## Title

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## Authors

Golledge, R.
Costanzo, C. M.
Marston, J.

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**Reginald G. Golledge**
**C. Michael Costanzo**
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# Public Transit Use by Non-Driving Disabled Persons: The Case of the Blind and Vision Impaired

by

Reginald G. Golledge

C. Michael Costanzo

James Marston

Department of Geography
and
Research Unit in Spatial Cognition and Choice
University of California Santa Barbara
Santa Barbara, California 93106-4060

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## Abstract with Key Words

Abstract:

In this paper we examine characteristics of the activity patterns of blind and vision impaired non-driving populations. We begin by evaluating the impact of non-driving on employability and movement potential of the disabled non-driving group. We then examine the results of a survey of blind and vision impaired users of public transit facilities (primarily bus travel) in a moderate sized city in California USA. In addition to detailing some of the particular characteristics of dependency as far as movement is concerned by this population we attempt to define what characteristics of travel behavior and travel modes are deemed most frustrating, most useful, and most difficult to use via a survey questionnaire. Possible assistive technologies to aid in making travel decisions and undertaking travel are discussed from both the survey population's point of view and from the view of the most favored assistive technologies likely to be supported or currently being supported by private and public transportation organizations. In particular the negative impacts on activity patterns and quality of life produced by non-driving in the United States environment are emphasized, and suggestions made for ways to improve the accessibility of public transit for disabled groups.

Key Words:

Disabled blind persons; public transit; assistive devices; user survey; user attitudes

## Executive Summary

To date, most attention and compliance to the ADA mandates for equal access to transportation has been focused on the non-ambulatory/wheelchair bound traveler. These modification costs have been tremendous. Buses and trains have had to be refitted or new equipment purchased to provide wheelchair lifts and designated seating areas. Much transit infrastructure has been totally rebuilt to allow for elevators to bypass stairs, level access boarding and other costly structural modifications. Not so subtle grumbling is heard when few wheelchair users are seen in these facilities or on the expensive retrofitted buses.

The blind and visually impaired, in this country, represent a significantly large group of disabled persons who also need help with transportation modifications. The good news, uncovered in this survey, is that their needs do not seem to require anywhere near the massive outlays required by the adaptations for wheelchair users.

What we found was that the blind and visually impaired do not need many physical adaptations to existing equipment and infrastructure. Traveling for visually impaired people means moving through a world lacking many or all of the visual cues that sighted travelers, and many transit providers, take for granted. The absence of visual cues such as bus stop signs, bus numbers and street signs are the main barriers to equal access to transportation reported in this study. This group's main need is simply more and better INFORMATION.

1. The single most important characteristic of public transit use for blind and vision impaired people is <u>not</u> related to hardware improvement but rather to <u>improving access to information</u>.
2. The type of information most needed consists of:
   (a) Brailled or large print timetables and schedules.
   (b) Larger signs on transit vehicles to identify their routes.
   (c) Information at transit stops regarding whether or not a vehicle has just passed and wait time for next vehicle.
   (d) Clearer PA systems in terminals and on board vehicles.
   (e) Announcements of stops - either mechanical or verbal.
   (f) Auditory messages and signals at lights when change of vehicle or route necessitates crossing the street.

(g) Talking signs on transit vehicles and in terminals.

(h) Joint auditory/tactile information in terminals (e.g., talking tactual maps).

(i) Transit HOT LINES with human operators, not touch-tone access to pre-recorded messages.

3. Survey results indicate that improving information access should relieve many of the frustrations blind and vision impaired people experience when having to use public transit.
4. Auditory messages are needed to complement the abundance of visual messages currently available to sighted travelers.
5. For relatively little outlay, it may be possible to improve the attractiveness of public transit for this group.

Our respondents indicated that they needed more information about services for disabled travelers, that transit information was not always easy to obtain and that it was not always easy to understand and use.

Some of these needs can be addressed simply with better enforcement of existing procedures. Our respondents heaped praise on the local bus drivers for their assistance with their required stops, but a common theme was that bus stops and streets were not always announced, leading to missed stops and confusion. Also mentioned was the poor quality of announcements at the hub terminal. Both of these concerns could be addressed with stricter enforcement, or if needed, a taped announcement, either manual or automatic. Another problem that is easily addressed is that seats reserved for disabled, located near the door and the driver, were not always available for their intended patrons. Again stricter enforcement of existing rules would alleviate this problem. Our blind and visually impaired travelers also rated the telephone hotline, with human operators, as very valuable. Some travelers, however, were not aware of this service.

When asked to rate difficulties when using transit the problems were not with entering or exiting, paying the fare or other design issues. The most difficulty was rated for lack of information issues like knowing which bus to enter, knowing their location on a moving bus and dealing with transfers and crossing the street. More easily provided information was shown by their desire for timetables in suitable format, large print or Braille, available onboard.

The few technological helps they desired are certainly not as costly as infrastructure or equipment retrofitting. They showed a preference for auditory prompts at terminals and bus stops giving bus numbers and times of arrival of the next bus. Given the inability of many in the general public to read or understand transit schedules, these investments in auditory information systems would likely increase ridership in the total population. High preference was also shown for "talking signs," identifying output from a bus or sign that is transmitted to a hand held auditory device. They also indicated concern when crossing streets and therefore requested auditory traffic signals. These requests are the only technological aid requested that would be used only by the visually impaired.

## 1) Introduction

There is no doubt that America's passion for private automobile transportation has reformed the landscape and shaped the habits and lifestyles of almost all who live here. The magic 16th birthday, when a child gets a drivers license and becomes an independent adult, the decentralization and suburbanization of our major cities, the commonly accepted hour or more commute to a job, are major results of this passion for the private auto. Car ownership has changed the urban environment from one that was densely populated but livable (because of mixed zoning use where jobs were close to residential and shopping areas), to one where the majority of the population lives in suburban areas with single use zoning, where autos must be used for almost all trips. Jobs, shopping centers, entertainment, even schools are usually located at a distance from desirable residential areas. There are more cars in the United States than licensed drivers, in some counties, more cars are registered than the total population, including children.

Who needs public transportation anyway? The 1990 U.S. census reports 3,500,000 persons aged 16-64 with a mobility limitation. Of these only 22.9 percent are in the work force. A major factor in this dismal statistic is the lack of transportation to work centers. Another 4.6 million persons over age 65 report a mobility limitation. Many of these are denied freedom of movement and independence, a privilege most Americans take for granted.

## 2) The Study Area

This is a pilot project designed to develop and test a survey instrument that could b e used to evaluate the use of, preferences for, and attitudes towards public transit by blind and vision impaired non-drivers. This group is part of the larger group of mobility or self-care disabled groups that include the physically impaired, mentally ill and mentally retarded, the hearing impaired, cognitively impaired and those suffering from diseases such as AIDS, cancer, diabetes, arthritis, and other debilitating diseases. A recent estimate indicates that 43 million people suffer a disability in the USA (Table 1) and that 8.2 percent (about 14 million) suffer a work disability (Table 2). The corresponding disability percentages in California and Santa Barbara are 7.4 percent and 6.9 percent respectively.

Table 1 shows that there are about 3 million legally blind people in the USA. Other resources show that another 3-4 million are severely vision impaired. Many of these are also elderly, and about 20 percent of people over 64 years have difficulty or unable to see newsprint (see Table 3).

In the Santa Barbara area, there appears to be a lower than normal proportion of work disabled people (Table 2) and a higher than usual proportion of disabled people in the work force (30%). This figure is low, but we must remember that many disabled people are elderly and are beyond the work force age. However, on the whole, our study area exhibits a profile similar to that of both the USA and California.

2.1) Target Population.

Our primary target population was the blind and vision impaired population of the Santa Barbara-Goleta area; some participants were obtained from other towns in the North County area, notably Lompoc and Santa Maria.

**Table 1**

**Estimates of Types of Disability: USA, 1986**

| | |
|---|---|
| **Physical Disability** | |
| Non-Paralytic Orthopedic Impairments | 12,470,000 |
| Neurologic Impairments | 3,440,000 |
| Brain Dysfunction | 2,580,000 |
| Other Physical Disabilities | 860,000 |
| **Sensory Impairments** | |
| Blindness/Significant Vision Loss | 3,010,000 |
| Hearing/Speech/Language Impairments | 2,580,000 |
| **Cognitive Impairments** | |
| Mental Retardation (moderate/severe/profound) | 1,290,000 |
| Other (traumatic brain injury, learning disability, etc.) | 945,000 |
| **Mental Illness** | |
| Chronic and Severe Mental Illness | 1,290,000 |
| **Other Serious Health Impairments** | |
| Heart Disease/Vascular Disease | 6,880,000 |
| Pulmonary/Respiratory Disease | 2,150,000 |
| Cancer/Diabetes/Renal/Other | 4,730,000 |
| Epilepsy/Seizure Disorders | 1,204,000 |
| **TOTAL** | 43,429,000 |

Source: Harris Survey, 1986.

**Table 2**

**Disability Status: USA, California and Santa Barbara**

| Civilian non-institutionalized: 16-64 | USA | CA | SB |
|---|---|---|---|
| total | 157,323,922 | 19,165,104 | 57,518 |
| % with work disability | 8.2 | 7.4 | 6.9 |
| work dis, prevented from working | 4.2 | 3.7 | 3.0 |
| % with mobility or self care dis | 4.6 | 4.9 | 3.9 |
| % mobility | 2.2 | 2.1 | 1.6 |
| % self care | 3.4 | 3.8 | 3.0 |
| Civilian non-institutionalized: 65+ | 29,563,511 | 2,986,288 | 12,380 |
| % mobility or self care disability | 20.1 | 19.0 | 15.8 |
| % mobility | 15.6 | 14.7 | 13.6 |
| % self care | 11.9 | 11.6 | 9.1 |
| % in labor forces, civilian non-institutionalized: | | | |
| with work disability | 39.3 | 40.2 | 50.4 |
| no work disability | 79.3 | 78.9 | 84.6 |
| mobility limitation | 22.9 | 27.2 | 30.4 |
| no mobility limitation | 77.3 | 77.1 | 82.8 |

(Source: U.S. Census, 1990)

Unlike some societies which use social welfare programs and a paternalistic approach to address the needs of the disabled population, the United States has used a “Self Help” approach. Mainstreaming, normalization and most importantly independence have become the ethos of this country’s approach to the needs of the disabled, including its governmental policies. The American Standards Act (1961) and Americans with Disabilities Act (1990) are clear indications of this approach. One of the strongest results of this survey is the overwhelming belief of our respondents that they lead an independent life, with little pity or discontent. There is little evidence that these people consider themselves to be “victims,” but rather people with a problem that can be overcome with dignity, self-reliance and pride. As lack of independence has been reported to be the most keenly felt disadvantage of disabled people, this strong reporting of independence is a tribute to the efforts of the blind services agencies, the local bus companyy and especially the individuals who took part in this survey.

2.2) Estimate of functional sight disability.

In the volume, Americans with Disabilities: 1991-1992, a survey shows that 4.7 percent of the population in the United States over 15 years old have difficulty seeing newsprint and 0.7 percent are unable to read newsprint. The effects of aging are shown when we see that of the US population aged 15-64, 2.9 percent have difficulty and only 0.4 percent are unable to see words and letters. For the US population 65 and older, the percent of people with difficulty seeing words and letters rises to 15.9 percent and those unable to see newsprint comprise 3.3 percent of this population.

**Table 3**
**Aged Related Effects of Vision Impairment**

| Age | difficulty in seeing words and letters (newsprint) | | unable to see (newsprint) | |
|---|---|---|---|---|
| 15+ years | 9,685,000 | 5.0% | 1,590,000 | 0.8% |
| 15-64 | 4,801,000 | 2.9% | 579,000 | 0.4% |
| 65+ | 4,884,000 | 15.9% | 1,011,000 | 3.3% |

The same survey also shows that for people 21-64, only 45.6 percent of those with difficulty reading newsprint are employed and of those who are unable to read only 25.6 percent are employed. This means that some 2.9 million persons, of working age (21-60), with visual disabilities are unemployed. These numbers do not include those who are under-employed due to sight limitations. People with severe visual limitations do not (should not) drive a car and are denied that American institution, access to a private automobile. We believe that lack of transportation is a major cause of this unemployment and that society benefits when public transportation is made available to the disabled, to ensure their access to employment and other opportunities.

2.3) Selecting the survey population.

To study the public transportation needs and habits of visually impaired residents of the Santa Barbara, California area we felt a sample of 50 people would be needed. Current Braille Institute

data estimate that 7.2 of every 1000 persons have a severe vision impairment. Using a random digit dialing (RDD) technique would have demanded some 7000 calls. Other surveys have shown that more than half of all visually impaired people do not use public transit. Therefore, we would have had to make some 14,000 RDD calls.

Instead we decided to contact various service agencies that serve the target population and ask their clients to participate in our survey. To protect the security and privacy of their clients, all these agencies follow a strict policy of confidentiality. However, the four agencies we tuned to; the Disabled Students Program at UCSB, the local California Department of Rehabilitation, the local Braille Institute, and the local bus system MTD were all willing to pass our request on to their clients who met our criteria.

Our final subject pool consisted of 55 individuals. These were obtained as follows: from State Rehabilitation - 24; from the MTD - 10; from the Braille Institute - 11; from the Campus - 10.

Fifty-three (53) percent of the sample population preferred a mail survey, 33 percent a telephone survey, and 15 percent preferred an in-person interview. Sixty-two (62) percent of our respondents were female and 38 percent were male. The bulk of the respondents came from two zip-code areas - 93101, the central area of Santa Barbara, and 93117, the primary Goleta area. About 25 percent of the total respondents came from each of these zip-codes. The other 50 percent were scattered throughout the Santa Barbara and Goleta area, and several respondents came from North County towns of Lompoc and Santa Maria. Eighty-nine percent were legally blind. The average age of the onset of blindness was forty-two (standard deviation ± 31). Only 16.7 percent of the sample used Braille which is consistent with the national percent of blind people who use Braille. Three subjects still intermittently drive a car and 10 participants either owned a private mode of transportation or lived in a household in which a private mode of transportation was owned. Most of these were autos. Our sample was surprisingly highly educated. Twenty (20) percent had post-graduate training; 16.4 percent had four year college or university background; 23.6 percent had junior college; 25.5 percent had a high school diploma; and 14.5 percent had less than high school. No member of the subject pool was less than twenty years old, but the rest were distributed fairly uniformly through twenty year intervals; 21.8 percent were aged between twenty

and thirty-nine, 20 percent between forty and fifty-nine, 29.1 percent between sixty and seventy-nine, and 29.1 percent were eighty or older. Therefore, there is a bias towards older individuals of sixty plus in the sample, but this again is consistent with national trends for blindness and vision impairment (see Table 4).

**Table 4**

**Prevalence of Severe Vision Impairment by Age Group**
**United States, 1989**

| Age Range | Population | Impairment Per 1000 | Number Severe Vision Impairment |
|---|---|---|---|
| 0-24 | 90,428,000 | .528 | 47,746 |
| 25-34 | 43,835,000 | 1.23 | 53,917 |
| 35-44 | 36,503,000 | 1.68 | 61,352 |
| 45-54 | 25,897,000 | 4.8 | 119,505 |
| 55-64 | 21,593,000 | 7.8 | 168,425 |
| 65-74 | 18,182,000 | 47.0 | 854,554 |
| 75-84 | 9,761,000 | 99.0 | 966,339 |
| 85 + | 3,042,000 | 250.0 | 760,500 |

Source: Unpublished Data, Department of Commerce, Bureau of Census
Prevalence based on National Center for Health Statistics, Supplement on Aging, 1994

However, it does indicate that some of the results we present from this survey have application not only to vision impaired and blind people but also to the elderly.

2.4) Characteristics and activity patterns of the sample.

On average, members of this sample lived three blocks from the nearest transit stop. Sixty point four (60.4) percent of the sample agreed that they had no serious restrictions affecting the use of the mass-transit system except for the problems resulting from lack of vision. Thirty eight (38) percent required some special aid in order to move around freely. More than half the sample (56.4 percent) had no serious problem in walking while 29 percent of the sample had some difficulty in standing. Twenty three point six (23.6) percent had difficulty climbing stairs and 71 percent had difficulty reading newsprint or transit schedules. Ninety-three (93) percent agreed that they experience difficulty in reading signs or vehicle route numbers. Sixty (60) percent sample

members expected to wait more than 15 minutes when preparing to make a trip using public transport modes. But, non-car users expectred to wait<u>less</u> time for a bus than for access to a car! For car users, sixty-two (62) percent expected to wait more than 30 minutes for public transit. When not using public transit, fifty (50) percent of car users expected to wait less than 5 minutes. Although, as we shall see later, this was not categorized as being extremely troublesome, the difference in waiting time between car users and those using public transport is worthwhile noting. Some differences existed between the non-car users and car users with respect to why they would use public transit (Table 5), but the two top reasons, "meeting needs" and "cost" were the same. However, while car users in general agreed that the service met their needs (av = 2•4), non-car users were not as enthusiastic (av = 3•5)! Note that for legally blind users, public transit (bus) travel in Santa Barbara is free.

**Table 5**
**Why Use Public Transit**

| Non-car Users | Car Users |
|---|---|
| 1. Service meets my needs | 1.5 Service meets my needs |
| 2. No alternative | 1.5 Cost |
| 3. Cost | 3. Coverage of service area |
| 4. Driver/operator courtesy | 5. Time of day of service |
| 6. Ease of getting to pick up/drop off point | 5. No alternative |
| 8.5 On-time service | 5. Ease of arranging trips |
| 8.5 Ease of arranging trips | 8. Driver/operator courtesy |
| 8.5 Coverage of service area | |
| 8.5 Time of day service is available | |
| 11.5 Safety | |
| 11.5 Other | |
| 13. Security | |
| 14. Comfort | |

When non-car users were asked to name the primary activity for which participants needed travel assistance, 40 percent listed shopping, 17.1 percent education, 14.3 percent medical, and 8 percent work related and non-family social. Car users reported shopping (30 percent), medical (30 percent), and work (20 percent) as the major categories. The relative significance of this profile of

activities differs little from what one might expect from among a randomly selected population of elderly people where relatively small percentages have regular employment.

Seventy-four (74) percent of non-car users elected public transit as their primary mode of travel at least twice a week. Thirty-six (36) percent of the sample use it daily. Only eleven (11) percent of car users selected public transit as their primary mode more than twice per week. When estimating how long their usual travel time was from home to a variety of destinations, the significance of using the public transit system became obvious. For non-car users, trips to work averaged 28 minutes; to recreation 33 minutes; to visit family or friends 38 minutes; to obtain medical or other health related services 40 minutes; to obtain financial or legal advice or services 30 minutes; for grocery shopping 25 minutes; for non-grocery regular shopping trips 41 minutes; for agency services 33 minutes; and for religious purposes 23 minutes. Car user statistics for the same purposes were: work 13 minutes; recreation 18 minutes; visiting family or friends 22 minutes; medical 32 minutes; financial 37 minutes; groceries 15 minutes; non-grocery shopping 17 minutes; agency services 34 minutes; and religious 13 minutes. As a rule, car users halved travel times. This implies that there is a tendency for workers in our sample group to live somewhat close to their work, and in accordance with conventional urban theory, they have relatively quick access to grocery shopping and religious activities. It should also be noted that many non-car users walked to activities such as shopping, and that the mixture of walking and busing expanded average travel times. We should also note that car users lived on average more than 5 blocks from the nearest transit stop, whereas non-car users averaged onl about 3 blocks. Not having a car constrains location for this group because of the travel time and waiting factor. Participants frequently shared their mode of travel with others. This varied however between car users and non-car users; sixty (60) percent of the former never, rarely or sometimes shared, while sixty-seven (67) percent of the latter shared often or always.

Given the relatively high frequency of use of public transit (slightly over 50 percent) we asked participants to state up to three reasons why they use this mode. The dominant reason was that the service meets their needs such as having convenient routes, and convenient pick-up times. A significant proportion, however, indicated that they really had no alternative. The third most

frequently expressed factor was the cost - in the local area most vision impaired or blind people can register with the MTD and travel free. A significant factor, however, was the courtesy and assistance offered by drivers or operators of the transit vehicles. Insignificant responses were given with respect to reasons such as comfort, safety, security, on-time service, ease of arranging trips, ease of getting to or from drop-off points, coverage of service area, and time of day of service (i.e., accessibility factors).

2.5) Activity patterns of blind and vision impaired individuals in the Santa Barbara area.

Since the majority of subjects indicated they needed some type of assistance when traveling outside the home, our first task was try to determine what type of assistance that was needed and for what purpose. Considering that the majority of our participants were able to walk freely, it is not surprising that many of them indicated that they needed no technical assistance in order to complete a variety of trip purposes (see Table 6).

**Table 6**

**Trip Purpose**
**Column Headings**

| Column 1 | Work | Grocery shopping | Clothes or other shopping | Recreation / leisure | Social Trip (e.g. visit friend) | Religious temple / church | School / educational | Medical | Agency / Support Services | Business (legal; accounting; financial; etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| No assistance needed: independent traveler | 2.6 | 2.6 | 2.8 | 2.6 | 3.0 | 3.3 | 2.1 | 2.3 | 2.4 | 2.4 |
| Spouse / Significant other | 3.2 | 2.1 | 2.4 | 2.2 | 2.1 | 2.6 | 3.3 | 2.4 | 2.2 | 2.6 |
| Other family member (Mother, Father, Child) | 3.4 | 3.1 | 3.3 | 3.5 | 3.2 | 3.8 | 3.8 | 3.6 | 3.9 | 3.4 |
| Other relative | 5.0 | 4.3 | 4.2 | 3.6 | 3.5 | 4.3 | 5.0 | 3.8 | 4.3 | 4.5 |
| Roommate / Neighbor | 4.5 | 3.6 | 3.6 | 3.2 | 3.3 | 3.7 | 3.8 | 4.2 | 4.7 | 4.4 |
| Other Friend (Not co-worker) | 4.4 | 3.8 | 3.4 | 3.2 | 3.2 | 3.5 | 4.1 | 4.2 | 4.5 | 4.2 |
| Hired Assistant | 3.6 | 3.6 | 3.8 | 3.9 | 4.0 | 4.2 | 4.5 | 3.2 | 3.6 | 4.3 |
| Volunteer Assistant | 4.0 | 4.4 | 4.6 | 3.3 | 4.3 | 3.0 | 3.0 | 4.6 | 4.0 | 4.2 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Co-worker | 3.3 | 4.8 | 4.5 | 4.3 | 3.9 | 5.0 | 4.5 | 4.6 | 4.8 | 4.7 |

Table 6 gives mean scale scores on a range from 1 to 5 (1 = always, 5 = never) in terms of assistance used and trip purpose. A few things stand out. First for non-car users. Relatives other than immediate family members are rarely if ever used for any trip purpose. Co-workers are likewise not generally favored for trip purposes although sometimes they are used for trips to or from work. It may be that subjects do not want to put an unusual burden on others in their work place. Doing so could cause a deterioration in the general work atmosphere. Most of the participants also avoided having their friends drive them to work or to social, medical, agency, or business activities. Room-mates and neighbors were again not generally used for work trips but were more likely to be used for recreation and social activities. Of all the different types of personal assistance that most frequently favored was that offered by the spouse or significant other. This was very important with respect to grocery shopping, social activities, and agency activities. As a rule, therefore, there appeared to be a sentiment not to bother co-workers, neighbors, and relatives other than the immediate family, for assistance when making a wide variety of trips. For car users the assistance pattern varied somewhat, with more emphasis being placed on spouses and significant others, family members and volunteer assistants. The other trends observed in the behavior of non-car users was basically repeated. This family oriented assistance may not be as feasible for single blind or vision impaired persons. According to recent census results, approximately thirty-five (35) percent of all disabled people live alone; this figure escalates to more than sixty (60) percent among the elderly disabled.

2.6) Mode of travel by trip purpose.

We next examined what modes of local travel were used for different trip purposes. As far as travel to and from work was concerned, household car was the most frequent travel mode for both car users and non-car users. For the latter group, however, we must remember that only a small percentage worked. Other modes were used sometimes while social services paid taxies and mini-buses were not used, because they were not generally available in our study area. For grocery

shopping the household car (or friends car) was the most frequently mentioned travel mode when one was available. Since many participants lived near shopping places, walking was also favored. Social services paid taxies, hired limousines, power transit lift vans, and motorcycles or bicycles or self-paid taxi services and express buses, were rarely if ever used.

Local bus services were only moderately used for all the different trip purposes, which is somewhat surprising given that fifty (50) percent or more of the participants claimed to use local buses and to use them on average more than twice per week. Express buses appeared to be used for educational activities and somewhat for shopping goods such as clothes, shoes, etc., but otherwise were not popular. No doubt this is because of the selected routes they follow, many being to and from the suburban university area. Mini-buses were used fairly frequently to access agency services; this is understandable since the Braille Institute for example runs a fleet of mini-buses that ferry clients to and from the Institute. Taxis are used very infrequently as are limousines for any particular purpose. Hired drivers, sometimes perhaps for the household car, are often used. Lift or paratransit vehicles were again used primarily for medical and health related services and to a lesser extent for work related activities. Volunteer drivers were used intermittently. This profile indicates a fairly independent population that is capable of using a variety of transportation modes, but like many other of their able-bodied peers, prefers to use local bus services and household or friend's cars regardless of the trip purpose. We shall return to this point much later in the survey when we examine some of the preferences, perceptions and feelings and attitudes of our subject group.

2.7) Assistive devices.

In conformance to our previously recorded independence of movement, 60 percent of our subjects indicated that they required only a long-cane, crutches, or walker to allow them to navigate or travel. Only one subject used a guide dog. Since there are over 1.3 million blind and vision impaired people in the United States and only ten thousand of them use guide dogs, this statistic is not surprising. Twenty-three point five (23.5) percent of the sample used spotting telescopes - primarily to assist them in picking out route numbers on buses or when reading street signs. A significant proportion used a short-cane to help them avoid obstacles when walking. Fifteen point

four (15.4) percent referred to typed, Brailled, or handwritten signs on cards describing their route and the nature of the buses or transit stops. Other assistive devices such as laser canes, Mowat Sensors, sonic guides, tape recorded directions, tactual maps, wheelchairs, magnified copies of schedules, and verbal instructions, were mentioned but not in significant numbers. With the exception of a higher use pattern of spotting telescopes for non-car users, the profiles of assistive technology use are similar for both groups.

Even at this stage what is emerging is that for this population, assistive devices that help them process written or numerical information are the most important aids to navigation and travel. The many technical devices available to assist travel that are now readily available at relatively inexpensive prices, were not favored or used by this group. It is also evident that members of this group are capable of using public transit and that the almost fifty (50) percent nationwide that do not currently use it could potentially be encouraged to do so if the information environment relating to the transit service suited their needs. More on this later.

3) Perceptions of and Attitudes Towards Public Transit

In this section we asked the opinions, perceptions, and attitudes of participants with respect to how they feel about the condition of dependency in which their disability places them. This dependency is couched in terms of navigation, movement, and use of transit. Subjects were asked to strongly agree (scale score of 1), agree, to state uncertainty, disagreement, or strong disagreement (score 5), with each of the series of statements. Full details follow.

Participants in both car and non-car user groups in general followed a similar profile of agreement on questions covering a variety of perceptual, attitudinal, and informational topics. All realized their dependence on others for the provision of transportation though this realization was stronger for car users than non-car users. There was general agreement that this dependency produced frustration. Most agreed that they were familiar with the different mode choice options available to them. Car users were more reluctant to agree that the existing public transit service met their local travel needs.

3.1 Safety.

There was a general tendency to agree that public transit was safe. Most agreed that non-driving had a negative impact on their quality of life, including impacting their freedom to choose a residence. There was a tendency to agree that information about public transit information is easy to obtain, but were somewhat less certain that it was easy to understand and use.

3.2) Dignitiy.

There was strong disagreement with the statement that using public transit was undignified, and most also disagreed with the statement that there were no disadvantages associated with being a non-driver. Evidently this group is quite willing to accept that public transportation is a necessary mode of travel for many trip purposes and does not impinge on their personal dignity. This is somewhat at odds with the results obtained in the Corn and Sacks article previously quoted. Obviously this group recognizes the significance of the auto oriented U.S. society and the consequent distribution of urban functions that require considerable movement to access them.

3.3) Disadvantage.

There is here an indication that reliance on public transport is perhaps a little more of a disadvantage than subjects are prepared to admit. For example, when asked “Non-driving limits my freedom to choose a residence,” most people agreed with this. In other words, given that they did rely on public transit for many of their daily and weekly activities, there was a sentiment that it was unwise to live too far from a transit stop on a regularly scheduled transit line. Such feelings are greatly magnified in larger cities. The disadvantages of non-driving were all too obvious to this group.

3.4) Independence.

We then asked “I believe that having to use public transit does not affect my independence” and this produced an ambivalent or uncertain relationship with a slight tendency towards agreement (2.9). For the most part, however, our subject group had indicated that they were independent travelers and that as such they made use of environmental circumstances as much as possible as

part of this independent lifestyle. We next focused specifically on social activities stating "I believe that having to use public transit restricts my social life." Again, there was some slight tendency towards agreement, but for the most part responses were uncertain (2.9). This may reflect the age of our population. Other studies (e.g., Corn and Sacks, 1994) have indicated that this is a strong sentiment expressed by younger blind and vision impaired individuals. Since we have relatively few younger people in our sample our result is not surprising.

3.5) Social isolation.

The next social factor we examined is reflected in the statement "I believe that having to use public transit isolates me from society." There was a certain amount of disagreement with this statement. The mean of all responses tended towards uncertainty, but indicated there was a trend more to disagree than to agree. Obviously our particular subgroup had learned how to integrate public transit modes into their lifestyle and to use such modes effectively in social interactions. And for some, it may be that fellow transit riders are important social contacts.

3.6) Impact on lifestyle.

The next statement specifically addressed this issue. "Non-driving has a negative impact on my lifestyle and quality of life." There was modest agreement with this statement (2.4). Obviously, lacking the freedom of movement by private auto, some restrictions inevitably occur with respect to the places one can visit, the frequency with which one can go to those places, and the types of interactions that one can experience.

3.7) Frustrations.

Finally, we offered the statement "I feel frustration because I am a non-driver." Again, there was consistent agreement with this statement (2.2), indicating that our particular subject group saw themselves as being somewhat different or apart from the bulk of the population within the local area and distinct from their able-bodied peers.

3.8) Attitude towards public transit.

In our next set of questions we asked individuals to evaluate the degree of difficulty they felt they would have when using public transit. Again, a five-point scale was used ranging from never difficult (score of 1) to sometimes difficult, difficult, often difficult, and always difficult (score of 5). The same format was used here as in the last section in which statements are offered and individuals selected the appropriate scale term that indicated their feelings.

The majority of the group agreed that it was sometimes difficult but not often or always difficult to plan a route to a given destination This is a little surprising because the group does not generally have access to maps. Participants experienced only some difficulty in finding where to board a transit vehicle, but there was more agreement it was difficult to recognize which vehicle to enter. However, estimating when the vehicle will arrive at their stop was only classified as sometimes difficult, as was knowing when to exit the vehicle. Estimating where the individual was when in transit was usually evaluated as difficult and dealing with layovers with mode or route change was also regarded as difficult. Most participants had no difficulty entering and exiting public transit vehicles or finding empty seats, paying the fares, using the fare crediting system, or signaling the driver to stop. However, dealing with a crowded vehicle was regarded as difficult

and getting from the last stop of the transit system to a final destination was sometimes difficult. Finding the transit point when two or more different vehicles or modes have to be used is classified as difficult, and learning how much time remains before the connecting mode arrives is similarly rated as difficult. Getting from home to the transit stop, finding the correct stop, and getting the transfer ticket, are classed as never or only sometimes difficult, indicating that our subject group were experienced transit travelers. However, finding the transfer point if it is across the street or elsewhere is regarded as difficult and learning whether the connection is on time is similarly regarded as difficult.

In this section, therefore, we find that for this particular group, even though many are elderly, very little difficulty is expressed in terms of entering or exiting vehicles, finding seats, knowing where one has to get off, and paying fares. The most difficulty is found when it is required to

cross the street in order to make a transfer, when dealing with layovers or route changes, and when dealing with a crowded vehicle. All produce significant problems. None of these problems require great investment in transport infrastructure (i.e., vehicles or terminals) in order to correct.

3.9) The importance of accessible information.

The next two sets of questions focused on how useful subjects found certain types of information for planning trips. We then asked for evaluations of the usefulness of various types of assistive technologies and devices as an aid to trip planning. Categories of responses ranged from extremely useful (1.0), to very useful, useful, not very useful, and not at all useful (5.0). Things generally regarded as useful but on the side of not very useful included printed transit district schedules, cable TV messages, regular radio messages, written signs posted at pickup and drop off points, timetables or schedules available only at a central terminal area, timetables or schedules distributed via mail, and e-mail schedules available on home computers. Types of information that were regarded as very useful included verbal cues from transit system drivers or operators (i.e., calling out street names at various transit stops or giving advice on which numbered route to take), transit district telephone information hot-lines, timetables in large print or Braille available onboard different modes of travel. The most useful form of information, however, generally agreed on by the sample included auditory messages at pickup and drop-off points and talking signs. These would be considered very to extremely useful.

Next we asked participants to use the same scale of usefulness to indicate the degree to which a set of devices could be used when planning their trips. Those considered less useful included tactual maps of specific routes, and tactual maps of the urban area in which they are traveling. Tactual maps of a route with verbal descriptions spoken at key places when touched, and tactual maps of a city with verbal information given at key points, were rated as being very useful. Computer assisted telephone instructions, and location and timetable information presented visually and verbally on cable TV channels were regarded as NOT being useful, and a similar evaluation was given to computerized telephone service using push button keys to provide route and timetable information. Auditory and tactile information systems located in terminals were seen as potentially very useful, but tactual maps or diagrams of routes available at central locations,

personalized tactual maps at the location of pickup and drop-off points in your home or work neighborhoods were not favored. The idea of a personal guidance system to help navigate to or from your home or work to a transit point on special radio broadcasts giving continuous information on transit operating conditions such as delays, current location of vehicles by route number, and so on were seen as not very useful. The two most supported devices were visual and auditory prompts at transit stops to tell when the last pickup occurred and when the next is due, and telephone hot-lines with human operators to provide route and timetable information. Again, this is consistent with our previous information which indicated that since the bulk of our subjects were elderly and blind or vision impaired, they were not particularly inclined to use state-of-the-art technical aids when planning, navigating, or traveling. Telephone hot-lines with human operators received the strongest support overall, but talking signs, auditory prompts, and recorded messages which indicated if an expected transit vehicle had already passed the spot or when it was due to arrive, appeared to be the most uniformly supported ideas. In all these areas, the response profiles of car users and non-car users were similar.

3.10) Concerns with public transport.

Our next task was to evaluate what concerns the subjects had with respect to public transit. Again, a five-point scale was used ranging from extremely concerned (1.0), very concerned, concerned, not very concerned, and unconcerned (5.0). Subjects indicated considerable concern with having to cross streets to get to distant points for a connecting service, not knowing whether a transit vehicle had already passed their point of pickup, and waiting around for a service vehicle to show up. Other concerns related to the timeliness of the operating system and their frequency of service.

Some concern was expressed with respect to becoming a victim of crime on a transit vehicle, crowding, lack of civility by drivers or operators, being unsure of arrival times at designated stops, or poor location of transit stops. Additional concerns were expressed with respect to the lack of connectivity to other systems, and a lack of service to places that one needed to visit. These are transit routing problems that depend very much on the configuration of functions and services within a particular environment.

3.11) Frustration.

In this question we attempted to evaluate the degree of frustration that our participants felt with traveling. Again, we used a five-point scale ranging from extremely frustrated (1.0), very frustrated, frustrated, not very frustrated, to not at all frustrated (5.0). There was a considerable degree of frustration generally expressed. Specific items with which a lack of frustration was indicated included the need to carry special equipment as an aid to navigation and obstacle avoidance, or when a blind or vision impaired person had to negotiate narrow doors and steps to enter a bus or train. Obviously if the sample included other disabled groups such as the wheelchair bound, the importance of these two factors could change dramatically. There is an indication, however, that even though our subject population is primarily over 60, these factors do not produce frustration and are not of major concern to them. A certain degree of frustration <u>is</u> felt when an individual has to accept offers of personal transportation from others, such as when they may have missed their transit vehicle and would otherwise be forced to wait a long period of time before the next one is due to leave. Evidently the attitude of our particular group, since it was dominated by elderly people, was that basically they had little else that put a great demand on their time schedules and that waiting for the next transit vehicle, under reasonable environmental conditions, was not a major problem.

The greatest degrees of frustration were felt when the individual had to request a ride to a destination after missing a transport connection, when there was a significant need to rely on the donation of other people's time and scheduling in order to get to a destination, and when non-disabled people occupy seats and locations reserved for the disabled. Higher degrees of frustration are experienced when difficulties emerge in getting access to information about scheduling, and when a potential traveler needs to explain to someone their inability to get to a specific location that is not served by public transit.

High degrees of frustration are obtained when travelers exit a transit mode at a wrong stop because of inadequate information provided by drivers or operators or as a result of being unable to exit the vehicle because of crowding (as in rush hours).

Extreme frustration was expressed with respect to the poor clarity of voice announcements over public address systems used to announce locations or times of arrival or departure of transit vehicles. This seems to be exaggerated for elderly people if they also have suffered some hearing loss. There is also frustration expressed with improper and inaccessible locations and legibility of Braille or large print signs designed to give information about routes or timetables. Poor location of elevators or stairs is again a frustrating experience. This might occur when elevators are provided to bypass stairs but are hidden away in less obvious places to prevent their overuse by the general public. The existence of many obstacles in terminals is also a source of frustration. These might include non-permanent waste baskets, moveable plants, shopping carts, moveable seats, and so on. These things are particularly important for the blind and vision impaired person who in essence may have to learn a completely new layout configuration every time they go into a terminal. Considerable frustration is also expressed with poorly located and poorly designed "you are here" maps, particularly if they are flat maps and have no tactual surface or auditory explanation. Many also felt high degrees of frustration when they found that entranceways to transit terminals were not clearly marked.

3.12) The ideal situation.

We finally asked subjects to indicate their beliefs with respect to the importance of a variety of features of a public transit system in terms of how well they would ideally suit their needs for transportation. A five-point scale of importance ranging from very important (1.0), to somewhat important, important, somewhat unimportant, and very unimportant (5.0) was used. The most important potential addition to existing transit systems was seen to be spoken messages at transit stops indicating the time of arrival of the next vehicle and its destination. Next in importance was in-vehicle visual and/or auditory displays of vehicle location on route so that one would always know where one was. Many thought it was somewhat important to have a volunteer or guide to help disabled people through the first few uses of a particular transit mode. Other features that were seen to be particularly useful were some type of early warning system that would alert mode operators that a disabled person was waiting at a pickup point. Other innovations that would be useful included mini systems that serve areas between the major transit lines, thus eliminating the

need to walk long distances to transit stops or to have to go all the way into the center and out on a different line in order to get to a relatively nearby location. Systems that offered terminal flexibility including home and work pickup and delivery are also seen as being somewhat important. Of less importance was the need to provide ground level access to different modes so that steps or lifts could be avoided. Lukewarm support (av = 3•1) was given for mechanisms such as cable televised maps and visual and verbal descriptions of the location of different transit vehicles at all times. Somewhat stronger support (av = 2•8) was offered to the provision of housing relocation schemes that consider transit needs when searching to find a living place, in our environment they were not regarded as being as important as other features. Perhaps in larger urban areas this need would be evaluated as being much more important.

4) Summary

With respect to this population, 50.9 percent regarded a local bus service as their primary mode of travel. Eighteen point two (18.2) percent relied on a household car, 12.7 percent on walking, 7.5 percent on easy-lift vans, and the remainder on institutional shuttles, retirement home shuttles, or friends' vehicles. When we asked individuals what would be the most significant things that had to be done to improve travel for them, a variety of responses were elicited. These are summarized in Table 7 (next page). Almost invariably the information that could most help this subgroup was auditory, tactile, or large print. Auditory information included access to human operators on phones, access to auditory information at transit stops and in the main terminals, and regular announcement by drivers of nearest cross streets at stops. Certainly the announcement of streets and stops by drivers came out time and time again as a critical factor. Although many transit systems may have this as a policy, it is not always implemented. This fact places a substantial burden on the blind or vision impaired traveler who has no real alternative to determine where they are. It is impossible to count stops because many transit stops are bypassed at particular times of the day when travel is light. For those with low vision or legal blindness, it is impossible to pick up environmental cues to determine where one is currently located. What is left is reliance on an

internal sense of timing which can vary dramatically by varying traffic conditions, or momentary or more extensive distractions - such as a seat partner talking to you.

Large print schedules were often indicated as being of great potential value. These should be available either at the central terminal or available for distribution on the buses themselves. Many people argue that the identification number on the buses should be larger. Current numbers cannot be seen at a distance by blind, vision impaired, or low vision people and many have significant difficulty even when close in making out such numbers. Other people indicated that a major contribution would be for some signaling device to be installed at transit stops so that a driver is aware that a disabled person is waiting to be picked up. This could influence actions such as the distance the bus came to stop from the curb, seats, shelters, or other devices that signified the place of stopping.

**Table 7**
**Improvement Suggestions**

| Subject ID | Primary Mode | Up to Four Comments | | | |
|---|---|---|---|---|---|
| 0 | 1 | Good phone info | Audio info at stop | Onboard locator info | Audio(Cross/Landmark) |
| 1 | 2 | Auditory info posts | AIP on campus | | |
| 2 | 1 | Auto announce stops | Alt. FMT. schedules | | |
| 3 | 1 | Large print - sched | Better signs on bus | | |
| 4 | 3 | | | | |
| 5 | 1 | Announce Stops | Clear handicap seat | Stop as requested | |
| 6 | 1 | Call out streets | Clear announcements | Driver name posted | |
| 7 | 1 | On time more | Later availability | Greater frequency | |
| 8 | 2 | Beepers@cross signal | Closer bus stop | | |
| 9 | 1 | Large route # on bus | Large print timetable | Bus left stop notice | |
| 10 | 1 | Help across street | Call out stops | Give directions | |
| 11 | 1 | | | | |
| 12 | 4 | | | | |
| 13 | 1 | >Freq: Line 23 & 25 | Announce streets | Don't pass up | |
| 14 | 1 | Bigger bus numbers | Louder/repeat announ | Call out streets | |
| 15 | 1 | Button to alert driver | Talking signs | | |
| 16 | 5 | | | | |
| 17 | 1 | | | | |
| 18 | 4 | More vans | More drivers | | |
| 19 | 4 | More vans | More drivers | More donations | |
| 20 | 1 | HC seating identif. | Larger sign on bus | Clearer announcement | |
| 21 | 1 | Weekend schedules | Call out stops | Larger bus numbers | |
| 22 | 6 | | | | |
| 23 | 3 | | | | |
| 24 | 1 | Lower steps | Clearer announcement | Wait for passenger | |
| 25 | 3 | Available immediately | Reduce waiting time | | |
| 26 | 1 | Announce streets | Bigger bus numbers | Clear term. announce | Route # at bus stops |
| 27 | 1 | Bigger bus numbers | Tactile route maps | Audio tapes of routes | Drop close to lights |

| | | | | | |
|---|---|---|---|---|---|
| 28 | 6 | | | | |
| 29 | 4 | More vans | | | |
| 30 | 1 | More often | | | |
| 31 | 3 | Need more EZ-Lift | | | |
| 32 | 0 | | | | |
| 33 | 0 | No crossing street | Larger bus numbers | | |
| 34 | 3 | Available more often | | | |
| 35 | 1 | More buses | | | |
| 36 | 3 | | | | |
| 37 | 2 | Better sidewalks | More stoplights | Streets repaired | |
| 38 | 1 | Coordinated transfers | Easy on/off | Reachable stop cord | |
| 39 | 2 | | | | |
| 40 | 3 | | | | |
| 41 | 1 | Personal attention... | ...at terminal | | |
| 42 | 3 | | | | |
| 43 | 1 | Call stops loudly | Auditory Bus ID | Larger bus numbers | Large print sched. W/O req |
| 44 | 3 | | | | |
| 45 | 1 | Later service | Lower steps | Call out streets | |
| 46 | 1 | Leave open front seats | Sunday service | | |
| 47 | 2 | Call out stops | Reserve seats | Not ahead of schedule | |
| 48 | 7 | | | | |
| 49 | 2 | | | | |
| 50 | 2 | Crosswalks | Signal lights | Driver courtesy | |
| 51 | 1 | More buses | Longer hours | Bus benches w/buses | |
| 52 | 3 | | | | |
| 53 | 1 | Courteous people | Announce stops | Helper at Trnst. Ctr. | |
| 54 | 1 | Call signs and stops | Drivers more considerate | Courteous drivers | |

Other travelers argued that when it was necessary to cross the street in order to make a connection, street crossings at that point should have auditory pedestrian signals. When multiple buses converge on particular stopping areas, as is common in moderate to larger sized cities, devices for indicating clearly which bus is stopped at which pickup point would be extremely useful. This could consist of an auditory message activated by a push button, or by Talking Signs on the vehicles. Others argued that the immediate front seats on both sides of the bus should be reserved for disabled people and the driver should enforce use for these purposes when a disabled person enters the bus. Some disabled people felt extremely uncomfortable when upon boarding the bus and not finding seats available immediately, they were thrown off balance by the driver starting the vehicle before they were able to find a secure hand-hold or a seat. Obviously increasing the sensitivity of drivers to the special needs of disabled people generally and blind and vision impaired persons in particular could have a significant impact on increasing ridership of public transit by these groups.

Some drivers may be self-conscious about calling out streets and signs. One way around this may be to install in each bus a tape which can auditorally play the required street and stop

information. This could be driver activated by pressing a button or automatically operated by tying it into the vehicle odometer, radio locator, or other device.

Considerable support was also offered by our subject group for the use of talking signs. These can be placed on buses, on transit stops, or in terminals, and would be activated only by a receiver carried by a disabled person. San Francisco is already experimenting with such talking signs on buses and on their local rail systems (Bentzen, et al. 1995). We see talking signs as a very important part of the process that removes mystery, fear, and frustration from the blind person wishing to use public transit on a regular basis.

Other suggestions made by our participants include things such as onboard locator information, the posting of drivers' names so that more direct and personal communication can take place, and a request that drivers wait for disabled people who are trying to catch a transit vehicle at a particular stop. Here the disabled alert button at the stop, which could be triggered at a distance of up to one-hundred yards, would be of considerable assistance. Other suggestions include relocating the stop cord in buses so that it is at a more convenient level so that a traveler does not have to rise from her/his seat in order to reach it.

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