National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: January 22, 2002

In reply refer to: H-01-39 through -41

Honorable Jeffrey W. Runge
Administrator
National Highway Traffic Safety Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

On March 28, 2000, about 6:40 a.m. (sunrise was at 6:33 a.m.), a CSX Transportation, Inc., (CSXT) freight train traveling 51 mph struck the passenger side of a Murray County, Georgia, School District school bus at a railroad/highway grade crossing near Conasauga, Tennessee.[1] The accident occurred as the school bus was crossing the tracks at a speed of approximately 15 mph. During the accident sequence, the driver and three children were ejected. Two ejected passengers received serious injuries and one was fatally injured. The driver, who had been wearing a lap/shoulder belt that broke during the crash sequence, received minor injuries. Of the four passengers who remained inside the bus, two were fatally injured, one sustained serious injuries, and one, who was restrained by a lap belt, received minor injuries. The two train crewmembers were not injured.

One safety issue examined by the National Transportation Safety Board in its investigation of this accident was the busdriver's ability to hear the train horn. Locomotive event recorder data from the train involved in the Conasauga accident indicate that the train horn was activated for about 3 seconds when the train was 952 feet from the crossing and then continuously for 9 seconds (a minimum of 574 feet) before the collision. The busdriver had the radio on, and a speaker was positioned above her head. Additionally, the two panels above the driver's head were covered with sound attenuation material.[2]

With the door closed and the radio on (the conditions at the time of the accident), audibility testing revealed that the sound of the horn was only 4 decibels greater than the ambient

[1] For more information, read: National Transportation Safety Board, *Collision of CSXT Freight Train and Murray County, Georgia, School District School Bus at Railroad/Highway Grade Crossing in Conasauga, Tennessee, on March 28, 2000,* Highway Accident Report NTSB/HAR-01/03 (Washington, DC: NTSB, 2001).

[2] While it is unclear how much this material contributed to the driver's inability to hear the train horn, it may have absorbed some of the horn sound. The Safety Board remains concerned about the effects of sound attenuation material on a driver's ability to hear an alerting signal. As explained in the Fox River Grove, Illinois, report, sound attenuation material reduced the volume of both the train horn and the warnings shouted by bus passengers in that accident. For more information, read: National Transportation Safety Board, *Collision of Northeast Illinois Regional Commuter Railroad Corporation (METRA) Train and Transportation Joint Agreement School District 47/155 School Bus at Railroad/Highway Grade Crossing in Fox River Grove, Illinois, on October 25, 1995,* Highway/Railroad Accident Report NTSB/HAR-96/02 (Washington, DC: NTSB, 1996).

noise when the train was 1,268 feet from the crossing; the horn was barely detectable to a volunteer busdriver. To be identified, a sound must be 3 to 9 decibels above the threshold of detection;[3] to reach the alerting level, it must be at least 10 decibels above the ambient noise level.[4] Since the sound level increases by about 6 decibels when the distance is halved, at 574 feet (the point where the horn was sounded continuously), the sound of the horn would have been about 11 decibels above the threshold of ambient noise. During the accident sequence, with the radio on and the door and window closed, the audio portion of the videotape did not pick up the sound of the horn over the ambient noise. During testing, with the radio off and the door open, even at 1,268 feet, the sound level of the horn was 25 decibels above that of the ambient noise, and a driver would probably be able to detect the sound and be alerted to the approaching train. Therefore, the Safety Board concluded that the driver did not stop, had the radio on, and the door closed; thus she had difficulty detecting the train horn and was probably unaware of the presence of the train.

The Safety Board made two recommendations concerning bus speakers to the National Association of State Directors of Pupil Transportation Services (NASDPTS) in the 1996 Fox River Grove, Illinois, highway accident report:[5]

> H-96-50
> Develop guidelines for the appropriate placement of radio speakers and use of radios on school buses and disseminate these guidelines to your members.
>
> H-96-51
> Advise your members to check their school district buses and disable any radio speakers located immediately adjacent to the school bus drivers' heads.

The NASDPTS informed the Safety Board that it had surveyed the States and found that a majority of the States had prohibited, or had legislation pending that prohibited, radio speakers in the driver's compartment. The remaining States reviewed their policies on use of radios and radio speakers in school buses and stated that the policies were adequate to ensure that drivers can hear critical auditory information. Georgia informed its local school districts of the need to follow proper procedures, including turning off speakers, when crossing railroad tracks. The State did not require school districts to disconnect the speakers adjacent to the driver's head; Georgia left that decision to the local school districts. In October 1998, the National Safety Council revised its "Recommended Procedures for School Bus Drivers at Railroad Grade Crossings" to remind drivers of the importance of turning off radios at railroad/highway grade crossings; the revision was incorporated in the *2000 National School Transportation Specifications and Procedures*. Based on the NASDPTS survey and the association's efforts to inform its members of the hazards of not turning off the radio at grade crossings, Safety

[3] The "threshold of detection" is the level at which a person is aware of a sound.

[4] For more information, read: Stanley C. Skeiber, Robert L. Mason, and R. C. Potter "Effectiveness of Audible Warning Devices on Emergency Vehicles, Sound and Vibration," February 1978, pp. 14-22.

[5] For more information, read: NTSB/HAR-96/02.

Recommendations H-96-50 and –51 were classified "Closed—Acceptable Alternate Action"[6] on February 19, 1999.

Despite the NASDPTS' efforts, the 1-year-old school bus involved in this accident was equipped with a radio speaker adjacent to the driver's head. Speakers adjacent to a school bus driver's head probably contribute the most to masking exterior sounds, such as train horns, but air conditioning, heaters, defrosters, wiper motors, and other sounds also help mask exterior sounds. In addition, to exacerbate the audibility problem, the driver in the Conasauga accident did not follow prescribed policy to turn down the volume at railroad/highway grade crossings. The Safety Board understands from the NASDPTS' response to Safety Recommendations H-96-50 and -51 that the speakers are also used to transmit important information to the driver via two-way radio from the school district dispatcher. While the Safety Board agrees that information from the dispatcher is important, use of the speakers for music or entertainment broadcasts is not critical and can hamper the driver's ability to hear external auditory alerts.

The Safety Board also examined passenger survivability during its investigation of this accident. In this accident, as well as other school bus accidents the Safety Board has investigated, passengers sustained serious or fatal injuries due to impact with sidewall components. The unrestrained passengers on the driver side of the bus in this accident were propelled out of their seating compartment and received serious or fatal injuries as a result of such impacts. In several accidents discussed in the Safety Board's *Bus Crashworthiness Issues* report (Holmdel, New Jersey; Monticello, Minnesota; and Easton, Maryland),[7] passengers away from the impact area were also propelled laterally out of their seating compartments and sustained serious and fatal injuries due to contacting non-energy absorbing surfaces.

Even passengers seated on the same side as, but not in, the area of impact (such as the passenger in the first row in this accident), have struck non-energy absorbing sidewalls and components during a collision. In the Fox River Grove accident,[8] a passenger seated away from the impact area but on the same side of the bus as the impact sustained a fatal head injury and an abrasion across the forehead that matched the perforated sound panel pattern on the upper left side of the bus interior. The Safety Board concluded that even those passengers who are outside the area of impact and remain within their compartments can receive serious or fatal injuries due to impact with non-energy absorbing components within a school bus.

Sidewall components, such as window frames, screws and joints, and overhead storage rack supports are located throughout the interior of the passenger compartment, as are the sides of the seat frames,[9] yet are exempt from the *Federal Motor Vehicle Safety Standards* for passenger protection in school buses. Although energy-absorbing materials on the window frames, sidewall panels, roof racks, sides of seat frames and modesty panels might benefit

[6] The recommendations received this classification because the actions taken met the intent of the recommendations, even though formal guidelines were not developed, and school districts were reminded of the hazards of speaker use when approaching railroad tracks, but were not specifically told to disable the speakers.

[7] For more information, read: National Transportation Safety Board, *Bus Crashworthiness Issues*. Highway Special Investigation Report NTSB/SIR-99/04 (Washington, DC: NTSB, 1999).

[8] For more information, read: NTSB/HAR-96/02.

[9] Or in the case of the first row in this accident, the modesty panels.

passengers who impact these locations, school bus passengers are not afforded the benefit of energy-absorbing surfaces on these structures and components. If these components were included in the passenger protection requirements of Federal Motor Vehicle Safety Standard 222, "School Bus Passenger Seating and Crash Protection," passenger injuries would probably be mitigated. The Safety Board concluded that Federal Motor Vehicle Safety Standard 222 exempts sidewall components and sides of seat frames within the passenger compartment of school buses, thereby exposing passengers to these injury-producing components in lateral impact collisions.

Another safety issue highlighted by the circumstances of this accident was the benefit of automatic crash notification (ACN) systems. This particular accident was reported in a timely manner due to prompt action by a passerby familiar with the accident area. However, the outcome could have been less timely because the accident occurred in a rural area where traffic is not heavy. An ACN system on the school bus would have detected the crash immediately and transmitted the crash information, as well as the precise location, obtained via a global positioning system, to the local 911 center. Had such a system been in place, the school bus passengers would not have had to rely on a passerby to place the call or on the driver, who was incapacitated, to call 911. In this accident, the locomotive conductor notified CSXT of the accident, and CSXT then notified the 911 center; but not all accidents involve vehicles in which the driver (or in this case the train crew) is able to place an emergency call.

Because school buses often carry many children, quick and adequate emergency response is important if all children are to be treated expeditiously, particularly those with serious injuries. The more information provided to an emergency dispatch center, the better the response is likely to be. An ACN system can transmit information on the severity of the crash, the vehicle dynamics, and the location. Some systems include a voice communication line that automatically opens so that the emergency response center can communicate directly with the driver, if the driver is capable. If the school bus in this accident had been equipped with an ACN system, a call would have immediately been forwarded to the 911 center, either directly or through a relay center, and the 911 dispatcher would have known the exact location of the accident. A more advanced ACN system would have relayed information about the severity of the crash, indicating to the dispatcher a need to send multiple responders. The time lag would most likely have been less than 2 minutes from the time of the collision to the time when emergency response was dispatched.

Currently available ACN systems have helped reduce emergency response time, thereby leading to more lives saved.[10] In an operational test in New York, emergency notification was sent to the sheriff's office within 2 minutes of the accidents that occurred.[11] Cellular telephone system coverage has expanded and geolocation systems have become more accurate; as a result, ACN system accuracy has improved. While the school bus passengers in this accident were fortunate in the actions of a quick-thinking passerby and a train crew that was able to place an

[10] For more information, read: W. Evanco "Reducing Accident Fatalities with Rural Mayday Systems," Mitretek Systems, Inc. WN96W0000048, April 1996, in U.S. Department of Transportation, Federal Highway Administration, *Review of ITS Benefits: Emerging Successes*, FHWA-JPO-97-001, HVH 1/10-96(1M0) E (Washington, DC: FHWA) 19.

[11] For more information, read: B. Donnelly, D. Schabel, A.J. Blatt, and A. Carter, "The Automated Collision Notification System," *International Symposium on Transportation Recorders, May 3-5, 1999* (Washington, DC: National Transportation Safety Board and International Transportation Safety Association, 1999).

emergency call, severe accidents, particularly in rural areas, do not always occur in such circumstances.

In such situations, ACN systems can help emergency call centers dispatch emergency responders to locations more expeditiously, particularly in rural areas or when drivers are incapacitated. The Safety Board concluded that, given the limited amount of traffic traversing Liberty Church Road, emergency response might have been delayed if the passerby had not noticed the accident or if the train crew had been incapacitated. While ACN systems are already available on cars, testing of such systems on school buses has yet to be done. While the cellular technology would be compatible with any vehicle, testing of ACN systems on school buses is needed to evaluate factors such as vehicle dynamics and crash severity.

Therefore, the National Transportation Safety Board recommends the National Highway Traffic Safety Administration:

> Implement rulemaking to prohibit radio speakers used for music or entertainment from being placed adjacent to drivers' heads in school buses. (H-01-39)
>
> Develop and incorporate into the *Federal Motor Vehicle Safety Standards* performance standards for school buses that address passenger protection for sidewalls, sidewall components, and seat frames. (H-01-40)
>
> Evaluate the feasibility of incorporating automatic crash notification systems on school buses and, if feasible, proceed with system development. (H-01-41)

The Safety Board also issued safety recommendations to the States, the Federal Highway Administration, the Georgia Department of Education, the National Association of State Directors of Pupil Transportation Services, and the school bus manufacturers. The Safety Board also reiterated a recommendation to the U.S. Department of Transportation.

Please refer to Safety Recommendations H-01-39 through -41 in your reply. If you need additional information, you may call (202) 314-6607.

Chairman BLAKEY, Vice Chairman CARMODY, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

Original Signed

By: Marion C. Blakey
Chairman

Safety Recommendation Reiteration List

SR Number	Reiteration Number	Report Number	Report Date	Accident Description	Accident City	Accident State	Accident Date
H-01-040	1	HAR-13-01	7/23/2013	School Bus and Truck Collision at Intersection	Chesterfield	NJ	2/16/2012