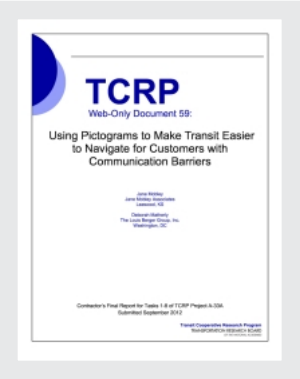

Using Pictograms to Make Transit Easier to Navigate for Customers with Communication Barriers

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Using Pictograms to Make Transit Easier to Navigate for Customers with Communication Barriers

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The researchers and authors of this report are Jane Mobley, Ph.D., Kelly Reinhardt, Julie MacLachlan, J.D., Rea Wilson, and Vivian Strand, the graphic designer who developed the pictograms. Deborah Matherly, P.E., of LBG, also contributed to the project.

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Kentucky Department for Public Health, Frankfort, Kentucky.

New York City Transit, New York, New York

New York City Department of Education, Travel Training Office, New York, New York

Pinellas Suncoast Transit Authority, St. Petersburg, Florida

TriMet, Portland, Oregon

Ride Connection, Portland, Oregon

Tuscaloosa City Transit, Tuscaloosa, Alabama

ABSTRACT

This is an evidence-based report on efforts to determine if pictograms – picture-based communication tools that use illustrations with few or no words – can be effective in communicating emergency information and behavioral modification in a transit emergency to people with communication challenges. This report distills efforts that have gone into developing and implementing pictograms in a variety of settings, including transit, transportation, health, manufacturing, and hospitality. It also analyzes a body of primary research from interviews with bus drivers and operators who identified critical messages; experts who work with or serve people with communication challenges; and end users, passengers with communication challenges. The end users included people who were native English-speakers; who spoke little or no English; people who were deaf or hard of hearing; people with cognitive, sensory, or physical disabilities; people who were over the age of 65; and people who were new to the transit system. Bus transit was selected to fit the limited scope of this study, although the conclusions reached can have applicability to other transit modes as well. Four transit agencies and their partner community service providers conducted pilot tests inside parked buses to assess a set of 10 original pictograms designed to capture the drivers' messages. The research proves that pictograms can be effective, but it also suggests that substantial study is yet to be done to identify universal images that would convey the messages transit drivers consider most important.

SUMMARY

The concept that picture-based messages could be effective tools to communicate during an emergency with transit riders, especially those with communication barriers, arose as part of the work for the Transportation Research Board study TCRP A-33: *Communication with Vulnerable Populations: A Transportation and Emergency Management Toolkit* (TCRP Report 150). That study and the resulting toolkit targeted transportation and emergency managers with guidance and tools for reaching people who would need transportation in an emergency and whose functional needs make them especially vulnerable (e.g., physical, cognitive, sensory disabilities; low- or no-English proficiency; aged or very young; or combinations of these). Working on the toolkit, the research team began to consider tools that would be effective during an emergency to help drivers and oSthers engaged with passengers to communicate with people who have communication barriers. Exploring the possibilities for pictograms led to a problem statement for follow-on work to TCRP A-33 and the pilot study described here.

The scope of this study was small, intended to be a first inquiry into the potential for using pictograms as communication tools in emergencies. The visual iconography of the digital age has encouraged the global use of pictographs (information about objects or physical circumstances) and ideographs (information about concepts or behavior) and combinations of the two (e.g., a human figure on a step expresses "Step Up" or "Step Down," or, by extension, "Watch Your Step."). Many recent explorations of pictograms are available, especially related to graphic design, but discussions of transportation-related pictograms are almost entirely focused on wayfinding and locations. This study appears to be the first to explore whether transit riders in an emergency could and would respond to picture-based directions from a driver.

The results of this study suggest the value of pictograms in emergency communications in buses and paratransit, and, indeed, the value for non-emergency circumstances, as well. Clearly, this study is just a first peek at the possibilities, with an enormous range of opportunities for further exploration. It is foreseeable that a set of universal pictograms could be developed for transit, as has been done by the Universal Health Symbols (UHS) project, which, in 2010, released 54 tested and understandable pictograms for use by healthcare institutions.

A major difference in the UHS pictograms and those that would be needed for effective communication in transit is the difference between locating places and directing behavior. The UHS pictograms help explain, describe and locate things and places users of healthcare services would need to recognize (e.g., the emblem of a pair of eyeglasses could identify the vision clinic in a hospital). Pictograms could do some of that for transit, of course, but the focus of this study is the effectiveness of directing behavior, especially in an emergency, to guide people who have communication barriers and who might, therefore, be dependent on the image for information critical to their safety and well-being. Images were tested among both English-speakers and non-English-speakers, with one or two explanatory words below the image at three sites. At the last test site, the research team tested pictures without words among a group of all native English-speakers. Regardless of the use of words with the pictogram, the images most readily understandable to participants had a material element (e.g., "Turn Off Electronics," "Stay In Your Seat"). The images participants found more difficult to decipher contained ideas or abstractions (e.g. "Help Is Coming") or an emotional state (e.g., "Stay Calm").

The study had three fundamental components – a literature review; primary research with bus drivers and representatives of transit agencies and agencies serving vulnerable populations; development and testing of pictograms. Using the messages that bus drivers said would be most critical from their perspective, the research team developed and tested variations on each of a series of pictograms intended for use in a scenario where a bus was stopped. Although the team projected a scenario focused on a flood event, drivers responded with directions that could cover a range of circumstances that would cause a bus to be stopped, with various further circumstances possible, including delay, a change in route, or help arriving for passengers on a bus that would not be continuing to travel. This study was not directed at immediately life-threatening emergencies, such as fire or bomb threats, that would require immediate evacuation. However, one of the drivers at a test site reflected that even in dire emergencies, pictograms for "Danger," "Look At the Driver," "Turn Off Headphones" would be necessary to communicate with passengers.

The study gained even more relevance than the team had anticipated when the work had been proposed because interviews with drivers revealed that MOST passengers have communication barriers when they are on a bus, due to the fact that they are tuned into digital devices, usually with headphones or ear buds. One driver estimated that 95 percent of the people who ride her routes have ear devices in use. The fact that passengers are tuned into personal electronics means that they cannot hear announcements any more than deaf or hard-of-hearing passengers could. Visual directions would help drivers get all passengers' attention, as well as those with communication barriers such as limited English proficiency or deafness, and communicate to them simple directions and basic information.

The pilot of the pictograms involved a bus driver's holding up and showing the images to respondents who were on a parked bus. These tests occurred in four cities, selected to represent communities of different sizes and diverse populations of transit riders in different locales in the United States. Participants included passengers with low- and no-English proficiency, native English-speakers, deaf and hard of hearing, young adults who had developmental and/or cognitive disabilities, teens in headphones, regular transit riders, and even some people who had never ridden a public bus. Holding the tests in a bus provided useful information about not only the images themselves, but also their production values (size, line weight, etc.) and their effectiveness in that environment.

Ten important results from the study are these:

1. Picture-based communication with bus transit riders is necessary, especially in emergencies, but also in ordinary travel, because many bus passengers are "incommunicado." They are isolated from the driver and to a large degree from each other voluntarily by digital devices or cultural behaviors, or involuntarily, because of language, disability, or distraction (care-giving, pestering by other passengers, etc.).
2. Pictograms that are connected to material facts or objects are the easiest for most people to grasp.

3. Pictograms that give directions that involve an object or person (e.g., headphones, the driver, "Stay In Your Seat") were mostly well understood.
4. Pictograms that give directions about simple behaviors without a material object were more difficult to understand (e.g. "Listen"), but more people grasped them than not.
5. Pictograms about an idea ("Help Is Coming") or an emotional state ("Stay Calm") were the least understood.
6. Pictograms are useful for conveying authority. People responded to the images and reported that in an emergency, seeing pictograms held up by a driver would focus their attention. All participants in the study indicated they would do as the directions in a pictogram told them (if they could understand it).
7. Bus drivers want effective tools for communicating with passengers and would welcome pictograms as a useful addition.
8. Passengers want direction, especially in emergencies. Participants said they would be glad to have simple pictures available to explain some aspects of public transit in general, especially when they can't understand the language spoken. Literature review research and previous experience of the team in pictogram testing suggest the value of adding one or two words describing the picture, e.g., "Look," to aid in comprehension.
9. Pictograms that are immediately understandable are a valuable tool. Any that are difficult for most people to decipher add to confusion and could make an emergency situation more stressful for all involved. No pictograms should be put into use without careful testing. Substantial research is needed to take the idea of using pictograms for transportation into effective reality.
10. Previous familiarity with the images would be helpful to passengers (this reinforced research findings from other studies). Flyers or other educational tools to familiarize passengers with images that would be used in emergencies would be important for transit agencies to provide their publics.

Overall, there is no doubt that pictograms can be effective for communication with transit passengers who have voluntary or involuntary communication barriers. The opportunities for further research and implementation of pictograms are myriad. The importance of this future inquiry to public transit in a multicultural, multi-lingual, diverse passenger environment and in a world where private digital devices are defining people's behavior in public space cannot be overstated.

CHAPTER 1 Background

1.1 Problem Statement and Research Objectives

Problem Statement

Navigating the public transit system appears simple for frequent riders during routine times, but in an emergency the transportation system can bewilder all riders. In emergencies – no-notice or short-notice events – every aspect of communication becomes more difficult, particularly for people who can't understand spoken or written English. Studies of human brain response show that no one in an emergency has full capacity to receive information, apply reasoning, and make and act on sound decisions. (Galea 2010) Critical information must be far more concise and compelling than in normal circumstances. For especially vulnerable audiences, information must be conveyed so that it leaps communication barriers, including lack of language proficiency; physical, sensory, or cognitive disabilities; age (very old or very young); and specific cultural orientations or other limiting factors. This research will explore issues raised by previous work in TCRP A-33 about providing direction to people who are unable to read or speak English as well as to usually competent English-speakers whose emergency-related responses (e.g., fear, haste, distraction) are barriers to understanding and action.

Pictograms are picture-based communication tools that use illustrations with few or no words to communicate critical information. Pictograms can be advantageous when used because they are more noticeable than written communication; provide the public with concise, instantaneous information; improve comprehension of critical messages for people with functional needs; and reduce the need for message translation.

Research Objectives

The objectives of this research project include:

1. Locate and review especially relevant exemplars of existing information and research on driver communication with passengers and passenger behaviors in emergencies, particularly focused on bus transit and paratransit and including best or promising practices.
2. Develop and test with diverse audiences a set of pictograms around a pre-selected scenario, such as a weather disaster or terrorist attack.
3. Apply findings by conducting a pilot program around pictograms in emergency situations.

Research tasks include the following:

Task 1: Scan of relevant case studies, emerging practices, and reported failures with regard to using picture-based communication for wayfinding and behavior modification.

Task 2: Interviews with transit providers to identify fundamental emergency messages to bus or paratransit passengers that would need to be conveyed in virtually every emergency transportation circumstance.

Task 3: Interviews with experts who provide services to vulnerable populations to identify groups most likely to need pictograms.

Task 4: Selection of a scenario useful for developing and testing messages (e.g., a weather evacuation).

Task 5: Interim report.

Task 6: Development of and testing a set of pictograms for selected scenario.

Task 7: Pilot program with transit organizations to sample the effectiveness of pictograms to convey transportation information in routine and emergency situations.

Task 8: Draft final report.

Task 9: Final report

1.2 Scope of Study

The scope of A-33A was limited by available funding and by time, as all parties involved believed the need for the research conclusions was pressing enough to warrant an accelerated schedule. While pictograms have potential relevance to many kinds of circumstances and audiences in the transportation environment, the scope of this study was limited to bus transit; pictograms presented by a driver (not affixed to the bus or part of a dynamic messaging system) on a stopped bus; an emergency scenario that did not involve an immediate life-safety event; and passengers with diverse barriers to communication, some involuntary (limited English proficiency, deaf or hard of hearing, cultural behaviors, etc.) and some voluntary (the use of personal digital sound devices).

The research team drew on critical previous experience accrued from several recent and relevant projects. First, the literature review, field interviews and body of research for TCRP A-33: *Communication with Vulnerable Populations: A Transportation and Emergency Management Toolkit* (TCRP Report 150) provided to the team a number of resources to draw on in the identification of case studies and sources of information for this project. Additionally, as a part of the research team for NCHRP Project 20-59(32): *A Transportation Guide for All-Hazards Emergency Evacuation* (NCHRP Report 740), members of this team have interfaced with and have established relationships with transit and paratransit organizations throughout the United States that have proven extremely valuable as conduits to interview sources for interviews with transit providers. Additionally, NCHRP 20-59(32) research provided background and information helpful to setting the parameters for scenario selection. Finally, the research team relied on the pictogram research conducted for the Centers for Disease Control and Prevention Division of Strategic National Stockpile and Kentucky Cabinet for Health and Family Services/Department for Public Health. This previous research and the work in development and testing of pictograms with populations experiencing communication barriers has proved valuable in accessing experts who provide services to vulnerable populations. In addition to the previous relevant experience of the research team, members of the project panel and project officer have

served as sources of information related to identification of case studies, emerging practices, and recently released TRB study reports that brought added layers of information to the project team.

CHAPTER 2 Research Approach

2.0 Approach – Literature Review

Preliminary research included a literature review to identify new and emerging research or recommendations regarding the use of pictograms for emergency communication in transit. Research topics that guided the literature review process included existing symbols, pictograms, and illustrations in use; processes for developing and testing effective symbols and forms of communication for populations with functional communication needs; pictograms for conveying safety and emergency information; identified communication needs of populations with communication barriers; and barriers to communicating with these populations. Literature sources included industry specific journals, online articles and resources, websites, and Transportation Research Board (TRB) staff-recommended research reports.

The literature review primarily benchmarked representative research conducted in the fields of health, transportation, hospitality, and manufacturing as it related to pictograms for the purposes of communicating specific actions or behaviors, rather than wayfinding or locators. The review identified common terminology or symbols already in use.

2.1 Summary

From cave drawings to emoticons, people have used picture symbols, such as pictograms, to convey information to one another across time and cultures. Pictograms, specifically, are "pictorial signs used to warn, guide or protect and need to be immediately decipherable. They must get right to the heart of the matter by visually conveying a vital piece of information in such a way that it cannot be misunderstood." (Abdullah and Hübner 2006) The use of picture-signage at the 2008 Olympics in Beijing gave broad international exposure to contemporary graphic pictograms as a means of communicating around language barriers. As a result, pictograms have become important as a means of communicating in the current global community and are starting to play a role in daily life for all populations, including those with functional communication needs (people who are deaf or hard of hearing, have Limited English Proficiency or no English skills, are illiterate, or have cognitive impairments.) (Ting-Ju 2006)

Few pictograms, however, are universally understood and all groups do not always correctly interpret even those that have wide acceptance. It takes years for a pictogram to reach maximum effectiveness – no pictogram is instantly recognized. (CDC/SNS 2006) Research for the development of a pictogram system in the health field confirmed that a well-designed system could assist English-speakers as well as people with communication barriers, but would not solve all the issues involved in delivering vital, actionable information that is understood by all populations. (Hablamos Juntos)

Of interesting note to the research team was the extensive practice and creation of universal health symbols.

> *A few of the lessons learned in the symbol design testing process included focusing on a limited number of distinct symbols that could be recognized instead of a large*

> *group of symbols similar in appearance. It was also learned that while some symbols, representing easy to understand destinations, could be read with few problems, others were difficult to comprehend. This is endemic of a lack of understanding of the meaning of certain hospital functions by the general population, and brought to light the need to use symbols for tough-to-comprehend destinations as educational tools.* (Hablamos Juntos)

Directional signage and picture-based instruction are used extensively in the transportation field. Picture-based identification developed by the U.S. Department of Transportation is seen in airports, rail and transit stations, and ports to convey wayfinding information, such as location of stairs, elevators, restrooms, and gift shops. However, pictograms, which may be designed to shape behavior as well as show direction or location, for the specific purpose of directing transit passengers in an emergency, are few. They are most familiar to users of subways, or light rail and commuter trains. For example, the Bay Area Rapid Transit (BART) system and the Metropolitan Transportation Authority (MTA) New York City Transit (NYCT) system have installed picture-based messages to guide passengers during emergency situations. These usually depict evacuation routes or means of exiting a conveyance and contain a series of actions. Other than signs at bus stops to indicate a hurricane evacuation site, pictograms to relay emergency information and actions to passengers on a bus were not found in the research. Nor did the research uncover transportation-related picture-based instructions for behaviors other than entering or exiting vehicles or spaces (e.g., no expressions for "Stay in your seat").

At the same time, an increasing number of people can now access public transportation systems as a result of as the Americans with Disabilities Act (ADA) and the Individuals with Disabilities Education Act (IDEA). "The ADA recognizes the critical role that public transportation plays in the lives of many people and mandates that public transit systems become accessible to people who have disabilities and that paratransit services are available and accessible to individuals who are unable to use public transportation." (Groce 1996) Many travel training programs have become available across the nation to help people with disabilities navigate the public transportation system or paratransit services.

Because population groups who would be vulnerable as bus passengers during an emergency event comprise a variety of communication characteristics and needs related to physical and mental vulnerabilities, pictograms need to address the following:

- Different cultures
- Different cognitive abilities to understand the meaning
- Different languages
- Mental state at time of incident (high stress, etc.) (Galea 2011)

In the event of an emergency while riding a bus, all populations need to be able to see pictograms and quickly recognize messages. "Visual perception occupies by far the largest area of the human brain, at 80 percent (followed by hearing at 10 percent), and sight is therefore the most influential of the senses." (Abudullah and Hubner 2006) This makes the clear, visual representation of important messages vital in disseminating information in emergency situations.

According to many graphic design experts, the best examples of pictograms for emergencies included the following traits:

- Black on white; color tends to distract from the message.
- Simple. Not a lot of shading or lines. Simple shapes and movement.
- Size dependent on the usage. Be sure it is big enough for the surroundings.
- File size and type important for distribution to a large audience.
- Maximum message in the minimum space.
- Look the same/seem related in a series. The viewer will not have to "start over" with each pictogram. For instance, if each pictogram is in a square, with the same width of line used in its creation, the viewer will focus on the message, not on the fact that one may be in a circle, another using thinner lines.
- Messages:
    - Simple. This allows for greater ease in creating a visual (e.g., "Sit Down" vs. "Sit down slowly on the leather couch by the window").
    - Concise.
    - Direct, with a call to action. Clear direction for the viewer to see and act on. Viewers should not have to make their own decision.
    - Understood without words.
    - Make sense within its surroundings
    - Understood immediately or within one-to-two seconds. If the viewer has to think about it, he/she has wasted time that may be in short supply in an emergency.
- Public education is most important. If the viewers have never encountered pictograms before, they may be confused or want more information. It is best to explain pictograms several times before an emergency, so viewers have a basic level of familiarity.
- Responses are different when pictograms are read independently versus used as a support for a verbal direction.

In addition to the graphic elements required, federal regulations and other code and regulating agencies govern regulatory and information signs used in transportation, including the use, placement, and size. (Harding 2011) Many of these regulations may also apply to pictograms, such as ADA-specific requirements. ISO 7001 ("Public Information Symbols") is a standard published by the International Organization for Standardization that defines a set of pictograms and symbols for public information. The latest version, ISO 7001:2007, was published in November 2007. The set is the result of extensive testing in several countries and different cultures and have met the criteria for comprehensibility set up by the ISO. Common examples of public information symbols include those representing toilets, car parking and information, and the International Symbol for access.

Research also examined emergency preparedness within the public transportation service sector. In 2003, the U.S. Department of Transportation Federal Transit Administration published "The Public Transportation System Security and Emergency Preparedness Planning Guide," which focuses primarily on a response to terrorism. "Since the early 1990s, the nation's 100 largest rail and bus properties, which combine to move approximately 85 percent of all passengers who use public transportation, have been working to address the credible threat from terrorism." The National Transit Institute offers courses to help improve overall security, such as *System Security*

Awareness for Transit Employees, which covers skills for observing, determining, and reporting people or things that are suspicious. (Balog, Boyd and Caton 2003)

Although the FTA Guide recognizes that major incidents, such as train accidents, fires, floods, violent crime, and terrorist attacks, have been an issue for public transportation for decades, it does not specifically address the communication needs of bus passengers and the responsibilities of drivers and operators to meet those needs during an emergency. (Balog, Boyd and Caton 2003)

2.2 Interviews with Transit Providers

Approach

The team developed and internally reviewed an interview discussion guide (see Appendix A). The project team worked with panel members and transit providers to assemble a list of potential candidates representing six to seven different geographic regions of the United States. Where possible, the team requested "cluster" interviews with groups of drivers/operators to gain the widest possible perspective.

The research team interviewed 21 drivers, operators, and safety professionals in New York City; Houston, Texas; Portland, Oregon; Des Moines, Iowa; and Tuscaloosa, Alabama.

Summary

Bus transit drivers, operators, and agency representatives take their responsibility for the safety of the traveling public extremely seriously. Interviewers participating in this research effort share complete admiration for the professionalism and capability of the drivers and operators who were willing to give their time to participate in this study. In addition, drivers and operators indicated support for the study and the potential of pictograms as a communication aid in emergency situations.

- Current methods for communicating messages to passengers include drivers making announcements via the bus Public Address (PA) system or dispatch announcements via the PA system. Pictograms would be somewhat limited in their use, in that it would require the bus to be stopped. Drivers may use a microphone to make announcements (sometimes using a pedal that operates the microphone while they are driving). When able, drivers will stand and face passengers when making announcements. Eye contact and clear engagement with passengers was emphasized.

- Driver behavior and rapport with passengers was identified as very important. Drivers and operators were clear that they are key to keeping control of circumstances and situations on the bus. Drivers emphasized the importance of confidence and control and building relationships with riders. All of this aids in riders' willingness to accept directions and improves the likelihood riders would come to the driver's aid in difficult situations.

- Passengers with cognitive or other communication challenges represent a different level of responsibility. Drivers report that when they observe that a passenger is confused, they may augment their announcements with hand gestures. It was widely reported that IF ASKED, other passengers are often willing to help in translating information or messages to passengers with communication challenges. People who are deaf or hard-of-hearing will often carry paper with them so that critical information can be written down. For passengers with cognitive challenges, messages must be communicated in a very simplified form (e.g., "the bus won't move" versus "the bus is out of service").

- If picture-based tools and communication aids were to be made available to the industry, the following suggestions were made by drivers, operators, and safety professionals:

  - Public awareness and training on the tools would be very important.
  - Periodic reminders/refresher training about the picture-based messages, their purpose and meaning would be required.
  - The best means for informing passengers about pictograms and their meaning would include posting the pictograms on buses (in driver's area, laminated), at bus shelters, in transfer centers, on screens at bus stops, and on E-cards. Some drivers saw a need to alert people through a universal signal with light and sound that everyone would recognize (similar to Emergency Broadcast signals) prior to other important messaging.
  - Drivers would prefer a single consistent area in the bus where emergency information would always be posted. *
  - Driver safety training would be required, as described by drivers, with combined emphasis on how and what to communicate in an emergency and safe bus operation and driving.

- Tips/Suggestions for Pictogram Development:
  - Simple words/pictures
  - Not too large
  - Ease of use by the bus drivers
  - Not too many
  - Public awareness essential
  - Permanent diagram of all exits posted on bus*

- Potential Pictograms/Messages/Message themes
  - *Look*
  - *Listen*
  - *Turn off Electronics*
  - *Stay Calm or Remain Calm*
  - *Follow Me*
  - *Stay Seated/Remain Still/Don't Stand Up*
  - *Delay*
  - *Change in Route*
  - *Danger*
  - *Help is Coming*
  - *Will Get You to Safe Place*
  - *Move/Transfer to Another Bus/Vehicle*
  - *Stay together* (message for paratransit passengers who disembark the vehicle.)

*Exit Strategies/Bus Evacuation Instructions.

2.3 Interviews with Experts Serving Vulnerable Populations

Approach

The research team relied on long and trusted relationships with a range of advocates and service providers for vulnerable population groups in carrying out this information-gathering task. In addition to specific information sources referred by panel members (and two project panel members), a critical resource for this task was the Kentucky Outreach and Information Network (KOIN), a network of more than 300 different organizations and individuals who work in direct service to a range of vulnerable population groups across the Commonwealth of Kentucky. Members of the project team have long and trusted relationships with various members of this network and were able to gather critical information relevant to this research effort. (See Appendix B.)

Summary

Advocates and professionals who work as service providers to vulnerable population groups are passionate about their work and dedicated to the needs of the people they serve. Interviewees were enthusiastic about the concept of pictograms for use in emergencies where transit providers were critical to public safety and believed the idea has merit. Interviewees had experience in working with a wide range of vulnerable populations including people who are:

1. Deaf and hard-of-hearing and/or mute
2. Disabled by intellectual and other cognitive limitations
3. Limited English Proficient (LEP) or non-English speaking
4. Illiterate
5. In need of medical care or supervision
6. Socially and geographically isolated
7. Low income
8. Elderly or very young
9. Homeless

Interviewees had experience in preparedness and response to a number of different emergency incidents including the World Trade Center bombing in 1993; the 9/11 terror attacks; multiple weather incidents (including hurricane evacuation and sheltering scenarios); rural public transportation; and public health challenges, including the development and implementation of pictograms to overcome communication barriers. The interviewees suggested that all vulnerable population groups need and would respond to pictograms with education and training. Similar to findings from interviews with transit providers, the professionals who work with vulnerable populations believed the use of pictograms as a communication tool will only be successful if ongoing training and education are provided to all users. Additional recommendations from this group of interviewees include:

1. Focus on characteristics of picture-based signage as well as the picture itself. Characteristics to be considered would include the placement height of signage on the bus or in transit stations, vertical versus horizontal design and placement, and signage that is relevant to passenger travel decision points.

2. Test pictograms with very little or no wording combined with the pictures. Some settings where pictograms are in use and showing promise have no words attached, such as traffic signs for "No Parking," a simple circle with a negation sign through the letter "P."

3. Use messages of high importance, such as:

    a. *Stay on Bus*
    b. *Train/Bus not Working*
    c. *Go to…(arrow pointing the direction)*
    d. *Stay Calm*
    e. *Don't Worry*
    f. *Don't Move*
    g. *Stay Where You Are*
    h. *Help is Coming/Help is Not Coming*
    i. *Time to Leave/Need to Leave Now*
    j. *Move*
    k. *Stay in Safe Spot (*off transport*)*

4. Establish ongoing training in the meaning and use of pictograms for multiple target groups. Police, fire, and other public safety officials; transit providers (drivers and operators); and end users will all need awareness and education in order for pictograms to work at an optimum level. Awareness building and educational initiatives could include Public Service Announcements (PSAs); posters on buses, in immigrant or English as Second Language (ESL) service provider facilities; transit, emergency management, and public safety websites, etc.

5. Consider the following:

    a. Make the final pictogram products available and accessible to transit providers via simple technology and widely available software (e.g., Microsoft Word, PowerPoint, jpeg, or pdf files).
    b. Include color, white space, lines, borders, logos, and other information that may ultimately be included on a pictogram sign in the project research and testing.
    c. Incorporate individuals with cognitive impairment in target audiences for pictograms, as there is little research on this vulnerable population group.
    d. Use multiple methods of communication, including gestures, verbal, and static and dynamic messaging. Make sure people aren't receiving contradictory information between what's being said, shown or gestured.

2.4 Select a Scenario for Developing and Testing Messages

Approach

A scenario useful for studying the potential of pictograms in an emergency affecting bus transit needs several characteristics, if the study is to be broadly applicable in the transportation industry. These characteristics include an emergency circumstance that could occur:

- In a wide variety of locations throughout the U.S.;
- As an event that could be sudden in some instances, anticipated or forecast in others;
- With sufficient time for a bus driver to address the emergency with passengers as it is unfolding, not just in aftermath (e.g., not a collision or explosion);
- With fundamental elements that are similar no matter the geographic location; and
- With sufficient predictability in some locations that results of this study would potentially be valuable immediately for application to real-time emergencies.

Summary

The scenario that most meets these criteria is flooding.

- Scenario exists in a wide variety of locations throughout the U.S.

  According to the Federal Emergency Management Agency (FEMA), floods are the most common natural disaster in the United States. Capable of striking almost any river, creek, lake, or coast nationwide, they kill about 200 Americans each year and are often more destructive than the storms that caused them – water flowing at 10 mph exerts the same pressure on a structure as 270 mph wind gusts. Across the country, floods destroy approximately $6 billion worth of property every year. Floods constitute potential emergencies for bus transit in communities of every size. (FEMA 2012)

- Scenario is an event that could be sudden in some instances, anticipated or forecast in others.

  To study the applicability of various pictograms to circumstances that would cause abrupt need for emergency directions to bus passengers and guidance of their behaviors, it is important to have emergencies that could be sudden. Flash flooding is a good example. Overflowing rivers create most flooding situations, both flash and slower-rising floods, but quite a number of circumstances can cause flash flooding. Broken dams, broken pipes, urban run-off, as well as bigger events, such as hurricanes or even tsunamis, can create flash floods.

  Most deaths and damage from floods in the U.S. are due to flash flooding, which is defined by the National Weather Service as "a rapid and extreme flow of high water into a normally dry area, or a rapid rise in a stream or creek above a predetermined flood level." Flash floods develop suddenly, often in a surprisingly few minutes. Heavy rains are the top cause of flash floods, but urban runoff, "ice jams," dam failures, and other factors may contribute sufficient water for flash floods, which occur in all 50 states. They

are most common in hilly areas with steep valleys, or along small waterways in urban environments. Their speed, depth, and the element of surprise make flash floods very dangerous, giving vehicles in their paths little time to prepare, make a course correction, or evacuate. (NOAA 2012)

Other sudden bus transit emergencies can be caused by more infrequent, but not unknown, ground failures. Ground failures occur when the water table rises to the surface and washes away chunks of topsoil. This can cause a variety of ground failures, including "subsidence," or sinking soil, and "liquefaction," a process in which water-soaked sediment loses strength and acts like a liquid. Ground failures can create a range of dangerous transportation circumstances from roadway upheaval to "mudfloods," a liquid flood that carries up to 50 percent solid sediment loads, and "mudflows," which are solid landslides where the downward flow is viscous enough to support large boulders within a wave of smaller particles. Mudfloods and mudflows are most common in California and other Western states, because they tend to occur on hillsides burned bare by wildfire, but ground failures can occur almost anywhere. Even apparently dry land can be subject to a ground failure when other flooding has occurred. (Pierre and Collins)

Pictogram-use scenarios need to include foreseen potential emergencies, too. In such cases, bus transit could be interrupted by flooding, but with enough warning to be able to give passengers a set of instructions that might be different than those used for sudden emergencies. For example, King County Washington Emergency Service Network (ESN) regularly designates 52 core bus routes to address anticipated flooding of the Green River as well as snow or ice. (ESN 2011) Pictograms could be useful in such cases to let regular bus riders know what to do (e.g., exit) on unfamiliar routes, in perhaps unfamiliar areas. Some flooding is anticipated well in advance, giving communities and transportation organizations some opportunities for preparation. By early spring 2011, for instance, the National Weather Service forecast that more than half the U.S. was at risk of spring flooding, with many metropolitan areas of 1 million or more residents facing a 95 percent chance of flooding in the spring rains. (NOAA 2012) Getting bus transit ready to cope with flooding in those metro areas would be a good use of pictogram tools, and such areas provide opportunities to pilot this program.

- Scenario anticipates an onset with sufficient time for a bus driver to address the emergency with passengers, as it is unfolding, not just in the aftermath (e.g., not a collision or explosion).

  Pictograms are well suited for emergencies that are unfolding with time to give instructions and flooding most often affects buses in that way. Many bus and flood incidents are available for view on the web, and even in water that would be overwhelming for smaller vehicles, buses experience the event more stably. Presumably, except for anomaly flash flooding, bus drivers would have time to communicate with passengers as the event was under way.

- Scenario needs fundamental elements that are similar no matter the geographic location.

The effect of flooding on buses in most areas is similar, so this scenario has widespread use. Obvious exceptions include mudslides or flash floods on mountain roads, but otherwise flooding on roadways has important elements in common, including most people's lack of understanding about the dangers of running water that does not appear to them to be deep. Nearly half of all flooding deaths each year occur when people drive through or walk through moving water. (NOAA 2008) It's possible that a pictogram should depict "Stay on the bus," as many people might disregard the danger and attempt to disembark. Flooding is also often part of a larger weather event, with ramifications for handling the emergency. Rerouting for floods could cause confusion for some passengers, especially in large urban areas. No matter where it occurs, flooding raises people's anxiety levels (fears for safety, safety of family and others, property damage, etc.) so that the capability of individuals to remain calm and follow instructions may be affected by their stress that is unrelated to their own immediate circumstances. These kinds of elements affect the usefulness of the pictogram no matter where the event is occurring. (NOAA 2012)

- Scenario depicts event with sufficient predictability in some locations that results of this study would potentially be valuable immediately for application to real-time emergencies.

  Because flooding is predicted to increase, transportation agencies are increasingly making flood readiness a part of business and operational planning. *Flooded Bus Barns and Buckled Rails: Transportation and Climate Change Adaptation* is a Federal Transit Administration study undertaken to provide "transit professionals with information and analysis relevant to adapting U.S. public transportation assets and services to climate change impacts. (FTA 2011) Climate impacts such as heat waves and flooding will hinder agencies' ability to achieve goals such as attaining a state of good repair and providing reliability and safety." Many reports from transportation agencies at state and local levels discuss flooding and its impact.

  Bus drivers interviewed for this pictogram study cited flooding when asked about emergencies they anticipate. As a result, it is likely that the study will find ready participants to further test the pictograms and pilot initiatives. In coastal and river communities, where flooding events are regular, the pilot pictograms could well be put to use in real emergencies in the first rainy season after a study's completion.

2.5 Develop and Test Pictograms

Approach

Develop and test a set of pictograms for the selected scenario and test for effectiveness in communicating critical messages. Conduct field tests with people representing populations that have functional communication needs to discover whether the proposed pictograms communicate the message and elicit the desired behavior.

Summary

Much of the research for this study explored wayfinding pictograms and environmental graphics in hospitals, airports, transportation systems (including transit), public health settings and other public venues, because these are the pictograms currently in widespread use. In transit systems, the purpose of wayfinding signage is to move people from one place to another, using word messages, symbols, and images. Pictograms that attempt to explain or guide exigencies or occurrences (e.g., changes in schedule, location, or state of being), behavior (e.g. wait, follow, sit, etc.) or response (e.g., stay calm, hurry, listen, etc.) are almost non-existent in public settings, and even in other research efforts.

In this pilot project, the purpose of the pictograms is primarily not wayfinding, but rather providing information to riders that would aid their decision-making about actions or behaviors that should or must be taken for safety in an emergency situation on a transit vehicle. The challenge for the design team was to create a series of pictograms that captured messages that had been identified earlier in this study as essential by bus drivers and operators, as well as representatives of agencies that serve populations with communication challenges.

The messages aligned in two types: directive ("Look at me") and circumstantial ("Route Change"). The directive messages were in two categories: messages to influence action ("Turn off") and messages to influence feelings or understanding ("Stay calm" "Help is coming").

The design team also faced the difficulty of creating universal messages for a variety of people and places. Geographic location, cultures, languages, and prior experiences of the user audience affect the ways people decipher and process information.

The Design Process

The design team consisted of a graphic designer with experience in symbol design, wayfinding signage system designs, and pictograms and research team members with prior experience in evaluating and developing implementation guidance for transportation and healthcare system signage and wayfinding signage and pictograms. The designer participated in several of the interviews with bus driver/operators to understand firsthand the situations drivers and passengers face in an emergency situation. The design approach was based on best or model practices for symbols or pictograms identified in the literature review and subject matter expert interviews.

To design original pictograms, the design team considered the following:

- Audience – people who have communication challenges (specifically, people who are deaf or hard of hearing; people with developmental cognitive impairments, including

people who are elderly; people with mobility limitations; people with limited or no English proficiency; people who are distracted, such as adult caregivers of children, elders or disabled companions; people who are tuned in to electronic devices (estimated by drivers as more than 90 percent of bus riders).
- Scenario – roadway flooding.
- Messages – identified by the bus drivers/operators as critical during an emergency (flood)
- Messages – identified by representative organizations that serve populations with communication challenges.
- Existing pictogram designs and criteria in transit, transportation, health care facilities, and schools.
- Pictogram design requirements – size, content, legibility, readability, use of words, and color, etc.
- Location – held by driver on a parked bus. The basic test was to be of images shown by a bus driver, not affixed to the bus interior or shown on dynamic messaging technology. The reasoning for this approach was to use a communication tool (pictograms) selected/controlled by the driver and not dependent on the electrical system of the bus (which could be non-functional if the bus were disabled).

The messages that the designer selected for the pilot were ones that bus drivers interviewed for the study agreed were messages they would consider essential if the bus were facing an emergency that stopped the bus, but did not require immediate evacuation. This pilot did not study evacuation for fire, bomb threat or similar no-notice, immediate life-threatening danger events, as transit providers have protocols in place for those. The pilot study messages were:

- Look at me
- Listen
- Turn off (electronics)
- Stay calm
- Follow me
- Stay seated
- Delay
- Change in route
- Danger
- Help is coming
- Will get you to a safe place

The design team worked through many versions of the pictograms to identify ways to better express the message graphically. After the preliminary testing, the team concluded that the last message (Will get you to a safe place) was too abstract to convey in a single pictogram (viewers' ideas about what constitutes "safe place" are almost entirely personal) and removed it from the set of pictograms to be tested with pilot groups of end users.

Preliminary evaluation

For a preliminary field evaluation of 11 pictograms, the research team reached out to respected experts with a strong interest and experience in working with populations with communication

barriers. The feedback indicated that the pictograms generally "looked very good,' but needed refinement.

In this preliminary review, the pictograms that needed no changes were:

1. "Turn off"
2. "Delay" (not entirely clear but basically communicated message)
3. "Change in route"
4. "Danger"

Those that needed to be revised for clarity – and representative comments –were:

- "Look at Me"
  - *Change dotted line to continuous line.*
  - *Align the line from the passenger's eye to the driver's eye, rather than to the driver's nose.*

- "Listen"
  - *Too much black.*
  - *Side-by-side with just an ear (minus the head).*

- "Follow Me"
  - *Draw lines to delineate the walkway movement that coincides with following.*
  - *Look at pictograms in other settings for Form Line. Those are the lines that this is missing.*

- "Help is Coming"
  - *I like this one, but could the cross on the help coming vehicle maybe be widened to look more like the first aid cross?*
  - *When the cross is italicized to make it look like it is in motion, it takes away from the cross so it needs to be made wider visually.*

Those that were least intelligible to viewers were:

1. "Stay Calm"
   - *This one is hard.*
   - *Looks like the bus driver is lifting the passenger.*
   - *Put bus driver hands on shoulders of passenger.*

2. "Stay Seated"
   a. *Something looks weird here.*
   b. *The arrows are too small?*

3. "Will Go to Safe Place"
   a. *Hardest one yet.*
   b. *I'm not sure about this one.*
   c. *You could go ahead and test it to see what kinds of responses you get.*

The final set of pictograms was printed on 8.5" x 11" card stock in black and white; the actual images comprised slightly more than half the sheet (see Appendix C). Literature review research and previous experience of the team in pictogram testing suggested the value of adding one or two words describing the picture, e.g., "Look," to aid in comprehension. Some Limited English Proficiency (LEP) viewers may have enough English familiarity to decipher simple words when attached to the picture. The pictograms were numbered in sequence, corresponding to the numbers on the participants' and observers' comment cards.

The development and testing of this first set of pictograms is early-stage research to determine how graphic messages can be effective for transit systems' communicating with riders, especially those with communication challenges, especially in an emergency. Ideally, pictograms can also be found to be effective in ordinary communication requirements of transit systems, as well. The objective of this study is to be an early step in long-term research around the possible design and implementation of universal, standardized symbols for transit systems. This study models a process for what could become ongoing pictogram design and testing.

2.6 Conduct Pilot Tests

Approach

Create a pilot program. Apply the findings from all tasks to develop a pilot program that transit managers can use to sample the effectiveness of pictograms to convey transportation information in routine and emergency situations. Recruit three selected transit entities or agencies representing urban, rural or multi-jurisdiction transportation agencies to use the pilot and report outcomes. Pilot program can be made available to other transit agencies interested in trying it, but project scope limited the research report to reflect only outcomes from three selected organizations. Without addition to project cost, the research team decided to include a fourth provider to expand the diversity of participating transit systems.

Summary

The accepted protocol for assessing whether a pictogram conveys the intended message is a controlled and impartial evaluation by individuals representing the target audience. To accomplish this, the research team started by recruiting four pilot test sites representing the eastern, middle and Western United States. The research team contacted organizations that had indicated an interest in participating as a pilot site during interviews: New York City Department of Education/New York City Transit (part of the Metropolitan Transportation Authority); Portland, Oregon's TriMet transportation system; St. Petersburg, Florida's Pinellas Suncoast Transit Authority (PSTA); and the Kansas City Area Transportation Authority (KCATA), which serves customers in the greater Kansas City metropolitan area, comprising seven counties and several smaller cities.

Due to budget limitations, the research team was not able to travel to the pilot sites to set up, help recruit community partners and individual group participants, conduct the discussion group, observe the participants' reaction to the pictograms, or provide direct reporting. This required the pilot site agencies to bear a majority of the effort without any remuneration. The four transit agencies, however, were eager to participate, saying the research was valuable to them and important in finding ways to better serve all their customers. Partnership with these transit agencies made this research possible inside the scope and schedule of the project, and the input from the agencies themselves added immeasurably to the information gathered in the study.

Testing location: The research team recommended the use of a parked bus that was not in service. By conducting the test in a bus rather than a conference room, the team believed that both the driver and riders involved in the testing would be able to give more accurate feedback about how the pictograms would work in the environment where they were intended to be used. A parked bus not in service would prevent the risk of testing on a moving vehicle and allow the necessary time for testing and discussion without the pressure of a route schedule. All four of the participating transit agencies were delighted with that approach and provided necessary buses and drivers, as well as representatives of the agencies to serve as observers and note-takers. This represented a substantial commitment of resources by each of these agencies.

Discussion Group Guidance: The research team created a "focus group in a box," a set of step-by-step directions for the transit agency to follow in preparing for the pilot test; locating and working with a community service partner; conducting the focus group; and reporting the

outcomes. Another set of guidelines was created for the community service provider to use in recruiting participants; working with the transit agency; observing during the test; and reporting outcomes. See Appendix D and Appendix E.

In addition, the research team provided materials for the discussion group process, including a set of 10 pictograms; nametags, markers, and pencils; comment cards for the participants, drivers, and observers; and pre-paid return envelopes. The packets of instructions and materials were sent simultaneously to all the transit agencies and service providers participating in the pilot tests.

What was required: The following is a synopsis of what the transit agency was asked to do:

1. Review materials to become familiar with the overall project.
2. Provide a parked bus for the testing location.
3. Identify a two-hour block of time when it can provide the bus and spare the driver for the testing.
4. Identify a driver who is interested in the project and is willing to assist in the testing by:
    a. Committing approximately three hours of time (30 minutes of preparation, one hour for the actual testing and 30 minutes to one hour for notes and wrap-up). The research team recognized that transit agencies would be required to pay their drivers for this time commitment.
    b. Leading the discussion group by following a script provided by the research team.
    c. Showing the pictures on a parked bus to discussion group participants.
    d. Collecting the rider/customer response forms.
    e. Making observations during the testing about
        i. How the customers/riders respond to the pictograms and
        ii. How the driver him- or herself evaluates the ease of use from the driver's standpoint as well as the usefulness of the picture-based messages.
    f. Preparing written notes about his/her observations.
5. Coordinate with the identified community service provider about the time, date, and location of the testing.
6. Return the testing paperwork in a pre-paid envelope.

The following is a synopsis of what the community service provider was asked to do:

1. Review materials to become familiar with the overall project.
2. Coordinate with transit agency to confirm the date, time, and location of the pictogram testing.
3. Commit necessary resources to:
    a. Identify six to eight individuals who have some sort of communication challenge (e.g., people who are deaf or hard-of-hearing; people with English as a second language or limited English proficiency; people who don't read well or don't read at all; people with cognitive and mobility disabilities).
    b. Provide candidates with an explanation of the research project and how testing works, including how their personal information will be protected.
    c. Provide transportation for volunteers to and from the test location at the time established by the transit agency (there is no requirement that testing location be on a bus route or that it occur coincidental to regularly scheduled bus routes).

d. Provide staff to support the transit agency by being present during the testing to assist the bus driver with making observations and taking notes.

Pilot Process at Four Sites and Results

Portland, Oregon: The first pilot test was conducted in Portland by TriMet, which provides bus, light rail, and commuter rail service in the Portland metro area. According to TriMet's website, more people ride transit in the Portland area than in larger cities, such as Dallas, Denver, and San Diego. The community is a cultural and ethnic melting pot with scores of languages other than English – the Portland School district, for example, reports 94 non-English languages spoken among their student population.

TriMet bus operators participated in the interviews for Task 2 and the agency's representative indicated an interest in participating in the pilot tests. TriMet enlisted Ride Connection as its community service partner. Ride Connection is a nonprofit agency that provides responsive, accessible transportation service to populations with a range of transportation needs, including people who are elderly and people with physical disabilities.

Ride Connection recruited and provided transportation for seven people to participate in the discussion group pilot test. Two were non-English-speakers and writers; the TriMet manager of multicultural programs translated their written comments after the test was over. Four persons were unable to write and an assistant recorded their comments. The seventh person wrote down her own comments in English.

New York City, New York: The second pilot test was conducted by New York City Transit, a division of the Metropolitan Transportation Authority, North America's largest transportation network, serving a population of 14.9 million people in the 5,000-square-mile area. Drivers and operators from NYC Transit participated in the Task 2 interviews. The point of contact with NYC Transit indicated at that time a willingness to participate in the pilot tests.

Peggy Groce, a Project Panel member and director of the New York City Department of Education Travel Training Office, previously in the study had been interviewed as a representative of populations with communication challenges and had volunteered her office as a community service partner for NYC Transit. Travel Training is comprehensive, specially designed, one-to-one instruction to teach high school age students how to travel safely and independently on public transportation, where appropriate. Independent travel and use of public transit is closely connected to successful post-school results for students in terms of employment, education, community inclusion, and independent living.

The Travel Training Office recruited eight people between the ages of 24 to 34, all graduates of the travel training program. All of the participants were daily commuters on the fixed-route bus system in NYC. The group included individuals with autism, Down syndrome, language and communication difficulties, English as a Second Language and significant intellectual disabilities with associated communication problems. "At first impression, it may seem that these individuals might not be representative of transit riders who are considered communication vulnerable. But they are because they may travel more than many other communication

vulnerable individuals. They have learned to cope with the number of changes that do occur when one is a regular commuter," Ms. Groce wrote in her comments, adding, "They were really pleased to be part of your project."

St. Petersburg, Florida. A prior relationship for studies with a transit agency in Des Moines, Iowa, whose former director relocated to Florida, led the research team to Pinellas Suncoast Transit Authority (PSTA) in St. Petersburg. Situated on the Gulf of Mexico, Pinellas County has recurring weather events that can cause disruption; traffic incidents that can aggravate congestion and travel times; a large population of Spanish speaking individuals; and a presence of transit dependent adults (including seniors). The contact at PSTA immediately recognized the value of the research and expressed willingness to be a research partner.

PSTA operates the bus, trolley, and paratransit services that run between Clearwater and St. Petersburg with two express routes that connect with Tampa's Hartline transit. The PSTA representative volunteered to recruit focus group participants from several organizations with which the transit agency had established relationships. Participants included six people who were Spanish-speakers and had interpreters; a person from Africa who had limited English proficiency and no interpreter; and one other person, a native English-speaker.

Kansas City, Missouri. The KCATA has worked in the past with members of the research team on other projects related to transit and transportation within the Greater Kansas City Metropolitan Area, serving seven counties and 10 municipalities. It is the only form of public transit in Kansas City, Missouri, and provides fixed-route, express, paratransit, and demand-responsive service. It also coordinates with other bus services on the Kansas side of the state line.

The KCATA representative had initially planned to work with the agency's new travel training program, but scheduling made that impossible and KCATA asked the research team to help assemble a group of people for the pilot test. KCATA arranged for the driver, parked bus, and observer. The research team reached out to community-based and faith-based direct service providers, as well as individuals known to members of the team. Participants included two people who were hard of hearing; one person who had never been on a public transit bus; two teenagers (with headphones); and one other person with experience in using bus service in other nations. See Table 1 for a summary of respondent characteristics by test cities.

Respondent Characteristics	Portland, Ore.	New York, N.Y.	St. Petersburg, Fla.	Kansas City, Mo.	Totals
Native English-Speaker	1		1	4	6
Limited English Proficiency (LEP)	2		7		9
Disability	4	8	0	2	14
Totals:	7	8	8	6	29

Table 1. ***Summary of respondent characteristics by test cities.***

Pilot Tests

On a parked bus, drivers stood facing the "passengers" for pictogram pilot tests. After brief introductions and an explanation of how the discussion process would flow, the drivers faced the back of the bus, held up the pictograms one at a time, and followed scripts provided by the research team. For the first three pilot sites, Portland, New York, and St. Petersburg, participants were asked to look at each picture underscored with one or two words of text printed in English and write (or ask an interpreter or assistant to write) what they understood the message in the pictogram to be; whether or not they would do what the pictogram told them to do; and what they liked or did not like about the pictogram. At these first sites, drivers and observers noted that individuals who could read English would read the words beneath the pictogram and say or indicate they understood the picture. Or, participants would hear what others said about the pictogram and repeat the same comment. However, because the point of the study was to discover whether picture-based communication could be effective – not to test whether pictures could be identified – results included any combination of information that caused people to understand the message correctly.

Based on the findings at these three sites, the research team decided to cover up the explanatory words beneath the pictures at the fourth pilot site in Kansas City where all participants were English speakers (including two people who were deaf/hard of hearing). This made a difference in respondents' understanding of several of the pictograms, although this group identified as most understandable the same images other groups did.

CHAPTER 3 Findings and Applications

Table 2 captures the numbers of participants who said they understood the message; the number whose response indicated a limited understanding; and those who said they did not understand or whose comments missed the message entirely.

Table 2. Responses from Pictogram Discussion Groups

	Understand message	Somewhat understand	Do not understand	No answer
#1: Look At Me	17	3	8	1
#2: Listen	17	5	6	1
#3: Turn Off	26	1	1	1
#4: Stay Calm	6	5	18	0
#5: Follow Me	14	5	10	0
#6: Stay Seated	17	4	8	0
#7: Delay	4	7	18	0
#8: Change in Route	11	6	11	1
#9: Danger	16	2	10	1
#10: Help Is Coming	3	8	17	1

n= 29

1. As Table 2 shows, the pictograms that received the highest scores in understanding were:

- "Turn Off" – This pictogram was the most well received pictogram by participants – 26 participants said they understood the pictogram message.
    - Several participants noted, however, that they believed that passengers would not turn off their cell/mobile phones in an emergency situation.
    - Several suggested showing only the ear buds or headphones with a negation line through them, to indicate that phones or other electronics could stay activated but ears needed to be free for listening to directions.

- "Look At Me," "Listen," and "Stay Seated" – 17 participants said they understood each of these pictogram messages.
    - Two participants said the design of the ear should be changed to look less like a hearing aid symbol. One man with a hearing aid thought it meant turn off his hearing aid.
    - The arrows surrounding the ear confused some participants. They indicated they were not sure what to listen to – the driver or all sounds coming from different directions. Several suggested using sound waves instead of arrows, but others said that might indicate a message from a sound system instead of the driver.

- "Help Is Coming" was the least understood pictogram.

  - Only three people said they understood the message.
  - Eight understood that "help" was part of the message, but may have been reading the words rather than comprehending the image.
  - Several people thought the image meant, "A collision will occur."
  - Three people thought the image meant, "The bus will wait for an ambulance to pass."

- "Danger," "Change in Route," and "Follow Me" received the most inconsistent responses.

  - Participants either said they understood the message clearly or they responded in a way that indicated they did not understand.
  - In the Kansas City pilot test in which the words underneath the image were removed, participants offered more widely varying interpretations of these pictograms, although the meanings of "Danger" and "Follow Me [the driver]" were understood. This suggests that in other pilot tests, participants may have been reading the words rather than understanding the image, as noted by observers.

2. The responses from the 29 participants to pictogram content varied from apparent broad understanding of the message to attempts to describe (usually wrongly) what the individual thought was going on in the picture. Sometimes, respondents wrote nothing on their comment cards.

   - The messages that relayed concrete actions with objective messages ("Turn Off") scored the highest in participant understanding among all participants, regardless of the presence of explanatory text.
   - Pictograms with abstract messages about how people should feel ("Stay Calm") generally were not well understood or completely misunderstood, even among those who could read the words.
   - Pictograms that conveyed information about what was happening inside the bus were better understood than those related to things occurring outside the bus.

   Application: Identify pictograms that convey concrete, objective messages about activities inside the bus (those with the greatest levels of understanding by the discussion group participants) for future pictogram research study.

3. Participants universally wanted the pictures to be larger, regardless of their level of understanding. Some commented they could not see the picture well, especially when seated at the back of the bus. Several observed that pictures that convey urgency or negative actions, such as "Turn Off," should be in a circle rather than a rectangle to conform to more widely used or familiar pictograms, such as "No Smoking." One driver said, "A rectangle means this direction has to do with your well-being and we are requesting you to do this, but a circle is authoritative and means 'Do this now.'"

Application: Revise and refine the most accepted designs based on end-user comments. Retest this smaller set of pictograms with a larger group of transit agencies. Testing to further refine the effectiveness and acceptability of these pictograms must be comprehensive and vigorous.

In addition, testing needs to be conducted on the how the pictograms will be used – held by drivers standing at the front of a bus; on a visual display at the front of the bus; in a brochure similar to the ones used on airlines to inform passengers about safety procedures; or in another form or fashion.

4. Partnering with the transit agencies and their community service provider partners to set up, recruit and conduct the focus groups was very productive. Questions about procedures were answered early through calls and email with the transit agencies' points of contact. The transit agencies quickly "owned" the pilot effort, once it was approved by senior management. Points of contact recruited bus drivers and coordinated with community service partners to establish the time, date and place of the test.

The research team applauds and is grateful for the transit agencies' cooperation and hard work – and the expense – that was essential to conduct these tests. The team also expresses gratitude to the community service partners who collaborated with the transit systems, transported people to and from the pilot sites, and helped with translation or interpretation.

Application: Use the "focus group in a box" model created in this research study to conduct pilot tests of pictograms in the future. While professionally trained facilitators certainly would be preferred to provide control and impartiality in the testing, this project demonstrated that a research team could depend on transit agency staff to manage the logistics and facilitation of pilot tests.

CHAPTER 4 Conclusions and Recommendations for Further Study

Conclusions

The results of this study suggest the value of pictograms in emergency communications in buses and paratransit, and, indeed, the value for non-emergency circumstances, as well. Clearly, this study is just a first examination at the possibilities, with an enormous range of opportunities for further exploration. It is foreseeable that a set of universal pictograms could be developed for transit.

Ten important conclusions from the study are these:

1. Picture-based communication with bus transit riders is necessary, especially in emergencies, but also in ordinary travel, because based on driver comments most bus passengers are "incommunicado." They are isolated from the driver and to a large degree from each other voluntarily by digital devices or cultural behaviors, or involuntarily, because of language, disability, or distraction (care-giving, pestering by other passengers, etc.).
2. Pictograms that are connected to material facts or objects are the easiest for most people to grasp with or without explanatory text.
3. Pictograms that give directions that involve an object or person (e.g., headphones, the driver, "Stay In Your Seat") also were mostly well understood whether presented with or without descriptive words.
4. Pictograms that give directions about simple behaviors without a material object were more difficult to understand (e.g. "Listen"), but more people grasped them than not, regardless of having or not having descriptive text. Some participants said they were confused about what they were supposed to listen to.
5. Pictograms about an idea ("Help Is Coming") or an emotional state ("Stay Calm") were the least understood with or without explanatory words.
6. Pictograms are useful for conveying authority. People responded to the images and reported that in an emergency, seeing pictograms held up by a driver would focus their attention. Participants indicated they would do as the directions in a pictogram told them (if they could understand it).
7. Bus drivers said they wanted effective tools for communicating with passengers and would welcome pictograms as a useful addition.
8. Passengers want direction, especially in emergencies. Participants said they would be glad to have simple pictures available to explain some aspects of public transit in general, especially when they can't understand the language spoken.
9. Pictograms that are immediately understandable are a valuable tool. Any that are difficult for most people to decipher add to confusion and could make an emergency situation more stressful for all involved. No pictograms should be put into use without careful testing. Substantial research is needed to take the idea of using pictograms for transportation into effective reality.
10. Previous familiarity with the images would be helpful to passengers (this reinforced research findings from other studies). Flyers or other educational tools to familiarize passengers with images that would be used in emergencies would be important for transit agencies to provide their publics.

Overall, there is no doubt that pictograms can be effective for communication with transit passengers who have voluntary or involuntary communication barriers. The opportunities for further research and implementation of pictograms are myriad. The importance of this future inquiry to public transit in a multicultural, multi-lingual, diverse passenger environment and in a world where private digital devices are defining people's behavior in public space cannot be overstated.

Standardization

Standardization is the procedure whereby a new graphical symbol is validated against the relevant design criteria and then accepted as a standard and published. Standardization is not mandatory, but it encourages greater use of graphical symbols leading to better public adoption. (Perry) Certification or accreditation through documented attainment of agreed upon and recognized standards can be a mechanism for assuring consumers about reliability and/or utility of a product or service. Standardization is seen as a "seal of approval" that gives users confidence to choose and then rely on a product or service.

Panelists expressed interest in obtaining information about standardization or some type of formal accreditation attesting to the universality as well as utility of tested pictograms. The most likely body through which pictograms might be accredited is the American National Standards Institute (ANSI 2012). ANSI facilitates voluntary, consensus-based standards that protect consumers and the environment and makes U.S. businesses more competitive internationally by promoting safety and reliability. Approval by ANSI lays the groundwork for consideration for adoption or approval by the International Organization for Standardization (ISO).

ISO 7001 addresses international standards for public information and ISO 22727:2007 provide standards for the creation and design of public information symbols. (ISO 2007) They define procedures for defining and testing of public information symbols, with the goal being the development and adoption of symbols that can be understood by large numbers of people regardless of their culture or language. ISO also depends of a highly collaborative and voluntary process utilizing technical committees and circulation among member nations.

Especially useful for considering standards applied to pictograms that would be used by transit agencies could the American Public Transportation Association (APTA) Standards Development Program. APTA's program, certified by ANSI, includes standards, recommended practices, guidelines and whitepapers, and one of its 10 program areas is bus transit. With more than 20 active standards development committees, APTA's program might well include pictograms developed in this project for inclusion in its standards recommendations process.

The standardization processes are demanding and lengthy, but confer a high degree of legitimacy for those symbols that are adopted. The research team recommends that embarking on this process should follow additional rounds of pictogram testing and evaluation. Another step in this effort would be to form a technical advisory committee of design experts in transportation, symbol, regulatory, and testing fields to provide guidance and advice on best practices. In addition, representatives of professional associations in graphic arts, transportation design, transit, and other related fields can be engaged to comment on the design and testing process and

help develop an educational/public awareness effort for the use of pictograms to assist people with communication challenges to navigate the transit system.

Recommendations for Further Study

Available funding and time necessarily limited the scope of this research, but the work yielded results that are very promising. With more refinement, some of the pictograms tested could be ready for use by transit agencies. Plus, the value of picture-based communication in reaching transit passengers is clear and invites further study: more messages and images, more discovery of situations where pictograms can be effective tools, more consideration of transit agencies' rapidly changing customer communication environment.

The research team offers three recommendations for further study:

1. Refine the pictograms tested in this study, using guidance provided by participants, but, in addition, consulting more passengers, drivers, transit personnel and representatives of agencies that serve people with functional needs, to assure that images are understandable quickly by as many people as possible. Test revised images with a broader audience, representing locales and community sizes different from those used in A-33A, incorporating responses into a final set of images sufficiently understandable (e.g., 60 percent of people tested recognize what the pictogram is expressing or directing) to be useful in any bus transit irregular operations and during emergencies.

   Of the images the team tested, these are the six that are closest to being ready to use: (a) Look At Me, (b) Turn Off Electronics, (c) Listen, (d) Follow Me, (e) Stay Seated, (f) Danger. Images for Delay and Change in Route need more work, but they appear to be ones that could be made functional. Stay Calm and Help is Coming were the least understood and seem the least likely to be successful as pictograms.

2. Study the impact personal listening devices make on the communication circumstances in bus transit. One of the most surprising findings in this project was the prevalence of passengers' use of digital sound devices, a trend that will likely only increase. Preparing for the challenges of this "incommunicado" communications environment will be important to transit agencies for regular messages and for emergencies. Accommodating passengers' use of devices and still maintaining order, safety and customer connection presents a service challenge for transit agencies that pictograms could help address. A possible problem statement to study this phenomenon is attached in Appendix F.

3. Research communication tools in use currently by transit agencies, with descriptions and assessments (by the agencies) of their effectiveness. Currently, transit agencies have no way to know what is in use and working or not for other agencies, except in occasional examples. Drivers told this research team they need every communication tool available to address the diverse ridership they now serve and they expect only more diversity over time. A compendium of what is currently in use or is planned (or tried and abandoned) would be very valuable to the industry.

This would be very good research for a University Transportation Center (UTC) to undertake because it would lend well to academic inquiry, analysis, and reporting and to the engagement of students as primary researchers. The pictogram project team found transit agencies very willing, even eager, to talk about their communication efforts. Research on this topic could be done electronically and at distance very readily, as agency personnel seem willing to engage on the topic. The results of such inquiry could be the ground of many interesting and strategic ideas that would further the service, security and preparedness goals of the transit industry.

The opportunities for pictograms to make meaningful contributions to transit are sufficient that further study and future implementation could be led and conducted by a variety of organizations. The scope and findings of this project show that good progress can be made with relatively few resources. Six pictograms that were most easily understood with or without accompanying text offer benefit to the transit industry, bringing a measure of compelling simplicity to communication in an increasingly complex and diverse transit passenger setting.

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ABBREVIATIONS, ACRONYMS, INITIALISMS, AND SYMBOLS

Access – Technically defined as, "*Permission, liberty, or ability to enter, approach, communicate with, or pass to and from a place, thing, or person*," access means different things to different people. Two examples of access concerns are:

1. Poverty: People living in poverty may have the physical ability to drive, but if they don't have money to buy gas, they cannot, in practice, *access* the roads out of town.
2. Sensory ability: People who don't have sensory access to early warning messages—because they can't hear or see—have limited access to emergency transportation.

Accessible – Having the legally required features and/or qualities that ensure easy entrance, participation, and usability of places, programs, services, and activities by individuals with a wide variety of disabilities. (NIMS definition)

Accident – an undesirable or unfortunate event that results in unintended harm or damage. (See also Emergency or Incident)

ADA – See Americans with Disabilities Act

ADA Definition of Persons with Disabilities – According to the ADA, persons with disabilities are a protected class. An individual is defined as someone with a disability if they: (1) have a physical or mental impairment that substantially limits a major life activity; (2) have a record of such an impairment; and/or (3) are regarded as having such an impairment.

Americans with Disabilities Act (ADA) – Passed in 1990, the ADA is civil rights legislation that protects individuals with disabilities. It guarantees equal opportunity for individuals with disabilities in public accommodations, employment, transportation, state and local government services, and telecommunications.

ASL – American Sign Language

Disability – A physical or mental impairment that substantially limits one or more of a person's major life activities. There are many definitions for "disability," some of which are narrow, others which are broad. A person with a visual impairment correctable by contact lenses could be considered disabled in some circumstances but not in others, for example.

Cognitive Disabilities – Cognitive disabilities can vary as much as sensory or mobility situations. Cognitive disabilities can be temporary such as the impact of a stroke or brain injury, as permanent as a cognitive development disability such as mental retardation, or as fluctuating as an individual going through early stages of Alzheimer's or other types of dementia.

CBO – Community-Based Organization

DMS – Dynamic Message Sign (also known as VMS or CMS)

DOT – Department of Transportation

Emergency – A sudden, urgent, usually unexpected occurrence or occasion requiring immediate action. (See also incident.)

ESL – English as a Second Language

FEMA – Federal Emergency Management Agency

FHWA – Federal Highway Administration

Fixed-Route—Refers to transit services where vehicles run on regular, pre-designated, pre-scheduled routes with little or no deviation

FTA – Federal Transit Administration

Functional Needs – Functional needs include communication, transportation, medical, independence, and supervision needs. Communication needs are experiences by those who have low literacy, speak English as a second language, people who have limited or no eyesight or people who are deaf or hard of hearing. Transportation needs include people who are elderly, disabled, or carless.
See also "vulnerable populations."

Incident – an event that has the potential to result in unintended harm or damage.

Inclusive communication – Exchanges that reach all affected people and groups in a respectful manner. Inclusive communication allows everyone the opportunity to receive communication, engage with information, and act upon it. Recognizing that people communicate in a variety of ways, inclusive communication encourages the use of a variety of techniques.

Interpreter – a person who carries out oral translation from one language to another.

Limited English Proficiency (LEP)—Individuals who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English can be limited English proficient, or "LEP." These individuals may be entitled to language assistance with respect to a particular type or service, benefit, or encounter.

Mobility Management – The law defines mobility management as, "short-range planning and management activities and projects for improving coordination among public transportation and other transportation service providers."

Mudflood – a liquid flood that carries up to 50 percent solid sediment loads

Mudflows – solid landslides where the downward flow is viscous enough to support large boulders within a wave of smaller particles.

National Transit Institute (NTI) – Established under the Intermodal Surface Transportation Efficiency Act of 1991 to develop, promote, and deliver training and education programs for the public transit industry.

PA – Public Address system.

Paratransit— This is the family of transportation services that falls between the single-occupant automobile and fixed-route transit. Examples of paratransit include taxis, carpools, vanpools, minibuses, jitneys, demand-responsive bus services, and specialized bus services for the mobility impaired or transportation disadvantaged.

People with Medical Conditions – Individuals who have one or more medical diagnoses that may or may not interfere with activities of daily living, but who may need assistance during an emergency evacuation. If a person with a medical condition becomes debilitated, limited, or otherwise impaired, that person may be protected under the ADA.

People with Mobility Disabilities – Mobility disabilities can range from those who experience difficulty moving to those who use assistive devices such as canes, walkers, wheelchairs, or scooters or who may need to remain in beds or similar conveyances.

People with No Access to a Vehicle – Individuals and families in a community that do not have a car and generally rely on public transportation on a daily basis. Individuals and families may not have a car for several reasons including economic factors, geographic location (i.e., people who live in urban environments may not own a vehicle), health conditions (e.g., those with physical disabilities, some of the very elderly), environmental conscientiousness, and lack of a license.

People with Sensory Disabilities – People with sensory disabilities may experience varying levels of vision impairment or may be deaf or hard-of-hearing. Levels of functioning may vary.

PSA – Public Service Announcement

Reasonable Accommodations – In general, an accommodation is any change to the rules, policies, procedures, or environment or in the way things are customarily done that enables an individual with a disability to enjoy greater participation. A requested accommodation is unreasonable if it poses an undue financial or administrative burden or a fundamental alteration in the program or service.

Sign Language Interpreter – A person who has been trained to use a system of conventional symbols or gestures made with the hands and body to help people communicate who are deaf or hard of hearing, or have speech impairments.

Special Needs Populations – No singular definition of the term “special needs” exists, although the term is widely used within the disaster services and emergency management field and is often primarily focused on persons with disabilities. In fact, the term “special needs” is currently

under debate in the disability, healthcare, and emergency management communities. "Special needs" can be narrowly defined or seen as a broad and overarching concept. (*See also functional needs and vulnerable populations.)*

TCRP – Transit Cooperative Research Program

Transportation Disadvantaged – Individuals who do not have access to personal transportation for reasons of health, disability, level of income, or other reasons. Florida statutes define it as, "Persons who because of physical or mental disability, income status, or age are unable to transport themselves or to purchase transportation and are, therefore, dependent upon others to obtain access to health care, employment, education, shopping, social activities, or other life-sustaining activities, or children who are handicapped or high-risk or at-risk (as defined in s. 411.202 - http://www.cfrpc.org/prtda.html).

Variable Message Signs (VMS) – VMS, also known as changeable message signs (CMS) or dynamic message signs (DMS), are electronic signs that display messages to system users.

Vulnerable Populations – Those who are made vulnerable by their financial circumstances or place of residence, health, age, personal characteristics, functional or developmental status, ability to communicate effectively, or presence of chronic illness or disability. Examples include the elderly, people with disabilities, and young children. *(See also functional needs and special needs populations.)*

APPENDIX A

Driver Interview Discussion Guide

Purpose

Although unusual, transit riders and drivers can encounter emergencies that require a sudden change in service or operating procedures. Transit drivers must then inform their riders about the change(s), the reason for the change, and what the riders can expect as they try to reach their destinations.

This interview is part of a research project funded by the Transportation Research Board to identify what types of picture-based communication tools (pictograms) would be most helpful to assist transit riders and drivers in communicating with each other in the event of an emergency. Pictograms can be especially useful for riders with limited English proficiency, who are deaf or hard of hearing or have some sort of difficulty understanding complex information. However, stressful situations can make it difficult for anyone to understand emergency information and to take appropriate action.

The information collected through this research project will identify pictures that drivers can use to communicate effectively with their passengers in difficult or dangerous circumstances.

The answers you provide will not be directly attributed to you and your name will not be used in the research report. Only your transit company will be identified in the report.

Questions:

a. What are the messages or information that you will need to tell your passengers? b. What kinds of questions will passengers likely ask? c. What different/additional questions do you expect from passengers who are deaf/hard of hearing, speak English as a second language or have another condition that affects communication? d. What type of personal experience have you had with communicating information to passengers in an emergency or major, unplanned change in service or operations?	1. What is the first direction you would give? What else? 2. What are the critical actions passengers will be asked to take? Stay in your seat? Line up? Watch forward? Other actions? 3. Where will you be positioned when you're giving directions? From the front? Walking up and down the aisles? 4. When passengers are unloaded from a bus during an unplanned event, when do they cease to be the driver's responsibility? 5. If you had pictures to communicate important directions, what would be the best way to inform passengers about the pictures and their meanings? A pamphlet? Post in bus stops or on the buses?

Conclusion

Thank you for participating in this interview. The research will continue for another 10 months. A final report with recommended pictograms will likely be releases sometime in 2013. Please feel free to contact me if you have additional thoughts or ideas after today.

APPENDIX B

Interview Discussion Guide with Experts Representing Populations with Communication Challenges

Purpose

Although unusual, transit passengers and drivers can encounter emergencies that require a sudden change in service or operating procedures. Transit and paratransit drivers must then inform their passengers about the change(s), the reason for the change, and what the passengers can expect as they try to reach their destinations.

This interview is part of a research project funded by the Transportation Research Board to identify what types of picture-based communication tools (pictograms) would be most helpful to assist transit and paratransit passengers and drivers/operators in communicating with each other in the event of an emergency or during routine bus travel. Pictograms can be especially useful for people with functional communication needs. However, stressful situations can make it difficult for anyone to understand emergency information and to take appropriate action.

The information collected through this research project will help identify pictures that drivers can use to communicate effectively with their passengers in difficult or dangerous circumstances.

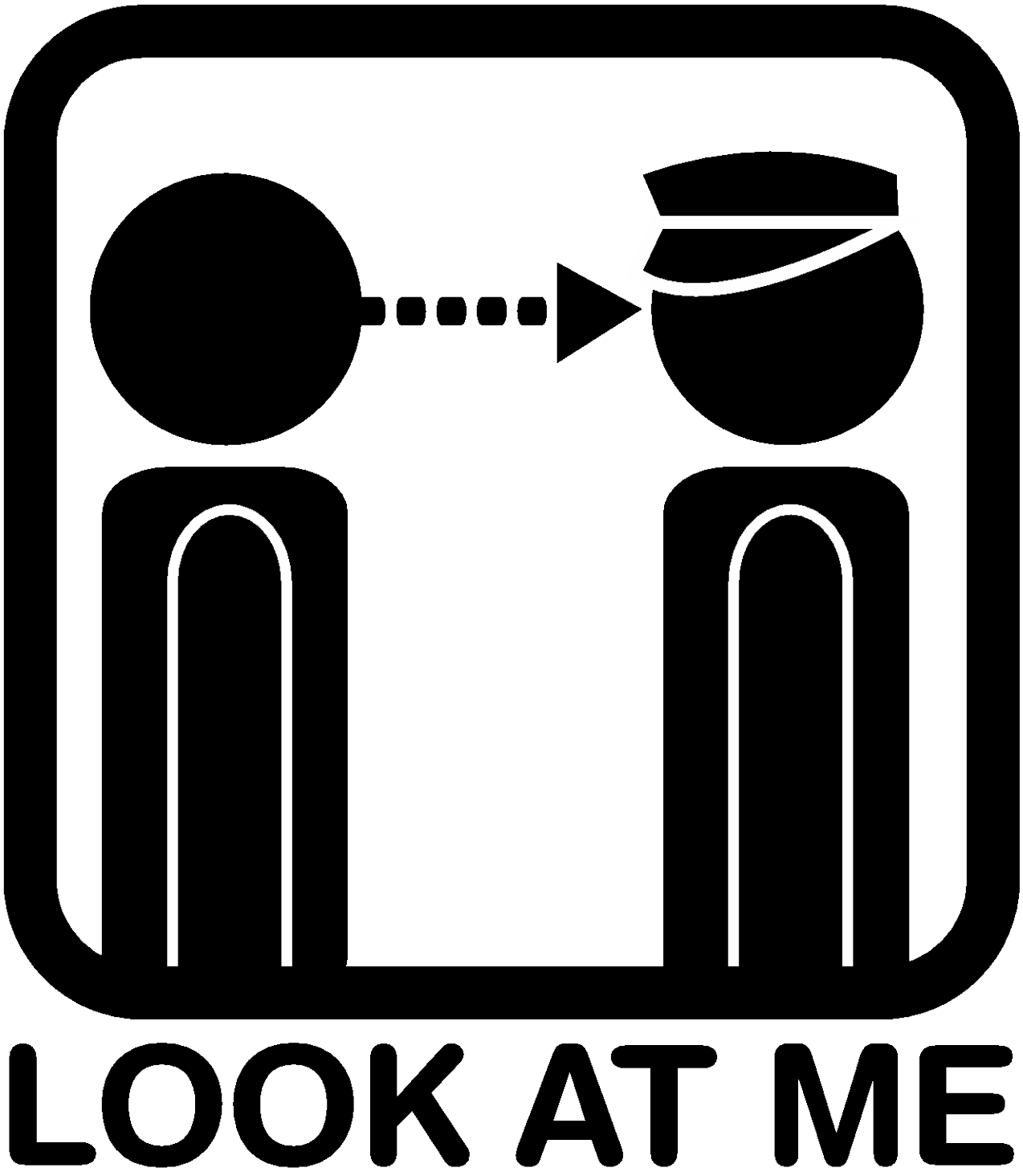
The answers you provide will not be directly attributed to you and your name will not be used in the research report. Only your organization or agency will be identified in the report.

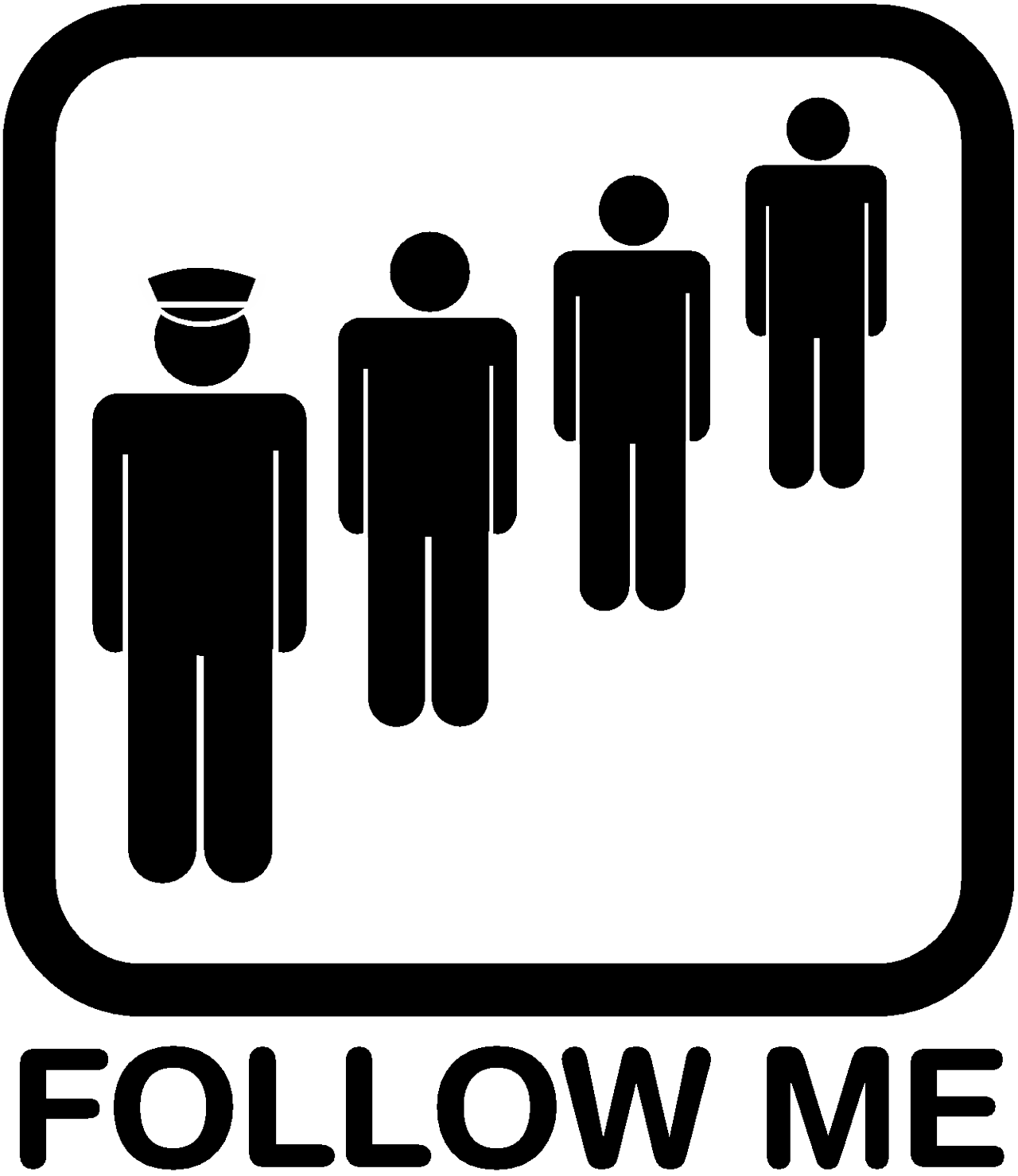
QUESTIONS	PROMPTS
1. Which populations groups do you represent or serve?	Communication needs Transportation needs Medical care Supervision needs Geographic/social isolation Low income Elderly/Very Young Other
2. Of those groups, which would be most likely to need and respond to picture-based communication tools in an emergency situation or for routine trips on a bus?	
3. What personal experience have you had in working with the population group(s) you serve in communicating about riding a bus? About a hazardous event? About transportation options in an emergency?	None Training/education Frontline (actual event) Emergency Communication Network
4. Imagine some sort of unexpected, major change in service or operating procedures. What do you think is likely to be the first thing that passengers with communication barriers would **need** to know?	It could be a weather-related event, a catastrophic accident or other dangerous event.
5. What would passengers with communication barriers likely **want to ask** driver if the bus changed its routine operations?	How do you think these questions would differ from those asked by other passengers?
6. If a driver uses pictures to communicate, how helpful do you think it would be if passengers had seen them before?	Pamphlet? Bus Stop? Posted on the bus? In a transfer station? On a route map?

Thank you for participating in this interview. The research will continue for another 10 months. A final report with recommended pictograms will likely be releases sometime in 2013. Please feel free to contact me if you have additional thoughts or ideas after today.

APPENDIX C

PICTOGRAMS





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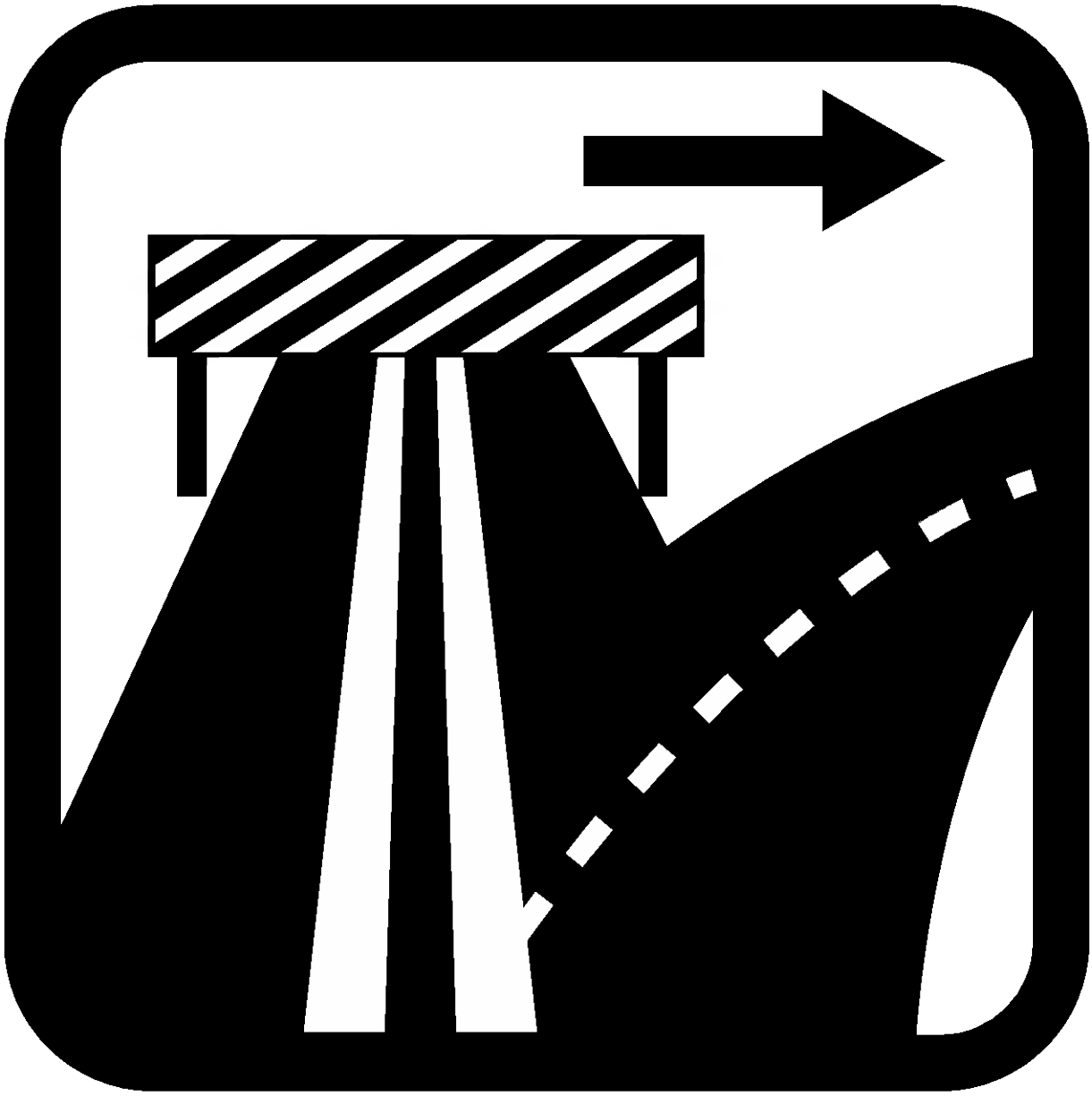
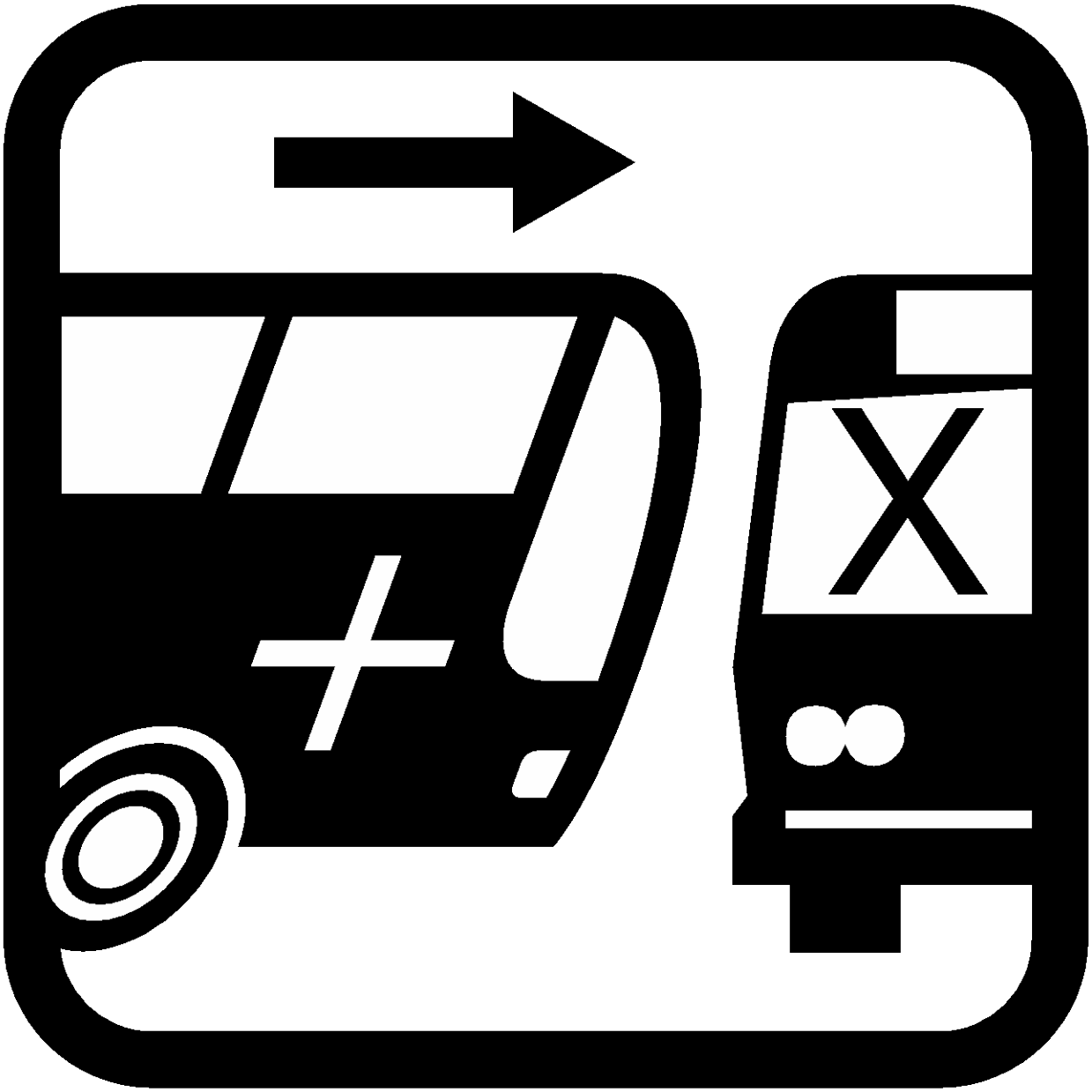
SEATED



CHANGE IN ROUTE



HELP IS COMING

APPENDIX D

INSTRUCTIONS FOR TRANSIT AGENCIES

OVERVIEW OF PROJECT

Thank you for agreeing to assist in this research project for the Transportation Research Board to test using picture-based communication tools (pictograms) as a way to make communication easier in an emergency.

As a transit agency, you know that drivers and transit riders can encounter emergencies that require a sudden change in service or operating procedures. Transit drivers must then inform their riders about the change(s), the reason for the change and what the riders can expect as they try to reach their destinations. That communication between driver and riders can be difficult if the passengers have some form of communication challenge such as being deaf/hard of hearing, speaking English as a second language or if they have any other condition that can inhibit communication in an emergency.

You will be working with a local human service agency/provider who will recruit up to six (6) to eight (8) people for the focus group discussion. Your agency is being asked to provide a *parked* bus to serve as a venue for a one hour focus group discussion and a driver to lead the discussion, show participants pictures and write a few notes about his/her observations. Once the focus group is over, we ask that you return the materials to the JMA research team (Pre-paid mailing labels and all materials are provided).

INSTRUCTIONS FOR TRANSIT AGENCIES

STEP 1

Participate in phone call with JMA research team to meet your local human service provider representative

This introductory phone call will give you a chance to connect with the human service agency that will be assisting with the project, ask questions directly of the JMA team and jumpstart your local work. The local service provider will also be receiving a packet of information with tailored action steps to complement what your agency will be doing.

Before the call:

1. JMA will coordinate times between you and the local service provider and then notify you both of the final date, time and call-in information. Please respond within 24 hours to any emails or phone calls about scheduling the team conference call.
2. Review all the materials in each of the six envelopes you have been provided. Some topics we might discuss include:
    a. What type of riders can the service provider help recruit for the testing?
    b. What are likely dates and times for the 1-hour focus group discussion that will be convenient for the focus group members, your agency and the driver that will help with testing?
    c. How will you and the service provider agency communicate and plan together?
    d. Are there special challenges that either of you expect in bringing the group together and doing the pictogram testing?

During the call:

3. JMA staff will call you at the agreed upon time. Plan on the call lasting an hour. JMA staff will make introductions and lead the discussion.
4. Take notes; although JMA will send out a summary afterwards, you will likely hear information you will want to put into action right away.
5. Confirm your next steps with your local human service agency partner at the end of the call; know what to expect of each other, how to contact each other and your next steps and time frames.

INSTRUCTIONS FOR TRANSIT AGENCIES

STEP 2

Decide on the date, time and location for your focus group testing

Location

1. Use a parked bus to test the pictograms. By using a bus rather than a conference room, both the driver and the focus group participants will be able to give the most accurate feedback about how the pictograms will work in the environment where they will be used. (If using a parked bus is a problem, it is acceptable to test the pictograms in a conference room.)
2. Reserve the bus and identify where it will be parked so you can give specific instructions to your service provider-partner about the location.

Time and Date

3. Decide on the best date and time for your agency to make a bus and driver available for the focus group.
4. Plan for about two hours total to allow time to get people situated on the bus, do introductions, discuss the pictograms and wrap up.
5. Discuss your plan with other people at the transit agency who will be interested in what you are doing or share some responsibility in any of the action steps.
6. Call your partner service provider agency with the time, date and location for the focus group. Make sure partner service provider can arrange to have a sign language interpreter or language translator to assist any members of the focus group.
7. Two to three days before the focus group meeting, confirm time, date and place with the driver and the service provider.

INSTRUCTIONS FOR TRANSIT AGENCIES

STEP 3

Recruit a driver who is willing to help test the pictograms

This project is unique because the people who would actually use the final pictograms will be testing them for clarity and usefulness. The bus driver who will lead the discussion is a key person in the testing process. Although the transit agency will be acknowledged for its participation in the research, the individual driver's name will not be used nor any other personal identifying information.

Driver recruitment

1. Look for a driver who is relaxed when speaking to people and who will be willing to follow the instructions for leading the discussion.
2. Talk with his/her supervisor about participating in the study as a discussion leader. The supervisor will likely want to know when the driver will be scheduled, how much time is needed and where the discussion will happen. The supervisor will want to find a time that will work with the driver's route requirements and that match the availability of a parked bus. Work out as many details as you can before approaching the driver, including whether the invitation can/should come from you or his/her supervisor.
3. Extend the invitation. Tell the driver what you will be asking him/her to do (*see details in Step 4*). Explain the date, time and location for the testing and the overall time commitment. Be sure to tell the driver why you think she or he would be a good discussion leader.
4. Feel free to share the information in the Step 4 envelope with the driver. That will likely answer many of his/her questions.
5. Invite the driver to ask questions. The driver may have questions about the research, its purpose, whether he or she will be identified, and want more details about logistics. Use the *Overview of the Project in Envelope 1* to help answer questions about the project.
6. Assure the driver that you and a staff person from the service provider agency will be there to assist with all the focus group activities.
7. Tell the driver that the JMA staff is happy to talk with him/her before the focus group discussion about how to lead the discussion or for any other background information or support. If the driver would like to talk with us, determine the best way for that to happen (you contact us by email or phone, the driver takes the initiative to call or email us).

8. Ask the driver for an explicit commitment to participate: for example, "Are you willing to lead a focus group discussion for this project on (date), (time) and (location)?"
9. Be sure the driver has your contact information and knows how to reach you.
10. Identify a check-in time two to three days before the scheduled focus group to address any additional questions and identify any problems.

INSTRUCTIONS FOR TRANSIT AGENCIES

STEP 4

Conduct the focus group discussion about the pictograms

In this envelope, you will find the following materials to help you lead and record the discussion:

- Blank name tags and marker
- Numbered pictograms
- Comment cards
- Forms for taking notes
- Pens
- Incentive gifts for participants to be handed out at the end of the focus group discussion

Please follow these steps in the exact order they are written

1. Set the scene. You and the driver will want to arrive 30 minutes in advance of the scheduled focus group discussion. Go through this packet to review what you will be doing. Think about where you want people to sit so that you can provide direction and move the group quickly into the discussion. You will want people to sit at different places on the bus so they can tell you whether the pictures and words are visible from a range of distances.
2. Wear nametags with your name and your agency's name. Offer participants nametags when they arrive. Tell them first names are all that's needed.
3. Welcome the focus group members when they arrive. *(The community service provider or the rider may have an interpreter/translator present. Allow time for your words to be relayed.)* Introduce yourselves and chat with participants to put them at ease. Be sure to let people know where restrooms are located and tell them they are welcome to take a comfort break whenever they wish – that the discussion will only last an hour or less, so there won't be a scheduled break.

Driver's instructions

Please exactly follow the directions listed below. This will allow the best comparisons between different discussion groups.

1. Call the group to attention with your voice and hand gestures. Tell people where you would like them to sit and explain that those locations are part of the testing guidelines.

2. Introduce yourself and say this:
   - **"Thank you for agreeing to help in this research project for the Transportation Research Board.**
   - **"As a bus rider, you know that we sometimes have emergencies that cause a sudden change in service or routes.**
   - **"Drivers like me then have to tell riders like you about the change, why we have to change, and what you can expect as you try to get where you are going.**
   - **"For some of you and other riders, the information may be difficult to understand. If you are deaf/hard of hearing, or speak English as a second language or are distracted – like a crying infant nearby – you and others may find it hard to understand or follow directions in an emergency.**
   - **"This research project is testing message tools that are picture-based (pictograms) to see if they could make it easier to understand directions in an emergency.**
   - **"Thank you for volunteering to help with this research! The results will help people all across the country."**

3. Invite people to introduce themselves. Assure them their names will not be used in the research report.
   - Say: **"I'd like each of you to introduce yourself. Just use your first name and, if you'd like, tell us why you ride the bus. Let's start on my right side and then go around to each of you."** (Remember, you may need to work through an interpreter/translator – allow extra time for this.)

4. Give these instructions before you actually start the discussion:

- **"Please listen to these instructions before we start. I am going to ask you to discuss and write down your reactions as I go through the pictures.**
- **"First, I am passing out comment forms and pencils for you. Please don't write anything yet!**
- **"This is how the discussion will work:**
  - **I will hold up the pictures one at a time.**
  - **You will have about a minute to look at the picture – think silently to yourself about what the picture tells you to do and if you would do what it says. Write down your ideas and any other thoughts you have.**
  - **Next, I will ask you some questions and invite your discussion. This part is important because when people talk together, new ideas often come out. I want to encourage all of you share your ideas out loud when we reach that part."**
- **"When we reach the discussion part:**
  - **Please give everyone a chance to talk. If you've told me what you think, let other people have a chance to talk before you add more comments.**
  - **There are no right or wrong answers. We expect people to have different ideas and want to hear them.**
  - **We'll be taking notes but we will NOT write down any names in those notes.**
  - **At the end, I will collect your comment card and give you a small "thank you" for being a part of the discussion."**

5. Begin the review of the pictures/pictograms. Hold up the first pictogram. Show them in the order they are numbered. Say the following:

- **"Can you see this picture clearly from where you are seated?"**
  - If someone says "no" ask, **"how much bigger would the picture need to be for you to see it clearly from you are sitting?"**
  - Then, invite the people who can't see clearly to move closer so they can see during the discussion.
- **"Please look at this picture: What does it tell you to do? Would you do this? Think silently and then jot down any ideas next to its number. You will have two minutes to look, think and write; then we'll talk."**

- (WAIT 2 minutes – the service provider will help keep track of the time)
- "**Now, let's start the group discussion. What does this picture tell you? Would you do this?** (PAUSE – watch to see if people look confused, are writing, look thoughtful and so on). You can also ask or say the following to encourage the group:
- **"Remember, there are no right or wrong ideas – who'd like to start us off?"**
- **"I've heard a couple of the same ideas – do people have other ideas or reactions?"**
- If some people aren't speaking, say, **"I want to be sure everyone has a chance to share their ideas. Do any of you who haven't said anything yet want to add ideas? I'm interested in knowing what you agree with, what you don't agree with and what other ideas you may have."** (PAUSE and give the group time to respond).
- Be sure to ask: **"Can you suggest anything that will make the picture and its message more clear?"**
- When the conversation dies down say, **"Any other thoughts before we move on to the next picture?"** (Sometimes this prompts a few more comments. If it does, let people talk. If there are no responses, move on to the next pictogram).

6. Use the same procedure for each picture – strike a balance between giving people enough time to think and react *and* moving the discussion along. Feel free to encourage people to talk back and forth among themselves when they have different ideas. Remind them they don't have to agree and that it's helpful for the research if there are different ideas.

7. After you have shown *all* the pictograms, say:
   - **"We have reached the end of the pictograms. Please pass me your comment cards."**
   - **"Is there anything else you'd like to say about this project or what we've done here today?"**
   - **"The company leading the research has provided a small "Thank you" for your willingness to share your time."**
   - **"We have a small gift card to thank you for volunteering your time and sharing your ideas."** (Have the service provider help you hand out the gift cards.)
   - **"The notes we have taken about the discussion will NOT include your names or any identifying information."**

- **"THANK YOU for being here today. Your contributions will make transit safer in the future for all people who ride buses!"**

INSTRUCTIONS FOR TRANSIT AGENCIES

STEP 5

Gather notes and observations from test

THIS STEP IS VERY IMPORTANT. The research team is relying on you – the driver (and the transit agency observer, if participating) and the service provider representative – to write notes about what you heard people say and how you saw people react. **This information will determine which pictograms may be changed or altered to be clearer and which will remain the same in the remainder of the research.** In this envelope you will find:

1. Extra comments forms for the driver and note-takers to capture their observations
2. Clips to hold the comment cards
3. Pencils

Follow these steps

1. After everyone leaves, find a place where you are able to sit and write.
2. Collect all the discussion group comment cards and clip them together.
3. Even though other people took notes, the driver who led the conversation is encouraged to write brief notes about what people said and their reactions to each picture. Feel free to use the same comment cards that were used by the group; this will help organize the notes. The driver should keep his/her comments separate from what the discussion group members said and did. The driver is then encouraged to write up his/her **own** reactions and suggestions on a separate comment card that is clearly marked "DRIVER'S COMMENTS."
4. The person who took notes during the focus group discussion should look over his/her own notes to see if there are comments that may be hard for another to person to read and, if so, perhaps re-write some.
5. If there's time, talk among yourselves about what you heard, what you saw and any thoughts and ideas that developed in your own minds from the time you first saw the pictograms until after the discussion group ended. Add those comments to the notes as well.

INSTRUCTIONS FOR TRANSIT AGENCIES

STEP 6

Return the packet of materials to JMA

This final step ends your participation. In this envelope you will find:

1. Pre-paid mailing labels
2. Mailing envelops

Double check to be sure all the materials are in the mailing envelopes:

1. Pictograms
2. Comment cards
3. Notes from the discussion
4. Notes and comments from the driver and other note-takers

Please send an email to your JMA contact person when you return the envelopes so that staff can be on the lookout for the package.

Thank you for your assistance. You have been the eyes and ears for this test. Without your willingness to share your time and accurate reporting, this research could not move forward.

Comment Cards

- The next five pages contain the comment cards to be used by participants.
- The following five pages contain the comment cards to be used by drivers to record their observations.

PICTOGRAM COMMENT CARD

Tips on what to look for:

- Size of pictogram: Is it too big? Not big enough?
- Do you understand the message in the pictogram?
- What do you like about the pictogram?
- What would you change?

Pictogram #1

Pictogram #2

PICTOGRAM COMMENT CARD

Tips on what to look for:

- Size of pictogram: Is it too big? Not big enough?
- Do you understand the message in the pictogram?
- What do you like about the pictogram?
- What would you change?

Pictogram #3

Pictogram #4

PICTOGRAM COMMENT CARD

Tips on what to look for:

- Size of pictogram: Is it too big? Not big enough?
- Do you understand the message in the pictogram?
- What do you like about the pictogram?
- What would you change?

Pictogram #5

Pictogram #6

PICTOGRAM COMMENT CARD

Tips on what to look for:

- Size of pictogram: Is it too big? Not big enough?
- Do you understand the message in the pictogram?
- What do you like about the pictogram?
- What would you change?

Pictogram #7

Pictogram #8

PICTOGRAM COMMENT CARD

Tips on what to look for:

- Size of pictogram: Is it too big? Not big enough?
- Do you understand the message in the pictogram?
- What do you like about the pictogram?
- What would you change?

Pictogram #9

Pictogram #10

DRIVER PICTOGRAM COMMENTS

Tips

- Listen for the main idea; jot down important words that will help you remember what a speaker says. You can write more detail at the end of the discussion.
- Use the same words that speaker uses.
- Watch for and note obvious facial expressions.
- Watch for and note when someone is nodding their heads in agreement or is shaking his/her head in disagreement.
- Set aside your own ideas about and reactions to the pictograms and what is being said – your job is to capture the words, ideas, and reactions of the discussion group participants.

Pictogram #1 – "Look At Me."

Pictogram #2 – "Listen"

Pictogram #3 – "Turn Off"

Pictogram #4 – "Stay Calm"

Pictogram # 5 – "Follow Me"

Pictogram # 6 – "Stay Seated"

Pictogram #7 – "Delay"

Pictogram #8 – "Change in Route

Pictogram #9 – "Danger"

Pictogram #10 – "Help Is Coming"

APPENDIX E

INSTRUCTIONS FOR SERVICE PROVIDERS

PROJECT OVERVIEW

Thank you for agreeing to assist in this research project for the Transportation Research Board to test picture-based communication tools (pictograms) that could be used as a way to make communication easier in an emergency. You will be working closely with a local transit agency, which will be leading the discussion about the pictograms. Your role will be to recruit the discussion participants while the transit agency provides the testing location and the discussion leader. You will both be asked to take notes and make observations.

As a service provider (and possibly as a transit rider), you know that drivers and transit riders can encounter emergencies that require a sudden change in service or operating procedures. Transit drivers must then inform their riders about the change(s), the reason for the change and what the riders can expect as they try to reach their destinations. That communication between driver and riders can be difficult if the passengers have some form of communication challenge such as being deaf/hard of hearing, speaking English as a second language or having any other condition that can inhibit communication in an emergency. Even the simple distraction of a crying baby could make spoken directions hard to understand and follow. This study is examining picture-based instructions that could help overcome these difficulties.

You are being asked to recruit up six 6) to eight (8) clients or people your agency serves who ride the bus and who personally have communication challenges or are very familiar with challenges. These individuals will take part in a one (1) hour focus group discussion to review and react to pictograms designed specifically to communicate with transit riders. It is important that you recruit people who will actually be able to follow through with the commitment. They must also be willing to actively participate in the discussion to share their reactions and ideas about the pictograms. **If your recruits need transportation, translators, or interpreters, please arrange to have those resources available so your people can fully participate in the pictogram testing discussion.**

You are also being asked attend the discussion group to help take notes and to assist in distributing a small incentive/thank-you item to discussion group members to thank them for their time.

INSTRUCTIONS FOR SERVICE PROVIDERS

STEP 1

Participate in phone call with JMA research team to meet your local transit team member

This introductory phone call will give you a chance to meet your local transit team member, ask questions directly of the JMA research team and jumpstart your local work. This packet of information with tailored action steps complements your partner transit agency's action plan.

Before the conference call

1 JMA will coordinate times between you and the local transit agency and then notify you both of the final date, time and call-in information. Please respond within 24 hours to any emails or phone calls about scheduling the conference call.

2 Review **all** the materials in each of the five envelopes you have been provided. Some topics we might discuss include:

   a. What type of riders can the service provider help recruit for the testing?
   b. What are likely dates and times for the 1-hour focus group discussion that will be convenient for the focus group members, your agency and the driver that will help with testing?
   c. How will you and the transit agency communicate and plan together?
   d. Are there special challenges that either of you expect in bringing the group together and doing the pictogram testing?

During the call

3 JMA staff will provide call instructions. Plan on the call lasting an hour. JMA staff will make introductions and lead the discussion.

4 Take notes; although JMA will send out a summary afterwards, you will likely hear information you will want to put into action right away.

5 Confirm your next steps with your local transit partner at the end of the call; know what to expect of each other, how to contact each other and your next steps and time frames.

INSTRUCTIONS FOR SERVICE PROVIDERS

STEP 2

Identify focus group discussion participants

With this step you will find a project description sheet that you can use when talking with potential focus group participants; you can make copies to share with them.

Develop a list of potential recruits

1. Identify people who are regular bus riders, are willing to speak up in a group to say what they think and who have some personal communication challenges or are very familiar with what it means to live with communication barriers.
2. Remember, the goal is to have at least six (6) and no more than eight (8) people who will actually be able to attend the focus group discussion and be willing to talk and share their ideas. You will likely need to develop a list of 10 to 12 names.
3. **Identify any special needs or considerations that may apply to the potential recruits.** This will give you a head start in making additional arrangements if needed. Examples include whether someone might need an interpreter or translator, whether someone works an unusual shift that could limit the available times, whether someone will need additional transportation assistance if the focus group convenes in a location that is not easily accessible by regular transit routes. You will likely think of other factors to keep in mind.
4. As soon as the transit agency contacts with you the confirmed date, time and location, begin to make your calls to potential recruits.

INSTRUCTIONS FOR SERVICE PROVIDERS

STEP 3

Recruit focus group participants

To find a good mix of people for the focus group discussion you may need to tap into your own network of clients and also clients of other service providers. Be prepared to briefly describe the project, what participants will be asked to do and what support you can provide to help them attend the discussion group and get back home.

Contact potential participants

1. Use the project overview to tell people what the project is about. Emphasize that their contributions will help bus riders in future emergencies
2. Tell people what you are asking them to do. You are asking them to:
    - Commit about two (2) hours of their time to the research project;
    - Attend a focus group discussion to look at pictograms;
    - Share their thoughts and ideas about the pictures they look at; and
    - Write down their comments and ideas on a card.
3. Tell people what you will do (adjust this list to reflect what you are willing and able to do):
    - Provide them with all the information about when and where the focus group discussion will be;
    - Assist with transportation to and from the focus group location;
    - Provide interpretation/translation services;
    - Other items.
4. Ask the recruit if he or she has any questions. If they have questions you can't answer, reassure them that you will find out and then call or email the JMA staff; we are happy to talk with you or even directly to the person asking the question. *
5. Ask the person directly to commit the time to participate. If he or she says "yes," repeat the date, time and location so you are both confident in what has been agreed.
6. If the person has indicated a need for additional assistance and/or you think that will be needed, work out the details about what is needed and how it will be provided.

7. Exchange contact information so that each of you knows how to contact one another if there are changes in plans or there is a need for more information.
8. Thank the recruit for his/her willingness to participate. You may tell them they will receive a small gift of cash or a cash card as a thank you and an incentive to participate.

Your transit partner will check in with you at least one time before the day of the focus group and after you are contacted about the specific location, date and time. The agency will be interested in knowing about how recruiting is going. It also gives you a chance to talk about questions that have come up.

Please contact your recruits two-three days before the scheduled focus group to see if there have been any changes and to confirm the details about any additional support you are providing individuals.

*You can contact JMA at any time with any questions. Please send email questions to kreinhardt@janemobley.com or phone questions to either Kelly Reinhardt or Rea Wilson at 816-472-1930.

INSTRUCTIONS FOR SERVICE PROVIDERS

STEP 4

Act as a support person the day of the focus group

It is important that you as the representative of your agency/organization work closely with transit agency personnel **during** the focus group. Your assistance will be needed to take notes and to observe how people react to the pictograms.

On the day of the focus group

1. Follow through with any agreed upon support for recruits.
2. If you are not transporting people, arrive at least 15 minutes before the scheduled focus group.
3. Introduce yourself to the transit agency contact and the driver who will lead the discussion.
4. Help the transit staff organize the focus group members.
5. Briefly review the note-taking form. The transit driver will give you the form.
6. During the focus group take notes. **Write down comments that people make about the pictograms, your observations about people's reactions and any suggestions that are made to help the pictograms to be clearer.**

At the end of the discussion

7. Help the bus driver pass out the thank you incentives (gift cards or cash).
8. Thank people for their help.
9. If you have transported people to the site, arrange to transport them to their original location.

INSTRUCTIONS FOR SERVICE PROVIDERS

STEP 5

Gather notes and observations from the discussion

This step is very important. JMA is relying on you as well as the transit agency personnel to write notes about what you heard people say and how you saw people react. **This information will determine which pictograms may be changed, how they are changed to be clearer, and which pictograms successfully communicate the intended message.**

After the discussion group leaves

1. Even though you took notes, the driver who led the conversation will also write brief notes about what he or she heard people say and their reactions to the different pictures. Encourage him/her to use the same comment cards that were used by the participants; this will help organize the notes.
2. Look over your own notes to see if there are comments that may be hard for another to person to read and to re-write.
3. If there's time, talk among yourselves about what you heard, what you saw and any thoughts and ideas that developed in your own minds from the time you first saw the pictograms until after the discussion group ended. Add those comments to the notes as well, but mark them clearly as your observations so they aren't mistakenly credited to the discussion group.

The Transit Agency will return the comment cards, your notes, and other materials to JMA.

Thank you for your assistance. You have been the feet, eyes, and ears for this test. Without your willingness to share your time and provide accurate reporting, this research could not move forward.

Comment Cards

The next five pages contain the comment cards to be used by observers to record their observations.

OBSERVER PICTOGRAM COMMENTS

Tips

- Listen for the main idea; jot down important words that will help you remember what a speaker says. You can write more detail at the end of the discussion.
- Use the same words that speaker uses.
- Watch for and note obvious facial expressions.
- Watch for and note when someone is nodding their heads in agreement or is shaking his/her head in disagreement.
- Set aside your own ideas about and reactions to the pictograms and what is being said – your job is to capture the words, ideas, and reactions of the discussion group participants.

Pictogram #1

Pictogram #2

Pictogram #3

Pictogram #4

Pictogram #5

Pictogram #6

Pictogram #7

Pictogram #8

Pictogram #9

Pictogram #10

APPENDIX F

RESEARCH PROBLEM STATEMENT FOR FUTURE STUDY

I. PROBLEM TITLE

Visual Communication Tools to Reach Transit Customers with Voluntary and Involuntary Communication Barriers

II. RESEARCH PROBLEM STATEMENT

Frequent riders can make navigating the public transit system seem simple during routine times, but some travel occurrences – especially emergencies – can bewilder all populations using a transportation system. In emergencies – no-notice or short-notice events – every aspect of communication becomes more difficult. Studies of human brain response show that no one in an emergency has full capacity to receive information, apply reasoning, and make and act on sound decisions. Critical information must be far more concise and compelling than in normal circumstances. For especially vulnerable audiences, information must be able to leap communication barriers that include lack of language proficiency, physical or mental disabilities, age (very old or very young), and specific cultural orientations or other limiting factors.

This was the premise for TCRP A-33A, which focused especially on populations with functional needs, cultural behaviors, or language barriers. However, that study revealed that communication barriers are far more widespread than the involuntary barriers (language, age, disability) the research team expected. Instead, voluntary barriers – related in large part to passengers' use of digital listening devices – present the biggest challenges to alerting and directing passengers in emergency situations, or in ordinary but non-routine service interruptions.

Although TCRP A-33A began as a study of emergencies, it became clear in the research that ordinary but non-routine situations, such as route interruptions or delays, can also require direct communication with passengers who may not be "tuned into" the public airspace of the bus or train, as well as passengers who have language or other limiting communication barriers. Bus drivers and transit representatives that participated in A-33A research suggested that pictograms used for emergencies could also be extremely useful in communicating with customers in ways that would make the transit experience more orderly, more understandable and safer for everyone.

TCRP A-33A began with the assumption that communicating with people who have functional communication needs is regarded increasingly in transportation as every agency's concern, but, as yet, no entity's responsibility. The concept was that a particular set of tools – pictograms – could make a substantial contribution to effective communication with all populations in emergencies, and especially with people who have functional communication needs.

Pictograms are communication tools that use picture-based communication with few or no words. Pictograms can be advantageous when used to communicate critical information

because they are more noticeable than written communication; provide the public with concise, instantaneous information; improve comprehension of critical messages for people with functional needs; and reduce the need for message translation. The pilot tests conducted for TCRP A-33A also revealed that pictograms had a riveting quality for passengers: seeing a bus driver hold up a picture caused people to focus intently to try to decipher the message. Simply achieving that much intense attention, no matter the message, is advantageous to a driver trying to manage a non-routine travel interruption or an emergency.

Universally understandable images are difficult to develop. From the pilot work of A-33A, further work is necessary to use the research and pilot findings to refine the images tested for that study. Moreover, research for A-33A revealed that gathering basic information about the current communication challenges that occur on buses (and perhaps trains, although A-33A's scope permitted only a bus study) to create a baseline of understanding across the transportation industry could help agencies provide a higher level of service, situation management, and emergency readiness for all populations.

III. OBJECTIVES

The objectives of this research include:

1. Develop a revised set of pictograms most understood by audiences in pilot project (A-33A), with particular attention to images designed to convey direction and direct behavior in a bus transit environment.
2. Examine the prevalence of digital sound devices in use by transit customers to examine the impact of these devices (e.g., headphones, ear buds, etc.) in creating communication barriers.
3. Determine the effectiveness of pictograms in bus transit to reach passengers with voluntary communication barriers.

IV. RESEARCH PROPOSED

This research proposal would extend to further usefulness the work in TCRP A-33 and A-33A by addressing the ways in which directive pictograms could help communicate important transportation messages to diverse audiences in emergencies and in day-to-day operations. The research approach and tasks envisioned include, but are not limited to:

Task 1: Literature review

5.1 Conduct a limited, focused literature review on the impact of personal digital devices on behavior in public space.

Task 2: Study bus passengers' voluntary communication barriers and transit response

2.1 Use secondary (previous studies, as well as reports by drivers and other transit personnel) and primary (focus groups, interviews) research to establish patterns in passengers' use of digital sound devices that prevent their hearing instructions from bus drivers or announcement systems.

Task 3: Apply Research findings to pilot program

3.1 Conduct field tests of set of pictograms determined in Task 2 with digitally distracted, engrossed, or isolated passengers (including some who are deaf or hard of hearing or

have limited English proficiency) to determine whether images get and hold attention, secure compliance, adequately direct behavior, or impart information.

3.2 Further refine images in response to findings.

Task 5: Reporting

5.1 Draft and submit a final report to TCRP on the outcomes of the research and pilot program. The report will provide the set of best-understood pictograms in digital format that can be used by transportation agencies.

V. ESTIMATE OF THE PROBLEM FUNDING AND RESEARCH PERIOD

Recommended funding: $100,000.
Research period: 12 months

VI. URGENCY AND PAYOFF POTENTIAL

The need to find a practical solution to providing clear, concise messages is urgent, as immediate as the next hurricane or chemical spill. The outcome of this study would be a set of picture-based communication elements that can be used to communicate with passengers who have either voluntary or involuntary communication barriers, or both.

VII. RELATIONSHIP TO FTA STRATEGIC RESEARCH GOALS AND TCRP STRATEGIC PRIORITIES

This proposal relates to the FTA research goal to support increasing transit's market share with research to improve the rider experience, as well as the goal to support improving the performance of transit operations and systems with research to improve safety, security, and emergency preparation. This proposal also aligns with the TCRP strategic priority of placing the transit customer first by addressing customer needs for clear, succinct messages