TCRP

TRANSIT COOPERATIVE RESEARCH PROGRAM

SYNTHESIS 37

Sponsored by
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Communicating with Persons with Disabilities in a Multimodal Transit Environment

A Synthesis of Transit Practice

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Communicating with Persons with Disabilities in a Multimodal Transit Environment

A Synthesis of Transit Practice

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SUBJECT AREAS
Public Transit

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TRANSPORTATION RESEARCH BOARD — NATIONAL RESEARCH COUNCIL

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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions*, published in 1987 and based on a study sponsored by the Federal Transit Administration (FTA). A report by the American Public Transit Association (APTA), *Transportation 2000*, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of vice configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA, the National Academy of Sciences, acting through the Transportation Research Board (TRB), and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at anytime. It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end-users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. TCRP results support and complement other ongoing transit research and training programs.

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NOTICE

The project that is the subject of this report was a part of the Transit Cooperative Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the project concerned is appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical advisory panel selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and while they have been accepted as appropriate by the technical panel, they are not necessarily those of the Transportation Research Board, the Transit Development Corporation, the National Research Council, or the Federal Transit Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

Special Notice

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PREFACE

A vast storehouse of information exists on many subjects of concern to the transit industry. This information has resulted from research and from the successful application of solutions to problems by individuals or organizations. There is a continuing need to provide a systematic means for compiling this information and making it available to the entire transit community in a usable format. The Transit Cooperative Research Program includes a synthesis series designed to search for and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in subject areas of concern to the transit industry.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis will be of interest to transit agency professionals and the consultants who work with them in dealing with travelers with disabilities. These are travelers with sensory, vision, hearing, and cognitive impairments who need alternative methods for accessing and processing the transit information that is now being commonly provided to the general public. The report describes current North American transit practice in information and communication technologies, as well as operations, implementation, and human factor issues. Attention is given to information and communication technologies related to planning, customer service, marketing, and training that can improve the travel experience for all persons traveling in a transit environment. The focus is on the communication techniques and technologies for persons with sensory and cognitive disabilities.

Administrators, practitioners, and researchers are continually faced with issues or problems on which there is much information, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered or not readily available in the literature, and, as a consequence, in seeking solutions, full information on what has been learned about an issue or problem is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to the available methods of solving or alleviating the issue or problem. In an effort to correct this situation, the Transit Cooperative Research Program (TCRP) Synthesis Project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common transit issues and problems and synthesizing available information. The synthesis reports from this endeavor constitute a TCRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to a specific problem or closely related issues.

This document from the Transportation Research Board integrates information from a literature review, survey responses from 19 transit agencies, and extensive telephone interviews with seven specific providers.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, available information was assembled from numerous sources,

including a number of public transportation agencies. A topic panel of experts in the subject area was established to guide the researchers in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

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This study was managed by Donna L. Vlasak, Senior Program Officer, who worked with the consultant, the Topic Panel, and the J-7 project committee in the development and review of the report. Assistance in Topic Panel selection and project scope development was provided by Stephen F. Maher, P.E., Manager, Synthesis Studies. Don Tippman was responsible for editing and production. Cheryl Keith assisted in meeting logistics and distribution of the questionnaire and draft reports.

Christopher W. Jenks, Manager, Transit Cooperative Research Program, assisted TCRP staff in project review.

Information on current practice was provided by many transit agencies. Their cooperation and assistance was most helpful.

COMMUNICATING WITH PERSONS WITH DISABILITIES IN A MULTIMODAL TRANSIT ENVIRONMENT

SUMMARY

Appropriate attention to information and communication technologies related to planning, customer service, marketing, and training can improve the experience for all persons traveling in a transit environment. Travelers with disabilities, including sensory, vision, hearing, and cognition impairments, as well as seniors, need alternative methods for accessing and processing transit information that is provided for the general public. Several pieces of legislation have been passed in the United States and Canada requiring transit agencies to address these issues to better improve transit service to the general public and, in particular, people with disabilities.

A significant amount of literature has been produced on the various technologies and their application by transit agencies to assist them in complying with the legislation. This project creates a synthesis paper from:

- A literature review of current North American experience in information and communication technologies aimed at improving communications with persons with disabilities within a multimodal transit environment; and
- A survey of selected transit agencies to obtain information on practical or innovative solutions addressing the items noted above.

Reported gaps in information, recommendations for alternative solutions, and suggestions for future research are also included.

The current methods available to transit agencies to better communicate with persons with disabilities are achieved through the following groups of technologies and training methods.

Advanced technologies such as smart cards have a universal appeal because they are more convenient and easier for passengers with disabilities, seniors, and the general population to use. Smart technologies can make transit systems more user friendly, simplify the fare payment system for passengers, and, at the same time, provide transit agencies with information regarding passenger travel patterns without adding significantly to transit costs.

Visual technologies such as light emitting diodes and liquid crystal display provide a significant benefit to all passengers and are particularly useful to persons with both visual and hearing impairments in identifying stops and providing orientation on route. These technologies can provide way-finding information, as well as critical real-time information, and assist transit agencies in complying with the Americans with Disabilities Act.

Auditory technologies provide a variety of options in which important information can be relayed to passengers. This is particularly useful to passengers with visual impairments, where such technologies as talking signs, talking directories, auditory maps, and audible alarms can significantly improve their travelling experience.

Tactile technologies such as tactile maps, tactile pathways, and detectable warnings provide significant benefits to passengers with visual impairments by significantly improving the safety of the travel environment.

Geographic information systems are a special type of computerized database management system in which geographic databases are related to one another by means of a common set of locational coordinates. In a transit application, this system provides transit agencies with the ability to accurately respond in real time to passenger inquiries regarding bus location and schedule information.

Passenger training programs assist riders to become more informed and independent travelers. “Orientation and Mobility Training” helps riders who are visually impaired to become familiar with their travel environments and helps them obtain travel information; identify bus stops, stations, and landmarks; and operate equipment such as fare and transfer machines.

Sensitivity training for staff informs transit personnel on how to better identify persons with disabilities and provide them with the assistance they require.

Results from the transit agencies surveyed and personnel interviewed indicate that these agencies are currently using a wide range of the available technologies to better communicate with travelers with disabilities. The following communication methods were the most frequently identified as very effective: telephone information service, fax information service, voice for direction, detectable warnings, specialized signage for the visually impaired, flashing warning lights, and electronic vehicle identification.

The dilemma facing transit agencies is one of selecting the most appropriate technology to satisfy the primary travel requirements of persons with disabilities and, at the same time, benefit the general transit passenger as well. For this reason, transit agencies must examine the full range of assistive devices available, including both “low” and “high” technology, knowing the characteristics/demographics of their riders and, from that base, selecting equipment that provides the most effective financial investment for the transit system as a whole.

The research has shown that those transit agencies with the most progressive and comprehensive communication technologies employed to benefit persons with disabilities were those with a “general” budget for communications. Those agencies that reported specific budgets for communication technologies, specifically for persons with disabilities, did not demonstrate significant progress towards the implementation of accessible communication features nor did they have enough budgeted to address the issue.

Information obtained from the survey suggests that a large number of transit agencies are responding in a reactive way to communication issues related to serving passengers with disabilities. Their reaction is driven by federal legislation and complaints from transit users or groups representing the interests of these persons. All transit agencies surveyed were aware of and are taking the necessary steps to comply with the legislation that requires them to improve access for persons with disabilities. However, very few transit

agencies reported plans to expand their services or identified methods of providing service beyond that which the legislation required.

The research indicated that the most successful approach was to implement communication techniques and technologies with universal benefits to all passengers and to ensure that the specific needs of those individuals with disabilities were incorporated as part of the process. Those agencies that are proactive in responding to these needs demonstrated the most progress in the implementation of communication technologies.

Based on information derived from the literature and responses from the transit agencies surveyed, the following areas and issues require further research or analysis: smart technologies, personal cellular phones and pagers, costing of techniques, and obtaining customer input.

CHAPTER ONE

INTRODUCTION

GOVERNMENT AND LEGAL ENVIRONMENT

The Americans with Disabilities Act (ADA) was passed on July 26, 1990. The act is designed to encourage integration and to eliminate discrimination against persons with disabilities in areas such as employment, public services, telecommunications, and transportation. The ADA defines disability as:

- Physical or mental impairment that substantially limits one or more of the major life activities of such individuals,
- A record of such an impairment, or
- Being regarded as having such an impairment.

Section 222 of the ADA states, "It shall be considered discrimination for purposes of section 202 of this Act and section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794) for a public entity which operates a fixed route system to purchase or lease a new bus, a new rapid rail vehicle, a new light rail vehicle, or any other new vehicle to be used on such system, if such bus, rail vehicle, or other vehicle is not readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs."

Within the Canadian context, the 1976 Canadian Human Rights Act made "disability" a prohibited "ground of discrimination." In 1982, the Canadian Charter of Rights and Freedom clarified that discrimination based on physical or mental disability is prohibited under law.

Since the passage of these laws, transit agencies have been undertaking significant initiatives to comply with the legislation and improve access to public transportation for persons with disabilities. To date, a significant number of reports and studies have been produced on the various technologies and their application by transit agencies to assist them in compliance. This synthesis report is derived from the literature produced on the issues of improving communications with persons with sensory or cognitive disabilities within a multimodal transit environment.

SCOPE

Travelers with disabilities, including sensory, vision, hearing, and cognitive impairments, need alternative methods for accessing and processing the information that is now commonly being provided to the general public by transit agencies. Appropriate attention to information and communication technologies related to planning, customer service, marketing, and training can improve the travel experience for all persons, including first time users of the system, persons whose first language is not English, and seniors.

The scope of this synthesis report is to:

- Identify current North American practice in information and communication technologies, as well as operations, implementation, and human factors issues;
- Conduct a literature review; and
- Survey selected transit agencies to obtain information on practical or innovative solutions addressing the items noted previously.

Reported gaps in information, recommendations for alternative solutions, and suggestions for future research are also discussed.

METHODOLOGY

The literature review and a survey of selected transit agencies revealed the current methods of communicating with persons with disabilities. The literature review included an extensive search of various on-line libraries and information clearinghouse databases within the United States and Canada. Information was collected on the current practices, major issues, trends, innovations, case studies, and research in this area.

The survey included a written questionnaire and telephone interviews. Surveys were sent to a select sample of transit agencies representing small and large operators providing or connecting to more than one mode of transportation service in the United States and Canada. From the 19 transit agencies that responded to the survey, 7 were interviewed extensively by telephone about the methods they are currently using or planning to implement to improve the communication needs of passengers with disabilities.

ORGANIZATION OF REPORT

This synthesis report is presented in six chapters, with supporting references, bibliography, and appendixes. Chapter 1 describes the project background and the scope and

methodologies used to successfully complete the project. Chapter 2 provides definitions and an explanation of sensory and cognitive disabilities. Chapter 3 synthesizes the current communication methods and technologies available to transit agencies to better communicate with persons with disabilities, as described in numerous reports on the subject. Chapter 4 describes the results from those transit agencies that were surveyed and the employees interviewed. Chapter 5 summarizes the currently available methods of communicating with persons with sensory and cognitive disabilities in a multimodal transit environment as they relate to various aspects of a transit trip. Chapter 6 concludes the report by summarizing the major issues identified from the literature review and the information obtained from the transit agencies, and also identifies the gaps in the literature and areas for future research.

Appendix A reproduces the survey questionnaire, Appendix B lists the transit agencies that participated in the survey, Appendix C contains additional information on planning and design and training, and Appendix D provides a list of on-line resources.

LIMITATIONS

New technologies and advances in communication systems are occurring today at an unprecedented pace, particularly in the area of advanced technologies such as smart cards and global information systems. By necessity the literature review conducted for this report covered material published from the late 1960s through 1999. Materials published thereafter will have to be covered in a future study.

This report focuses on the communication techniques and technologies for persons with sensory and cognitive disabilities. Mobility related disabilities are not specifically addressed.

CHAPTER TWO

SENSORY AND COGNITIVE DISABILITIES

The emphasis of this synthesis is on travelers with sensory impairments, including those of vision, hearing, and cognition. The following sections provide a definition of each disability and briefly identify the needs of each of these persons with disabilities when traveling in a multimodal transit environment.

DEAFNESS AND HEARING IMPAIRMENTS

Deafness can be defined as "a profound or total loss of auditory sensitivity perception." Hearing impairment, with or without a hearing aid, is the inability to successfully process linguistic information through audition" (*1*). Therefore, a person with a hearing impairment may have the following problems when using public transit:

- Obtaining telephone information for travel planning such as location of stops, routes and schedules, and fares;
- Obtaining information from transit operators at bus stops, stations, terminals, or on route; and
- Understanding information from announcements made in stations and on vehicles. Such information could be routine in nature or may involve an emergency situation that requires immediate action.

Not having access to these information sources can make the experience of using public transportation difficult and in some instances dangerous for a person with a hearing impairment.

To address these concerns and others, the literature identifies six categories of techniques to improve communication for persons with hearing impairments:

- Telephone devices,
- Converting text-to-speech and speech-to-text,
- Visual devices,
- Assistive listening systems,
- Internet and e-mail, and
- Interactive pagers.

BLINDNESS AND VISUAL IMPAIRMENTS

Blindness, or visual impairment, can be defined as "the total loss of visual perception, sufficiently diminished visual acuity, and/or limited fields of vision." A person with a visual impairment may have the following difficulties when using public transit:

- Receiving information that is typically presented visually, such as system maps, the location of bus stops, routes and schedules, and fares;
- Deciphering printed signage or early generation of electronic signage;
- Locating and using equipment necessary to travel on public transit, such as ticket machines, fare boxes, and turnstiles;
- Undertaking functions that require physical movement, including all activities related to entering, moving through, and exiting existing stations and vehicles; and
- Understanding the arrival of buses, trains, and paratransit vehicles.

Not having access to this information can make the experience of public transportation difficult and in some instances dangerous for a person with a visual impairment.

To address these concerns the literature identifies five categories of techniques or technologies that can improve communication for persons with visual impairments:

- Orientation and mobility training,
- Visual technologies,
- Auditory technologies,
- Tactile technologies, and
- Braille writing.

COGNITIVE IMPAIRMENTS

A cognitive impairment is defined as "any disorder requiring special attention to or alternate methods for communicating concepts and instructions…" Individuals with cognitive impairments may have difficulty acquiring, storing, or retrieving information such as reading and understanding directions, accessing the correct vehicle, exiting from the correct station or stop, and understanding announcements.

Many of the technologies and techniques used to assist individuals with hearing and visual impairments are beneficial to individuals with cognitive impairments. The literature suggests that training is the key to assisting a passenger with a cognitive impairment traveling within a transit environment. Such passengers should be trained not only to use the transit system, but also to understand all aspects of a transit trip. Information and/or assistance may be obtained from local human service agencies.

CHAPTER THREE

LITERATURE REVIEW

An extensive search of on-line libraries and information clearinghouse databases was conducted within the United States and Canada to obtain relevant literature in the area of communications with persons with sensory and cognitive disabilities in a transit environment. Information was collected on the current practices, major issues, trends, innovations, case studies, and research. Because of the rapidly changing pace of technology improvements, some of the most current technologies (e.g., smart cards) are not adequately reflected in the literature review.

This chapter presents a variety of communication techniques and technologies available to transit agencies to better communicate with persons with sensory and cognitive disabilities, as documented in the literature. Each technology, technique, or method of communication is grouped with those that have similar functions into categories. Information is also presented on staff and passenger training and specific applications of various communication techniques currently in use.

TECHNIQUES FOR COMMUNICATING WITH PERSONS WITH DISABILITIES

Traditionally, transit agencies have used a variety of methods to communicate with their passengers; however, some of these methods have limited and, at times, excluded access to persons with particular disabilities. Since the passage of the ADA in the United States in 1990 and the Canadian Charter of Rights and Freedom in 1982, transit agencies have been studying ways to improve communication with persons with disabilities.

The communication techniques and technologies represent a cross section of those being used within transit stations and terminals, on platforms, and on transit vehicles by transit staff and individuals.

The techniques presented range from nonsophisticated methods of communication, such as the route card, where passengers write their desired travel route on a card and the bus operator for that route will pick them up, to more sophisticated technology, such as automatic vehicle location (AVL), where the specific location of a given vehicle equipped with the appropriate equipment can be identified instantly. This technology can be used by transit agencies to automatically announce stop locations along a route.

The introduction and implementation for each technology or method of communication varies. However, all have been initiated within the past 20 years. A large portion of the audio technology and techniques presented in the research was introduced in the mid-1980s and early 1990s, whereas the AVL and Geographic Information System (GIS)-based technologies have only recently been implemented in several transit systems.

Non-Electronic Communication

Non-electronic communication refers to techniques to improve communication that do not require technical support and are person-driven.

Destination Card Programs

These programs are enhancements to fixed-route services that permit passengers to alert vehicle operators of their need for assistance. Destination card forms filled out by riders or persons assisting riders contain information about the person's specific disability as well as information about the passenger's desired destination. Upon boarding the vehicle, the rider hands the completed card to the driver, who then recognizes the person's need for assistance and provides appropriate written or verbal information to enable the rider to exit the vehicle at the correct stop.

American Sign Language

The majority of deaf people in the United States use this language (*2*). Some agencies provide staff members, such as drivers and ticket agents, with training in sign language. This improves communication between staff and hearing-impaired passengers. However, this technique is not as common among transit operators as the destination card program.

Route Cards

Route cards are a low-technology signaling device of large-lettered or numbered cards and are used primarily by visually impaired passengers. Passengers at bus stops display the card that identifies their desired route. The driver

of an approaching bus traveling that route will stop for the passenger.

Orientation Cues

Orientation cues help persons with visual impairments to orient themselves and distinguish pathways. These cues may include changes in illumination levels, bright colors, unique patterns, and the location of special equipment or other architectural features (*3*).

Braille Writing

This is a system of writing that uses raised dots to represent the letters of the alphabet. The American Foundation for the Blind estimates that less than 15 percent of all persons with a significant vision loss can read braille (*1*). Growth in the availability of assistive communication technologies has continued to lessen the reliance on braille. Therefore, braille should be provided to complement other methods of communication, rather than as the primary method of communication for persons who are visually impaired.

Telephone Devices

Help Phones

Help phones can provide orientation and way-finding information by providing passengers with a verbal description of a building's major characteristics or by identifying where facilities are in relation to the passenger's current position (*4*). Help phones are generally placed inside terminal buildings and on platform areas.

Hearing Aid Compatible Telephones

These phones convert sound into magnetic energy when used with a compatible hearing aid and convert that energy back into sound through a flux coil located inside the telephone handset. This allows individuals using special hearing aids to make more effective use of the telephone, by allowing them to use a telephone that they otherwise would not have been able to use at all. Legislation in both the United States and Canada requires that flux coils be mandatory in all telephones (*5*).

Adjustable volume telephones are designed primarily for use by persons who are hard of hearing, as well as for those who use hearing aids. The volume control on these phones can be adjusted to meet the requirements of those using hearing aids. Both hearing aid compatible and adjustable volume telephones are fairly common in the transit environment (i.e., at stations, platforms, terminals, or on vehicles) and in the surrounding communities, and universal access to such telephones should be relatively easy to achieve.

Text Telephone (TTY)

This is a device that allows messages to be sent over a telephone line by typing on a special keyboard connected to a telephone. Most TTY systems are portable and some models can be connected to a computer. TTY systems provide persons with hearing impairments access to critical travel data, such as route and schedule information.

All telephones for use by persons who are deaf and persons that are hard of hearing should have a volume control, flux coil, push button controls, a nearby electrical outlet, and comply with CSA Standard CAN3-T515 (*4*). Section 1.0 of the ADA Accessibility Guideline for Buildings and Facilities indicates that TTY phones shall be provided in fixed transportation facilities and stations.

Automated Voice Message Systems

Many transit agencies use automated voice message systems to offer users pretrip information. The most basic systems are computerized databases that give customers information about services offered, such as routes, schedules, and fares, when they call the transit authority. The more advanced automated voice message systems allow callers to use touch-tone telephones to book trips.

Interactive voice response (IVR) is an example of an automated voice message system that has been developed for paratransit use. By using a touch-tone telephone, users can automatically make, confirm, or cancel requests for service. The system also has automatic "dial-out" capabilities to notify callers of available trip times, changes in trip status, or any other message the authority would like sent. The IVR systems are designed to work with automated scheduling systems. IVR is being used extensively at New Jersey Transit, in Newark, New Jersey; the Dallas Area Rapid Transit, Dallas, Texas; and TransLink in Vancouver, British Columbia.

Fax Machines

Fax machines allow users to transmit hand-written information, and thus eliminate the need for typing, as required by the TTY system. Another advantage of the fax machine is that it allows for personal "in-home" use. Thus, passengers who are hearing impaired but have a fax machine could request transit information from home.

Converting Text to Speech and Speech to Text

Automatic Speech Recognition (ASR) Systems

ASR systems convert speech to text by means of voice recognition software. The hearing person speaks into a microphone connected to the ASR computer and the computer converts the speech to text. ASR devices can be connected to TTYs, and thus are a potential means of disseminating transit information to a person who is hard of hearing. The ASR technology however has a drawback. The system currently works on a matching principle in which memory patterns represent sound. It is only after repeated use that a voice pattern can be recognized. As the ASR technology evolves, however, the rate at which the computer interprets speech will be closer to real-time speech recognition. This will allow the technology to be more widely used in the transportation industry to improve communication between the hard of hearing and transit operators (*1*).

Countertop Devices

Countertop devices and translation aids are currently used by the airline industry for facilitating dialogue between the hearing disabled and service representatives, and this technique may have some customer service applications in transit as well. This system consists of two touch screens, one for the passengers and one for the agent. A computer controls the program flow and transmits messages from one screen to the other (*1*). Such a system could be used at the customer service counter in a transit terminal and would be of immediate benefit to passengers who are hard of hearing and in need of travel information.

Translation aids are portable translators used in transportation terminals that enable persons with speech or language impairments to communicate directly with an agent by keying questions and responses on a dual-screen terminal. Translaid, a device for passengers, uses audio, text, and symbol modes, and has the ability to comprehend 16 languages. This device could be adopted in the transit industry, particularly at information centers in transit terminals.

Tactile Technologies

Tactile Maps

Tactile maps consist of a combination of braille and large print that transform printed maps into useful tools for the visually impaired. An audio signal may be used to indicate the location of the tactile map, and different textures are used to identify various features of the environment. Tactile maps used in conjunction with other auditory tools can provide a better method of communication for visually impaired passengers (*1*). The Massachusetts Bay Transportation Authority and the Washington Metropolitan Area Transit Authority (WMATA) are currently using tactile maps.

Tactile Signs

These signs contain raised letters or characters that can be read by persons who are visually impaired. The signs are typically located at bus stops, information kiosks, and customer information centers. Tactile signage using raised characters should conform to American National Standards Institute (ADAG 4030 or 1996 ANSI) standards. Incised letters should not be used (*6*).

Tactile Pathways and Detectable Warnings

Tactile pathways are textured and surface designed to be detectable by foot or cane and distinct from the surrounding surface area. Textured surfaces assist those with visual, orientation, and mobility impairments in a transit environment (*6*).

A detectable warning is a standardized surface feature built in or applied to walking surfaces or other elements to warn the visually impaired of hazards on circulation paths (*7*). Detectable warnings differ from a tactile pathway in that they alert passengers to the presence of hazards in their path. In a transit environment, detectable warnings are used where passenger movements can conflict with traffic flows, such as on the edges of platforms and busways, where tracks cross a walking area, and on sidewalks or at curb ramps leading from a walkway or parking lot to a platform or a station. Because detectable warnings can be placed adjacent to tactile pathways, it is critical that the pattern used for the warning strip not be the same as that used for the tactile path. Serious problems may arise if these two patterns are confused (*6*).

Electronic Information Systems

Electronic information signs can convey information and announcements to all sighted passengers and are the best means of providing infrequent information that has traditionally been verbalized, such as notices about train delays. Some transit agencies use these signs to provide route information based on fixed schedules, whereas other more advanced systems provide real-time information by either telephone line or radio signal based on AVL (*8*). Electronic information can be provided inside and outside vehicles, in terminal buildings, and on platform areas. This section identifies and describes the various types of electronic display systems and methods currently available.

Light Emitting Diodes (LED)/Liquid Crystal Display (LCD)

LEDs and LCDs are readerboards using either single or multicolored lettering. They can provide a two-dimensional array of display letters, numbers, or symbols and allow some animation depending on the system capabilities. Information is viewed from LED/LCD display panels located at vehicle stops or on board vehicles (*9*). The LED systems have traditionally been used indoors and LCDs can be used both indoors and outdoors.

Video/Television Monitors

In a transit environment video/television monitors are the most effective means of providing detailed and continuous information regarding schedules, routes, etc. Monitors can be easily programmed and updated regularly from a centralized computer.

Captioning

Captioning translates the audio portion of a video or film program into visible subtitles or captions. All information shown regularly or that provides essential messages such as emergency information should be captioned. Captioning devices are generally found inside terminal buildings. There are two forms, closed and open. Closed captioning requires a decoder for display on a standard television receiver and can be switched on or off. Open captioning, which is present on the screen at all times, does not require special equipment, but cannot be switched off. Standards developed by the U.S. National Captioning Institute should be used.

Visual Alerting Devices

These devices convert sounds such as telephone rings and alarms to visual signals. Visual alarms should be used with audible alarms, especially in main concourses and washrooms of terminal buildings. These devices are very important for a person with a hearing impairment, because they provide a visual form of communicating emergencies.

Electronic information systems are an important component of the communication system of a transit agency. They are helpful to the general public but are of added importance to passengers with disabilities, particularly those with hearing impairments. The display of a visual sign is possibly the only direct form of communication that passengers with hearing impairments have, particularly while on a transit vehicle. Therefore, transit agencies should ensure that signs are consistent and uniform in design, are placed in an accessible location, and use proper illumination, color, and brightness to avoid confusion (*1*).

Audio Techniques and Technologies

One significant issue facing transit operators is complaints about the inconsistency in announcing major stops, transfer points, and stop requests. This is in violation of the ADA, which requires that major stops and other related announcements be made on fixed-route systems. The American Council of the Blind estimated that the average compliance rate for fixed-route operators in calling out stops was not more than 10 to 15 percent in the United States (*10*). The failure to call out major stops and stop requests can present serious safety risks for individuals with visual impairments, a prime factor in rendering a fixed-route system inaccessible to those individuals.

Calling out stops on transit vehicles can be achieved, for the most part, by the operator's use of a public address (PA) system, which amplifies auditory messages and distributes them by means of loudspeakers located on the vehicle. In addition, a variety of technological devices have been developed to assist the transit operator with stop announcements or to provide information to passengers independently.

Voice Enunciator Systems

These systems provide announcements in a human voice, and may be triggered by the approaching vehicle to notify passengers of the arrival of a bus or train. Some voice enunciator systems can be set to activate when the bus door opens to broadcast the route number and destination of the bus to passengers waiting at the stop. This is particularly useful for passengers who are visually impaired.

Integrated communication information and security systems provide passengers with visual and auditory stop announcements and emergency information. Data are also provided through animated color graphics and continuous programming features, keeping passengers updated on current news, weather, sports, cultural events, and items of educational interest. Similarly, audio information is communicated by means of a digitized voice enunciator.

The Visual Communications Network (VCN) system is a multimodal, multimedia passenger information system in use in the Montreal subway system and the shuttle bus terminal platform at the Kansas City, Missouri, international airport (*9*). Using high-definition color LED technology, it delivers easy-to-read real-time messages. Similar systems are used on the city of Laval's urban buses in Quebec and at Dallas/Fort Worth Airport in Texas.

Talking Signs

Talking signs provide an audio message that allows persons who are visually impaired to orient themselves in the same way as a sighted person looking at a sign. An infrared transmitter is built into the base of a talking sign and when a small, handheld receiver is aimed at the sign, it activates and transmits identifying messages. Messages may be programmed in any language and can contain information about what may be found in the immediate area, such as a reception desk, public telephones, elevators, or directional information routinely found on printed signs (*11*). Information may be provided on approaching buses, bus stop locations, ticket machines, and platform edges. At the touch of a button, boxes mounted at bus or train stops may provide route and timetable information to persons with visual impairments. Talking signs are useful for those with reading difficulties or learning disabilities, seniors, and those with visual impairments. Talking signs are currently in use on the San Francisco Municipal Railway (Muni), the Bay Area Rapid Transit District (BART), and the Vancouver–Richmond Rapid BusLine.

Another example of a talking sign technology is Electronic Speech Information Equipment (ELSIE), also referred to the "talking bus stop," developed by the British Department of the Transport Environment and Regions. ELSIE combines three technologies: (1) a component that uses digital speech, (2) a unit that reads the route numbers of approaching buses, and (3) a microcomputer that coordinates the first two components. ELSIE enables visually impaired travelers to locate a bus stop, activate audible route and schedule information, and be alerted to the arrival of bus (*1*). Talking bus stop technology is also being used by New Jersey Transit, Newark, New Jersey.

Talking Buses/Trains

These information systems use digital speech to announce destinations, stops, and intersections. The system can be programmed to automatically announce a message when the door opens, and is activated by pole transmitters located along the route or by other automatic vehicle location devices. Current technologies exist such that digital speech could interface with a visual display allowing for simultaneous broadcast (*1*).

The Talking Directory Display System

This system is a "talking kiosk" designed to aid persons with visual impairments. The kiosk is located by means of an audible beacon and provides voice orientation to individuals who are within 2 feet. It contains a tactile station map and telephone keypad with information on station layout and services (*12*).

Auditory Maps/Sound Maps

These maps, recorded on cassette tapes, provide step-by-step directions to guide a person through a particular environment. The tapes may describe specific pathways, general neighborhood features, and other information about the transit system. Auditory maps can be very helpful to passengers with visual impairments. The tapes can be made to provide the level of detail required by the traveler (*6*).

Auditory Pathways/Acoustical Finders

Auditory pathways and acoustical finders consist of a series of speakers positioned along a predetermined route, which can be electronically activated by depressing a button or by means of an object worn by a passenger that activates a sensor on the speakers. Once the speakers are activated, they will announce instructions that guide the person to their destination. Another form of auditory pathways found on transit vehicles provides instructions when travelers press a button located at the entrance of the vehicle (*6*).

Auditory Beacons or Signals

These signals are emitted from transmitters located directly over open doors. They are used to prevent people from stepping in the gaps between subway cars and station platforms (*13*). This is especially useful for passengers with visual impairments.

Sonic Guide Systems

The Blind Mobility Research Unit in Nottingham, England, developed a sonic guide system that uses an ultrasonic pulse–echo device mounted on eyeglass frames that indicates the presence of obstacles to the wearer by providing selected notes on the musical scale (a single note for each 1 foot range). The system can assist a pedestrian in walking parallel to a wall or hedge by repeating a note in the inner ear, indicating distance from the object.

Assistive Listening Systems

These systems provide amplified messages directly to the user's ear. This diminishes the effect of background noise, which is a major problem for people with hearing impairments (*1*). Such systems can be used either on buses or in transit facilities. The following are three categories of assistive listening devices:

- *Induction Loop System*—A wire looped around a room or specific area where the information is to be received. A microphone provides input to a transmitter that is attached to the wire. The transmitter generates a magnetic field that can be picked up by hearing aids that are t-switch equipped. A t-switch allows an

individual to change the setting on a hearing aid to allow for the detection of an acoustic signal or electromagnetic field. The hearing aid converts the energy back to sound. A person without a t-switch-equipped hearing aid may carry a receiver to take in the transit information (*1*).

- *FM Systems*—Personal listening systems that transform an audio sound source into FM radio signals that can be picked up by a receiver. The message is sent by speaking into a microphone connected to a transmitter that sends out a signal. A person tuning into that frequency can pick up the signal. The FM transmitters can be either portable or stationary. Portable transmitters usually operate on batteries, whereas the stationary units operate on an electrical power supply. This system could be used in a transit environment, where the bus driver announces upcoming stops and a passenger picks up the information with a receiver. It is possible, however, for cross-signaling interference to occur because of the medium in which information is transmitted.

- *Infrared Systems*—These are similar to FM systems, but use infrared light rays instead of radio waves. The infrared system offers an advantage over the FM system in that the receiver only picks up signals that it can see. This is also a disadvantage in that signals cannot be transmitted through an object; therefore, if something is blocking the light path, the signal will not get through. Other disadvantages are its poor performance in natural light and its generally higher cost.

An example of an assistive listening and learning system is a pocket-sized receiver and transmitter designed to keep travelers with visual impairments, cognitive impairments, reading disabilities, or a language barrier informed of their location and other information. When an individual wearing a receiver enters the field of transmission, data are transmitted through the receiver's speaker, providing information on building entrances and directories, elevators and stairways, restrooms, office entrances, mass transit vehicles, and public transit stops (*8*).

Audible Alarms

Audible alarms transmit an alarm sound during an emergency. "Where possible, the alarm should be placed immediately above an emergency exit door" (*4*).

Smart or Computerized Technologies

Smart Cards

Smart cards are plastic cards encoded with an integrated circuit. This circuit contains information that can be securely and accurately read by receptive terminals. Smart cards are able to store more information than magnetic stripe cards. Currently there are two types of smart cards, "contact cards," which require direct contact with the receptive terminal, and "contactless" or proximity cards, where activation occurs through a radio frequency inductive field. The combi-card is a recent innovation in smart card technology that combines the characteristics of both the contact and contactless cards.

Smart cards provide the opportunity to make machines more user friendly. For persons with disabilities or seniors, a smart card can carry information that tells a terminal to:

- Allow the user more time. Many seniors and those with cognitive impairments do not like to be rushed ("timed out") by a machine; therefore, it is necessary that these people be allowed to use the terminal at their own pace;
- Simplify the choices, such as issuing a preset amount of money;
- Display larger characters for people with reduced vision; and
- Increase audio output of nonconfidential information (*14*).

Smart card technologies are currently being used by WMATA (Washington, D.C.), and The Metropolitan Transportation Commission (San Francisco Bay area, California).

Automated Information Kiosk

The automated information kiosk is a system being developed that enables travelers to retrieve information from both static and real-time databases. Information on local restaurants, hotels, and points of interest is derived from the static database. The real-time data for travel comes directly from a transit operations center. Users access the information through interactive computers and can obtain a hard copy of schedule information, if required.

In Houston, Texas, automated information kiosks are situated in three downtown locations. Tourists are given a cartoon-style map of the city with the bus system superimposed. By touching their desired destination on the screen, they are shown which route to take. For their convenience, the information can also be printed (*9*).

Automated information kiosks are also found in airport terminals. Pearson International Airport in Toronto, Ontario, and Dorval Airport in Montreal, Quebec, are airports that have this system (*9*). It provides information on flight arrivals and departures, and the location of facilities, ground transportation, and accessible hotels. Some kiosks have a color touch screen with simplified controls, and magnification and contrast adjustment for people with visual

disabilities. The information is provided in large-text, audio, and symbol modes in English and French.

The automated information kiosk can be used as a method of communication for people with some types of visual, speech, or hearing disabilities, as well as for the general public. These kiosks are also being used by the Metropolitan Atlanta Rapid Transit Authority; the Department of Transportation, Seattle, Washington; and WMATA.

Automatic Vehicle Location (AVL)

AVL systems are computer-based vehicle tracking systems. This is made possible through GISs, which are a special type of computerized database management system in which geographic databases are related to one another by means of a common set of locational coordinates (*12*). In a transit application, this system gives transit agencies the ability to accurately respond in real-time to passenger inquiries regarding bus location and schedule information.

The installation of on-board information display and annunciation technology is usually made possible through AVL systems. The availability of on-board information display and annunciation technology has the following advantages:

- Compliance with ADA provisions,
- Improved en-route information that allows the vehicle operator to concentrate on the task of driving and reduces driver distraction,
- Communication of public service information between bus stops,
- Vehicle destination sign changes that can be automated, and
- Passengers on vehicles can obtain confirmation on transfers to other transit services (*12*).

Some transit agencies currently incorporating AVL in their service delivery are the New Jersey Transit Corporation; King County Department of Transportation/Metro Transit, Seattle, Washington; Ann Arbor Transportation Authority, Ann Arbor, Michigan; and Tri-County Metropolitan Transportation, Portland, Oregon.

Seven transit agencies have integrated GISs with their Internet information systems. This allows passengers direct access to the system to obtain information on routes and schedules at their leisure. This feature also assists passengers in pretrip planning and could reduce their reliance on obtaining information from transit staff.

The information provided on web sites should be in an accessible format or one that can be easily converted to an accessible format (*15*).

TRAINING

The literature emphasizes that training is an essential element in improving communication between transit operators and passengers with disabilities. Furthermore, to be in compliance with federal regulations such as ADA, transit agencies are required to ensure that their employees and contractors are properly trained to serve such passengers.

Transit agencies should review federal regulations and guidelines and consult national and local organizations that provide services to persons with disabilities to assist in the development of an appropriate training program.

This section reviews some of the training programs currently available for transit operators and passengers. See Appendix C for more detailed information on each of the training programs.

Transit Personnel

The goal of training programs for transit personnel should be to ensure that bus operators are more aware of and sensitive to the needs of customers with various types of disabilities. To increase sensitivity, training should involve one-on-one interaction and group discussion with a qualified facilitator and should extend to all transit personnel (*1*). Some of the training programs currently available to transit agencies that are designed to assist operators in better serving passengers with disabilities are described here.

Sensitivity Training

The sensitivity training program provided by the Canadian Urban Transit Association is designed to train as well as to screen people who want to be operators for paratransit services. The training program includes the following:

- The role of the operator;
- Methods for operators to recognize the range of abilities and assist persons with disabilities;
- Positive attitudes to employ in helping passengers;
- Teamwork, knowledge, and techniques; and
- A video, “Good Riding for Everyone.”

Transit Ambassador Program

This program, provided by the Canadian Urban Transit Association, is a customer-service training package designed to give transit employees the skills and concepts needed to significantly improve customer relations and to assist management in developing a strong internal commitment to

teamwork and customer service. There are custom versions in English and French for bus and rail services.

ADA Stop Announcement Program

The Easter Seals Project ACTION developed a stop announcement training program, which is documented in a 1998 American Council of the Blind report (*16*). The report identifies and describes the essential components for developing and carrying out an ADA stop announcement implementation, as well as a training program for operators and supervisors on calling out major stops.

Serving Passengers with Cognitive Disabilities

Easter Seals Project ACTION also developed a training program for fixed-route bus operators on serving passengers with cognitive disabilities (*17*). The report is designed for use in conducting in-service training with current bus operators or as part of the initial training for new operators, and is meant to help a transit system meet its ADA obligations.

Passenger Training

The goal of training programs for passengers of regular transit services is to achieve speed, maximum agility, and smoothness when using these services. New passengers with disabilities should be assisted one-on-one by a person with similar disabilities. Independent living centers and programs conducted by persons with disabilities provide the best training (*1*).

Training People with Disabilities

Easter Seals Project ACTION, in "Training People with Disabilities to Access Public Transportation," offers a five-step training curriculum as documented in reference 1. The steps are:

- Referral,
- Assessment,
- Program planning,
- Training, and
- Evaluation and follow-up.

The referral steps include a press release and brochure distributed to various agencies that provide services for persons with disabilities in the communities. In the second step, the potential user's cognitive abilities, general awareness, physical skills, interpersonal skills, and safety are assessed. From this checklist an individual program is planned (step three). The program plan identifies goals and objectives and is flexible so that either the trainer or the new user may revise the goals and objectives.

Orientation and Mobility Training

Measures to make a mass transit system accessible are not enough to ensure that the visually impaired will be able to use the system (*18*). Therefore, most passengers who are visually impaired or blind require training on how to safely and effectively use the transit system. Orientation and mobility training is provided by an orientation and mobility specialist. Orientation involves establishing one's position in relation to desired destinations and landmarks. Mobility is moving in a safe and dignified manner from one's current position to a desired location (*1*). Transit operators should also be trained on how to assist passengers who are visually impaired. They can work closely with organizations serving the visually impaired to locate and utilize appropriate training programs.

SELECTED EXAMPLES OF APPLICATION FROM THE LITERATURE

The following are applications of some of the communication methods currently being implemented by transit agencies in the United States and Canada.

Talking Directory Display: Long Island Railroad, New York

The Baruch College Computer Center for Visually Impaired People worked with the Long Island Railroad (LIRR) to develop a Talking Directory Display System (TTYS). This demonstration project was funded by Easter Seals Project ACTION. Baruch College staff was responsible for system design, software development, and maintenance, and the LIRR staff identified a suitable location for the unit and briefed personnel about the kiosk's existence and function.

The TTYS, nicknamed the "Talking Kiosk," is specifically designed to assist persons who are visually impaired locate LIRR facilities throughout Penn Station in New York City. Users are able to initially find the system by following an audible beacon coupled with recorded voice directions. Once a user approaches within 2 feet of the TTYS, a proximity sensor activates more detailed voice directions that provide initial orientation to the kiosk.

The TTYS consists of a tactile map of the station and a standard telephone keypad. One or both can be used to make it easier for persons who are visually impaired to navigate through the system in order to obtain information about the location of services within Penn Station, such as

the ticket counter, information booth, platforms, or specific tracks. One important feature of the keypad component is the availability of a brief tutorial on using the map. Three different levels of detailed information are available and are accessed on the map by repeatedly touching a particular map feature, a characteristic that is explained during the audio tutorial.

During a three-month demonstration period, the Talking Kiosk was used almost 13,000 times, approximately 99 percent of the time by persons with no visual impairment. A detailed evaluation of the system involving a series of trials by the visually impaired showed that TTYS was user friendly, more people use the keypad than the map, and 18 of 20 people who successfully completed the trial would use the TTYS again. Although the keypad was used more frequently, the evaluation found that users would also employ the map once they had become familiar with the general operations of the system. The majority of participants indicated they would like to have similar installations in other locations.

The TTYS continues to operate, and Baruch College and the LIRR staff have discussed the possibility of physically integrating it with an installation that would also house a ticket vending machine (*12*).

Public Address/Customer Information Signs

New York City Transit has undertaken a major upgrade of its customer communication system, called Public Address/Customer Information Signs, throughout its subway network. A $49 million first phase of the system was installed, which integrated new customer information signs with new or upgraded PA systems in 140 stations (another 17 stations will receive information signs under separate station rehabilitation contracts). The next step was installing its subway train and traffic information systems, which use the existing block signal system to provide information to passengers on the platform by means of the signs and PA systems. The announcements will inform passengers how many stations away the next train is. This "semi real-time" information is the precursor to real-time information.

A subsequent $78 million project will result in the installation of information signs in another 57 stations. The project is expected to be integrated with the simultaneous installation of automated train supervision on the Number 4 line running through Brooklyn, Manhattan, and the Bronx and is slated for completion in 2001. Data from automated train supervision will be fed into the signs and PA system to provide customers with real-time information. The information will include the arrival time of the next several trains, the length of the next train (to allow customers to position themselves properly on the platform for long or short trains), and advisories regarding planned service disruptions and detours (*12*).

Interactive Voice Response (IVR): Vancouver HandyLine and BusLine

BusLine, the IVR system used in Victoria, British Columbia, was originally developed by Oracle Communications, Inc. HandyLine, a similar system for paratransit services is used in Vancouver, British Columbia. BusLine permits automatic confirmation or cancellation of requests for service. Customers can communicate with both systems using touch-tone telephones. The Vancouver HandyLine system was first installed in 1991. By 1996, it had run for 5 years without interruption. A second generation of IVR systems has been developed by Oracle Communications for Victoria. These IVRs are designed to work with automated scheduling systems.

In Calgary, Alberta, Calgary Transit's Handi-Bus has installed a new IVR system on it's Trapeze QV scheduler. This IVR, called HandyQ, will provide Handi-Bus customers with automatic trip confirmation and cancellation capability, as well as information of a general nature and urgent last-minute bulletins. The confirmation and cancellation capabilities are expected to provide an early payback to Handi-Bus by off-loading significant numbers of operator-handled calls to the automated system (*9*).

Trip Planning: Vancouver, British Columbia

BC Transit in the Greater Vancouver Area makes trip itinerary planning available to its customers by means of the telephone. A clerk answers the calls and inputs the origin, destination, and other required information into the system, which is linked to a GIS map display showing the roads, bus stops, rivers, bodies of water, significant points of interest, and parks. The system contains the schedules for all buses, light rail trains, SkyTrain commuter rail trains, SeaBuses, and heavy rail trains in the Greater Vancouver Transportation District, which encompasses Vancouver and the lower mainland of British Columbia. The trip planning software produces two or three optional itineraries based on the customer's origin, destination, and other specifications. The clerk informs the caller of the results. The system receives about 5,000 calls per day, or 175 calls per clerk per day. BC Transit is currently investigating interactive voice response and Internet options that would more than quadruple its ability to handle customer information requests (*12*).

CHAPTER FOUR

SURVEY OF TRANSIT OPERATORS

Transit agencies were selected and surveyed to assemble current policies and procedures specifically aimed at addressing the communication needs of persons with disabilities. In addition to gathering general characteristics and operating parameters, the questionnaire was specifically aimed at current communication methods, how transit agencies are marketed to their customers, problems encountered in communicating with persons with disabilities, particular training programs for employees, and pilot projects or demonstrations in which the transit authority participated. A copy of the questionnaire is found in Appendix A.

SURVEY METHODOLOGY AND RESPONSE RATE

A number of transit agencies providing a variety of transportation services in the United States and Canada were selected to be surveyed using the following criteria:

- Size of operation and modes of transportation,
- Geographic location,
- Population of city or service area or annual ridership, and
- Funding sources.

On the basis of these criteria, 63 transit agencies from 29 states and 4 Canadian provinces were selected for the survey. The general manager or appropriate person for each transit agency was first contacted by telephone, introduced to the TRB project, and then sent the survey questionnaire. To increase the response rate and obtain better representation, follow-up phone calls were made to selected operators who did not initially complete the survey. Of the 63 transit agencies receiving surveys, 19 (16 from the United States and 3 from Canada) responded, a response rate of 30 percent. The list of transit agencies surveyed is presented in Appendix B.

CHARACTERISTICS OF SURVEY RESPONDENTS

Table 1 presents key characteristics about the transit agencies that responded to the survey. In general, 1998 budgets ranged from $6.6 million to $1.3 billion. Approximately 40 percent of the agencies spent 1 percent or less of their budget on communicating with persons with disabilities, and 10 percent spent more than 3 percent of their budget in this area.

TABLE 1
CHARACTERISTICS OF SURVEY RESPONDENTS

No.	Budget (Operating + Capital) (Millions $)	Transportation Modes			Annual Ridership (1998) (millions)	Connection Modes				
		Buses	Rail	Vanpools		Rail	Air	Coach	Ferry	Subway
1	1,329	√	√	√	387	√	√	√	√	
2	1,154	√	√	√	284	√	√	√		√
3	530		√		76	√	√	√	√	
4	405		√	√	99	√	√	√		
5	350	√	√	√	84	√	√	√	√	
6	241	√			66	√	√	√		
7	236	√	√		80.7	√	√	√		
8	202	√	√		36			√		√
9	173	√		√	63	√	√	√	√	
10	150		√		65	√		√		
11	143	√			72					
12	132	√	√		70	√	√			
13	130	√		√	39	√	√	√		
14	75	√	√		42			√		
15	72	√	√	√	N/A		√	√		√
16	25	√			5.6	√	√	√		
17	16	√	√	√	5.9			√		
18	12	√		√	3.4	√				
19	6.6	√			3.3		√		√	

N/A = not available.
Sources: Survey of Transit Agencies, 1999 APTA Membership Directory, and 1999–2000 Canadian Urban Transit Membership Directory.

TABLE 2
EFFECTIVENESS OF COMMUNICATION METHODS: RESPONSE FROM TRANSIT AGENCIES

Communication Methods	Score*	Frequency**	No. of Responses
Telephone information service	71	4	17
TDD (telecommunication devices for the deaf) phone information service	58	4	16
Call out stops (voice)	56	4	15
Web-based information service	55	3	14
Automated telephone information service	45	4	12
Customer training	45	4	11
Trip planning	41	4	10
Detectable warnings (e.g., surface treatments)	32	5	7
Call-out stops (electronic)	24	3	6
Specialized signage for visually impaired persons	23	5	5
Male/female voices for vehicle direction	22	3	4
Fax information service	21	4	5
Symbols for persons with visual impairments	21	4	5
Flashing warning lights	18	5	4
PIBS (passenger information at bus stops)	16	4	4
Global Positioning Systems (GPS)	16	4	3
Braille cards	15	2	5
Electronic vehicle identification	14	5	3
Digitized voice messages	11	3	3
Automated information kiosks/touch screens	10	3	3
Travel ambassadors	10	5	2
Captioning	7		2
Tactile maps	5		1
Television monitors in big print	4		1

Measure of Effectiveness (Score): very ineffective, 1; ineffective, 2; somewhat effective, 3; effective, 4; very effective, 5.
*Sum of individual scores.
**Number of times each option identified by a survey respondent.

Annual ridership for these agencies ranged from 3.3 to 387 million passengers. Seniors and persons with disabilities represented from 2 to 47 percent of the annual ridership.

Thirteen of the transit agencies operate at least two of the following modes of transit: bus, commuter rail, heavy rail, vans, paratransit service, or ferry service. Two agencies operate only commuter or heavy rail, and four operate only bus service.

All of the transit agencies provide access to multimodal facilities, with 13 connected to a rail facility, 13 to an airport, 15 to a bus facility, and 5 to a ferry service.

SUMMARY OF SURVEY RESULTS

Reason for Improving Communication

Two-thirds of the respondents indicated that the most important reason for improving communication methods for persons with disabilities was the benefit it provided to all riders. Government legislation was the reason given by approximately one-third of the agencies, whereas one-quarter indicated that such improvements would attract more customers to their services. Some agencies stated that it would be more cost-effective to transport persons with disabilities on conventional transit and, thus, there is a need to make conventional transit more accessible. Only one agency indicated that their improvements to communication systems were a result of public demand.

Methods of Communicating

Transit agencies were asked to identify and rank their current methods of communicating with persons with disabilities. The ranking options were: very effective, effective, somewhat effective, ineffective, and very ineffective. Each option was assigned a score of from one to five, with five being very effective, and the totals were tabulated to determine the methods identified as most and least effective. The number of times each option was identified by a survey respondent was tabulated and identified as the frequency. Table 2 provides a summary of the results.

Telephone information service was identified by transit agencies as the most effective method of communicating with persons with disabilities. Other methods of communication with high scores were customer training, providing web-based information, and the operator calling out stops.

The communication methods that were most frequently identified as very effective were:

- Telephone information service
- Fax information service
- Male/female voice for direction
- Detectable warning (e.g., surface treatments)
- Specialized signage for the visually impaired
- Flashing warning lights
- LED destination signs.

Methods of communication most frequently identified as being effective included:

- Automated telephone information service
- Customer training
- Trip planning
- TTY phone information service
- Symbols for persons with visual impairments
- Passenger information at bus stops.

Transit agencies responded most frequently that the following methods were somewhat effective:

- Web-based information service
- Call out stops (voice)
- Call out stops (electronic)
- Automated information kiosks (touch screens).

Braille cards were identified most frequently as being ineffective.

The communication methods identified by the transit agencies are all documented in the literature. The ranking of the braille card as an ineffective method of communication appears to be consistent with the recommendations in the literature that braille should be used in conjunction with another method of communication.

Communication Methods at Connecting Intermodal Terminals

Transit agencies were asked if they investigated the communication methods available at connecting intermodal facilities. Approximately one-half answered no. Explanations were that it was not within their jurisdiction to do so, they lacked the resources to examine intermodal facilities, or that passengers have not requested or complained about communication systems at these facilities. The remaining agencies indicated that they investigate the communication methods available at connecting facilities by:

- Utilizing surveys, research, site visits, or conducting audits;
- Investigating complaints received from customers; or
- Asking members of their Advisory Committee to ride the system.

Once these transit agencies complete their investigations, the information is distributed to passengers on board the vehicles, at bus stops, and through their travel information centers. This information is in the form of TTY, flyers, e-mail, mail-outs, rider alerts, and news releases. The information is also posted in ride guides and distributed through public service announcements.

The provision of appropriate communication methods to connecting intermodal facilities is an important component of the trip planning decision for passengers with disabilities. If the necessary communication mechanisms are not available, passengers either will not travel or will choose an alternate method of transportation. In either case, it is an added hardship for those needing to make a connecting trip.

Problems Identified with Current Communication Methods

The problems identified by individual transit agencies with their current methods of communication were derived from their experience and complaints from passengers and special interest groups.

A frequent problem concerned operators not calling out major stops on a consistent basis. Other related problems included passengers requesting individual talk boxes for each platform and that audible destination messages are disrupting some neighborhoods late at night.

Problems were identified with the real-time aspects of the communication system. Transit agencies indicated information was not being effectively relayed and that the systems do not have an audio component.

Problems related to signage and literature included passengers requesting information in another language or in braille. A lack of proper identification of tracks and station platforms was also reported.

Accessibility-related problems include:

- Web-site information needs to be developed to meet the concerns of persons with visual disabilities,
- Operators not being able to quickly accommodate detours/irregular routing requests,
- Route and schedule information not being accessible by telephone to passengers who are deaf,
- The lack of a single communication method that meets everyone’s needs, and
- Difficulties conducting accessibility and safety audits, including the examination of communication access.

Several of the communication techniques and devices described in chapter 3 could address the problems identified by the transit agencies. Potential solutions for the audio-related problems could include:

- Driver training for announcing stops,
- Electronic stop announcements,
- Talking signs on platforms, and
- Implementation of an audio component with ALV.

To address signage and literature:

- Electronic signs could be displayed in vehicles and on platform areas and
- Schedule and route information could be provided in other languages and in braille.

To address electronic accessibility:

- Develop an accessible web site,
- Accommodate flexible routing requests, and
- Make TTY devices available.

Methods Used to Determine the Communication Requirements

To determine the communication requirements of persons with disabilities:

- Thirteen transit agencies consult with organizations representing persons with disabilities,
- Ten transit agencies use customer surveys and focus groups,
- Nine transit agencies use field observations and unsolicited input from passengers, and
- Four transit agencies indicated that they have formed their own advisory committees to recommend appropriate communication methods.

Planned Improvements for Current Communication Methods

Communication techniques and technologies that transit agencies are planning to implement covers a large segment of the communication methods available. Transit agencies' plans are heavily focused on expanding Internet-based information and announcing stops. These two methods of communication were ranked as the most effective methods of communicating with persons with disabilities. Other forms of communication improvements include:

- Staff Training
  - Train staff on the use of TTY equipment,
  - Continue driver training on serving passengers with disabilities, and
  - Implement a focused retraining program for fixed-route operators concentrating on ADA compliance.

- Information
  - Provide web page formatting based on customer requirements;
  - Implement a web site for customers;
  - Improve and expand the web site;
  - Provide an automated transit itinerary planning service on the web site;
  - Feature accessible routes, stations, and so forth in system literature (ride guide);
  - Improve communications in subway stations and trains through the use of fiber optics; and
  - Reorganize phone systems (automated) to make it easier for customers to choose appropriate topics.

- Signage
  - Install electronic signage and audio communication at key stations on all lines and
  - Develop braille and tactile maps for persons who are visually impaired.

- Stop Announcement
  - Place voice enunciators in every bus to announce bus stops, major intersections, major attractions, and the end of the line;
  - Complete installation of next-stop audible and captioning systems;
  - Experiment with automated stop-calling devices as part of the Intelligent Bus System program;
  - Make calling out stops a requirement (with disciplinary action for noncompliance); and
  - Implement electronic stop announcements.

- Computerization
  - Implement AVL/Global Positioning System;
  - Implement new scheduling and dispatching software to allow for the use of interactive voice response to confirm trips, pick-up times, and to make cancellations; and
  - Continue to research adding the audio component to display terminals at the transit centers.

Factors Determining the Priorities for Improving Communication

Factors affecting agency priorities for improving communication with persons with disabilities were prioritized by the transit agencies as follows:

- Feasibility of implementation,
- Government legislation,
- Cost,
- Number of requests for improvements,

- How the proposed communication improvement fit into overall agency plan, and
- Integration with the needs of the general riding public.

Effective Ways of Marketing to Persons with Disabilities

The transit agencies prioritized the most effective marketing methods as follows:

- Transit promotional material
- Radio
- Television
- Electronic signs
- Internet.

Newspapers and magazines were identified as the least effective marketing methods.

Calling Out Stops

Calling out stops was rated as a somewhat effective method of communicating with persons with disabilities, and all transit agencies indicated that they have a procedure for announcing transit stops. The majority of the agencies however do not have an automated system for announcing stops, and for these agencies the calling out of major stops is the responsibility of the operator. Calling out stops, transfer points, major intersections, and destinations, as well as at sufficient intervals along a route, to permit individuals with disability to orientate themselves, is a requirement of the ADA. As a result, a greater responsibility has been placed on the operator, and ultimately the transit administration, to ensure that the act is being followed consistently and comprehensively.

Electronic Display

Two-thirds of the responding transit agencies reported that they currently use electronic displays as a method of communication. The electronic displays typically transmit information about vehicle schedule, vehicle location, stop requests, fares, safety, special events, news, and weather. The electronic display system is typically located on transit vehicles, within bus waiting areas, within the transit terminals, and on train or bus platforms.

Audio System

Approximately one-half of the responding transit agencies indicated that they currently use a PA system as a method of communication. Several agencies with electronic display systems also have an audio system associated with it.

Employee Training

All respondents indicated that their agency provides special training to front-line personnel to familiarize and educate them about the communication needs of persons with disabilities. Specific training provided includes:

- Customer and sensitivity training,
- Use of TTY and TDD,
- Lift operation training,
- Active listening techniques,
- Training dedicated to ADA,
- Transit Ambassador Program,
- Bus operator training and retraining classes,
- Disability awareness training for supervisors and drivers, and
- Passenger assistance training for all operators, dispatchers, and office personnel.

The training identified by the transit agencies included that recommended in the literature.

SELECTED EXAMPLES OF APPLICATION FROM TRANSIT AGENCIES SURVEYED

The following are examples of the types of communication methods that have been used by the surveyed agencies.

Miami–Dade Transit Agency (MDTA)

The MDTA provides transit services to the city of Miami and Dade County in Florida. This area encompasses approximately 315 square miles, with a population of approximately 2.1 million. In 1998, MDTA carried approximately 81 million passengers.

To accommodate and encourage persons with disabilities to use the rail and bus systems, the MDTA introduced a number of assistive devices on its equipment (rolling stock) and at its stations.

Specialized Signage for the Visually Impaired

On all MDTA buses, route identification and destination signs use large, oversized optic yellow lettering to assist passengers who are visually impaired. (The agency has chosen optic yellow over other available colors because it presents a superior recognition format in the Miami environment).

Digitized Voice Message

To assist the visually impaired to use the People Mover System, the agency has installed a digitized male and female

voice message system to announce the approach of the next transit vehicle arriving at the station. A male voice is used for a vehicle travelling in one direction, and a female voice is used to indicate a train traveling in the opposite direction.

Detectable Warning

The MDTA has installed detectable warning strips along the leading edge of all of its rail and people mover stations. The warning strips are tactile tiles; 12-in.-wide rubber-finished tiles set flush with the surrounding surface, installed prior to the ADA legislation.

Double-width (24-in.) tactile tiles are also positioned opposite the vehicle door opening locations along the station platforms, thus enabling both persons who are visually impaired and persons who use wheelchairs to line themselves up at the appropriate location on the platform before the arrival of the next train. This facilitates the train loading process and helps maintain schedules.

MDTA personnel have also used these detectable warning devices as a visual tool to teach both seniors and school children to distinguish between safe and caution areas on MDTA station platforms.

ADA Training

As part of its orientation training for new bus operators, the MDTA has created a 1-day ADA sensitivity training course designed to assist operators in identifying and transporting individuals with disabilities. These courses are also incorporated in driver retraining programs run by the agency.

Alameda–Contra Costa (AC) Transit

AC Transit operates surface transit routes in a 375-square-mile area centered on Oakland, California. The service area population is approximately 1.5 million and AC Transit carried 63 million riders in 1998.

Tactile Pathway Review

AC Transit has developed new guidelines for the design of its bus centers that include provisions to accommodate persons with disabilities. One of these provisions is tactile pathways. The pathway or "induction line" is a way-finding or guiding device that is used to assist visually impaired or blind persons to negotiate their way through transit centers and to locate bus stops within these facilities.

AC Transit is currently conducting a 3- to 6-month demonstration of Tactile Pathway Systems at the El Cerrito Plaza BART Station. This demonstration uses a 6-in.-wide bar tile "induction line" that runs from the fare gates at the entrance to the bus platform along a predetermined tiled pathway terminating at a bus stop pole on the platform where the bus would normally stop to allow passengers to embark. The patron following the "tactile pathway" is made aware of the bus stop pole position through the introduction of a 24-in.-wide cross-path bar tile, which intersects the induction line. This demonstration also included the placement of additional "cross-paths" preceding stop poles at other locations on the opposite side of the bus platform. In this instance, no induction lines were inlaid on the platform surface to guide the user to the bus stop pole. This demonstration project will help AC Transit evaluate the merits of each type of tactile pathway system and will influence the type of system recommended for other bus centers in the AC Transit network.

King County Metro

King County Metro Transit in Seattle, Washington, provides public transit service in about one-third of the county's 2,100-square-mile area. The population served is approximately 1.7 million. In 1998, Metro Transit carried 84.2 million passengers on its fixed route, paratransit, and vanpool services.

Web-Based Information Services

King County Metro Transit is currently updating its web site to make it more accessible to persons with disabilities. Transit information will be stored in a common database with consistent content. Users will then have the option to choose the format they wish to use to view this information (e.g., persons with visual impairments might choose a format with text only). The authority can also e-mail route alerts to riders who have signed up for this service. Route information is available in scheduled and real-time formats through various support programs.

Automated Traveler Information System (ATIS)

For trip-planning purposes, riders can also receive assistance from Metro Transit through a program known as ATIS. This is a geo-based trip-planning program providing origin and destination data to the transit agency. Transit riders can obtain trip-planning information that will include up to three alternative routings (including the walking distance) for using public transit. This information is obtained by inputting existing routes and schedules and the origin and destination information into the ATIS program,

which in turn creates the routing alternatives. ATIS currently provides travel information related to scheduled time rather than real time, which is appropriate for current purposes. Automated traveler information is currently available in numerous transit properties in the United States, such as Portland, Oregon.

Toronto Transit Commission (TTC) Wheel Trans

The TTC serves a 244-square-mile area that contains a population of approximately 2.3 million. In 1998, the TTC and its paratransit division (Wheel Trans) carried 389 million passengers on its surface, subway, light-rail transit, and paratransit services.

Customer Training

With the arrival of sufficient quantities of low-floor and lift-equipped buses, TTC has been able to identify a number of its surface routes as accessible. Wheel Trans has undertaken a customer training initiative designed to familiarize its clients with the accessible equipment assigned to these routes. For its customer training program, Wheel Trans has selected an area located in the northwest quadrant of Toronto, which has several accessible routes feeding into subway stations on both the north–south Yonge and Spadina lines. The program seeks customers living within the study area as volunteers to be trained in using the accessible routes and the various features of the low-floor and lift-equipped buses assigned.

For the training program, Wheel Trans provides assistance using either Wheel Trans customer service personnel or light duty operators, whose task it is to help the volunteers negotiate the interior of the buses and secure the assistive devices. The TTC will assess the effectiveness of the program following the completion of the test period.

Mentor Program

Wheel Trans intends to introduce a mentor training program following the initial customer training program. This program will provide training on equipment, access, and familiarization for human and social service representatives, and friends or relatives of Wheel Trans clients. This will ultimately allow the Wheel Trans customer service personnel and light duty operators to return to their regular tasks within the organization.

Sensitivity Training

The Operations Training Center (OTC) at TTC provides a special training course for new drivers, teaching them to understand the needs of riders with disabilities. Sensitivity training is also given to operators scheduled for refresher training by OTC. In addition, every driver signing up for an accessible route must now be trained on how to use the accessible features provided on the bus.

Calgary Transit

Calgary Transit is a multimodal transit authority operating in a 418-square-mile service area in and around the city of Calgary, Alberta. Calgary and environs contain a population of approximately 850,000, and its transit system (Calgary Transit) carried in excess of 70 million riders in 1998 on its rail and bus services.

Travel Training

In 1998, Calgary Transit implemented a travel training program for senior citizens and persons with disabilities. The program provides outreach services to agencies and individuals, and informs people about the accessible services available through the transit agency. Through individualized coaching, including arranging for the use of a low-floor bus for practicing embarking and disembarking safely, the program enables customers to use accessible Calgary Transit services and increase their independence.

A Calgary Transit travel trainer teaches clients the necessary skills required to use Calgary Transit by means of instructional aids, including videos, route maps, and schedules. Thus, by understanding how to use the system, they gain confidence in traveling and accessing the community-based services.

There is no cost to clients who participate in this travel-training program. The program covers trip planning, using Calgary Transit resources, and safety and security, while providing clients with direct experience on the transit system. The personalized instruction is self-paced and matches a schedule that meets each individual's needs.

Participating in travel training provides opportunities by increasing community awareness and offers a choice in transportation options. Since its inception, Calgary Transit has worked with a variety of clients including:

- Persons with physical disabilities,
- Persons with visual impairments, and
- Persons with cognitive disabilities.

Metra

Metra is a commuter rail service operating within a 3,000-square-mile area surrounding the city of Chicago, Illinois,

and its suburbs. The total population of Metra's service area is 7.9 million, and the line carried 76.2 million riders in 1998.

Metra is currently in the process of improving its ability to communicate with persons with hearing and visual impairments through the increased use of audio and visual devices. These devices include "Talk Boxes," which will activate speakers when a person is within a certain distance of the device. The Talk Box will then provide information such as track numbers, train arrival, and direction. Over the next 3 years, electronic signage, with accompanying audio enhancements, will provide further assistance to the hearing impaired.

Metra is also playing an active role in training both its employees and the disabled community. The employee training program focuses on how to accommodate persons with disabilities, whereas the training for the disabled community focuses on how to use the "assistive equipment" that Metra provides on its rolling stock and at its stations.

A recent example of the Metra commitment in serving persons with disabilities is its cooperative endeavor with Easter Seals Project ACTION. Metra is preparing a film designed to teach "travel trainers" how to recognize and use the various devices that Metra has made available to assist persons with disabilities in using its commuter rail system. Travel trainers, after viewing the film, will then be able to instruct and advise their clients with disabilities on how to access the Metra rail system.

CHAPTER FIVE

AVAILABLE TECHNOLOGIES BY TRANSIT FUNCTION

The communication methods identified from the literature review (chapter 3) and results from the transit agency survey (chapter 4) were categorized within the various elements of planning and taking a transit trip. This categorization of technologies demonstrates how each technique or device can meet the needs of persons with disabilities during the course of a transit trip.

The elements of a typical transit trip can be summarized into six basic functions:

1. Understanding the system,
2. Accessing the correct vehicle,
3. Entering a vehicle,
4. Traveling in a vehicle,
5. Exiting a vehicle, and
6. Exiting the stop/station/terminal.

These basic functions are further defined in the following list of basic functions associated with using transit and described in reference 6.

1. Understanding the System
   - Learn routes, stops/stations, and transfer points
   - Learn schedules
   - Learn fare schedule and payment media
   - Learn special services and provisions
2. Accessing the Correct Vehicle
   - Locate stop/station/terminal
   - Locate and access fare system
   - Activate and pass through fare gate**
   - Move to proper boarding area/platform
   - Identify correct incoming vehicle
   - Identify and move to vehicle doorway
3. Entering a Vehicle
   - Move through doorway/cross railcar gap**
   - Ascend stairs/use lift
   - Pay fare*
   - Identify vacant seat or standing space
   - Reach seat/standing space
4. Traveling in a Vehicle
   - Accommodate motion of vehicle
   - Accommodate entrance and egress movements of others
   - Comprehend special announcements
   - Respond to selected special announcements
5. Exiting a Vehicle
   - Identify desired stop/station/terminal
   - Notify driver of desire to stop*
   - Move to doorway
   - Descend stairs/use lift*
   - Exit vehicle and reach platform/area
6. Exiting the Stop/Station/Terminal**
   - Determine desired exit direction**
   - Activate and pass through fare control gate**
   - Exit station/terminal**

(The functions with a single asterisk are applicable only to bus transit systems; those functions with a double asterisk are applicable only to rail transit systems.) These basic transit trip functions do not include “making connections” and “dealing with emergencies”; however, because these functions can be critical elements for persons with disabilities, they are included in this chapter.

UNDERSTANDING THE SYSTEM

Understanding the transit system involves obtaining information about the trip prior to traveling and obtaining information during the trip. For a successful trip it is necessary that passengers or potential passengers receive the appropriate information from the transit agency. During the pretrip phase, potential passengers may require information on various aspects of their trip including routes; stops; schedules; fares; location of accessible stations; special services, including TTY equipment; and policies of the transit agency.

During the trip a passenger, who may be accessing the system for the first time, could require information on the location of fare boxes and ticket agents, how the transfer system works, location of platforms, and how to identify desired stations or stops.

A typical passenger without any particular disability or special need would obtain the required information relatively easily through printed materials supplied by the transit agency or by making telephone inquires. However, for persons with sensory and cognitive disabilities these methods of communication may not be appropriate. Table 3 outlines the communication methods available to assist persons with disabilities in understanding a transit system.

ACCESSING THE CORRECT VEHICLE

Accessing the correct transit vehicle requires that the passenger:

TABLE 3

TECHNIQUES TO IMPROVE COMMUNICATION: UNDERSTANDING THE TRANSIT SYSTEM

	Methods of Communication by Disability		
Information Required	Hearing	Visual	Cognitive
	Adjustable volume telephones	Auditory maps/sound maps	Orientation and mobility training
Learn routes, stops/station, and transfer points	Automatic speech recognition system	Automated voice message systems	Simple text and graphics
Learn schedules	Speech-to-text (countertop device)	Braille material	Standard symbol
Learn fare schedule and payment media	Hearing aid compatible telephone	Large print information	Standard signage
Learn special services and provisions	Manual communication/sign language	Orientation and mobility training	Color coding
	Printed media TTY	Tactile maps	Travel training

Note: Modified from *Guidelines for Improvements to Transit Accessibility for the Disabled* (Battelle 1992).

TABLE 4

TECHNIQUES TO IMPROVE COMMUNICATION: ACCESSING THE CORRECT VEHICLE

	Methods of Communication by Disability		
Information Required	Hearing	Visual	Cognitive
	Visual signs with clear instructions	Route cards	Passenger training
Locate stop/station terminal	Visual display signs (LED/LCD)	Auditory pathways	Standard symbol
Locate and access fare system			
Locate and move to proper boarding area	Assistive listening system	Talking signs/buses	Color coding
Identify and move to vehicle door way	Smart kiosk	Talking bus stops	Public address announcements
		Sonic guide system	Universal design
	Visual communication network	Public address announcements	
	Universal design	Universal design	

Note: Modified from *Guidelines for Improvements to Transit Accessibility for the Disabled* (Battelle 1992).

- Know where to wait for the vehicle,
- Identify the correct vehicle, and
- Move to the vehicle doorway.

The level of information required to do this will vary between a bus stop and a rail station and the individual's ability and experience.

If the bus stop serves multiple routes, the passenger must take measures to ensure that they enter the correct vehicle. In turn, the bus driver has the ability to stop in front of the passenger, thereby reducing the burden on the passenger to stand in the correct position.

At a rail station or terminal the passenger must locate the ticket agent or ticket machine, purchase the appropriate ticket, and then locate the platform area. Accessing the correct platform may require passengers to negotiate their way through complicated and crowded building layouts, which could include tunnels, escalators, and stairs. On the platform passengers must be able to identify the train doors, because trains stop at approximate rather than precise locations. Therefore, passengers, particularly those with visual impairments, must find the train doors, which should not be confused with the gap between train cars. In addition, this must be done in a timely manner to avoid being trapped by the closing doors. Other concerns are the noise level, platforms with more than average noise can reduce the hearing level for persons with hearing impairments, and the size of the crowd on the platform, crowded areas can also be a barrier for persons with visual impairments and individuals with cognitive disabilities. Table 4 outlines several techniques and devices designed to assist passengers with disabilities to access the correct transit vehicle.

ENTERING A VEHICLE

The challenges an individual with disabilities must overcome to enter a transit vehicle are very similar to those discussed in the previous section. On entering the vehicle, the individual must pay the designated fare and find a seat or identify an appropriate standing area. Standard signage, training (driver and passenger), and Smart Cards are some of the methods that can be used to assist persons with disabilities. Smart Cards can make the fare payment process easier by allowing for automatic collection of the appropriate fare.

Persons with physical disabilities, particularly those using wheelchairs, typically must communicate with the transit operator to deploy lifts or ramps or use securement devices. Training allows the passenger to become familiar with the transit vehicle. Sensitivity training teaches the driver to take the necessary and appropriate steps with passengers with disabilities, such as making sure the passenger is securely in the vehicle before driving off. Table 5 indicates some of the methods and devices that can assist passengers with disabilities upon entering a transit vehicle.

TRAVELING IN A VEHICLE

When traveling in transit vehicles, passengers should be able to comprehend announcements being made by the operators, respond to special announcements, and be prepared to respond to emergencies. Extra effort is required to keep individuals with sensory or cognitive disabilities adequately informed. Table 6 illustrates the available technologies or techniques that can keep a person with sensory and cognitive disabilities, traveling on a transit vehicle, better informed.

TABLE 5

TECHNIQUES TO IMPROVE COMMUNICATION: ENTERING A VEHICLE

	Methods of Communication by Disability		
Information Required	Hearing	Visual	Cognitive
	Smart cards	Smart cards	Smart cards
Pay fare	Signage and symbols	Talking fare box	Passenger training
Locate and access the fare system	Staff training	Talking buses/trains	Standard visual/audio signal
Locate and move to proper boarding area	Orientation and mobility training	Staff training	Staff training
	Orientation cues	Orientation and mobility training	
		Orientation cues	

Note: Modified from *Guidelines for Improvements to Transit Accessibility for the Disabled* (Battelle 1992).

TABLE 6

TECHNIQUES TO IMPROVE COMMUNICATION: TRAVELING IN A VEHICLE

	Methods of Communication by Disability		
Information Required	Hearing	Visual	Cognitive
	Directional signage	Large print	Passenger training
Comprehend announcements	Assistive listening device	Public address announcements	Public address announcements
Respond to selected special announcements	Sign language	Auditory/visual display	Destination card
Respond to emergency announcements	Visual connumication network	Visual communication network	Route card
	Orientation mobility training	Orientation mobility training	Orientation mobility training
	Visual display		

Note: Modified from *Guidelines for Improvements to Transit Accessibility for the Disabled* (Battelle 1992).

TABLE 7

TECHNIQUES TO IMPROVE COMMUNICATION: EXITING A VEHICLE

	Methods of Communication by Disability		
Information Required	Hearing	Visual	Cognitive
	Public address announcement	Public address announcement	Public address announcement
Identify the desired stop/ station/terminal	Visual display of announcement	Auditory signal	Automated announcements
Notify driver of desired stop	Next stop display	Automated announcements	Destination card
Move to doorway	Destination card	Destination card	Orientation and mobility training
Exit vehicle and reach platform	Orientation and mobility training	Orientation and mobility training	
	Assistive listening system	Talking signs	
	Captioning	Tactile pathways/maps	
	Detectable warning	Detectable warning	
	Electronic signage		

Note: Modified from *Guidelines for Improvements to Transit Accessibility for the Disabled* (Battelle 1992).

TABLE 8

TECHNIQUES TO IMPROVE COMMUNICATION: EXITING THE STOP/STATION/TERMINAL

	Methods of Communication by Disability		
Information Required	Hearing	Visual	Cognitive
	Visual sign	Large print	Standard symbol
Determine desired exit direction	Electronic signage	Orientation and mobility training	Standard signage
	Orientation and mobility training	Tactile signs/maps	Orientation and mobility training
	Assistive listening systems	Auditory pathways	
		Talking signs	

Note: Modified from *Guidelines for Improvements to Transit Accessibility for the Disabled* (Battelle 1992).

TABLE 9

TECHNIQUES TO IMPROVE COMMUNICATION: CONNECTING TO OTHER TRANSPORTATION MODES

	Methods of Communication by Disability		
Information Required	Hearing	Visual	Cognitive
	Orientation and mobility training	Auditory pathway/acoustical finder	Orientation and mobility training
Identify correct connection vehicle	Orientation cues	Auditory maps	Staff training
Locate and move to proper boarding area	Captioning	Public address system	Public address system
Identify and move to vehicle doorway	Route card	Route card	Route card
Pass through fare control gate	Smart cards	Smart cards	Smart cards
	Staff training	Staff training	
	Smart kiosk	Tactile signs	
	Electronic signage		
	Visual signage		

Note: Modified from *Guidelines for Improvements to Transit Accessibility for the Disabled* (Battelle 1992).

TABLE 10

TECHNIQUES TO IMPROVE COMMUNICATION: EMERGENCY CONDITIONS

	Methods of Communication by Disability		
Information Required	Hearing	Visual	Cognitive
	Electronic signage	Electronic signage	Public address system
Route deviations	Cell phones	AVL	Staff training
Canceled routes	AVL	Staff training	
Weather conditions	Staff training	Auditory alert	
	Visual alerting device	Public address system	
	Assistive listening systems		
	Captioning		
	Sign language		

Note: Modified from *Guidelines for Improvements to Transit Accessibility for the Disabled* (Battelle 1992).

EXITING A VEHICLE

To successfully exit a transit vehicle it is necessary to identify the desired destination (stop, station, or facility), notify the driver of the desired stop, move to the doorway, and exit the vehicle to the platform or stop area. The ability to identify or recognize one's stop is perhaps the most important factor. The ADA requires that major transit stops be announced. However, as documented in the literature review and results from the surveys, a significant number of transit operators are not doing this consistently. Therefore, other measures of communicating this information to passengers might be required, particularly to persons with disabilities, or better enforcement of the ADA regulations must be considered. The communication methods and techniques identified in Table 7 can assist passengers with disabilities in obtaining the information they require to successfully exit a transit vehicle.

EXITING THE STOP/STATION/TERMINAL

Exiting at a station or terminal, particularly one with multiple operators and multitransit modes, can be challenging. In these complex environments it is critical to select the correct pathway or exit to successfully reach the desired destination. Selecting the incorrect pathway may prolong the travel time, as well as present serious safety issues. Therefore, it is important for transit agencies to provide proper signage or access to information, so that persons with disabilities can safely exit a transit station or terminal. Table 8 presents some of the available techniques and methods designed to improve such signage and information access.

CONNECTING TO OTHER TRANSPORTATION MODES

Making connections from one vehicle to another at a station or terminal can be a complex exercise for persons with disabilities. It is imperative that proper signage and access to information be provided for passengers departing the station or terminal, as discussed in the previous section, as well as for passengers making connections at a terminal or station. Table 9 identifies some of the methods used to improve signage and information to assist persons with disabilities in making proper connections or transfers at stations and terminals.

EMERGENCY CONDITIONS

Persons with disabilities must be able to comprehend and respond appropriately to an emergency situation while traveling on any type of transit system. Emergencies may include everything from unforeseen or unusual weather conditions, route deviations, and canceled routes, to more serious conditions such as accidents, evacuations, and fire. The AVL and visual signage are two good ways of providing passengers with real-time information in emergency situations. Table 10 lists some of the mechanisms that are available to improve the timely delivery information to passengers with disabilities.

CHAPTER SIX

CONCLUSIONS

The results of the transit surveys and literature review provide useful information about the communication techniques and technologies serving the need of all transit passengers, not only those individuals with sensory and cognitive disabilities. Generally, the most successful approaches were those to implement communication techniques and technologies with universal benefits to all passengers, and as part of the process, ensure that the specific needs of those individuals with disabilities are also met. This concluding chapter reviews the common issues related to communication needs, technologies, and training, and to operations and implementation.

COMMUNICATION NEEDS

Issues that were found to be common to transit passengers with disabilities included:

- Obtaining pretravel information on such essentials as routes, schedules, and fares;
- Obtaining information from transit operators at bus stops, stations and terminals, or on route;
- Understanding information from announcements made in stations and on vehicles;
- Receiving information that is typically presented visually;
- The level of assistance provided to passengers with disabilities by transit staff; and
- Making passengers more familiar with their travel environment.

These issues are of concern to all passengers and relate to information access, signage, and training.

- Information Access

All active and potential transit passengers require access to information concerning their trip. This information should be made available in a variety of media that will meet the needs of all passengers and in particular those with disabilities.

Route maps, schedules, and fare information need to be made available in a format(s) other than print for those passengers with visual impairments. Likewise, messages announced over the public address system should be provided as an alternative for passengers with hearing impairments. Whenever possible, audio messages should supplement visual information and visual information should supplement audio messages. Other information should be provided with the consideration of the complex characteristics of riders related to levels of understanding, language, and familiarity with the system, in addition to levels of disability.

- Signage

The signage provided at stops, stations, terminals, and in vehicles needs to be accessible to all passengers, regardless of the type of disability. Signs should be standardized in font, text, color, size, and location. In general, they should be of light color on a contrasting dark/black background, with large print in a simple font, and be situated along the pathway. Other instructional assistance should be provided for passengers with perceptual or cognitive disabilities.

- Training

Training is an issue for transit operators both from the perspective of staff sensitivity and passenger familiarity with the system. Passenger orientation and training programs assist riders and potential riders in becoming better-informed and independent travelers. Orientation and mobility training helps riders become familiar with their travel environments, including obtaining transit information; identifying bus stops, stations, and landmarks; and operating equipment such as fare and transfer machines.

Sensitivity training for transit staff assists operators and other front line staff on how to better identify persons with different disabilities and provide them with the required assistance.

COMMUNICATION TECHNOLOGIES

Numerous technologies are currently available to specifically address the communication needs of persons with disabilities.

- Advanced Technologies

Advanced technologies such as smart cards have the potential to be of significant assistance in improving passenger independence. Such technologies have a universal appeal and, in addition to the general population, they can provide significant assistance to passengers with disabilities, seniors,

and persons whose first language is not English. With little additional cost these technologies can help make transit systems more user friendly, simplify the fare system for passengers, and at the same time provide transit agencies with information regarding passenger travel patterns.

More research is needed in the application of smart technologies in ways that can further assist persons with disabilities, including their use in fare payments, opening doors, and activating announcements.

- Visual Technologies

Systems that use LED/LCD technology or computer screens provide a significant benefit to all passengers and are particularly useful to the hearing impaired. These technologies can provide way-finding as well as critical real-time information. These technologies have also assisted transit agencies in complying with ADA requirements of announcing stops at major intersections. Such systems can be more reliable than manual systems, which require the operator to remember to call out stop-related information.

- Auditory Technologies

Auditory technologies provide a variety of options in which important information can be easily provided to passengers. This is particularly useful to passengers who are visually impaired, where such technologies as Talking Signs, talking directories, auditory maps, and audible alarms can significantly improve their traveling experience. Auditory technologies can also assist transit operators in complying with ADA-related requirements such as stop announcements at major intersections. Some transit agencies have begun to hear complaints from passengers about these features. In some instances, frequent riders without disabilities have indicated that they find the practice of calling out stops both annoying and disruptive.

- Tactile Technologies

Tactile technologies such as tactile maps, tactile pathways, and detectable warnings provide significant benefits to passengers with visual disabilities. Such technologies must be considered in conjunction with their impact on persons with other types of disabilities to significantly improve the safety of the traveling environment for all passengers.

- Cellular (Wireless) Technologies

Given the technological advancements in wireless technologies, such as personal cellular phones and pagers, measures need to be taken to determine the feasibility of using this technology to provide real-time information to transit passengers. In addition, the cell phone could more effectively replace or complement existing technology by using a Global Positioning System (GPS) signal. Personal cell phones are potentially more cost-effective and they offer many features, such as two-way communication and answering services. Most importantly, a significant percentage of the population now owns a cellular phone.

OPERATIONS AND IMPLEMENTATION

- Universality

In an environment that encourages the use of private transportation, public transit agencies are cognizant of the need to promote the use of transit to all of the traveling public at every opportunity. Transit administrators must continually assess the impact that various technologies, primarily those designed to meet the needs of persons with disabilities, will have on the general riding public. Several of the features noted here are beneficial to the overall rider population because they present no obstacles to able-bodied riders but, by embracing technologies that appeal to the senses of sight, sound, and touch, promote a user-friendly atmosphere that complements and enhances overall public transit use. In most cases, a successful approach when implementing communication techniques and technologies to aid the disabled, is to address the universal benefits to all passengers first and then ensure that the specific needs of those with disabilities are specifically incorporated. For example, enhanced audio and visual communications (such as electronic LED/LCD signage and synthesized voice annunciation) are of specific benefit to persons with auditory and visual impairments. However, these devices also serve persons with cognitive impairments and seniors, who may also be experiencing a reduction in hearing or perception as a result of the aging process.

Special features, such as the induction line or tactile pathways, which are incorporated into the design of bus and rail station platforms at several transit authority facilities, provide specific guides for individuals with visual impairments. These guides enable those riders to travel unassisted. To a lesser extent, persons using wheelchairs can use the induction line system to access bus stops on station platforms.

Tactile pathways also benefit persons using wheelchairs, providing alignment relative to train door openings on station platforms. In addition, pathways play an important role as a delineation tool to teach the very young, such as school children, and seniors to identify areas on platforms at both rail and bus facilities where caution should be exercised.

The above-noted technologies present a clear benefit to able-bodied riders who can make use of the several "assist features" offered by the transit agencies to navigate the system.

- Proactive Versus Reactive Response to Improving Methods of Communication

Information obtained from the survey respondents suggests that a large number of transit agencies are actively responding to communication issues involving persons with disabilities. Their reaction is typically driven by complaints from transit users or groups representing the interests of persons with disabilities or by federal regulations. However, those agencies that are proactive in responding to the needs of persons with disabilities also demonstrated the most advancement in the implementation of communication technologies.

All transit agencies were aware of and are taking the necessary steps to comply with the legislation that requires them to improve access for persons with disabilities. However, few transit agencies had recorded plans to improve or expand their methods of communication, primarily because passengers have not requested any change nor have they complained about the current system.

- Cost of Technologies

There is very little information provided in the literature on the cost of communication technologies or techniques, because such costs are a function of development. It is therefore essential that transit agencies give particular consideration to total cost factors when considering the introduction of new technologies. For example, although some of the "in-ground" technologies associated with transit facilities such as tactile pathways have identifiable costs from being part of bid items, other technologies have costs that vary with their degree of sophistication. Thus, it is imperative that implementation of new technology include consideration of capital costs as well as recognizing ongoing expenditures associated with long-term maintenance, staff training, and upgrading.

- Obtaining Customer Input

Several of the survey respondents indicated that it would be more productive if persons with disabilities were asked to comment on the communication methods available to them for their transit trip. In the literature, there is very little information that would suggest passenger experience and input were sought. This is not to say that transit agencies do not seek input from the disability community when making provisions in stations for persons with disabilities. AC Transit, for example, recently sought input from the AC Transit Accessibility Advisory Committee, the BART Accessibility Task Force, the Living Skills Centre and nondisabled observers when assessing tactile pathway options for inclusion in AC Transit's Cerrito Plaza BART Station.

Although several agencies have sought advice from other interest groups for inclusion in their transit service design and operation, more research is required on how to obtain the input of persons with disabilities and on how to use that input in the application of new technology in a transit system.

- Budgetary Considerations

The research has shown that those transit agencies with the most progressive and comprehensive communication technologies that benefit persons with disabilities did not specifically identify communication technologies as a line item in their budgets. Conversely, agencies that identified specific budgets for communication technologies did not demonstrate a significant degree of success in implementing accessible communication features, because they were not provided sufficient funds.

- Cost Effectiveness

All technologies available to transit agencies that are designed to improve communication with persons with disabilities have cost implications, be it capital, operating, or both. Therefore, it is imperative that transit management, when considering the introduction of new technologies, evaluate the full impact of the equipment throughout their operation, including the entire customer base, to ensure that the maximum cost-effectiveness is achieved systemwide.

Transit agencies, in delivering transit services, must fulfill the ADA requirements of making public transit accessible to all. The cost-effectiveness of the communication technology or techniques must be measured relative to the benefits of all riders, not just those with identified disabilities.

The research into communications equipment suggests that the marketplace abounds with devices and strategies, which entail varying levels of sophistication, designed to accommodate or address some segment of the needs of the riding public. Thus, the dilemma facing transit agencies is one of selecting the most appropriate technology to satisfy the primary travel requirements of persons with disabilities and, at the same time, also benefit the general riding public.

For these reasons, transit agencies must examine the full range of assistive devices that are available, knowing the characteristics/demographics of their riders and, from that information base, select equipment that provides the most effective financial investment for the transit system as a whole.

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APPENDIX A

Survey Questionnaire

TRANSIT COOPERATIVE RESEARCH PROGRAM

Synthesis Topic SB-05

"Communicating with Persons with Disabilities in a Multimodal Transit Environment

Survey Questionnaire

Purpose

Travelers with sensory impairments, as well as seniors, require alternatives for accessing and processing transit information that may be available to the general public. Transit agencies have implemented a wide range of policies and procedures to address the information needs of persons with disabilities. The goal of this project is to identify the current practices of transit agencies in this regard, and to provide ideas for future improvements in this area. Respondents should answer all questions relevant to their operations, while providing information on what is working and what is not working in the area of Communicating with Persons with Disabilities in a Multimodal Transit Environment. All survey responses will be confidential and will be presented only in an aggregate format. Please call the number at the end of this survey if you have any questions concerning either survey questions or the confidentiality of your response. The final results will be synthesized into a report available from the Transportation Research Board (TRB).

Instructions

Please complete this survey BY **FRIDAY NOVEMBER 19, 1999** and return it by **FAX** or **MAIL** to:
Ms. Angela S. Iannuzziello, P.Eng.
ENTRA Consultants (Int'l) Inc.
2020 Pennsylvania Avenue NW
Suite 909
Washington, D.C. 20006

Toll Free Fax: 1-888-959-3400
Toll Free Phone: 1-800-959-6788

EMAIL:
If you would like to respond to the survey by email, please email your request to info@entra-markham.com and the survey questionnaire will be email to you.

Please call Ms. Angela S. Iannuzziello, should you have any questions regarding the survey or the synthesis paper.

THANK YOU VERY MUCH FOR YOUR PARTICIPATION!

General Information

Transit Agency Name _____ Name/Title of Respondent _____

Contact Phone Number (_____) _____ Contact Fax Number (_____)_____

Agency Characteristics

A. What is the approximate geographic area (square miles) of your agency's service area? _____

B. What is the total population in your agency's service area? _____

C. What was the total budget (operating and capital) for your agency in Fiscal Year 1998?

Operating Budget $ _____

Capital Budget $ _____

D. What was the total number of passengers carried by your transit agency in 1998? _____

E. What percentage of passengers in your service area are persons with disabilities? _____ %

F. What percentage of passengers in your service area are seniors? _____ %

G. What modes of transportation are provided by your agency? (Check all that apply.)

Commuter Rail		Heavy Rail		Subway		Light Rail	
Streetcar		Rapid Transit (Bus)		Trolley Bus		Ferry	
Urban Transit Bus		Van Pool		Others (Specify):			

H. Please check all of the transportation operators that your agency connects with:

Rail		Air		Bus		Ferry	
Others (specify):							

The following questions pertain to how your agency communicates with persons with disabilities.

1. Please indicate from the list below the method(s) of communication that your agency currently uses and check the effectiveness of each method.

COMMUNICATION METHODS	*In Use*	*Very Ineffective*	*Not Effective*	*Somewhat Effective*	*Effective*	*Very Effective*
Communicating with the Public						
Telephone information service						
TDD phone information service						
Automated telephone information service						
Web-based information service						
Automated information kiosks/touch screens						
Fax information service						
Travel Planning						
Trip planning						
Customer training						
Mentoring						
Travel ambassadors						
Communicating with Passengers at Transit Terminals and Stops						
Male/female voices for vehicle direction						
PIBS (Passenger Information at Bus Stops)						
Audio pathways						
Audio induction loop system						
On-Vehicle Communication						
Call-out stops (voice)						
Call-out stops (electronic)						
Captioning						
Electronic Vehicle Identification						
Global Positioning Systems (GPS)						
Advanced Public Transportation Systems (APTS)						
Infrared Transmission Systems						
Tactile Features						
Detectable warnings (e.g., surface treatments)						
Tactile maps						
Braille cards						
Other Forms of Communication						
Specialized signage for the visually impaired (e.g., white on dark background)						
Symbols for persons with visual impairments						
Color coding						
Flashing warning lights						
Captioning						
Digitized voice messages						
Please list and rate any others not mentioned						

2. Describe any problem(s) with the communication methods you are currently using.

3. Please summarize comments or feedback received from persons with disabilities on your communication methods.

4. Will you be making any improvements to your current communication methods? If yes, specify.

_____

_____

The following questions pertain to electronic display signs.

5. Does your agency use electronic display signs to address the information needs of persons with disabilities?
   Yes ☐ No ☐

If "yes," please answer the following questions. If "no," please skip to question number 8.

5a) What type of information is transmitted? (Please check all that apply.)

Next vehicle departure		Fare information		News	
Schedule		Safety information		Weather	
Location		Special events		Advertising	
Others (please specify):					

6. Where is the electronic display located? (Please check all that apply.)

Inside train		Inside trolley		Bus waiting area	
Inside bus		Outside the bus		Transit terminal	
Inside streetcar		Outside the train		Train platform	
Others (please specify):					

7. Is there an audio system provided for those customers who are unable to read the electronic display?
   Yes ☐ No ☐

7a) If "yes," describe the system:

_____

7b) If "no," why not?

_____

The following questions pertain to announcing or calling out transit stops.

8. Does your transit system have procedures for the announcing/call-out of stops? Yes ☐ No ☐

8a) How are stops announced?

_____

9. On what vehicles are these stops announced?

_____

The following questions pertain to your agency's future plans for communicating with persons with disabilities.

10. Which of the following methods does your transit agency use to determine the communications requirements of persons with disabilities? (Please check all that apply.)

Customer surveys		Field observations	
Other customer input		Focus groups	
Consultation with organizations representing persons with disabilities			
Others (please specify):			

11. Which factors are important in determining the priorities for improving communication with persons with disabilities? Please indicate the effectiveness of the following factors:

PRIORITIES FOR IMPROVEMENTS	*Not Important*	*Somewhat Important*	*Important*	*Very Important*
Feasibility				
Cost				
How it fits in overall plan				
Number of requests for improvement				
Integration with needs of general population				
Government legislation				
Others (please specify):				

12. Does your transit agency have an overall plan for improving communications to persons with disabilities?
Yes ☐ No ☐

12a) If "yes," please summarize this plan and submit the plan if possible.

_____

_____

12b) If "no," why is there no plan?

_____

_____

13. How important is it to integrate plans for persons with disabilities with overall plans for the transit system and why?

_____

_____

The following questions pertain to your agency's budget for communicating with persons with disabilities.

14. What percentage of your agency's total budget is spent on communicating with persons with disabilities?
_____ %

15. Please indicate the sources of funding for spending on communications for persons with disabilities. *(For each source, state percentage of total spending.)*

Federal government		Local government		Private business	
State/Provincial government		Agencies representing disabled persons		Others (please specify):	

16. If your agency received a lump sum of unrestricted funding to spend on communicating with persons with disabilities, how would you use this money? (Please be as specific as possible.)

17. Is the current funding from external sources adequate to pay for communications for persons with disabilities? Please discuss.

The following questions pertain to the marketing methods of your agency.

18. What percentage of your transit agency's total advertising budget is spent on advertising to persons with disabilities? _____ %

19. What are the most effective ways of marketing to persons with disabilities? Please indicate the effectiveness of the following media by degree of effectiveness in advertising to persons with disabilities.

METHODS OF ADVERTISING	*Very Ineffective*	*Not Effective*	*Somewhat Effective*	*Effective*	*Very Effective*
Radio					
Television					
Internet					
Newspaper					
Magazine					
Transit promotional material					
Electronic signs					
Others (please specify):					

The following questions pertain to problems associated with providing adequate communication to persons with disabilities.

20. What are the operational problems associated with providing communications for persons with disabilities? (If none, please skip to Question 22.)

20a) Please suggest ways of improving these operational problems.

The following questions pertain to the multimodal aspect of your operation.

21. Does your agency investigate if the communications methods provided at connecting transportation terminals (Bus, Rail, Air, Ferry) are appropriate for your passengers with a disability? Yes ☐ No ☐

21a) If yes, what methods are they using?

21b) How does your agency distribute this information to your passengers?

21c) If no, why doesn't your agency investigate the communication methods available for your passengers?

22. Describe any special problems related to the multimodal aspect of your operation in the provision of communications to persons with disabilities.

22a) Please suggest ways to solve these problems of multimodal integration.

The following questions pertain to the training of employees.

23. Does your agency provide special training to front-line personnel to educate them about the communication needs of persons with disabilities? Yes ☐ No ☐

23a) If "yes," describe the training.

23b) If "no," why is training not provided?

The following questions pertain to your agency's objective in providing adequate communication for persons with disabilities.

24. What is the most important reason for taking steps to improve communications with persons with disabilities? (Please check one only.)

Government legislation		Attracts more customers		Others (please specify):
Public demands		Improves the situation for all customers		

25. Do you feel that improvements in communications for persons with disabilities are an advantage to all transit customers? Please choose the most appropriate response and explain.

Not an advantage at all		Minor disadvantage		No impact	
Minor advantage		Major advantage			

25a) Please explain.

Pilot projects/case studies.

26. Was your agency involved in any pilot projects or case studies that involve improving communication or accessibility for persons with disabilities? Please describe the project and the results or attach pamphlets or reports documenting the project.

Improving service for the disabled.

27. How does your agency identify ways of improving communication for passengers with disabilities?

****** Please attach any pamphlets or reports documenting your current ******
or future communication methods. Thank You.

THANK YOU VERY MUCH FOR YOUR TIME

APPENDIX B

Transit Agencies Surveyed

No.	Transit Agency	State/Province	No.	Transit Agency	State/Province
1	City of Phoenix Transit System Public Transit Department	AZ	32	New Jersey Transit Corporation (NJ Transit)	NJ
2	Sacramento Regional Transit District	CA	33	City of Albuquerque Transit & Parking Department	NM
3	AC Transit (Alameda–Contra Costa) Transit District	CA	34	Metropolitan Transportation Authority	NY
4	Los Angeles County Metropolitan Transportation Authority	CA	35	Niagara Frontier Transportation Authority	NY
5	San Francisco Municipal Railway (MUNI)	CA	36	Port Authority Trans-Hudson Corporation	NY
6	South Coast Area Transit	CA	37	Central Ohio Transit Authority (COTA)	OH
7	Orange County Transportation Authority	CA	38	Greater Cleveland Regional Transit Authority	OH
8	San Diego Metropolitan Transit Development Board	CA	39	METRO Regional Transit Authority	OH
9	Access Services Inc.	CA	40	Laketran	OH
10	Santa Clara Valley Transportation Authority	CA	41	Central Oklahoma Transportation & Parking Authority	OK
11	Sunline Transit Agency	CA	42	Tri-County Metropolitan Transportation District of Oregon	OR
12	Regional Transportation District	CA	43	Lane Transit District	OR
13	Washington Metropolitan Area Transit Authority	DC	44	Southeastern Pennsylvania Transportation Authority	PA
14	Miami–Dade Transit Agency	FL	45	Port Authority of Allegheny County	PA
15	Hillsborough Area Regional Transit Authority (HART)	FL	46	Memphis Area Transit Authority	TN
16	Jacksonville Transportation Authority	FL	47	Dallas Area Rapid Transit (DART)	TX
17	LYNX–Central Florida Regional Transportation Authority	FL	48	Capital Area Rural Transportation System	TX
18	Metropolitan Atlanta Rapid Transit Authority	GA	49	Corpus Christi Regional Transportation Authority	TX
19	City and County of Honolulu Department of Transportation Services	HI	50	VIA Metropolitan Transit	TX
20	Chicago Transit Authority	IL	51	Metro Transit Authority Harris County	TX
21	Metra	IL	52	Utah Transit Authority	UT
22	Pace Suburban Bus Division of RTA	IL	53	Tidewater Transportation District Commission	VA
23	Transit Authority of River City (TARC)	KY	54	King County Dept. of Transportation/Metro Transit	WA
24	Mass Transit Administration of Maryland	MD	55	Kitsap Transit	WA
25	Massachusetts Bay Transportation Authority	MA	56	Intercity Transit	WA
26	City of Detroit Department of Transportation	MI	57	Madison Metro Transit	WI
27	Ann Arbor Transportation Authority	MI	58	Edmonton Transit/Disabled Adult Transportation System	AB
28	Metro Transit	MN	59	Toronto Transit Commission	ON
29	Jackson Public Transportation Co. Inc. (JANTRAN)	MS	60	Vancouver Regional Transit System–Handydart	BC
30	Bi-State Development Agency	MO	61	Calgary Transit	AB
31	Regional Transportation Commission of Clark County/Citizens Area Transit	NV	62	GO Transit	ON
			63	Montreal Transport Society (Public) STCUM	PQ

APPENDIX C

Additional Information on Planning and Design and Training

PLANNING AND DESIGN

An important component of the literature on improving communication with persons with disabilities provides detailed information on planning standards, design guidelines, and best principles on how to construct, implement, and operate the various communication methods, techniques, and devices discussed in this document. The detailed design guidelines and standards are not within the scope of this synthesis paper. For reference, the report, *Design for All: Ergonomic Guidelines for Information*, by Katharine Hunter-Zaworski, and Caroline Bricheux, for the Transportation Research Board (TRB ITS-IDEA Project No. ITS-40, 1997), presents a synthesis of the research that has been done, and delineates guidelines for the improvement of information in transportation vehicles and terminals to enhance accessibility for people who are older or have disabilities. The contents of the report comprise:

- Introduction
- Chapter 1: System of Information
- Chapter 2: Visual Information
- Chapter 3: Audible Information
- Chapter 4: Tactile Information

See the bibliography for additional reports on design guidelines and standards.

TRAINING

Transit Ambassador Program

The Transit Ambassador Program provided by the Canadian Urban Transit Association (CUTA) is a customer-service training package designed to give transit employees skills and concepts to improve customer relations significantly and to assist management in developing a strong internal commitment to teamwork and customer service.

The 10 modules of the program include the following topics:

- Module #1: Fundamentals
  - Awareness and understanding the importance of customer service
  - Professionalism
  - "Value added" service.
- Module #2: Communications
  - Blocks to effective communication
  - Reading body language
  - Interpreting tone
  - Speaking effectively
  - Asking questions.
- Module #3: "Your Attention Please"
  - Public announcement skills
  - Routine, nonroutine, and emergency situations
  - Using the Landset (microphone).
- Module #4: Special Needs
  - Identifying "cues"
  - How to offer assistance
  - Use of diplomacy and intuitive skills.
- Module #5: Complaints or Opportunities
  - Turning complaints into opportunities
  - Verifying understanding
  - Providing a resolution
  - Avoiding future occurrences.
- Module #6: Difficult Situations
  - Passenger rule infractions
  - Fare and transfer disputes
  - Active listening
  - Maintaining safety.
- Module #7: Stress
  - Explanation of stress
  - How stress affects performance
  - Recognizing symptoms
  - Stress-handling techniques.
- Module #8: Management Support
  - Understanding and supporting the values of the Transit Ambassador
  - Giving recognition
  - Coaching.
- Module #9: Everybody's Business
  - Teamwork and interdepartmental relations
  - True customer orientation for all employees
  - Recognizing other employees as "internal customers."
- Module #10: Review
  - Evaluation of personal skills
  - Review of what was learned
  - Renewing commitments.

ADA Stop Announcement Program

Easter Seals Project ACTION developed a stop announcement training program that is documented in the report, *ADA Stop Announcement Program, Training Transit Operators and Supervisors on Calling Out Stops* (February 1998). The report identifies and describes the essential components for developing and carrying out an ADA stop announcement implementation, as well as a training program for operators and supervisors on calling out major stops.

The training curriculum includes the following four modules:

- Module I: The ADA and Calling Out Major Stops as a Civil Right—The objective of this module will be to get operators and supervisors to understand why calling out major stops was declared a civil right in the ADA and why calling out major stops is a mandatory requirement under the ADA Legislation.
- Module II: Roadblocks and Obstacles to Calling Out Major Stops—The objective of this module is to enhance operator and supervisor understanding of the real roadblocks and obstacles to calling out major stops. The facilitator will guide operators and supervisors in a free and open discussion on "what is going on" with regard to calling out major stops and what is preventing operators from doing this.
- Module III: Simulation Experience of Standing in the Shoes of the Consumer—The objective of this module is to give operators and supervisors an "on the street" experience of the kinds of obstacles and barriers encountered by persons who are blind or visually impaired and other persons with disabilities who are left off at the wrong stop or who are not given the route and destination information requested when boarding.
- Module IV: Practice on Calling Out Major Stops—The purpose of this module is to provide operators with experience in the calling out of major stops. In addition, each operator will get feedback on how well they call out major stops from other operators and supervisors.

Serving Passengers with Cognitive Disabilities

A training program for fixed-route bus operators on serving passengers with cognitive disabilities was developed by Easter Seals Project ACTION. The material presented will assist operators in their communication with passengers regardless of an individual passenger's type of cognitive disability. The training program includes the following five modules:

- Module 1: Attitude and Perception—The objectives of this module include:
  - Introducing the training program;
  - Introducing "cognitive disabilities" and personal functions that can be affected by such disabilities;
  - Identifying and sharing personal attitudes and perceptions regarding people with disabilities; and
  - Becoming familiar with using "people first" language.
- Module 2: Cognitive Disabilities (Part A)—The objectives of this module include:
  - Learning basic information about mental retardation and autism; and
  - Learning tips on interacting and communicating in an appropriate, helpful manner to assist passengers with cognitive disabilities.
- Module 3: Cognitive Disabilities (Part B)—The objectives of this module include:
  - Learning basic information about mental illnesses, traumatic brain injury, and epilepsy;
  - Identifying ways of interacting in an appropriate, helpful manner to assist passengers with any type of cognitive disability; and
  - Learning tips on asking questions.
- Module 4: Cognitive Disabilities (Part C)—The objectives of this module include:
  - Learning basic information about learning disabilities, cognitive disabilities associated with aging and cerebral palsy;
  - Identifying ways of interacting in an appropriate, helpful manner to assist passengers; and
  - Becoming aware of the importance of nonverbal communication (body language).
- Module 5: Review Session—The objectives of this module include:
  - Reviewing functional difficulties that may exist for individuals with cognitive disabilities; and
  - Reviewing key elements in effective interaction and communication.

APPENDIX D

Resources

Trace Center
http://trace.wisc.edu
This is the primary American web site concerning access to public terminals by people with disabilities.

Royal National Institute for the Blind (RNIB) Scientific Research Unit
http://www.rnib.org.uk/wedo/research/sru/
This unit is concerned with influencing the design of equipment and systems for the general public, so that they are accessible by visually disabled persons, and influencing the development of relevant standards.

Bobby
http://www.Cast.org/bobby/
Bobby is a graphical web-based program designed to help web site designers and graphic artists make their web pages accessible by the largest number of people. It will help find design problems, which prevent a web page from being displayed correctly on different web browsers without having to individually adjust for each web browser. Bobby performs a series of tests to determine the ways in which a web site is inaccessible to those with disabilities such as blindness, deafness, or physical disabilities.

Access to Telecommunications Equipment and Customer Premises Equipment by Individuals with Disabilities
http://www.access-board.gov/telecomm/html/telfinal.htm
This contains the final report from the Telecommunications Access Advisory Committee (TAAC).

Easter Seals Project ACTION
http://www.projectaction.org

Americans with Disabilities Act Document Center
http://janweb.icdi.wvu.edu/Kinder/
The Americans with Disabilities Act Document Center contains the ADA statute, regulations, ADAAG (Americans with Disabilities Act Accessibility Guidelines) federally reviewed technical sheets, and other assistance documents.

World Information on Disabilities
www.sd.soft.iwate-pu.ac.ip/sensui/index-e.html
A useful starting point for a web search on disabilities

National Center for Accessible Media
http://www.wgbh.org/wgbh/pages/ncam/webaccess/symbolwinner.html
A web access symbol, which may be used by webmasters to denote that their site contains accessibility features to accommodate the needs of disabled users. There is no charge to use this symbol; simply copy it from this page and paste it into your document.

WebABLE
http://www.webable.com/
The WebABLE site goal is to stimulate education, research, and development of technologies that will ensure accessibility for people with disabilities to advanced information systems and emerging technologies.

Additional Resources

American National Standards Institute
http://web.ansi.org/default_js.htm

American Speech-Language-Hearing Association
http://www.asha.org/

Center for Applied Special Technology
http://www.cast.org/

Inclusion of Disabled and Elderly People in Telematics (INCLUDE)
http://beatles.cselt.it/cfrs/include/info/

U.S. Department of Justice
http://www.usdoj.gov

U.S. Department of Transportation
http://www.dot.gov