the aforementioned liabilities (see Appendix V for the liabilities mentioned). If at this stage I were forced to use either system, I'm sure I would adapt, but I would have to be very cautious and wary with the systems. Part of my misgivings are borne out of a hatred for public transportation that goes back to High School days, when I was required to use it on a regular basis. So perhaps I am more prejudiced than those who really need a public system.

- #8
 - I find that I have to ride the transit buses more because the LRT is usually out of my way. I have also had a number of problems using the transit system.
- #29
 - have always had trouble organizing time with Handi-Dart - called arrival time and they don't show up.
- #46
 - In Edmonton, the LRT system consists of only one line. The LRT begins in a large community in northeast Edmonton and travels directly into the downtown core. There are only nine stops between the beginning of the route and its completion. So, in actual fact, our system is extremely easy to use. The only problems I do have are the stairs descending into the station - they are terribly dim, with either no light or very little overhead lighting. The other problem exists because of the small print on the time schedules, which I am unable to read.

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