

PEDESTRIAN CROSSING SAFETY AT OR NEAR PASSENGER STATIONS

December 2010



U.S. Department of Transportation
Federal Railroad Administration
Office of Railroad Safety

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Background

On October 16, 2008, President George W. Bush signed into law the Rail Safety Improvement Act (RSIA), which in Title II, Division A, contains 10 safety initiatives related to grade crossing safety and trespass prevention. In Section 201 of the statute, the Federal Railroad Administration (FRA)—by delegation from the Secretary of Transportation—is directed to provide guidance to railroads concerning pedestrian safety that addresses four specific pedestrian safety areas. Section 201 reads as follows:

SEC. 201. PEDESTRIAN CROSSING SAFETY.

Not later than 1 year after the date of enactment of this Act, the Secretary shall provide guidance to railroads on strategies and methods to prevent pedestrian accidents, incidents, injuries, and fatalities at or near passenger stations, including—

- (1) providing audible warning of approaching trains to the pedestrians at railroad passenger stations;
- (2) using signs, signals, or other visual devices to warn pedestrians of approaching trains;
- (3) installing infrastructure at pedestrian crossings to improve the safety of pedestrians crossing railroad tracks;
- (4) installing fences to prohibit access to railroad tracks;
- (5) other strategies or methods as determined by the Secretary.

FRA has worked with its rail safety partners in government, industry, and labor to assemble this material that is intended to form the basis of the guidance that is required by the RSIA.

Hazard Analysis Approach to Enhancing Safety

FRA recommends that passenger rail operators use hazard analysis methods to evaluate the risk associated with the movement of pedestrians at or near passenger stations, in light of the history of tragic incidents that have resulted in serious pedestrian injuries and fatalities. These unfortunate events can be mitigated or reduced in number if the steps outlined in this document are implemented based upon the specific requirements and conditions of every passenger rail operation.

Passenger rail operators should perform their own hazard analysis and identify methods that they can use to make their operation safer, especially for pedestrians in or near stations. Using this hazard management approach, passenger railroads can realize improvements in passenger rail safety. All passenger railroads will benefit from sharing of the hazard management experiences of individual railroads among all operators.

The hazard management and hazard analysis approach promoted by FRA in its October 2007 publication titled, "Collision Hazard Analysis Guide: Commuter and Intercity Passenger Rail Service," represents one method to conduct a hazard analysis. However, there are many other techniques for conducting a hazard analysis, and additional information on how to apply hazard analysis techniques to railroad operations is readily available.

FRA recommends that the first step of an effective hazard identification and resolution process is to define the system under consideration. A good system definition is important to understand the environment and interfaces that occur during operation of trains in and around passenger stations. Such a system definition is best accomplished by individuals who are intimately familiar with the passenger rail operation.

The system definition should be a narrative statement that fully describes train operations and the passenger station environment. The system definition will vary depending on the specific conditions and circumstances that exist on a particular passenger railroad. The system definition is best developed by a group of individuals with expertise in pedestrian safety and passenger railroading. Many organizations form a hazard management team to develop the definition, develop the hazard model, identify the hazards related to the operation, and identify appropriate mitigation strategies.

The second step in the hazard analysis process is hazard identification; this means looking for potential hazards or undesired events that may involve pedestrians walking in or near passenger rail stations. Use the hazard management team to identify these hazards. Hazard identification is a "What if?" activity that looks for potential causes and results of incidents. The hazard management team "brainstorms" to come up with as many credible hazards as possible for use in the hazard analysis. The hazard management team should consider the physical characteristics of the passenger station platforms and associated walking paths in or near the station when identifying these hazards.

Hazard assessments should use severity and frequency rankings, which will lead to the hazard resolution procedures defined in the passenger railroad's system safety program plan or established by the hazard management team. The hazard resolution procedure should be established before beginning the hazard assessment process to prevent unnecessary disagreements on hazard assessment.

The results of the hazard identification and hazard assessment steps should be captured on a hazard analysis worksheet. The hazard analysis worksheet contains all of the information collected on each hazard and serves as the record of how hazards are to be controlled or mitigated. Use the worksheet for hazard management to ensure that all identified hazards are systematically addressed.

Train-Borne Audible and Visual Warnings

The Federal regulation at Title 49 Code of Federal Regulations section 222.21 requires that a locomotive audible warning device (usually an air-activated horn) be sounded while trains approach and enter public highway-rail grade crossings. This requirement extends to pedestrian-only crossings at or near rail passenger stations only if State law requires the sounding of audible warning devices at such pedestrian crossings. The sounding of locomotive horns on approach to an adjacent passenger station platform away from a pedestrian crossing is not addressed by Federal regulation, and is usually performed in accordance with a railroad-issued instruction or operating rule.

FRA recommends that the locomotive bell be sounded on approach and while moving through passenger stations, whether or not the train will service that station. Some railroads may already require this in their operating rules.

FRA recommends that locomotive alerting lights, displayed in a triangular pattern, be illuminated while trains approach and enter passenger stations.

Station-Sited Audible and Visual Warnings

Audible and visual warnings should be used at or near passenger stations to guide pedestrians to proper crossing points, and also to indicate when it is appropriate to cross the tracks in order to get to the correct station platform to board the desired train. The audible warning can consist of announcements that specify train arrival track, eventual train destination, and the location of certain cars within the train, such as food service cars, "quiet cars," or deluxe accommodation cars. FRA recommends that such audible announcements be supplemented by a display of the text of the announcement on a changeable message sign using a light-emitting diode display or other high-legibility technology.

The types of information needed by pedestrians wishing to cross the tracks in a station prior to train arrival include the arrival track of any trains entering the station, the direction of travel of any trains moving within the station, and the location of the desired train relative to the pedestrian's current location.

Given the obviously wide range of potential messages needed to provide this information, such a system should be able to accept several types of message inputs, such as a stored library of standard safety messages, as well as accepting typed, recorded, or spoken messages from station personnel as the situation may warrant. This system should also allow the operator to preview and edit any messages prior to their being given to passengers. Any such station-sited audible warning systems will require some method of detecting the approach of a train, determining its direction, whether it will stop at the station, and, possibly, its speed.

Railroads (including Amtrak) should work with the State and local agencies that are responsible for establishing or operating commuter rail service to implement a system of audible warning of the approach of a train to pedestrians at or near rail passenger stations. This system should be capable, in combination with simultaneous visual displays, of communicating the direction of the approaching train, and which platform it will either service or pass alongside if the train does not serve the station in question. This system should be given high priority when high-speed trains are present or when visibility of approaching trains is impeded by track curvature or physical sight distance obstructions.

Passenger railroads with station platforms in multiple track territory should work cooperatively to develop a standardized system to clearly and accurately communicate to passengers in station areas and on platforms that a second train (in addition to any train currently occupying or approaching any station track) is approaching the station, and its arrival may be obscured by the train in the station. Such a system should have both an audio and visual component, and its messages should be distinctive enough to attract attention in what may be a very busy and noisy environment. This system should be able to indicate tracks occupied, direction of travel, and whether any approaching train will stop at the station.

Infrastructure within Passenger Stations—Americans with Disabilities Act Considerations
Congress enacted the Architectural Barriers Act (ABA) in 1968.

Under the ABA, facilities such as rail passenger stations constructed or modified with Federal dollars must be made accessible to people with disabilities.

In the Rehabilitation Act of 1973, Section 502 created the Access Board, charged with ensuring Federal agency compliance with the ABA.

In 1990, President George Bush signed into law the Americans with Disabilities Act (ADA). The ADA prohibits discrimination on the basis of disability in public accommodations and services, including transportation, provided by public and private entities.

In 1991, the Access Board published the ADA Accessibility Guidelines (ADAAG), and the Justice Department adopted ADAAG as the standard for the construction and alteration of places of public accommodation and commercial facilities.

The first four sections of ADAAG contain general provisions and specifications for all types of buildings and facilities. Section 10 of ADAAG covers transportation facilities such as rail passenger stations. The Board also issued ADAAG for transportation vehicles (including rail

passenger vehicles of all types) as a separate document. The U.S. Department of Transportation has adopted the guidelines for transportation facilities and vehicles as enforceable standards in its ADA regulations.

Swing Gates

Swing gates have two distinct functions: providing entry to or exit from the track areas, or allowing for emergency exit only under dire circumstances. Swing gates must only open away from the track area and shall be designed to return to the closed position after use.

The entry or exit swing gate is used to slow pedestrians approaching the track area by encouraging them to stop, and then pull open the gate. The gate is placed so that a user will face down the tracks and look for approaching trains during the motion required to open the gate prior to entering the track area.

A corresponding exit gate is pushed open away from the track area, allowing pedestrians to leave the track area without delay, while then returning to the closed position for use by the next passenger.

At stations with high passenger flows, multiple entry and exit gates should be used side by side. An emergency exit swing gate may also be used. Emergency exit gates shall be clearly designated for use only as an escape route for pedestrians that find themselves between the track area and a lowered automatic pedestrian gate upon approach of a train.

Providing Safe Access for All Users

In order for safe access to be provided for all users, the following standards are to be incorporated into the design of stations:

- Swing gates, which must be pushed open by wheelchair or mobility aid users, shall have a smooth continuous surface, known as a kick plate, extending from 2 inches above the floor to 27 inches above the floor.
- Where it is necessary to cross tracks to reach boarding platforms, the route surface shall be level and flush with the rail top at the outer edge and between rails, except for a maximum 2½-inch gap on the inner edge of each rail to permit passage of wheel flanges. Where gap reduction is not practicable, an above-grade or below-grade accessible route shall be provided.
- A detectable warning consisting of raised truncated domes should be installed at pedestrian crossings. A detectable surface in advance of the crossing provides warning to visually impaired individuals of the presence of a crossing. The detectable warning should extend 24 inches in the direction of travel covering the full width of the designated pedestrian pathway.

- A detectable warning surface should be placed before and after the tracks to allow pedestrians to know when they have entered and exited the track area. The edge of the detectable warning surface closest to the track is located next to the warning sign or device, but no closer than 12 feet from the nearest rail on each side of the of the crossing.
- Where audible systems are used to communicate train arrival and track assignments to the public, a means of conveying the same or equivalent information to persons with hearing disabilities must also be provided.
- In consideration of the length of station platforms on high-density passenger rail lines, it may be necessary to install multiple audible/visual message display systems to ensure that all message formats can be clearly perceived and understood by passengers waiting anywhere along the portion of the platform open to public access.
- Unmanned stations can be accommodated by a system based upon a stored library of messages and software that can receive inputs from the train detection system and generate the appropriate set of audible and visible messages to advise pedestrians within station areas on current train arrival status, track, and direction of approach.
- Supplemental warnings can be provided by crossing bells or flashing lights that are connected to a train detection system so that upon train arrival, the bell sounds and flashing lights display to indicate when it is not safe to cross. A wayside bell or half-gates can be installed to help get the pedestrian's attention.

Infrastructure at Pedestrian Crossings to Improve Safety



Figure 1: Example of visually contrasting surface materials used at a pedestrian crossing.

Figure 1 illustrates the use of visually contrasting surface materials that are also detectable by the visually impaired.

A smooth, consistent crossing surface is important for safe crossing in all kinds of weather, during daylight and after dark.



Figure 2: Example of a high-volume passenger station with grade separation structure.

Infrastructure Improvements to Accommodate High Passenger and Train Volumes

Special situations involving stations serving both local commuter and intercity passenger rail service can justify greater expenditures for required pedestrian access features. The station illustrated above in Figure 2 serves a busy schedule of commuter local trains along with frequent intercity passenger service, with trains in both directions stopping at the station all day long. In addition, this three-track railroad is the freight mainline for a major Class I rail carrier.

The combination of high-passenger train volumes and mainline freight service necessitated the construction of this well-used grade separation structure. Wide stairways combine with elevator service to provide high-capacity crossover access for large volumes of passengers. In concert with the substantial intertrack fencing, this pedestrian overcrossing keeps pedestrian traffic away from a very busy three-track railroad.

FRA recommends that railroads with busy passenger stations located on multi-track rail lines with frequent freight service should investigate the application of a high-capacity grade separation structure to carry large volumes of pedestrians to and from their busy passenger platforms, separated from the potential hazards of crossing a multi-track railroad at grade.



Figure 3: This multi-track railroad features local and limited-stop passenger service.



Figure 4: Pedestrians going to or coming from a stopped train should be reminded to be watchful for other trains on adjacent tracks as shown here.

Infrastructure and Safety Issues At or Near Passenger Stations in Multi-Track Territory

Figures 4 and 5 illustrate the potential hazards associated with the movement of more than one train within station limits. Pedestrians wishing to cross the tracks are in need of specialized information displays that clearly indicate the position and direction of trains moving on adjacent tracks.



Figure 5: An example of a “Second train coming” display sign used on a passenger station platform.

An example of a “second train coming” display is shown above in Figure 5. Such systems must be designed to satisfy these information requirements. In this sample, the crossing prohibition is communicated by the traditional “hand/man” pedestrian signal display as shown on the left. The companion display on the right uses a simplified representation of a train that is capable of communicating train direction of travel as well as train location relative to the intended crossing point.

An unintended consequence on the provision of changing train arrival and departure information can be the sudden movement of passengers from one platform to another to meet their train, if its track assignment has been changed.

Announcements or sign displays of such updated information can result in confusion and hurried movements across tracks by passengers at low platform stations. In cases like this, the effective provision of “second train coming” warnings can become critical to ensuring passenger safety when those very passengers have become distracted from their surroundings by changing train arrival or departure information. In addition, such situations can also result in passenger injuries as they move quickly along or across station platforms or stairways in an attempt to catch a train that has arrived on a different track or platform than was originally anticipated.

Supplementary use of convex mirrors can be a simple way to provide pedestrians with a clearer view along the tracks, or to enhance their ability to see a train approaching from behind them. These mirrors may also serve to provide additional warning of a second train coming on a different track.



Figure 6: Example of a warning sign combined with right-of-way fencing to channelize pedestrians to the desired crossing location.

As shown in Figure 6, above, a warning sign with a clear message has been effectively combined with channelizing or right-of-way fencing to direct pedestrians to the intended crossing point. **In addition, the “LOOK” sign on the left and the walkway formed by the fencing combine to alert them of the need to look in both directions in anticipation of a train coming in either direction on any track.**

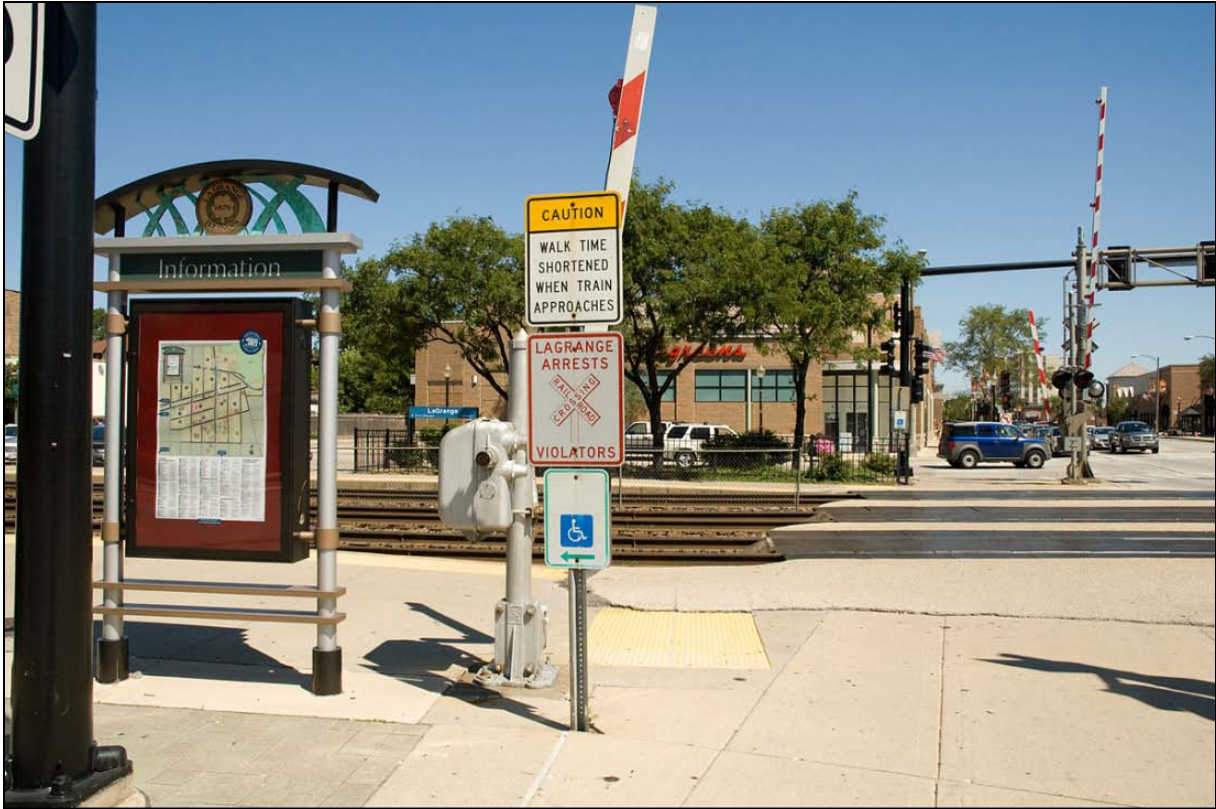


Figure 7: Example of the use of streetscape features, such as the “Information” sign, to enhance the effectiveness of a pedestrian gate by making it more difficult to walk around the warning device.



Figure 8: Example of railing used to delineate the desired crossing path for pedestrians.

Figure 7 is an example of the use of streetscape features, such as the decorative map sign shown to the far left that helps block people from walking around the short pedestrian gate arm, thus reducing violations of the lowered gate arm.

As illustrated by Figures 7 and 8, FRA recommends the use of fencing and other barrier materials, such as landscaping plantings, to funnel pedestrian traffic to the desired crossing point, where grade crossing warning devices are located.. Fencing and other barrier materials on approaches to the desired crossing point should be so arranged as to reduce or prevent crossing warning device violations.



Figure 9: Example of a clear, concise warning message communicated by this pavement marking.

Pavement markings can be used effectively to remind hurried passengers of the need to be wary of trains approaching on any track and in either direction. One example of such a warning is shown here.

This combination of a clear warning legend with the crosshatch pattern provides a good warning at the decision point for a crossing.

Repetition of such a warning pavement marking helps create a clear delineation of the intended crossing path, while also giving the warning message at each individual track, in both directions of pedestrian travel.

FRA recommends that when such pavement marking warning messages are used, the pavement marking should extend the full width of the pathway or sidewalk, so as to maximize the conspicuity and applicability of the warning message.

Station Signing and the Importance of Maintenance



Figure 10: Examples of poor sign maintenance (left) and good sign condition (right).

The provision of signing at intended pedestrian crossings is now a fairly common practice. Maintenance of these signs is unfortunately overlooked sometimes, and the exposure to the elements can rapidly degrade sign clarity and reduce sign effectiveness, as the two photographs shown in Figure 10 illustrate. FRA recommends that railroads follow the practice of maintaining a sign inventory for purposes of regular sign upkeep and replacement when necessary.

The difference in effectiveness between a clean, well-maintained guide sign and a worn-out sign could not be clearer than as shown in Figure 10.

Fencing At or Near Passenger Platforms

In light of the effectiveness of fence lines installed between tracks within station platform areas, FRA recommends that railroads work to establish a program of station assessments within multiple track territories to determine the most effective fencing material and fence height for that railroad's unique physical plant. The use of panelized fencing units can facilitate installation as well as minimize track time needed for maintenance.



Figure 1: Example of intertrack fencing with crossing surface providing for desired pedestrian movement between passenger platforms.

Fencing should be extended 200 feet beyond the end of station platforms, particularly where platforms are staggered (not directly across from each other for their full length). Fencing between tracks and along platform edges (where needed) should be designed to channelize passenger flows toward clearly marked, smooth crossing surfaces where passengers may cross safely and with minimal delay while within and adjacent to the track area.

The use of vandal-resistant “dense-mesh” fencing can enhance safety by resisting cutting or other damage as well as proving to be more difficult to climb over. Regular inspection of fencing installations is recommended as part of the overall pedestrian safety and channelization effort.



Figure 12: Example of station signing clearly indicating areas from which pedestrians are prohibited.

These crossings should be well delineated and marked by station signing clearly indicating the intended direction of travel and any areas from which pedestrians are prohibited (see Figure 11).

An important element in an intertrack fencing program is to provide clear, consistent warning signing (see Figure 12) that communicates to passengers that entry onto track areas or off platform ends constitutes trespassing (depending on local statutes) and is strictly prohibited. One of the many potential hazards for these trespassing passengers while illegally crossing multiple tracks is presented when a second train is approaching the station from either the same or the opposite direction than the train from which the passengers have just alighted.

Other treatments can supplement intertrack fencing; another recommended approach is to install fencing along platform edges where boarding or alighting is to be discouraged. As seen below in Figure 13, platform edge fencing helps to channelize passengers toward intended boarding locations on longer low platforms.



Figure 13: Example of platform edge fencing.



Figure 14: Example of signing and strategy to reduce “fence-jumping” by regular commuters who stubbornly insist on using a favorite shortcut.

Figure 14 shows an example of a strategy that has been used by some commuter railroads to help dissuade regular passengers from attempting to use a perceived shortcut across the tracks to get from their train to the parking lot or pickup area. Commuter agencies have applied lubricants or other coatings designed to dissuade “fence-jumping” by presenting the threat of damage to clothing if climbing on or over the fence is attempted. Surprisingly, however, some commuters have persisted in trying to climb over the intertrack fencing rather than using the intended crossings, even in light of the potential for damage to their clothing.

In addition, FRA recommends the use of fencing outside of immediate station areas to channelize pedestrian traffic toward desired entry points. Fencing and other channelizing features, such as landscaping along pedestrian walkways from parking areas to station entrances and platforms, should be installed to prevent “shortcut” trespassing by hurrying commuters who cross the tracks to avoid missing their train. Arranging the fencing or landscaping in Z-shaped “zig-zag” forms, adjacent to tracks, can point approaching pedestrians in the direction of approaching trains (“forcing” them to look for trains) as they walk toward the passenger station.

Other Strategies and Methods to Enhance Pedestrian Safety

FRA recommends that the railroads use hazard management techniques, such as hazard analysis, to identify appropriate hazard mitigation strategies when they address trespass problems and seek to identify potential hazardous locations. Hazard analysis is a process where hazards are identified and recorded, and corresponding hazard mitigation strategies are identified, recorded, and tracked to completion. The hazard mitigation strategies should be designed to eliminate, or control access to, railroad tracks at or near stations except at the designated crossing locations.

Hazard management is not a difficult process, but it is designed to be both comprehensive and continuous. Passenger railroads must be prepared to develop and support a long-term right-of-way access control and safety management program. A hazard management team, made up of interdepartmental technical and safety experts from the railroad, should be established to implement the safety management program. The hazard management team’s primary role would be to identify the hazards and agree on the mitigation strategies. Hazard management is not a one-time task but requires the railroad to go back and periodically reaffirm the trespass prevention program.

Enforcement Initiatives At or Near Passenger Stations

FRA recommends that railroads work cooperatively with law enforcement officials to develop locally focused legal sanctions for pedestrians who illegally enter onto or cross railroad tracks at or near passenger stations. One State recently considered a bill supported by the local commuter railroad that would have provided a fine of as much as \$500 for crossing the tracks at any crossing if a train is approaching and flashing lights and gates have been activated. In addition, this State’s laws currently prohibit vehicles from driving past any lowered crossing gate at a highway-rail grade crossing; the vehicle operator can get up to 1 year in jail and a \$2,500 fine.



Figure 15: Example of a targeted local enforcement campaign.

Figure 15 shows the signing component of a localized grade crossing safety campaign. The sign clearly indicates the fine amount for any violation of any railroad grade crossing warning devices. FRA recommends that any such crossing safety enforcement campaign be supplemented by clear, conspicuous signing that is visible and legible for pedestrians in and around all passenger stations within the campaign area. Similar, but larger, signing will be needed to provide the same warning to motorists and other road users in the campaign area.

Safety research has shown that one of the most effective education and enforcement programs has been one of focused law enforcement efforts, often known as “crossing safety blitzes.” A crossing safety blitz consists of police officers being present at selected highway-rail grade crossings within a community. These officers focus on encouraging safe crossing behaviors while enforcing the laws concerning pedestrians and vehicles around grade crossings. Violation rates have been reduced during blitz activity. Pedestrians generally respond more positively than motorists to the crossing safety blitzes; indeed, these programs were especially effective for commuters who were regularly exposed to enhanced education and enforcement programs.

Public Outreach and Crossing Safety Education Programs

The time spent by passengers while waiting on station platforms is available for education and safety outreach messages. FRA recommends the use of audio and video messaging to communicate important safety messages and reminders. Any station-specific safety concerns or special safety instructions should also be communicated in this manner, in addition to the more traditional station signing and station kiosk handouts.

FRA recommends that these messages be brief and to the point, with each message treating a single important safety message. Audio announcements should be coordinated with the placement of posters that reinforce the safety message being broadcast within the station

environment. These efforts will have a cumulative effect on regular users of the station—precisely, those with the greatest long-term exposure to potential hazards at or near passenger stations.

Many commuter railroads regularly distribute service update newsletters on their trains or through targeted email messages. FRA recommends that railroads always include grade crossing and station safety messages in each of these communications, along with the latest service changes or updates.

FRA recommends that railroads take the opportunity to participate in cooperative research projects that investigate the applicability, here in the United States, of Canada's report titled, "Pedestrian Safety at Grade Crossing Guide (Final Draft)," issued in September of 2007. This comprehensive report is available from Transport Canada on their Web site at <http://www.tc.gc.ca/eng/rail-menu.htm> under the "Pedestrians and Grade Crossings" section.

Summary

FRA has intended this guidance primarily for both passenger railroads as well as freight railroads that operate trains over trackage that also sees passenger operations. The presence of pedestrians within station areas and moving toward or across tracks to access station platforms can create several potential conflict areas where the movement of pedestrians must be restricted upon detection of an approaching train.

The guidance contained in this report is intended to provide railroads with strategies and methods that can help them to prevent pedestrian incidents and fatalities specifically in areas within or near passenger stations.

Measures that will assist railroads in providing audible warning of approaching trains to the pedestrians at railroad passenger stations will need to maximize message accuracy, brevity, clarity, and timeliness.

Visual warning of approaching trains should be made to pedestrians at or near passenger stations using a combination of signs, signals, or other visual devices.

Railroads should carefully select and install infrastructure at pedestrian crossings, as well as along approaches to desired crossing points to improve the safety of pedestrians crossing railroad tracks.

Installing fences and other barrier materials, such as landscape plantings, can be very effective in prohibiting access to railroad tracks, while funneling passengers away from potential hazards and toward desired crossing points that are equipped with appropriate warning devices.

In addition to these four emphasis areas, FRA has also put forth ideas for other strategies or methods that may prove effective when undertaken by railroads in partnership with local agencies, safety advocates, and law enforcement officials.