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Use of Locomotive Horns at Highway-Rail Grade Crossings; Interim Final Rule

warning systems in Pre-Rule Quiet Zones are upgraded, or new warning systems are installed, power-out indicators are required.

d. The gap between the ends of the entrance and exit gates (on the same side of the railroad tracks) when both are in the fully lowered, or down, position must be less than two feet if no median is present. If the highway approach is equipped with a median or a channelization device between the approach and exit lanes, the lowered gates must reach to within one foot of the median or channelization device, measured horizontally across the road from the end of the lowered gate to the median or channelization device or to a point over the edge of the median or channelization device. The gate and the median top or channelization device do not have to be at the same elevation.

e. ''Break-away'' channelization devices must be frequently monitored to replace broken elements.

Additionally, FRA is recommending that new installations conform to the following:

f. Gate timing should be established by a qualified traffic engineer based on site specific determinations. Such determination should consider the need for and timing of a delay in the descent of the exit gates (following descent of the conventional entrance gates). Factors to be considered may include available storage space between the gates that is outside the fouling limits of the track(s) and the possibility that traffic flows may be interrupted as a result of nearby intersections. It should be noted that the MUTCD recommends that exit gates should fail in the ''up'' position unless a traffic engineering study indicates otherwise.

g. A determination should be made as to whether it is necessary to provide vehicle presence detectors (VPDs) to open or keep open the exit gates until all vehicles are clear of the crossing. VPDs should be installed on one or both sides of the crossing and/or in the surface between the rails closest to the field. Among the factors that should be considered are the presence of intersecting roadways near the crossing, the priority that the traffic crossing the railroad is given at such intersections, the types of traffic control devices at those intersections, and the presence and timing of traffic signal preemption.

h. Highway approaches on one or both sides of the highway-rail crossing may be provided with medians or channelization devices between the opposing lanes. Medians should be defined by a non-traversable curb or traversable curb, or by reflectorized channelization devices, or by both. The installation of traffic channelization increases the effectiveness of the four quadrant gates and should be considered when looking at situations where it appears that motorists may be tempted to circumvent the warning devices.

i. Remote monitoring (in addition to power-out indicators, which are required) of the status of these crossing systems is preferable. This is especially important in those areas in which qualified railroad signal department personnel are not readily available.

Effectiveness:

FRA estimates effectiveness as follows:

Four-quadrant gates only, no presence detection: .82.

Four-quadrant gates only, with presence detection: .77.

Four-quadrant gates with medians of at least 60 feet (with or without presence detection): .92.

The estimate of .82 for free-standing four-quadrant gates (no medians and no presence detection) is a highly conservative figure involving a discount from documented experience. As noted above, four-quadrant gates installed in the United States thus far have been highly successful. North Carolina Department of Transportation (NCDOT) conducted a pilot study of a four quadrant gate system at the Sugar Creek Road crossing in Charlotte, NC. Following installation of the four quadrant gates, the number of violations fell by 86 percent. Traffic channelization was added later to the four quadrant gates, reducing violations to an even greater extent, by 97 percent. During the test, the train horn was also sounding. To account for any complementary effects of the train horn, FRA uses more conservative effectiveness rates of 82 percent and 92 percent for four quadrant gates without and with medians, respectively.

Four-quadrant gate installations undertaken thus far in the United States have generally not employed vehicle presence detection (VPD). However, some future installations will incorporate this feature to ensure coordination with other traffic signals and for other purposes. For instance, tight geometry may not allow for any storage space within the gates should queuing of traffic at a STOP sign on one side of the crossing prevent prompt clearance by a motor vehicle. In such cases, leaving the exit gates in the raised position may be elected. Installing VPD will cause exit gates to remain up indefinitely as one or more vehicles pass over the crossing. Although providing VPD avoids the scenario of ''entrapment'' (long feared by some in the railroad community as a liability risk), it also allows the possibility that some motorists will follow violators through the crossing in a steady stream, defeating the intended warning. Accordingly, where traffic channelization is not provided to prevent this pattern, we assume a lower effectiveness rate. FRA estimates that four-quadrant gates with presence detection, but without traffic channelization, would have an effectiveness rate of approximately .77.

By contrast, where four-quadrant gates are supplemented by lengthy traffic channelization to discourage the violation minded driver, the use of presence detection should make little or no difference in the safety effectiveness of the arrangement. The North Carolina demonstration showed that, when the four-quadrant gate installation was supplemented by medians (channelization devices) of at least 50 feet on each highway approach, the crossing experienced a 97 percent drop in violations. Again applying a discount to this illustration, FRA estimates an effectiveness rate of .92 for four-quadrant gates with traffic channelization of reasonable length.

It is important to re-emphasize that use of data regarding violations to estimate collision risk itself involves some hazard that effectiveness will be over- or under-estimated. FRA believes that the likelihood is that these estimates for four-quadrant gates are conservative, not only because of the excellent effectiveness of in-service four-quadrant installations, but also because of the North Carolina findings. In the North Carolina observations, as the number of violations decreased, the average number of seconds prior to arrival of the train also significantly increased (predicting that collisions might fall off at a faster rate than violations). The effectiveness of four-quadrant gates may thus be higher than the range stated above, both with and without medians and with presence detection.

It is also true that a variety of applications for these systems may result in a variety of effectiveness rates.

3. Gates With Medians or Channelization Devices

Keeping highway traffic on both highway approaches to a public highway-rail grade crossing in the proper lane denies the highway user the option of circumventing gates in the approach lanes by switching into the opposing (oncoming) traffic lane in order to drive around a lowered gate to cross the tracks.

FRA therefore is requiring that the following conditions be met.

a. Opposing traffic lanes on both highway approaches to the crossing must be separated by either: (1) Medians bounded by non-traversable curbs or (2) channelization devices.

b. Medians or channelization devices must extend at least 100 feet from the gate arm, or if there is an intersection within 100 feet of the gate, the median or channelization device must extend at least 60 feet from the gate arm. Driveways for private, residential properties (up to four units) are not considered intersections in calculating the required median length.

c. Intersections of two or more streets, or a street and an alley, that are within 60 feet of the gate arm must be closed or relocated. Driveways for private, residential properties (up to four units) within 60 feet of the gate arm are not considered to be intersections under this part and need not be closed. However, consideration should be given to taking steps to ensure that motorists exiting the driveways are not able to move against the flow of traffic to circumvent the purpose of the median and drive around lowered gates. This may be accomplished by the posting of ''no left turn'' signs or other means of notification. For the purpose of this part, driveways accessing commercial properties are considered to be intersections and are not allowed. It should be noted that if a public authority cannot comply with this 60 feet requirement, it may apply to FRA for a quiet zone under § 222.39(b), ''Public authority application to FRA.'' During the comment period FRA was made aware of many circumstances in which roadways parallel to the tracks would not physically accommodate a 60 feet median. It was always FRA's intent to allow public authorities to apply to FRA for consideration of SSMs that do not fully comply with the provisions of Appendix A. There should be many circumstances in which medians or traffic channelization of less that 60 feet in length may sufficiently reduce risk in order to permit the creation of a quiet zone. FRA will review such applications and give them due consideration.

d. Crossing warning systems must be activated by use of constant warning time devices unless existing conditions at the crossing would prevent the proper operation of the constant warning time devices. FRA has been made aware that constant warning devices may not work properly under certain circumstances such as in electrified territory. If conditions exist that would not allow constant warning time systems to work as intended, other appropriate types of control circuitry may be used. Constant warning time devices are not required to be added to existing warning systems in Pre-Rule Quiet Zones. However, if warning systems in Pre-Rule Quiet Zones are upgraded, or new warning systems are installed, constant warning time devices are required.

e. Crossing warning systems must be equipped with power-out indicators. Power-out indicators are not required to be added to existing warning systems in Pre-Rule Quiet Zones. However, if warning systems in Pre-Rule Quiet Zones are upgraded, or new warning systems are installed, power-out indicators are required.

f. The gap between the lowered gate and the curb or channelization device must be one foot or less, measured horizontally across the road from the end of the lowered gate to the curb or channelization device or to a point over the curb edge or channelization device. The gate and the curb top or channelization device do not have to be at the same elevation.

g. ''Break-away'' channelization devices must be frequently monitored to replace broken elements.

Effectiveness:

FRA estimates that channelization devices have an effectiveness of .75 and medians with non-traversable curbs with or without channelization devices have an effectiveness of .80. The installation of traffic channelization devices as part of North Carolina's ''Sealed Corridor'' demonstration project provides empirical data upon which to base an effectiveness rate. Traffic channelization devices were installed at the Sugar Creek Road crossing in Charlotte, NC. Prior to the traffic channelization devices being installed, the Norfolk Southern Corporation and NCDOT counted the number of motorists going around the crossing gates for twenty weeks. This data established a baseline traffic violation rate. The number of violations were then counted after installation of the channelization devices. Comparing the number of violations before and after the grade crossing treatment showed that violations decreased by 77 percent. As in the NPRM, FRA discounts this rate slightly for the novelty effect that may occur immediately following installation of the treatment and to account for the added safety benefit of the horn which was sounding during the study. FRA therefore assigns an effectiveness rate of 75 percent for traffic channelization devices. FRA reasons that medians with non-traversable curbs present a greater deterrence, and estimates their effectiveness rate at 80 percent. This reasoning is supported by data collected in Spokane County, WA where non-traversable medians reduced violations at the University Road crossing by 92 percent. The unusual physical and operating characteristics of the crossing are sufficiently different from an average crossing that FRA believes that the effectiveness rate in this study should be discounted when determining an effectiveness rate for a national rule.

4. One Way Street With Gates

This installation consists of one way streets with gates installed so that all approaching highway lanes are completely blocked. FRA is requiring that the following conditions are met.

a. Gate arms on the approach side of the crossing should extend across the road to within one foot of the far edge of the pavement. If a gate is used on each side of the road, the gap between the ends of the gates when both are in the lowered, or down, position should be no more than two feet.

b. If only one gate is used, the edge of the road opposite the gate mechanism must be configured with a non-traversable curb extending at least 100 feet.

c. Crossing warning systems must be activated by use of constant warning time devices unless existing conditions at the crossing would prevent the proper operation of the constant warning time devices. FRA has been made aware that constant warning devices may not work properly under certain circumstance such as in electrified territory. If conditions exist that would not allow constant warning time systems to work as intended, other appropriate types of control circuitry may be used. Constant warning time devices are not required to be added to existing warning systems in Pre-Rule Quiet Zones. However, if warning systems in Pre-Rule Quiet Zones are upgraded, or new warning systems are installed, constant warning time devices are required.

d. Crossing warning systems must be equipped with power-out indicators. Constant warning time devices are not required to be added to existing warning systems in Pre-Rule Quiet Zones. However, if warning systems in Pre-Rule Quiet Zones are upgraded, or new warning systems are installed, constant warning time devices are required.

Effectiveness: FRA does not have an empirical data source for an effectiveness rate for one way streets with gates. FRA reasons that as this SSM will fully block approach lanes to the highway rail crossing, it's effectiveness should be similar to other measures that physically prevent a motorist from entering a crossing when

the gates are activated. In this respect, one way streets with gates functions like four quadrant gates without medians, and FRA estimates an effectiveness rate of 82 percent.

Appendix B—Alternative Safety Measures

Introduction

Section 222.39(b) provides that a public authority may apply to FRA for approval of a quiet zone that does not meet the standards for public authority designation under § 222.39(a). Under § 222.39(b) a quiet zone application may be presented to FRA for consideration. Public authority application provides two unique benefits towards the creation of a quiet zone. The first benefit is the ability to use SSMs that may not conform to all of the requirements in Appendix A. FRA received many comments indicating that traffic channelization would not be practical due to parallel roadways that were closer than 60 feet. Under Appendix B, short traffic channelization devices may be considered. The second benefit is the ability to use programmed law enforcement, public education and awareness programs and photo enforcement to reduce risk and to compensate for the loss of the train horn. A public authority must receive written FRA approval of its quiet zone application prior to the silencing of train horns.

As with quiet zones created using the public authority designation method, credit will be given for closing of public highway-rail grade crossings. It will be necessary to adjust the baseline severity risk index at other crossings by increasing traffic counts at neighboring crossings as input data to the severity risk formula. If nearby grade separations are expected to carry some or all of the traffic, it will not be necessary. FRA Regional Managers for Grade Crossing Safety will be available to assist in performing the required analysis.

Appendix B addresses two types of ASMs-modified SSMs and non-engineering ASMs. Modified SSMs are SSMs that do no fully comply with the provisions listed in Appendix A. Depending on the resulting configuration, modified SSMs may still provide a substantial reduction in risk and can contribute to the creation of quiet zones. Non-engineering ASMs are programmed law enforcement, public education and awareness programs; and photo enforcement efforts that may be used to reduce risk in the creation of a quiet zone. It should be noted that if non-engineering ASMs are proposed, the application must demonstrate their effectiveness through the collection and analysis of data collected at the crossings. Periodic monitoring will be required throughout the existence of the quiet zone in order to show that the ASM is still effective. The public authority must receive written FRA approval of the quiet zone application prior to the silencing of train horns. The public authority is strongly encouraged to submit the application to FRA for review and comment before the Appendix B treatments are initiated to ensure that the proposed modified SSMs and/or non-engineering ASMs will meet with FRA's approval. If non-engineering ASMs are proposed, the public authority may wish to confirm with FRA that the sampling methods are appropriate. Submitting the application for review prior to implementation will enable FRA to provide comments to assist the public authority in developing a quiet zone plan that will be acceptable.

Modified SSMs

a. If there are unique circumstances pertaining to a specific crossing or number of crossings which prevent the SSMs from being fully compliant with all of the SSM requirements listed in Appendix A, those SSM requirements may be adjusted or revised. In that case, the SSM, as modified, will be treated as an ASM under this Appendix B, and not as a SSM under Appendix A, so that its safety effects may be evaluated. By using modified SSMs, a locality will be able to tailor the use and application of various SSM-types of applications to a specific set of circumstances (*e.g.* being able to use traffic channelization devices of less than 60 feet in length). Thus, a locality may propose a quiet zone that contains modified SSMs at a number of crossings, that due to specific circumstances, could not have been treated with an Appendix A SSM and would have to be omitted from the proposed quiet zone. FRA will review the proposed quiet zone, and will approve the proposal if it finds that the Quiet Zone Risk Index is reduced to the level that would be expected with sounding of the train horns or to the Nationwide Significant Risk Threshold.

b. Estimates of effectiveness may be proposed based upon adjustments from the effectiveness levels provided in Appendix A or from actual field data derived from the crossing sites. The application should provide an estimate for the effectiveness of the proposed ASM and the rationale for the estimate. For example, in Appendix A the effectiveness of a 60 foot traffic channelization device is .75. A public authority may propose for consideration that an effectiveness rate of .60 for a traffic channelization device that is 45 feet in length would be appropriate. The specific crossing and applied mitigation measure will be assessed to determine the effectiveness of the modified SSM. FRA will continue to develop and make available effectiveness estimates and data from actual experience under the rule.

c. The following engineering types of ASMs may be included in a proposal for approval by FRA for creation of a quiet zone. SSMs that are listed in Appendix A may be used for purposes of modified SSMs. If one or more of the requirements associated with an SSM as listed in Appendix A is revised or deleted, data or analysis supporting the revision or deletion must be provided to FRA for review. These SSMs include: (1) Temporary Closure of a Public Highway-Rail Grade Crossing, (2) Four-Quadrant Gate System, (3) Gates With Medians or Channelization Devices, and (4) One-Way Street With Gate(s). A discussion of these safety measures may be found in the discussion of Appendix A.

Non-Engineering ASMs

The following non-engineering ASMs may be used in the creation of a Quiet Zone. The method for determining the effectiveness of the non-engineering ASMs, the implementation of the quiet zone, subsequent monitoring requirements, and provision for dealing with an unacceptable effectiveness rate are provided in paragraph b.

1. *Programmed Enforcement:* Community and law enforcement officials commit to a systematic and measurable crossing monitoring and traffic law enforcement program at the public highway-rail grade crossing, alone or in combination with the Public Education and Awareness option.

Required:

a. Subject to audit, a statistically valid baseline violation rate must be established through automated or systematic manual monitoring or sampling at the subject crossing(s).

b. A law enforcement effort must be defined, established and continued along with continual or regular monitoring.

2. *Public Education and Awareness:* Conduct, alone or in combination with programmed law enforcement, a program of public education and awareness directed at motor vehicle drivers, pedestrians and residents near the railroad to emphasize the risks associated with public highway-rail grade crossings and applicable requirements of state and local traffic laws at those crossings.