

requires a minimum sound level of 96 dB at 100 feet from the front of the locomotive. The study also measured the frequency content of the wayside horn and using signal detection theory indicated that 99 percent of drivers with only a partial anticipation of a train event should hear the warning. No data were collected on actual driver behavior. This study provides information towards answering the first question suggested by the Volpe study. The sound level measured for the wayside horn meets FRA sound level requirement. Signal detection theory and measurement of the frequencies contained in the wayside horn indicate that the driver should be able to hear the wayside horn. Neither the Ames nor Fann study addresses questions two and three concerning directionality and credibility of the warning.

Texas Transportation Institute of Texas A&M University, was engaged by a manufacturer of a wayside horn system to revisit one of the crossings in Gering, NE to assess the level of driver compliance with the warning system after approximately six years of operation. Video data of driver behavior at the crossing was collected for 16 days. Driver compliance with the warning devices was then analyzed in the same manner as the 1995 Volpe study. The study, entitled *A Safety Evaluation of the RCL Automated Horn System* (Roop, May 2000), showed that after six years of operation of the wayside horn that driver compliance with the automatic warning devices at the crossing (flashing lights with gates) was slightly better than the baseline driver behavior observed when the locomotive train horn was used. It should be noted that there was a noticeable decrease in driver compliance with the use of the wayside horn from 1995 to 2000. However, driver behavior in 2000 with the wayside horn was still slightly better than the 1995 driver behavior with train horns. This research goes towards answering question number three.

After review of the accumulated experience with the use of wayside horns, FRA has determined that the use of wayside horns at crossings equipped with automatic flashing lights and gates as a replacement for train horns has merit under certain well-defined conditions. It has been clearly shown that wayside horns significantly reduce the noise footprint that a community would experience when compared to the routine sounding of train horns. At locations where wayside horns have been installed, community acceptance has been great and city officials cite that there has been no decrease in safety at

the crossings. TTI's study that revisited the original Gering, NE study after six years of wayside horn use indicates that the wayside horn at that location is still as effective as the locomotive horns used during the baseline period.

The Northwestern University Center for Public Safety evaluated the effectiveness of the wayside horn at three crossings in Mundelein, Illinois. The study, entitled, *Evaluation of the Automated Wayside Horn System in Mundelein, IL* (Raub, Lucke, January 2003), utilized video monitoring of driver behavior, sound level measurements and survey instruments to: (1) Assess the impact of wayside horns on the behavior of drivers; (2) measure loudness of train horns and the wayside horns in neighborhoods; (3) obtain the opinions of locomotive engineers on perceived changes in driver behavior; and (4) obtain the opinions of residents on the differences between locomotive horns and wayside horns. The Village of Mundelein, located 35 miles north of Chicago, has 40 to 50 trains per day passing through. A baseline of driver behavior was collected for three months during which there were 10,382 gate activations. There were 367 incidents of drivers disregarding the active warning devices (flashing lights and gates) during this period. Locomotive horn use was then discontinued, and the use of the wayside horns was instituted. Data was not collected until four months had passed to allow for the novelty effect of the wayside horns to pass. Video data was then collected for three months during which there were only 97 incidents observed during the 8,683 gate activations. The study results indicated a 70 percent decrease in the number of times drivers disregarded the warning devices. Additionally, noise levels in residential and business areas located near the tracks decreased by 80 percent. As in the Ames, Iowa study, there was acceptance of the system by both the public and locomotive engineers. Ten out of the 12 locomotive engineers surveyed felt that the wayside horn was as safe, or safer, than the use of the locomotive horn. This study contributes towards answering question 2 by providing additional data on the effectiveness of wayside horns in reducing incidents of driver disregard of the warning devices. While the study does not quantitatively study question 2, it can be inferred from the data that the lack of directionality does not contribute to an increase in incidents of driver disregard of the warning devices.

The interim final rule issued today provides that wayside horns may be used in lieu of locomotive horns at

crossings equipped with automatic flashing lights and gates. See § 222.59. Although clearly a wayside horn produces sound, because of its lower noise impact on the surrounding community, it may be installed within a quiet zone if the public authority determines that it is appropriate to do so. If used within a quiet zone, the risk at a crossing equipped with wayside horns will not be included in calculating the Quiet Zone Risk Index or Crossing Corridor Risk Index. It also should be noted that wayside horns have not yet been classified by FHWA as traffic control devices. If FHWA does classify them as traffic control devices, the wayside horn must also be approved in the Manual on Uniform Traffic Control Devices (MUTCD) or FHWA must approve experiments pursuant to section 1A.10 of the MUTCD.

13. Horn Sound Level and Directionality

Train horns are clearly a major source of unwanted noise in communities through which active railroad lines pass. FRA included in the NPRM provisions designed to limit the dispersal of horn noise into the community where the sound does not serve its warning purpose. These provisions were a maximum limit on horn sound output and a limit to sound emanating to the side of the locomotive. FRA has a long history of working with the railroad industry to improve locomotive cab working conditions and has been sensitive in this rulemaking to balance the need to reduce noise exposure to operating crews with community noise concerns. With the release of the NPRM and accompanying Draft Environmental Impact Statement, FRA gave needed consideration to the mitigation of locomotive horn noise on communities.

The NPRM proposed limiting the horn sound emanating to the side of the locomotive to no more than the sound measured to the front, and FRA had anticipated that this might cause railroads to modify their horns to reduce some of the unwanted noise. Many commenters supported these provisions and strongly favored reducing maximum horn sound output levels from the high levels in general use. The NPRM discussed a maximum sound level from horns of 104dB(A) for crossings with active warning devices and 111dB(A) for passively signed crossings. Communities generally commented in favor of using the lower sound level in all cases. On the other hand, the NTSB commented that there is a need for high sound levels to