National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation H-546

Date March 19, 1990
In reply refer to: H-89-46 through -52

Honorable Jerry R. Curry
Administrator
National Highway Traffic Safety Administration
400 7th Street, S.W.
Washington, D.C. 20590

In 1977, a series of new and modified Federal Motor Vehicle Safety Standards (FMVSS) for school buses became effective, mandating different performance standards for school buses compared to other buses. Data on the crash performance of school buses built to these standards were lacking, so the National Transportation Safety Board conducted a series of in-depth accident investigations from 1984 to 1988 to determine how well Federal school bus standards are working to protect passengers from injury and whether changes in the standards are needed. Two reports were planned because Federal standards and guidelines differentiate between school buses by size.

The first report, published in 1987, examined the crash performance of Type C and Type D school buses (the types commonly called large or Type I school buses) built after the new standards for school buses became effective.1/ The second report on school bus safety is now completed; it focuses on the performance of poststandard Type A and Type B school buses (the types referred to in some statistics as small or Type II school buses).

The safety issues relevant to small school buses,and the basis for the subsequent recommendations issued by the Safety Board, are discussed in detail in the publication about the study.2/ Copies of the publication are enclosed. Sections of particular relevance to the NHTSA are described below.

1/ National Transportation Safety Board. 1987. Safety study: Crashworthiness of large poststandard schoolbuses. NTSB/SS-87-01. Washington, DC. 300 p.

2/ National Transportation Safety Board. 1989. Safety study: Crashworthiness of small poststandard school buses. NTSB/SS-89/02. Washington, DC. 223 p.

Restraining Barriers (pages 33-50)

This section provides the basis for the Safety Board's recommendations regarding the installation of lap/shoulder belts and research to determine appropriate barrier design on Type A school buses. The findings of the Safety Board's study cases and Transport Canada crash tests suggest that occupants of the front rows of Type A school buses, regardless of whether they are lapbelted or unrestrained, are at increased risk of head injury.

The Safety Board investigations conducted for this study cannot provide a clear answer for how to resolve the restraining barrier problem. The accidents investigated for this "case" study document that a problem exists in Type A school buses, but they do not provide enough data for the solution. A case study provides accurate and comprehensive data on each case in contrast to other data sources. However, because of the limited number of cases and many variables that influence injury outcome (for example, crash configuration and severity, barrier design, restraint status, seating position, passenger size and age), a case study cannot isolate the variables. All variables interact to influence injury outcome.

Accident data files maintained at the State or Federal level will not provide needed data. Aside from the inaccuracies of restraint and injury status noted in the report, such files do not record seating position (hence, the researcher has no way of knowing what passengers were seated in the front rows), nor do they record whether the school bus was a Type A vehicle. Without tracing the Vehicle Identification Number (VIN), a researcher cannot know what type of frontal barrier, if any, was present in the bus. Even determining the make and model of the small school bus will not reveal this information because States and local school districts often order small school buses with custom options; for example, a specific type of frontal barrier.

Data from Canadian crash tests suggest that merely requiring that Type A school buses have frontal restraining barriers identical to those mandated in larger school buses (Types B, C, and D) will not provide a solution for head protection. Lapbelted anthropomorphic dummies seated in the front seats of Type A school buses equipped with barriers used for large school buses registered unacceptable head injury scores, more than twice the allowable limit.

Hence, the Safety Board believes that the NHTSA should conduct research to determine the relationship between restraining barrier design and injuries to unrestrained and lapbelted passengers of different sizes. Research should focus on the height, width, location, and anchorage strength of the barrier, and the spacing between the barrier and front seats. (Resultant data should help determine the optimum design for seating throughout the bus, regardless of bus size.)

The Safety Board also believes that NHTSA should determine the feasibility of installing some form of restraint that provides upper torso restraint on school buses. Current Federal regulations applicable to Type A school buses require that at least a lapbelt be provided for each passenger, and other Federal guidelines state that these belts should be worn. If student passengers must be belted, they should have the option of the superior protection afforded by a lap/shoulder belt or another form of restraint that provides upper torso protection. If States and school districts wish to order large school buses with restraint systems, they also should be able to provide upper torso restraints. Finally, if lapbelts prove to be the only seatbelt system that can be installed, the NHTSA should actively research the possibility of requiring rear-facing seats for small school buses. Additional requirements for mirrors may be necessary to allow the school bus driver to observe passenger behavior.

Structural Integrity (pages 51-60)

This section provides the basis for the Safety Board's recommendations regarding the need for a windshield retention standard and new evaluation of Federal standards applicable to roof and joint strength for school buses with a GVWR of less than 10,000 pounds. Discussion of inadvertent door opening during a crash is also included in this section.

An occupant's chances of surviving a school bus crash are enhanced if he or she remains within the vehicle. The primary defense against ejection is the structural integrity of the vehicle; floor, roof, and side panel joints must not separate, and bus windows and doors must not open during a crash. Any opening in the school bus offers opportunity for occupants to be ejected. Another defense would be seatbelt use, but ejection is still possible if the belt is worn loosely, or if the seat or seatbelt anchors are compromised. In addition, available seatbelts are not always worn.

In the cases investigated for this study, the Safety Board documented that the front windshields in school buses became dislodged, side boarding doors opened, roofs deformed, and body joints separated. Not only did this damage expose passengers to the possibility of ejection, but the deformation and exposed metal edges created potential for injury if contacted.

As a result of this safety study, the National Transportation Safety Board recommends that the National Highway Traffic Safety Administration:

Determine the feasibility of requiring lap/shoulder belts or other restraint systems that provide upper torso restraint at front seat passenger seating positions on Type A school buses (gross vehicle weight rating of 10,000 pounds or less). Amend Federal Motor Vehicle Safety Standard (FMVSS) 222, "School Bus Passenger Seating and Crash Protection," and FMVSS 210, "Seat Belt Assembly Anchorages," or any other standards, as needed, should standards prove incompatible. (Class II, Priority Action) (H-89-46)

Conduct research, including computer simulation and sled crash tests using Hybrid III dummies if needed, to determine the relationship between restraining barrier design and injuries to unrestrained and lapbelted passengers of different sizes on small school buses (gross vehicle weight rating of 10,000 pounds or less). Research should focus on the height, width, padding, location, and anchorage strength of the barrier, and the spacing between the barrier and front seats. Amend Federal Motor Vehicle Safety Standard 222, "School Bus Passenger Seating and Crash Protection," as needed. (Class II, Priority Action) (H-89-47)

Amend Federal Motor Vehicle Safety Standard 217, "Bus Window Retention and Release," to include a performance standard for the minimum retention of windshields in all sizes of school buses. (Class II, Priority Action) (H-89-48)

Collect and evaluate accident data on the crash performance of the roof and emergency exits on small school buses (gross vehicle weight rating of 10,000 pounds or less) in rollovers. Data should not be limited to van-based buses. Based on analysis, ascertain whether it

is appropriate to amend Federal Motor Vehicle Safety Standard 220, "School Bus Rollover Protection," to make roof performance tests for small school buses (gross vehicle weight of 10,000 pounds or less) to be identical in all aspects to those now required of large school buses (gross vehicle weight rating of more than 10,000 pounds). If such tests are not appropriate, modify the test for small school buses to stress the roof more than the present force application plate test does. (Class II, Priority Action) (H-89-49)

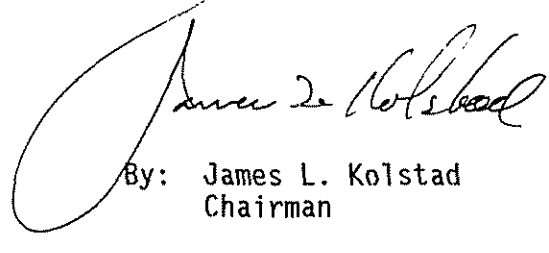
Collect and evaluate accident data involving small school buses to ascertain whether school buses with a gross vehicle weight rating of 10,000 pounds or less should be required to meet joint strength requirements of Federal Motor Vehicle Safety Standard 221, "School Bus Body Joint Strength." (Class II, Priority Action) (H-89-50)

Specify in new rulemaking or in an amendment to Federal Motor Vehicle Safety Standards 206, "Door Locks and Door Retention Components," a requirement for a positive latch locking mechanism on the passenger loading doors of small school buses (gross vehicle weight rating of 10,000 pounds or less) to eliminate the possibility of inadvertent door opening during a frontal crash or rollover. Work with school bus and school van manufacturers to develop the performance standards. (Class II, Priority Action) (H-89-51)

Urge manufacturers to provide means to retrofit positive latch locking mechanisms on existing door controls of small school buses (gross vehicle weight rating of 10,000 pounds or less). (Class II, Priority Action) (H-89-52)

Also as a result of the safety study, the Safety Board issued Safety Recommendations H-89-53 and -54 to the School Bus Manufacturers Institute and manufacturers of van conversion school buses, and Safety Recommendation H-89-55 to the National Association of State Directors of Pupil Transportation, the National Association for Pupil Transportation, and the National School Transportation Association.

KOLSTAD, Chairman, BURNETT, LAUBER, NALL, and DICKINSON, Members, concurred in these recommendations.



By: James L. Kolstad
Chairman