



US Department  
of Transportation  
**Federal Railroad  
Administration**

# Research Results

RR 10-03  
June 2010

---

## Use of Traffic Channelization Devices at Highway-Rail Grade Crossings

### SUMMARY

Traffic channelization devices have a long history of use on highways as a means to separate vehicular traffic or to accommodate smooth traffic flow. These devices have found new applications as safety measures at highway-rail grade crossings. Studies on driver behavior at grade crossings indicate that a strong correlation exists between violations of the crossing warning devices and collisions. Deterring the risky behavior of driving around a lowered gate makes the grade crossing a safer environment.

The U.S. Department of Transportation (DOT) Federal Railroad Administration (FRA) promotes the use of traffic channelization devices at highway-rail grade crossings with active warning devices, where applicable. The traffic channelization devices provide a proven safety benefit without the same hindrances to mobility that occur with crossing closure or the costs associated with four-quadrant gate systems. Median barriers that meet the criteria within the Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings are approved supplemental safety measures for the establishment of a quiet zone. Many studies have been performed at locations where driver violations occurred at highway-rail grade crossings and after installation of channelization devices at these locations; a significant reduction in driver violations occurred.

The purpose of this research is to provide information about the use of traffic channelizing devices at highway-rail grade crossings. It includes a survey of the types of installations available, considerations for design, quiet zones, and special circumstances, as well as a discussion on the effectiveness of traffic channelization devices at improving safety at highway-rail grade crossings.



**Figure 1: Traffic Channelization Devices** (photo courtesy of NCDOT)

## BACKGROUND

Since 1994, collisions at highway-rail grade crossings have declined by more than 40 percent. However, in 2008, 286 fatalities occurred in 2,391 highway-rail grade crossing collisions [1]. Eliminating these incidents altogether continues to pose a challenge. Studies on driver behavior at grade crossings indicate that a strong correlation between violations of the crossing warning devices and collisions. Deterring the risky behavior of driving around a lowered gate makes the grade crossing a safer environment.

The U.S. Department of Transportation (DOT) Federal Railroad Administration (FRA) promotes the use of traffic channelization devices at highway-rail grade crossings with active warning devices where applicable. In 2008, the FRA Office of Safety issued the brochure, "Guidance on the Use of Traffic Channelizing Devices at Highway-Rail Grade Crossings" [2], which was designed to assist in the selection of the appropriate traffic channelization device. It is distributed on the FRA Web site and at rail conferences with the hope of encouraging traffic engineers to pursue traffic channelization at grade crossings.

## OBJECTIVES

The objective of this research is to provide information about the use of traffic channelizing devices at highway-rail grade crossings. The information is intended for the use of transportation professionals and practitioners when considering improvements to highway-rail grade crossings.

## METHODS

The approach to this project was to gather pertinent information about the use of traffic channelization devices at highway-rail grade crossings. States have already installed these at grade crossings in an effort to improve compliance with the active warning devices and in turn, safety at the crossings. The experiences of states and researchers can be shared to encourage the appropriate use of median barriers at highway-rail grade crossings.

## FINDINGS

### *Traffic Channelization Options*

Wide raised medians provide the opportunity to include landscaping in its design. Although not a barrier, it can be an effective deterrent against violations of the crossing warning devices.

Barrier wall systems typically consist of concrete barriers, which are the most effective deterrent against circumventing lowered gates, but require a wide section between the roadway lanes.



**Figure 2: Wide Raised Median**

Nonmountable curb islands can be described as an island 6 to 9 inches high and 2 feet wide in which common roadway vehicles cannot mount and cross the island. This does cause concern, however, of increased crash risk and severity along the roadway and should be used judiciously.

Mountable raised curb seem to be the most effective traffic channelization device. It has minimal impact on the existing roadway and can easily be removed, if necessary. Raised vertical panels should always be installed with this system. The panels provide a visual deterrent to circumventing a lowered gate.

### *Installations at Crossings within a Quiet Zone*

One of the most frequent uses of median barriers at highway-rail grade crossings is in conjunction with the establishment of a quiet zone. The Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings standardized the establishment of quiet zones.

One of the supplemental safety measures (SSM) identified in this rule is gates with medians or channelization devices. The intent of an SSM is to reduce the risk at the crossing to permit the silencing of the train horn. The use of channelization devices as SSMs must be compliant with the specification outlined in the rule. Per the rule, the channelization devices or median barriers must be installed on both approaches to the crossing. This prevents drivers from circumventing the lowered gates by approaching the crossing in the opposing lane. The median barriers or channelization devices must extend 100 feet from the crossing gate arm, or if an intersection is within 100 feet of the crossing, the channelization device must extend 60 feet. Any intersections within 60 feet of the crossing should be closed or relocated.

One major reason that channelization devices are a popular installation at quiet zones is the cost. The cost of some SSMs can be prohibitive. For example, four-quadrant gate installations can cost upwards of \$250,000. The installation of median barriers at a crossing costs on average \$14,000 [3]. This magnitude of cost difference makes channelization devices an attractive safety measure to reduce risk at highway-rail grade crossings.



**Figure 3: Mountable Raised Curb**  
(photo courtesy of NCDOT)

#### *Issues and Considerations*

A successful median barrier project considers all potential impacts of the installation. If the crossing is on a route that is used by emergency vehicles, heavy trucks, or large

farm equipment, it may be necessary to accommodate a U-turn for these vehicles. This is especially important for vertically challenging “humped” crossings that low-clearance trailer trucks could potentially have problems traversing successfully. To accommodate U-turns for large vehicles, a potential option is to utilize mountable raised curbs with vertical panels. These installations can be driven over, if necessary. And, the replacement of the upright panels is easy and inexpensive.

The Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings states that the recommended length for a median barrier at a highway-rail grade crossing is 100 feet. However, a divided roadway for 100 feet could restrict access to intersecting streets or driveways within the 100-foot zone. An analysis of traffic patterns should be performed to see if the installation of a median barrier is appropriate for that location.

The installation of traffic channelization devices at highway-rail grade crossings requires the cooperation of many stakeholders. It is in the interest of the railroad to improve safety at the crossing and they are often the chief proponent of implementing a crossing with traffic channelization devices. However, because the traffic channelization devices extend beyond the right of way of the railroad, the roadway authority must also be involved. The local government will be in the best position to negotiate the purchase of additional frontage should there be any changes to the roadway width to accommodate median barriers.

#### *Effectiveness*

Several demonstration studies have been conducted that included an evaluation of the reduction of risky driver behavior after traffic channelization devices were installed at a grade crossing. Because incidents are rare, the studies frequently used circumventing the gates or other unsafe behavior as a surrogate. When the results from a variety of studies were averaged, it indicated that unsafe driver actions at grade

crossings were reduced by 68 percent after the installation of traffic channelization devices. The Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings assigned a 75 percent effectiveness rating to traffic channelization devices over crossings equipped with two-quadrant gates, which is in general agreement with the studies.

## CONCLUSIONS

The installation of traffic channelization devices at highway rail grade crossings has proven to be a cost-effective means of improving safety. The traffic channelization devices provide a proven safety benefit without the same hindrances to mobility that occur with crossing closure or the costs associated with four-quadrant gate systems. Median barriers/traffic channelization devices that meet the criteria within the Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings are approved supplemental safety measures for the establishment of a quiet zone.

Implementing median barriers at a highway-rail grade crossing with active warning devices can reduce the risk of a collision at that crossing.

## REFERENCES

- [1] U.S. Department of Transportation, Federal Railroad Administration, Railroad Accident-Incident Reporting System—Highway-Rail Accidents, June 2009.
- [2] U.S. Department of Transportation, Federal Railroad Administration, “Guidance on the Use of Traffic Channelizing Devices at Highway-Rail Grade Crossings,” Washington, DC: U.S. DOT, January 2008.
- [3] Code of Federal Regulations Volume 4, Title 49 Parts 222 and 229, “Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings,” August 17, 2006.

## ACKNOWLEDGEMENTS

This work is performed under an interagency agreement between FRA’s Signals, Train Control, and Communications Division in the Office of Research and Development and the Volpe National Transportation Systems Center’s System Engineering and Safety Division.

## AUTHORS

Suzanne M. Horton  
Volpe Center  
Systems Engineering and Safety Division  
55 Broadway  
Cambridge, MA 02142  
Tel: (617) 494-3678  
E-mail: [Suzanne.Horton@dot.gov](mailto:Suzanne.Horton@dot.gov)

## CONTACT

Leonard Allen  
Federal Railroad Administration  
Office of Research and Development  
1200 New Jersey Avenue, SE – Mail Stop 20  
Washington, DC 20590  
Tel: (202) 493-6329 Fax: (202) 493-6333  
E-mail: [Leonard.Allen@dot.gov](mailto:Leonard.Allen@dot.gov)

## KEYWORDS

Traffic channelization devices, median barriers, highway-rail grade crossings, railroad safety