



# National Transportation Safety Board

Washington, D.C. 20594  
Safety Recommendation

Log H-477C

Date: OCT 2 1986

In reply refer to: H-86-54 through -56

Honorable Diane Steed  
Administrator  
National Highway Traffic Safety  
Administration  
Washington, D.C. 20590

About 3:20 p.m. on May 31, 1985, a northbound Military Distributors of Virginia, Inc., (MDV) tractor-semitrailer collided with two southbound vehicles on a curve on U.S. 13, about 2.3 miles south of Snow Hill, North Carolina. The first collision on the two-lane, undivided highway was with a 1982 schoolbus owned and operated by the Greene County (North Carolina) Board of Education. After this collision, the MDV vehicle continued northbound and struck a tractor-semitrailer loaded with grain, which had been following the schoolbus on the two-lane highway. During the collision with the grain truck, the MDV semitrailer separated from its tractor, continued northbound, and overturned onto its right side in the northbound lane. The rear of the grain truck's semitrailer remained on the highway and was struck by a passenger automobile. After the collisions, the MDV tractor, the grain truck's tractor, and the front of the grain truck's semitrailer caught fire. The weather was clear and the pavement was dry. The MDV truckdriver sustained fatal injuries. Of the 27 schoolbus passengers (ages 5 to 13 years), 15 sustained minor or moderate injuries, 10 sustained serious or severe injuries, and 2 received critical injuries. Six of the passengers died. The schoolbus driver, the grain truck driver, and the automobile driver and passenger sustained minor injuries. 1/

The 48-passenger schoolbus was manufactured in 1982 with a Ford Motor Company chassis and a body constructed by Thomas Built Buses, L.P. (Thomas). The 8-foot-wide, 2-axle schoolbus was equipped with a gasoline engine and a 4-speed automatic transmission. The manager of the Greene County schoolbus maintenance facility reported that the schoolbus was governed to operate at a maximum speed of between 30 and 35 mph.

The schoolbus floor consisted of 0.075-inch-thick steel material bent into C-shaped channels. These channels were joined together by an exterior steel "cap" around the outside perimeter of the floor, by welds along the flanges at each end, by welds on the underside of the floor structure about 2 1/2 inches long located about 14 inches inboard of the outside edge of the floor structure, and by 12 spot welds 1/2 inch in diameter and about 6 5/8 inches apart near the center of the flanges on each channel. The collision

1/ For more detailed information, read Highway Accident Report—"Multiple-Vehicle Collision and Fire, U.S. 13, near Snow Hill, North Carolina, May 31, 1985" (NTSB/HAR-86/02).

separated two of these floor channel sections at the floor joint located near the seat legs of the fourth row of bench seats in front of the schoolbus drive axle. The floor separation created a triangular opening across the schoolbus floor which measured about 45 inches wide at the left sidewall. The schoolbus floor was crushed inboard about 7 inches immediately in front of this opening. The floor was relatively undamaged behind this opening and was 96 inches wide. The schoolbus driver reported that there were no defects in the vehicle she was driving, and a postaccident examination of the vehicle did not disclose any defects.

Federal Motor Vehicle Safety Standard (FMVSS) 221, Schoolbus Body Joint Strength, requires that an inside or outside body panel of a schoolbus be fastened so that the body panel joint is capable of holding the body panel to the member to which it is joined when subjected to a force of 60 percent of the tensile strength of the weakest joined body panel. The purpose of this standard is to reduce deaths and injuries resulting from the structural collapse of schoolbus bodies during crashes.

The rule defines the term "body panel" as a body component used on the exterior or interior surface to enclose the schoolbus' occupant space, and defines "body panel joint" as the area of contact or close proximity between the edges of a body panel and another body component, excluding spaces designed for ventilation or another functional purpose, and excluding doors, windows, and maintenance access panels.

On March 30, 1977, in response to a request to interpret how the joint strength requirement of FMVSS 221 applied to schoolbus floor joints, the National Highway Traffic Safety Administration (NHTSA) Associate Administrator for Motor Vehicle Programs wrote to Carpenter Body Works, Inc. (a manufacturer of schoolbuses) and advised:

The floor panels were described as having edges which are bent downward to form right angles and are attached to each other at these right angle legs some distance below the crease formed by the bend. It was agreed that these are body panel joints which must meet the requirements and would generally be tested using opposing tensile forces acting in planes that are parallel to the direction of the right angle legs.

After FMVSS 221 became effective in 1977, NHTSA began routinely testing all manufacturers' schoolbuses to determine if they complied with the standard. Since early 1980 various offices of the NHTSA have communicated with Thomas about the compliance with FMVSS 221 of the floor panel joints in their schoolbuses. During this time NHTSA contractors calculated and tested the strength of the floor panel joints. 2/ NHTSA repeatedly requested information from Thomas in Certified Information Requests (CIR) 2262, 2416, and 2527 that would demonstrate compliance of the floor panel joints with FMVSS 221 because the tests and calculations indicated the

2/ Report No. 221-MS-79-05-TR-05, National Highway Traffic Safety Administration, "School Bus Body Joint Strength, FMVSS 221, 1979 Thomas School Bus, 78 Passenger," February 1980, p. 58; Report No. 221-MS-80-04-TR-04, National Highway Traffic Safety Administration, "School Bus Body Joint Strength, FMVSS 221, 1980 Thomas School Bus, 65 Passenger," February 1981, p. 36; Report No. 221-MS-81-06-TR-06, National Highway Traffic Safety Administration, "School Bus Body Joint Strength, FMVSS 221, 1981 Thomas School Bus, 42 Passenger," March 1982, p. 40.

floor panel joints did not comply with the requirements of the standard. 3/ These tests and calculations yielded floor panel joint strengths ranging from 24 to 73 percent of that required by FMVSS 221. Thomas repeatedly replied to the NHTSA requests for data that the floor panel joints in question were structural joints, not body panel joints and therefore not subject to the requirements of FMVSS 221. 4/ However, NHTSA officials indicated to Thomas that the floor panel joints in question were indeed subject to FMVSS 221. 5/

After reviewing its test reports and Thomas' responses to the NHTSA CIRs 2262, 2416, and 2527, NHTSA's Office of the Chief Counsel notified Thomas, on June 21, 1985, that it was terminating the investigations of the apparent floor joint failures without further action. The letter did not give any reason(s) for the terminations.

In August 1982, the NHTSA Office of Vehicle Safety Compliance discontinued its program of testing schoolbus floor joints. The methods and the materials used to fabricate the floors of the schoolbuses that had been tested by NHTSA were similar to the method and the material used to fabricate the floor of the schoolbus involved in the Snow Hill accident. Safety Board investigators obtained undamaged sections of the floor of the schoolbus involved in the Snow Hill accident. These specimens were forwarded to the National Bureau of Standards to determine the strength of the material used in the floor and the strength of the floor joints.

Two specimens were used to determine the tensile strength of the steel in the C-shaped channel sections of the schoolbus floor. Based on the tests, the minimum tensile strength of the 0.075-inch-thick steel floor material was calculated to be 54,850 pounds per square inch (psi). Thus, the minimum strength of the floor panel joint required by FMVSS 221 would be 32,910 psi (.60 times 54,850).

Safety Board tests of three floor joint specimens from the Snow Hill accident schoolbus determined that the first floor joint specimen failed at 1,328 pounds; the second specimen failed at 1,226 pounds; and the third joint specimen failed at 1,214 pounds. The strength of the strongest joint specimen tested (2,213 psi) was 7 percent of the strength required for the floor joint to meet the joint strength requirement of FMVSS 221.

The intent of FMVSS 221 is to reduce deaths and injuries resulting from the separation of schoolbus bodies during crashes. FMVSS 221 should require that floor panel joints have strength adequate to withstand a reasonable amount of crash forces and retain the structural integrity of the passenger envelope.

The Safety Board has investigated one other accident and the NHTSA has data on another accident in which the floors of Thomas schoolbuses have separated. The Board also has investigated several other accidents (two of which are described in the Snow Hill report) which involved schoolbuses not manufactured by Thomas but which were similar in many respects to the three accidents involving Thomas buses. However, the floors of the schoolbuses built by manufacturers other than Thomas did not separate.

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3/ Letters from National Highway Traffic Safety Administration to Thomas Built Buses, Inc., dated April 10, 1980, April 6, 1981, and June 15, 1982.

4/ Letters from Thomas Built Buses, Inc., to National Highway Traffic Safety Administration dated May 30, 1980, April 30, 1981, and July 16, 1982.

5/ Letter from National Highway Traffic Safety Administration to Thomas Built Buses, Inc., dated December 2, 1980.

The Safety Board believes that the laboratory tests and the real-world crash data demonstrate that the floor panel joints of schoolbuses manufactured by Thomas need to be strengthened at least so that they meet the FMVSS 221 joint strength requirement.

As a result of its investigation of this accident, the National Transportation Safety Board recommends to the National Highway Traffic Safety Administration:

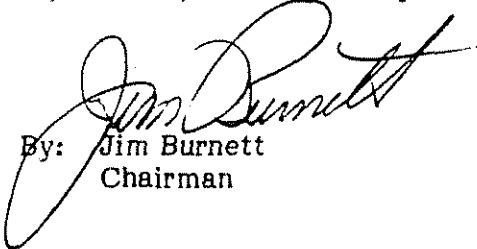
Amend or clarify Federal Motor Vehicle Safety Standard 221 to require that body panel joints for schoolbus body structures be tested in tension or peel unless they can only be tested in shear. (Class II, Priority Action) (H-86-54)

Amend or clarify Federal Motor Vehicle Safety Standard 221 to include all body panel joints that enclose the occupant space. (Class II, Priority Action) (H-86-55)

Resume testing of schoolbus floor joints to ensure compliance with Federal Motor Vehicle Safety Standard 221. (Class II, Priority Action) (H-86-56)

Also, as a result of its investigation, the Safety Board made Safety Recommendations H-86-50 to all States (except California and Hawaii) and the District of Columbia, H-86-51 and -52 to all States (except California, Connecticut, Delaware, Illinois, Indiana, Nevada, New Jersey, Oregon, and Pennsylvania) and the District of Columbia, H-86-53 to the American Medical Association, and H-86-57 to Thomas Built Buses, L.P.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER, Member, concurred in these recommendations. NALL, Member, did not participate.

  
By: Jim Burnett  
Chairman