SAFETY AND SECURITY TECHNOLOGIES OF IMPORTANCE TO TRANSPORTATION-DISADVANTAGED POPULATIONS USING PUBLIC TRANSIT

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ABSTRACT

All travelers have concerns about safety and security. For transportation-disadvantaged persons (i.e., older adults, persons with disabilities, and low-income individuals), these concerns are amplified by the vulnerability of the individuals. Safety and security can be improved for transportation-disadvantaged populations through the use of technology. Specific technologies include vehicle tracking systems, silent alarm systems, security cameras, and way-finding navigation systems. Other innovative safety devices and programs provide additional safety and security. Five sites across the United States were visited to determine how agencies of different sizes using different approaches meet the needs of these special populations. The agencies noted that technologies of benefit to the transportation-disadvantaged communities generally benefit all users of public transportation.

BACKGROUND

Older adults, persons with disabilities, and low-income individuals are considered transportation-disadvantaged because they often lack access to a personal vehicle. Transit agencies meet the needs of the transportation disadvantaged through both fixed route and paratransit systems. It must be noted that, although paratransit service is more expensive than fixed route, the number of paratransit trips is growing (National Museum of American History, 2005), which presents a fiscal challenge to transit agencies. Another challenge is meeting the variety of needs of these populations. Even in the community of persons with disabilities, for example, the needs of a person with a sensory loss (e.g., sight, hearing) are different from the needs of a person in a wheelchair or a person with a cognitive disability.

Intelligent Transportation System (ITS) technologies involve state-of-the-art computers, electronics, and communications systems. A prime purpose of ITS is to move people more efficiently and with greater safety. Thus, using ITS to respond to the safety and security needs of the transportation disadvantaged appears to be an obvious solution. According to Dan Marchand of TriMet, Portland, Oregon, “technology makes it possible to deliver a quality service at a time when funding is flat.”

OBJECTIVE

The objective of this paper is to share concrete examples of how specific transit agencies have provided additional safety and security to the transportation disadvantaged through the use of technology.

APPROACH/METHODS

Five focus sites were chosen for study based on (1) their successful deployment of ITS technologies that benefit the transportation disadvantaged and (2) their geographic and operational diversity. The sites included Wheels of Wellness in Philadelphia, Pennsylvania; Cape Cod Regional Transit Authority (CCRTA) in Cape Cod, Massachusetts; Flint Mass Transportation Authority (MTA) in Flint, Michigan; Ventura County Transportation Commission (VCTC) in Ventura County, California; and TriMet in Portland, Oregon (Figure 1). Specific examples of the use of technology to improve safety and security were documented.

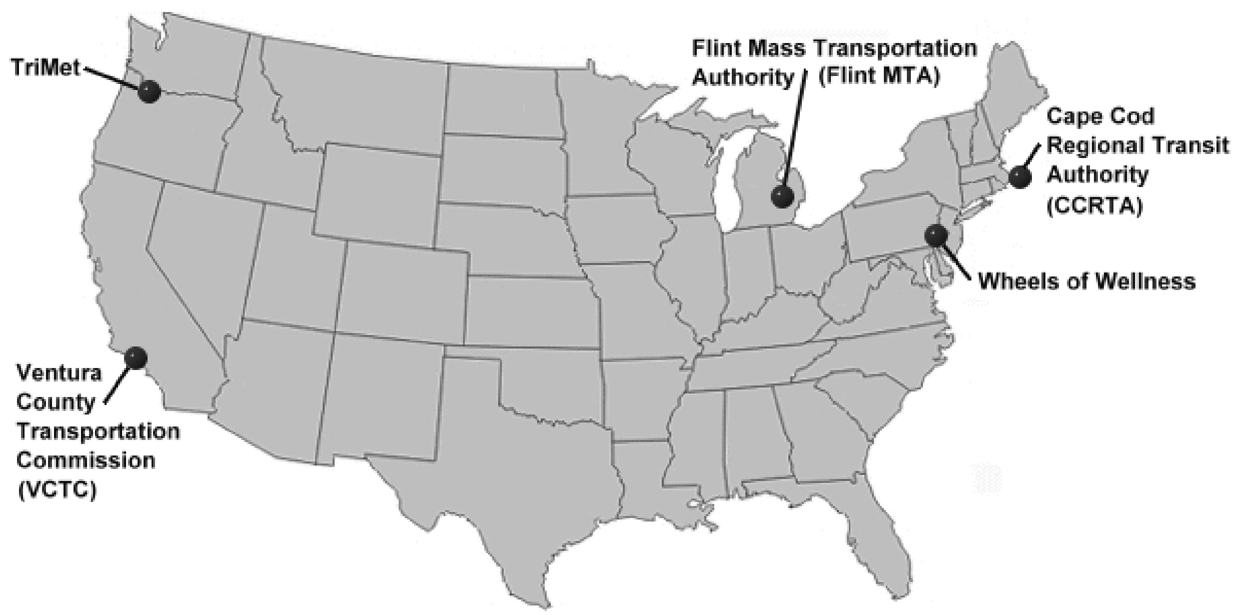

Figure 1. Locations of the five focus sites.

The size and scope of the operations at each of these five focus sites is presented in Table 1. The size of the sites, operational components, and technology applications differed greatly. Wheels of Wellness, for example, is a contract brokerage that arranges medical trips. TriMet, on the other hand, coordinates a very large, fixed route, multi-modal transit program with a paratransit program, a medical transportation program, and a three-county, regional connection providing work-related transportation.

Table 1. Size and scope of the five focus sites.

Site name/place	Size and scope
Wheels of Wellness, Philadelphia, Pennsylvania	Large urban service area. Contract brokerage involves eight carriers totaling 229 vehicles providing 5,000 door-to-door paratransit trips/day; volunteers provide 100 trips/day; service is limited to medical trips; use of public transit is encouraged and supported
CCRTA, Cape Cod, Massachusetts	Medium-sized system in a rural/urban area with high congestion during tourist season. 120 buses (about one-third are fixed route units) provide about 4,000 trips per week; service contains both fixed route and demand response
Flint MTA, Flint, Michigan	Medium-sized system with fixed routes in the city and county-wide curb-to-curb service. 150 vehicles provide 2,000 demand response trips/day
VCTC, Ventura, California	Medium-sized, multi-modal, county-wide system. 113 contracted vehicles plus 33 directly operated vehicles support both fixed route and a dial-a-ride program
TriMet, Portland, Oregon	Very large, urban, multi-modal, three-county system. Fixed route with 300,000 boardings/day includes bus and light rail (44-mile, 64-station light rail system and 93 fixed route bus lines comprised of 660 buses). Paratransit, with 210 buses and 15 sedans, provides 1 million rides/year. The medical transportation program uses 45 contract carriers to provide 1,400 trips/day. Regional connection for rides to work and other mobility needs uses 30 provider agencies to provide 250,000 rides/year

FINDINGS

The transportation disadvantaged are concerned about safety and security as they travel from their point of origin to the place where they board the transit vehicle, on the vehicle, and upon exiting the vehicle. Because of their vulnerability, the transportation-disadvantaged are afraid of being mugged or otherwise assaulted. Fragile, older adults have fears of stumbling or falling or being harassed because they might be slow. Persons with cognitive disabilities fear that they may fail to board the correct bus or to alight at the proper stop.

Typically, security is a larger issue on fixed route public transportation than it is on paratransit vehicles. Thus, for fixed route transit to be a viable option for the transportation disadvantaged, it is crucial that safety and security be addressed in conjunction with accessibility. The five agencies highlighted in this paper represent both paratransit and fixed route services.

Safety and security are addressed through a variety of technologies ranging from vehicle tracking systems, silent alarms, and security cameras to personal handheld devices. While physical design features – e.g., kneeling buses or securement devices – are not considered ITS technologies, they will be addressed briefly in this paper. Coordination and integration software for dispatching the appropriate type of vehicle to meet each client's needs is considered ITS.

Vehicle Tracking Systems

One of the most important safety features is that of knowing where the vehicles are located at all times in case of emergencies. All five sites use some type of automatic vehicle location (AVL) technology. Vehicle tracking systems can improve safety and security in a variety of ways. When an incident occurs, the exact vehicle location assists authorities in arriving at the scene as quickly as possible. If a driver becomes incapacitated for any reason, or is not performing his duties properly, it will quickly be evident that the vehicle is deviating from its schedule. Thus, problems, whether reported by the vehicle operator or not, will be identified and resolved in a more timely manner. Vehicle tracking technologies are frequently combined with other technologies, such as mobile data computers (MDCs) or computer-aided dispatch (CAD) devices.

Silent Alarm Systems

Silent alarms (sometimes called panic buttons), which can be operated by a vehicle operator, alert authorities to problems onboard the vehicle. These alarms are often integrated into the MDCs or placed in a covert location, so the vehicle operator can activate the alarm without being noticed. This can be particularly helpful in the event of a vehicle hijacking. Wherever the alarm is located, it is important to be located in such a way that is easily accessible yet will not give false alarms through inadvertent activations. Typically, panic buttons are installed with an AVL system so that the exact vehicle location can be known the moment the alarm is activated. Another common feature of panic buttons is that, when activated, a covert microphone is turned on so that the dispatch office or authorities can hear what is happening onboard the vehicle.

CCRTA has a silent alarm system which is activated by pressing a button located on the MDC (Figure 2). When the signal is activated, the dispatchers know the location of the bus because all buses have GPS-based AVL. In 1997, when AVL was first installed, an attempt was made to hijack a bus, but the operator was able to alert dispatchers via the silent alarm system. The hijacking attempt failed when police arrived within three minutes. A CCRTA paratransit driver noted that she is, first and foremost, a people person and not fond of electronic gadgetry. She admitted, however, that the alarm device came in handy when a passenger became ill and collapsed on her bus. She was able to push the emergency button and get help quickly without having to explain her location.

Figure 2. The CCRTA silent alarm is located on the MDC.

Wheels of Wellness was forced to discontinue the use of the onboard panic buttons due to an excessive number of accidental false alarms caused by driver error. It is believed, however, that the lack of a silent alarm system has had little impact on safety because all vehicles are very closely monitored and can be tracked at all times. The close monitoring of vehicles has not only thwarted vehicle theft but has also led to the quick discovery and rescue of a driver who became incapacitated and required immediate medical attention.

All TriMet buses have a silent alarm button, which is located on the left side of the driver's seat and is recessed to prevent false alarms. When the button is pushed, dispatchers can hear everything on the bus; they screen the conversation and also follow the bus's progress on their monitors.

Security Cameras

Security cameras on vehicles as well as security cameras at transit stops are perhaps the most obvious security technology employed. Large, easily visible cameras are effective at making surveillance known to the passengers. Live camera feeds from vehicles can be very helpful in emergency situations but require a wireless network connection with enough bandwidth to handle streaming video. Currently, most onboard cameras record to a tape which is collected for review after an incident has occurred. At transit stops where traditional hardwire communications networks are available, it is more common to find cameras providing live video feeds that are monitored in real time.

Wheels of Wellness currently uses a wireless network, which is being upgraded in 2005 to allow enough bandwidth to handle streaming video from in-vehicle security cameras. This capability will give Wheels yet another layer of security.

CCRTA fixed route buses have onboard surveillance cameras as do key bus terminals. With the implementation of the Cape-wide wireless network, streaming live video will be possible aboard the buses. Live video, if passengers are aware of it, can serve as a deterrent to criminal behavior.

VCTC has onboard security cameras for the buses that are maintained and operated by VCTC. VCTC also tracks the position of the other transit carriers' buses in Ventura County.

At Flint, security has not been a big problem, especially on paratransit vehicles. Fixed route buses are all equipped with security cameras as are the bus stations (Figure 3).

Figure 3. A video camera in the Flint Central Transportation Center is a security device.

About 80% of the TriMet's fixed route buses have video cameras. Video cameras protect the agency as well as passengers because they provide a true record of an incident. When an incident occurs on a vehicle, the tape is physically collected from the vehicle and stored until it is no longer needed.

Way-finding Navigation Systems

Way-finding navigation systems for persons with disabilities usually involve a personal handheld device for accessing information or receiving signals. Personal assistive devices such as infrared or GPS-based handheld receivers can alert users to intersections and crosswalks as they find their way to and from transit stops. TriMet data supports a new technology that allows the blind or visually impaired to access transit information in either Braille or audio format. Information is accessed via a portable note-taking system frequently used by the blind (Figure 4). Frank Synoground, a manager with the Oregon Commission for the Blind, notes, "Like any other blind person, I am looking to be as independent as possible, and this device is a tool for independence." Synoground continues, "We see this not only as a way to offer greater independence but also as a savings to our agency."

Figure 4. Use of a personal wayfinding device using TriMet data.

A type of technology that can provide mobility assistance for the visually impaired and even the cognitively disabled is the Remote Infrared Audible Signs (RIAS) directional wayfinding system (Talking Signs, Inc., 2003), which has been deployed in key facilities of the San Francisco Municipal Railway (MUNI) and other sites around the country. (Although MUNI was not one of the focus sites, personnel at MUNI were interviewed during this research project, and the technology has sufficient interest and applicability to be included in this paper.) In contrast to signs that merely convert on-screen text into an audible message which is broadcast through speakers to the general public, the RIAS system is targeted to only those who would benefit from the system. This system provides detailed and precise directional information that allows a blind traveler to accurately and safely navigate through areas where the system is deployed, as shown in Figure 5.

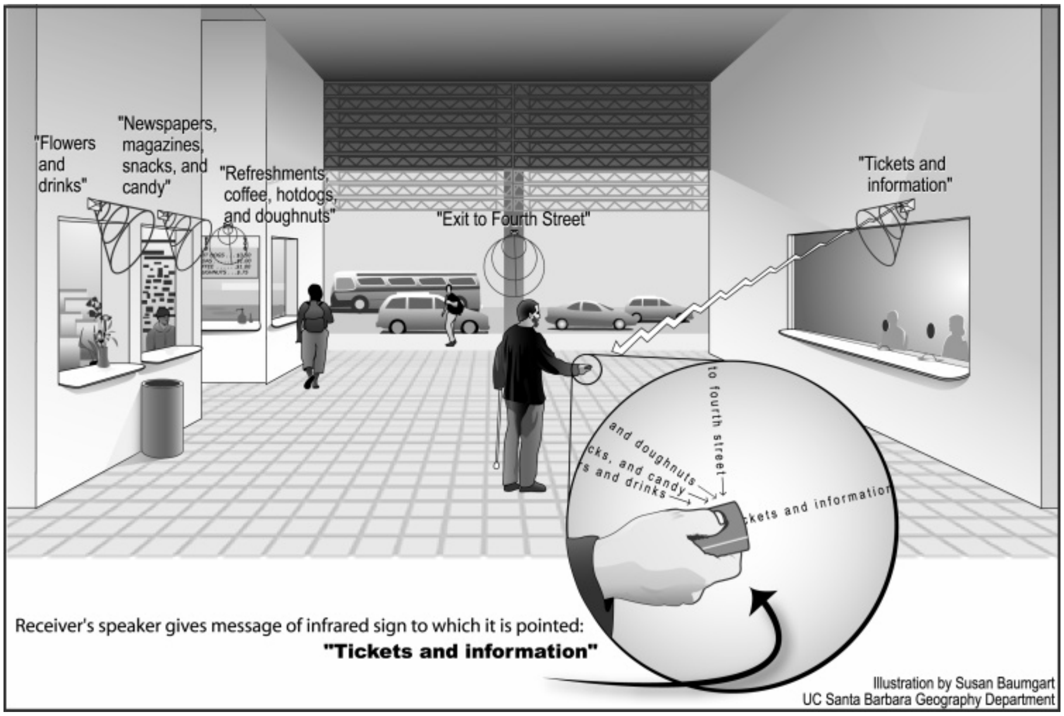

Figure 5. A schematic of the RIAS system.

Other Safety Devices and Programs

In addition to these ITS technologies, the focus agencies have installed other safety and security devices or developed specific programs to increase safety and security for the transportation disadvantaged.

"Smart" cards have multiple applications. Wheels of Wellness has an automated system that validates the credentials of each driver at the beginning of each shift. All drivers undergo background checks and a verification of all required documents such as the driver's license. The driver information is then loaded onto an electronic ID card. At the beginning of each shift, a driver must swipe an ID card in the vehicle's MDC. The information from the ID card is then transmitted to Wheels where it is verified by a database to ensure that the driver's records are current. Wheels maintains detailed client and driver databases. On public transit, fare cards promote safety and security because the rider does not need to handle money.

Low-floor kneeling buses (Figure 6) are not just more accessible but are also safer than the older lift equipped buses. During an evacuation, the ramps eliminate stairs and can be deployed quickly and even manually in the event of a mechanical failure.

Figure 6. Low-floor kneeling buses at Flint MTA provide easier access to all passengers.

Flint MTA identified a safety problem with wheelchairs that were not properly secured. The cause for this was that the system of straps was too awkward and time consuming and the straps became filthy and wet in the winter time as they laid on the floor of the vehicle. Flint MTA installed a new claw type of system for quickly securing wheelchairs and a padded arm to help stabilize the passenger in the wheelchair. This virtually eliminated incidents of improperly secured wheelchairs.

TriMet uses its extensive databases, to identify transit stops that need improved accessibility. TriMet has an agreement with the city to help with safety and security by modifying curbs and putting in ramps to make bus shelters more accessible and also by providing frequent police patrols of transit facilities. All new construction projects are reviewed for safety and security.

Technology Deployment

The sites mentioned in this paper used different approaches to ensure safety and security of transportation-disadvantaged riders. In addition, they approached the deployment of the technologies differently. Some sites developed the software in-house; others used vendor-supplied software. Additional information may be found in the full report documenting this research, *ITS Applications for Coordinating and Improving Human Services Transportation: A Cross-Cutting Study*, which may be accessed at http://www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/14140.htm.

CONCLUSIONS

A wide range of ITS technologies, which can help transit agencies better serve the transportation disadvantaged, are currently deployed in the real world. While technology is constantly evolving, many of these technologies have matured into fully functioning systems that are proving their value within transit agencies and are serving clients on a daily basis. Four technologies that specifically address safety and security issues for transportation-disadvantaged populations are vehicle tracking systems, silent alarm systems, security cameras, and way-finding navigation systems.

Although the primary purpose of "smart" cards is fare payment, cards are also safety tools, validating driver identification credentials and preventing the need for transportation-disadvantaged populations to handle money in public. Agencies also employ non-ITS applications to improve safety and security. These physical devices and improvements include low-floor kneeling buses, improved securement devices, and modified curbs and ramps. While these devices are not considered ITS, determining where they are needed is frequently established through use of ITS data generated from operations such as passenger counts and the number of ramp and lift deployments.

With the high degree of variability among transit providers and the areas they serve, there is no single technology or configuration that will be appropriate for all areas. Fortunately, with the breadth of technologies that are currently available and the degree to which technology can be customized, an ITS application can generally be developed for almost any setting.

The deployment of ITS technology will inevitably require overcoming some hurdles, either technical or institutional. By examining what other agencies have learned from their deployments, many valuable insights can be learned and many challenges overcome. While the technologies covered in this paper are focused on improving services for the transportation disadvantaged, it should be recognized that many of these technologies are of equal benefit to all transit riders. By the same token, ITS technologies are valuable to the transportation providers by providing the data needed for accurate reporting and streamlining operations.

ACKNOWLEDGEMENTS

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