



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: April 27, 2005

In reply refer to: H-05-10 and -11

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The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating transportation accidents, determining their probable cause, and making recommendations to prevent similar accidents from occurring. We are providing the following information to urge your organization to take action on the safety recommendations in this letter. The Safety Board is vitally interested in these recommendations because they are designed to prevent accidents and save lives.

These recommendations address inspections of motorcoach passenger seating anchorage points and performance standards for motorcoach passenger seating anchorages. The recommendations are derived from the Safety Board's investigation of the motorcoach run-off-the-road accident that took place in Tallulah, Louisiana, on October 13, 2003,¹ and are consistent with the evidence we found and the analysis we performed. As a result of this investigation, the Safety Board has issued 11 safety recommendations, 2 of which are addressed to Neoplan USA Corporation (Neoplan). Information supporting these recommendations is discussed below. The Safety Board would appreciate a response from you within 90 days addressing the actions you have taken or intend to take to implement our recommendations.

At 10:50 a.m. on October 13, 2003, a 1992 Neoplan 49-passenger motorcoach, owned and operated by the First Baptist Church of Eldorado, Texas, was traveling eastbound on Interstate 20 near Tallulah, Louisiana. The motorcoach, carrying 14 passengers, was en route from Shreveport, Louisiana, to Tuscaloosa, Alabama, as part of a multicity sightseeing tour that had originated in Eldorado. As the motorcoach approached milepost 168, it drifted rightward from the travel lanes and onto the shoulder, where it struck the rear of a 1988 Peterbilt tractor semitrailer operated by Alpha Trucking, Inc., which was stopped on the shoulder at milepost 167.9. As both vehicles moved forward, the motorcoach rotated clockwise slightly and the semitrailer rotated counter-clockwise slightly; the vehicles remained together. They traveled approximately 62 feet and came to rest, still oriented to the east, adjacent to the right side of the

¹ For additional information read National Transportation Safety Board, *Motorcoach Run-Off-The-Road Accident, Tallulah, Louisiana, October 13, 2003*, Highway Accident Report NTSB/HAR-05/01 (Washington, DC: 2005).

interstate on the outside shoulder. Eight motorcoach passengers sustained fatal injuries, the motorcoach driver and six passengers received serious injuries, and the Peterbilt driver was not injured.

The National Transportation Safety Board determined that the probable cause of the accident was the motorcoach driver's operation of the motorcoach in a reduced state of alertness due to fatigue as a result of his chronic insomnia and poor quality sleep. Further contributing to the accident was the failure of Alpha Trucking, Inc., to perform vehicle maintenance and to provide safety management controls, which resulted in the accident tractor semitrailer being parked on the interstate shoulder. Contributing to the severity of the injuries was the failure of the motorcoach seat anchorages.

During the Tallulah crash sequence, many passenger seats did not remain secure in their original positions in the passenger compartment, even in the space outside the intrusion area. Intrusion was limited to the first several rows on the right (passenger) side; nevertheless, the passengers seated outside the intrusion area sustained serious and fatal injuries. On the passenger side, all the passengers in the first seven rows sustained fatal injuries. On the driver side, the vehicle sustained no intrusion damage to the passenger compartment; however, two passengers seated on this side sustained fatal injuries, and five sustained serious injuries.

Emergency personnel said that when they arrived on scene, they found the seats "piled up" near the front of the coach and passengers trapped among and underneath the seats. The failure of the seat anchorages, which occurred when the unrestrained passengers struck the seats during the accident sequence, caused entire seat frames to move forward. As the seats moved forward, passengers were pinned between them, which increased the severity of their injuries.

One reason the seats did not remain in their original positions during the accident was that several of the T-bolts that fastened the seats to the stainless-steel floor track had been incorrectly installed. The T-bolts were designed so that they could only be inserted into the track when the bolt head was positioned parallel to the track. Turning the bolts slightly less than 90°, so that the head of the bolt was nearly perpendicular in the track, locked them into place and prevented the bolt and seat pedestal from "lifting" out. Of the 32 T-bolts in the 16 seat frames found outside the motorcoach, 7 T-bolts had not been properly secured to the track in the perpendicular direction.

According to Neoplan, the seat securement design of the accident motorcoach permitted the owner to move seats within the passenger compartment. However, the only information concerning passenger seating in the owner's manual addressed cleaning and maintaining the fabric and plastic components. Neoplan did not include any guidance on unlocking, moving, repositioning, or securing the seats. Lacking this important safety information, owners of Neoplan motorcoaches would not have known how to properly secure the seats or how to inspect and maintain the seats in a secure position. The Safety Board concluded that lack of information addressing seat securement in motorcoach owner's manuals can lead to improperly secured seats, which can cause seat failures, leading to severe or fatal passenger injuries in an accident. The Safety Board believes Neoplan should include information in its motorcoach owner's and maintenance manuals that fully informs owners of the necessity of, and proper procedures for, checking passenger seat anchorage securement through routine inspections.

In addition to addressing the improper seat anchorage installation and maintenance discovered during the Tallulah accident investigation, the Safety Board is concerned about the apparent lack of standardization in motorcoach seat anchorage system design. The Safety Board has examined the issue of motorcoach seat anchorage failure in six previous accident investigations. (See table 1.) Several different seat anchorage system designs were used in the motorcoaches involved in these accidents. Even when properly installed and maintained, some seat anchorage systems failed, while others did not, even in similar accident scenarios. The manufacturers of these seating systems primarily used either a seat anchorage design in which a threaded vertical rod was placed within the seat pedestal and attached to a floor track (or the flooring itself) or a design in which a T-bolt fit into the opening of the floor track and then was turned perpendicular to provide securement (as in the Tallulah motorcoach).

Table 1. Previous Safety Board investigations involving motorcoach passenger seat anchorage problems.

Location/Date	Injured/Fatalities	Failed Seat Units	Seat System Manufacturer
Nelson Township, New York September 7, 1996	5 Injuries 0 Fatalities	9	Prevost
Santa Fe, New Mexico January 5, 1998	22 Injuries 1 Fatality	15	Amaya-Astron
Burnt Cabins, Pennsylvania June 20, 1998	16 Injuries 6 Fatalities	0	National Seating
New Orleans, Louisiana May 9, 1999	21 Injuries 22 Fatalities	4	National Seating
Hewitt, Texas February 14, 2003	29 Injuries 5 Fatalities	3	Amaya-Astron
North Hudson, New York February 22, 2004	47 Injuries 0 Fatalities	2	Prevost

No Federal regulation or standard requires large motorcoaches sold or operated in the United States to be equipped with active or passive occupant protection (other than for the driver). Standards or requirements for the strength and adequacy of passenger seat anchorage systems are also lacking.

Although the seat anchorage designs differed in the seven accidents (including Tallulah) investigated by the Safety Board, the causes of the seat anchorage problems in all cases were impact from unrestrained passengers and intrusion during the accident sequence. Many different seating system designs are used in motorcoaches operating in the United States; each manufacturer uses its own hardware and anchorage designs, and these designs are not required to meet any strength requirements or other standards. This lack of requirements for seating systems results in inconsistent occupant protection. The Safety Board concluded that because no performance standards are in place for motorcoach seat anchorages, some anchorage systems may be inadequately designed to withstand crash forces, which can lead to severe or fatal passenger injuries in an accident. Consequently, the Safety Board made the following recommendation to the National Highway Traffic Safety Administration:

Safety Recommendation H-05-01

Develop performance standards for passenger seat anchorages in motorcoaches.

The Safety Board also investigated why those seating anchorages that were properly secured on the Neoplan accident motorcoach were not able to withstand the crash forces. In a very similar motorcoach accident scenario, the Burnt Cabins accident,² comparably designed seat anchorage hardware (National Seating) did withstand the crash forces. Moreover, passengers seated outside the intrusion area sustained only minor injuries. In the Tallulah accident, even passengers seated outside the intrusion area sustained serious and fatal injuries due to seat anchorage failure.

Metallurgical evidence from the testing of the seating hardware showed that the accident motorcoach's seats separated from the floor track as a result of deformation in the T-bolts and loss of clamping force or fracturing of the sidewall C-clamp assemblies. The results from the Safety Board's finite element analysis indicated that, when subjected to crash forces similar to the accident condition, even a properly installed Neoplan T-bolt from the accident motorcoach would have been expected to pull out of its track as a result of impact from occupants in any seating position.

Anchorage failure allowed the seats to come loose during the accident. Finite element analysis of seat anchorage hardware provided for postaccident testing by National Seating, which was comparable to that used in the Burnt Cabins accident motorcoach, showed that the National Seating assembly hardware would not have failed under the same loading conditions. As a result of the more robust design, this hardware would probably have retained the seats in place during the accident.

In the absence of standards or industry requirements that provide guidance about whether the T-bolts were properly designed or strong enough, the accident and exemplar hardware were tested for composition and hardness. The lowest-rated industry bolt, SAE³ grade 1, has a minimum tensile strength of 70 ksi and a hardness of HRB 70 to 100.⁴ Three out of the four Neoplan accident T-bolts tested after the accident had an average hardness below HRB 70, indicating that they did not match the hardness of even the lowest-rated industry bolt.

The new exemplar Neoplan bolts tested were manufactured to a hardness of HRB 88 (86 ksi), which would at least qualify them as SAE grade 1 bolts. However, the finite element analysis conducted by the Safety Board Materials Laboratory suggested that even these stronger bolts were only marginally acceptable and could fail under conditions similar to the Tallulah accident if their seats were struck from behind by even a single occupant.

² National Transportation Safety Board, *Greyhound Motorcoach Run-Off-The-Road Accident, Burnt Cabins, Pennsylvania, June 20, 1998*, Highway Accident Report NTSB/HAR-00/01 (Washington, DC: NTSB, 2000).

³ Society of Automotive Engineers.

⁴ ASM International, "Properties and Selection: Irons, Steels, and High-Performance Alloys," *ASM Handbook*, Volume 1, 10th edition (Materials Park, Ohio: 1997), 290-291.

Neoplan clearly used hardware to secure its seating systems that was inadequate to retain the seats in a frontal collision of a severity similar to the Tallulah accident. No Federal regulation requires the use of specific strength seat anchor hardware. Nonetheless, some seat and motorcoach manufacturers are using more robust hardware that has been proven capable of withstanding the forces involved in accident scenarios comparable to the Tallulah accident. Using lesser quality hardware in the crucial area of passenger protection is not occupant safety-oriented design. Occupant safety should be of paramount importance when designing and manufacturing passenger vehicles. The Safety Board concluded that the inadequate seat anchorage hardware used by Neoplan failed during the accident and resulted in more severe injuries to passengers. The Safety Board believes that, until the National Highway Traffic Safety Administration develops performance standards for passenger seat anchorages in motorcoaches, as recommended in Safety Recommendation H-05-01, Neoplan should substantially increase the load capacity of the passenger seat anchor systems in its newly manufactured motorcoaches so that the seats will not become detached during frontal impact collisions, side impact collisions, rear impact collisions, and rollovers.

Therefore, the National Transportation Safety Board makes the following safety recommendations to Neoplan USA Corporation:

Include information in your motorcoach owner's and maintenance manuals that fully informs owners of the necessity of, and proper procedures for, checking passenger seat anchorage securement through routine inspections. (H-05-10)

Until the National Highway Traffic Safety Administration develops performance standards for passenger seat anchorages in motorcoaches, as recommended in Safety Recommendation H-05-01, substantially increase the load capacity of the passenger seat anchor systems in your newly manufactured motorcoaches so that the seats will not become detached during frontal impact collisions, side impact collisions, rear impact collisions, and rollovers. (H-05-11)

The Safety Board also issued safety recommendations to the National Highway Traffic Safety Administration, the Federal Motor Carrier Safety Administration, the American Association of Motor Vehicle Administrators, and the Commercial Vehicle Safety Alliance.

In your response to the recommendations in this letter, please refer to H-05-10 and -11. If you need additional information, you may call (202) 314-6177.

Acting Chairman ROSENKER and Members ENGLEMAN CONNERS, HEALING, and HERSMAN concurred in these recommendations.

By: Mark V. Rosenker
Acting Chairman