

Key 11-11-72 Not 7-21 File H-72-30

UNITED STATES OF AMERICA
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: September 22, 1972

Adopted by the NATIONAL TRANSPORTATION SAFETY BOARD
at its office in Washington, D. C.
on the 30th day of August 1972

FORWARDED TO:)
Honorable Douglas W. Toms)
Administrator)
National Highway Traffic Safety)
Administration)
Washington, D. C. 20591)

SAFETY RECOMMENDATION H-72-30

The National Transportation Safety Board is investigating an accident involving the collision between a train and a schoolbus at Congers, New York, on March 24, 1972. This accident resulted in five fatalities and injuries to 45 occupants of the schoolbus.

The performance of the schoolbus in the crash has been initially observed and analyzed by the Safety Board, assisted by the Cornell Aeronautical Laboratory, the latter agency acting under its contract with the National Highway Traffic Safety Administration (NHTSA). Both agencies have tentatively concluded that the gross disintegration of the schoolbus body was made possible by widespread failures of the schoolbus body at the joints. Approximately the rear one-third of the bus was separated from the forward portion, with failures occurring at joints within the body and also at joints between the body and the chassis frame. A large portion of the roof was separated from the remainder of the body, the side walls on the right side were separated from the floor, and the floor sections were separated from each other and from the chassis frame. The construction method employing relatively few widely spaced rivets and other fasteners throughout the body of the schoolbus appears to have contributed to the large-scale disintegration of the schoolbus body and chassis.

In addition, the window columns failed in one portion of the schoolbus which was inverted after being torn away, and there were widespread failures of seats at their fastenings to the floor.

Analysis of the fatality and injury causation is not yet complete; however, some very evident factors appear to justify immediate corrective action by NHTSA standards. The seat anchorage failures and other seating factors are

already the subject of NHTSA standards proposals. We believe that standards should be established for the basic schoolbus structure. The Safety Board has analyzed the problem of extensive failures of structural joints in schoolbuses in a special study, "Inadequate Structural Assembly of Schoolbus Bodies," issued July 29, 1970. The Board also recommended on September 18, 1968, that the National Highway Safety Bureau, predecessor to NHTSA, "... consider the need for requirements for structural strength of schoolbus bodies in connection with its study of desirable standards for protection of schoolbus occupants. In particular, the Board recommends that program A.1.1.4 of the National Highway Safety Bureau titled 'Design, Fabrication, and Test of a Safe Schoolbus Interior,' be expanded in scope to include consideration of structural integrity and intrusion into the schoolbus interior."

As stated above, there are indications in the Congers accident that the failures of structural joints contributed to the injuries of the occupants. The speed of the schoolbus was slow and the speed of the train was moderate, apparently not more than 30 miles per hour. Although about two-thirds of the bus structure was accelerated to the full speed of the train by the impact, a majority of the schoolbus occupants survived and some received only relatively minor injuries. However, the penetration of the gross structure of motor vehicles in crashes, or the disintegration of the structure, generally does tend to reduce the probability of survival and increase the probability of injury.

In this connection, structural improvements which have been made by other agencies and private manufacturers in response to the Safety Board's earlier recommendations are important. In January 1971, the Vehicle Equipment Safety Commission (VESC) adopted a regulation which, when implemented by the States, would require that all schoolbuses under State purchasing authority have substantially increased strength of structural joints. The exact wording of this part of the regulation is attached as Appendix A. At least two schoolbus manufacturers have built and exhibited prototype buses which apparently meet this requirement. These prototypes are constructed of much larger steel sheets to reduce the number of joints, in effect providing 100-percent joint efficiency wherever a joint was eliminated. In addition, many more rivets are used to join sheets and structural members. An analysis by one manufacturer indicated that approximately half the joints have been eliminated and that about six times as many rivets are used in meeting the VESC specification than were used in the earlier designs which had unspecified joint strength. It appears that changes in the VESC specification increases the strength of the joints in a schoolbus body approximately fivefold.

The technical feasibility of implementing the VESC structural specification appears to be well established by these prototype buses. One of the manufacturers has stated that the change in sale price of a bus having more complete assembly of structural joints was only approximately 5 percent of the total cost.

The Safety Board is aware that the VESC specification does not insure the structural strength of schoolbus bodies. It is, no doubt, preferable to control the structural strength of bus bodies and chassis as a unit through the development and application of large-scale crash tests. However, the development of such tests and their use as standards have been very slow, as even passenger cars are not yet subjected to such testing. This critical weakness of schoolbus bodies must be eliminated as quickly as possible. Additionally, the VESC specification, in part, meets the statutory requirement of DOT that safety characteristics be controlled by performance rather than design.

It is the Board's opinion that the very high value that society places upon the protection of children riding in schoolbuses establishes the need for improvement in structural design. The adoption of a standard to control the assembly of structural joints in schoolbuses should not be regarded as a novel initiative to reduce schoolbus fatalities, but as correction of a long-standing failure to employ normal engineering practices in schoolbus construction. Many existing schoolbuses do not meet rivet-spacing recommendations of SAE Standard J-492, Rivets and Riveting, June, 1961.

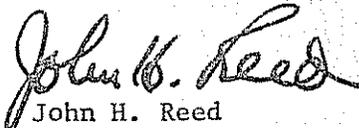
While NHTSA is taking steps to correct the structural inadequacies of schoolbus bodies through the establishment of standards to control strength of joints, they should resolve the problem of the column strength of schoolbuses. The failure of the window columns is very evident in the accident at Monarch Pass, Colorado, as well as in this accident at Congers, New York. Because of the similarity in construction methods used for domestically produced schoolbuses, the overall strength of schoolbus bodies possibly could be controlled through performance requirements of individual structural elements prior to the development of the full-scale tests which are more technically complete.

For the above reasons, the National Transportation Safety Board recommends that:

The National Highway Traffic Safety Administration expeditiously adopt a Federal Motor Vehicle Safety Standard to control the strength of structural joints of schoolbuses. In this connection careful consideration should be given to requirement 5.6 Body Structure, of the Vehicle Equipment Safety Commission. This standard should also apply to the strengthening of the window columns of schoolbuses.

This recommendation will be released to the public on the issue date shown above. No public dissemination of the contents of this document should be made prior to that date.

Reed, Chairman; McAdams, Burgess, and Haley, Members, concurred in the above recommendation. Thayer, Member, was absent, not voting.

By: 
John H. Reed
Chairman

Enclosure

APPENDIX A

Vehicle Equipment Safety Commission
Regulations VESC-6
Minimum Requirements for Schoolbus
Construction and Equipment
Approved January 1971
Revised February 1972
Washington, D. C.

5. BODY STRUCTURE:

- 5.6 Strength of structural joints of Schoolbus bodies. It is the intent of this section to insure that all structural joints within bus bodies which employ discrete fasteners, including those between heavy gauge members and those which join panels to panels or panels to heavier structures, achieve a significant proportion of the strength of the parent metal, so that all available panel materials are capable of serving as part of the structure. Accordingly, in all joints of the above named types which employ discrete fasteners such as rivets, screws or bolts, the pitch of fasteners shall not exceed 24 times the thickness of the thickest material used in the joint. Alternatively, for any method of joining such structural members, it shall be demonstrated by calculation that the strength of such joints is at least 60% of the tensile strength of the thinnest joined member. *

* (Board Comment: This sentence states the requirement in terms of performance.)

