Log H-577

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C. 20594

Safety Recommendation

Date: December 13, 1994

In Reply Refer To: H-94-10 and -11

Honorable Ricardo Martinez
Administrator
National Highway Traffic Safety Administration
Washington, D.C. 20590

About 3:28 p.m. on November 10, 1993, near Snyder, Oklahoma, a tractor-semitrailer traveling southbound on U.S. Route 183 struck a 1993 Thomas Built Minotour school bus that was crossing the highway while traveling west on County Line Road. The 20-passenger school bus was occupied by the driver and nine children. The school busdriver said that she stopped at the stop sign and then proceeded to drive across Route 183. The truckdriver stated that the school busdriver hesitated and then pulled out in front of his truck. The school bus was struck in the right side behind the right-front entrance door. Eight children were not wearing the available lapbelts and were ejected. Four of the ejected children died; the injuries of the other four ranged from minor to serious. One child, the only occupant of the bus who was restrained, was not ejected; he received minor injuries. The school busdriver was not ejected, but she was not wearing the lap-shoulder restraint and sustained severe injuries from contact with various parts of the bus interior. The truckdriver, who stated that he was wearing his lapbelt, received minor injuries.[1]

[1] For more detailed information, read Highway Accident Report--*Collision of School Bus with Tractor-Semitrailer near Snyder, Oklahoma, November 10, 1993* (NTSB/HAR-94-04).

The National Transportation Safety Board determines that the probable cause of the accident was that the school busdriver did not see the approaching truck because her view was obstructed, because she had not been provided with an effective strategy or other means for overcoming the view obstruction, and because she may have been distracted by the unruly passengers. Contributing to the severity of the accident was the truckdriver's failure to observe the speed advisory and the Cornell Construction Company's failure to systematically maintain the accident truck.

Based on the collision dynamics, the physical evidence, and the location of the ejected occupants, the Safety Board believes that the following occupant kinematics probably occurred. The school bus was traveling west through the intersection. When the truck struck the right side of the school bus, its mass and speed caused the school bus to suddenly acquire momentum in a perpendicular direction--south. The unrestrained occupants of the school bus almost immediately collided with the truck, with the right-side interior of the school bus, or with each other. At that point, their momentum, like that of the bus, suddenly changed from westward to southward. Simultaneously, the bus began to rotate clockwise. The unrestrained students, who were now pressed against the right-side interior of the bus, also experienced this rotation. Centripetal force kept them pinned against the right side as the bus rotated while moving south. Some of the occupants might have been partly ejected at this point. The school bus separated from the truck, continued southward, and moved onto the dirt embankment. Its right rear dug into the ground, and the vehicle suddenly lost momentum. Most of the occupants were probably fully ejected at this point as a result of the loss of momentum, the rotational forces, or a combination of both. Five occupants were ejected and thrown clear of the bus. They were followed by three other occupants who were ejected close to the bus. The bus tilted toward its right side and either dragged or ran over these three occupants as it continued down the embankment.

The Safety Board concludes that if the unrestrained passengers had been wearing the available lapbelts, none of them would have been ejected. Prospects for survival might have been better for three of the children who were killed. Two of the children who survived might have received less severe injuries. One seriously injured child who survived might have been killed, depending on her position on the bench seat. For two children--one who received minor injuries and one who was killed--the outcome probably would have been the same.

Safety officials, manufacturers, researchers, and advocates continue to disagree regarding the benefits of lapbelts in both large and small school buses. A 1989 safety study, *Crashworthiness of Small Poststandard School Buses* (NTSB/SS-89/02), concluded that small school buses generally provide good crash protection to both restrained and unrestrained passengers and that seating position is more important than restraint status in determining injury severity. In small school bus accidents, seating position will continue to be an important factor in determining injury severity, and lapbelts probably will not protect occupants in the impact area. In addition, crash test research suggests that in severe frontal school bus collisions, spinal and head injuries can result from the use of lapbelts. Because the data regarding this controversy are inconclusive, the Safety Board will investigate school bus accidents involving restrained

children and will focus on the occupant injury-kinematics correlation to determine whether lapbelts provide additional protection or cause injury.

Nonetheless, this accident demonstrates that the use of lapbelts can prevent occupant ejections. In addition, neither NHTSA nor the Safety Board has identified any accident in which a school bus fatality was due to a seatbelt-induced injury. Furthermore, the technological advances in passive and active occupant protection for passenger and commercial vehicles have not been broadly applied to school buses.

The Safety Board attempted to determine why the school busdriver drove in front of the approaching tractor-semitrailer. The weather was clear, the road was dry, and about 100 feet from the intersection, the view of the highway to the north is clear. The school busdriver was operating a vehicle that had been regularly assigned to her since the beginning of the school year. She was familiar with the highways and secondary roads because she had driven the same route for about 12 months--during the previous school year and the first 3 months of the current school year. She was apparently concerned about safety; for example, the school district's director of transportation said that this school busdriver had recommended the installation of CB radios and had reported the view obstruction problem on the right side of the Minotour school bus. In disciplining the passengers just before the accident, she followed the procedures prescribed in the training course; she stopped at the stop sign and then reprimanded the children. The Safety Board's view obstruction tests determined that the sun would not have affected the school busdriver's vision at the intersection. In addition, there is no evidence that the school busdriver was impaired by loss of sleep or by the use of alcohol or other drugs.

Nonetheless, the school busdriver stated that she did not see the approaching tractor-semitrailer when she started across Route 183. She said that she had looked twice for crossing traffic and that before entering the intersection, she had moved the school bus several feet forward to improve her view to the right. She apparently entered the intersection because she believed the highway was clear of traffic.

The right-front vertical support structure of the school bus created a view obstruction 8 1/2 inches wide. Safety Board investigators calculated an angle of obstruction between 75 and 83.5 degrees. The positions of the school bus and truck relative to each other in distance and time are not known. However, in four tests--two at 10 feet from the highway edge and two at 30 feet--the tractor-semitrailer was obscured from view about 7 seconds from impact and remained obscured for 4 seconds.

The school busdriver told the Safety Board that she was aware of the view obstruction and that she dealt with the problem by stopping at intersections, slowly moving forward, and stopping again. This technique would not circumvent the blind spot and would in fact prolong its duration because the occluded zone would move forward with the bus. Although the Safety Board's tests indicated a view obstruction of about 4 seconds, these tests were conducted with a stationary school bus. Before the accident, however, the school bus, as well as the truck, was moving toward the point of impact, increasing the period of time that the truck was obstructed

from the school busdriver's view. Therefore, the Safety Board concludes that because of the right-front vertical support structure, the approaching truck may have been obscured from the school busdriver's view for 5 to 7 seconds before the collision.

A similar accident investigation in Canada supports these findings. On June 8, 1994, in Sudbury, Ontario, a 65,000-pound Freightliner dump truck traveling 55 mph in a 60-mph zone struck a 48-passenger Bluebird school bus that was crossing a 5-lane highway. Although the highway was straight and level and the weather was clear, the busdriver apparently did not see the truck. Transport Canada investigators conducted view-obstruction tests similar to those conducted by the Safety Board in the Snyder case. Transport Canada found that with the bus in a stationary position, the truck would have been obscured from the school busdriver's view for 3 to 5 seconds.

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

> Evaluate occupant restraint systems, including those presently required, for small school buses. Based on the results of this evaluation, require the installation of those systems that prove to be effective in reducing occupant deaths, injuries, and ejections. (Class II, Priority Action) (H-94-10)
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> In cooperation with the National Association of State Directors of Pupil Transportation Service, identify design or equipment modifications that will reduce the view obstructions in school buses. (Class II, Priority Action) (H-94-11)

Also, the Safety Board issued Safety Recommendations H-94-12 to the Federal Highway Administration, H-94-13 and -14 to the Governors of the 50 States and the mayor of the District of Columbia, H-94-15 and -16 to the National Association of State Directors of Pupil Transportation Service, and H-94-17 to the Cornell Construction Company, Inc. If you need additional information, you may call (202) 382-6850.

Chairman HALL and Members LAUBER and HAMMERSCHMIDT concurred in these recommendations.

By: Jim Hall
Chairman