National Transportation Safety Board

Washington, DC 20594

Safety Recommendation

Date: July 20, 2015

In reply refer to: H-15-10 and -11

The Honorable Mark Rosekind
Administrator
National Highway Traffic Safety
Administration
Washington, DC 20590

The National Transportation Safety Board (NTSB) urges the National Highway Traffic Safety Administration (NHTSA) to take action on the safety recommendations issued in this letter. The NTSB is investigating a collision between a medium-size bus and a truck-tractor in combination with a semitrailer that occurred near Davis, Oklahoma, in September 2014. This letter addresses a seat design feature on the medium-size bus that could affect safety and survivability in such buses. As a result of our findings concerning this design feature, we have issued two safety recommendations to NHTSA. Information supporting these recommendations is discussed below.

Davis, Oklahoma, crash

About 9:05 p.m. central daylight time on Friday, September 26, 2014, a 2013 Peterbilt truck-tractor in combination with a 2014 Great Dane semitrailer, operated by a 53-year-old male, was traveling north in the left lane of Interstate 35 (I-35) near Davis, in Murray County, Oklahoma. At the same time, a 2008 Champion Defender 32-passenger medium-size bus, operated by a 48-year-old male, was traveling south in the right lane of I-35, transporting 15 female members of the North Central Texas College softball team.

Near mile marker 47, after negotiating a slight rightward curve, the combination vehicle departed the left lane and entered the 92-foot-wide depressed earthen median at an angle of approximately 2 degrees. It continued through the median at an average angle of 2–9 degrees and traveled more than 1,100 feet as it traversed the median. The combination vehicle then entered the I-35 southbound lanes and collided with the left side of the medium-size bus, as the bus driver steered to the right in an attempt to avoid the collision.

Following the impact, the medium-size bus rolled onto its right side, and the combination vehicle continued off the roadway and into a wooded area. As a result of the crash, four bus passengers died. The remaining passengers received minor-to-serious injuries and were transported to area hospitals for treatment. The combination vehicle driver and the bus driver sustained minor injuries.

Side-Slide Seats

Aisle width. At all aisle seating positions, the medium-size bus was equipped with side-slide seats manufactured by Freedman Seating of Chicago, Illinois (Freedman). The side-slide option enables a passenger to move the seat laterally into the aisle approximately 3 inches, using a knob located at the front center of the seat cushion. The lateral sliding is accomplished via a track attached to the seat base. According to Freedman, this design provides occupants with additional lateral seating room to increase ride comfort. Freedman also said that, ideally, an occupant would slide the seat laterally to provide additional room while the bus is in motion but return it to the original position before offloading. If adjacent aisle seats were slid laterally to their maximum inboard positions, the bus aisle width would decrease from 13 inches to 7 inches. A 7-inch aisle width would be significantly less than is typical on school and other buses, which usually have aisle widths of 12–14 inches.

School bus manufacturers follow guidelines and standards that establish aisle clearance in front of an emergency exit and address safe egress from the exit.[1] The minimum permissible clearance in front of an emergency exit is 12 inches. Transit buses are subject to the aisle width guidance provided by the Federal Transit Administration and the American Public Transportation Association, which addresses a variety of seat configurations, including side-facing seats.[2] The minimum aisle width commonly permitted for transit buses is 14 inches. A European standard requires the aisle width to be a minimum of 12 inches for class III buses; it permits lateral movement of seats, as long as the aisle width does not fall below 8.8 inches and the seat's lateral control mechanism is accessible by a person standing in the aisle.[3] For purposes of comparison, in commercial aviation, a minimum aisle width is specified based on the aircraft's passenger-seating capacity and the seat height above the floor.[4] For example, for an aircraft with a passenger-seating capacity of 20 or more, the minimum passenger aisle width ranges from 15 inches to 20 inches, depending on the position above the floor. Thus, the 32-passenger bus in the Davis crash could potentially have had an aisle width of 7 inches, less than half the minimum permitted for an aircraft in commercial aviation.

[1] (1) Guidelines are provided by the *National School Transportation Specifications and Procedures*, which were adopted by the Fifteenth National Congress on School Transportation in May 2010. (2) Aisle clearance requirements in front of an emergency exit are specified in Federal Motor Vehicle Safety Standard 217.

[2] The Federal Transit Administration and the American Public Transportation Association both cite Federal Motor Vehicle Safety Standard 217 for all emergency exit door clearance requirements.

[3] See United Nations Economic Commission for Europe (ECE) Regulation 36, "Uniform Provisions Concerning the Approval of Large Passenger Vehicles with Regard to their General Construction."

[4] See 14 *Code of Federal Regulations* 25.815, "Width of Aisle."

Although it is commonly recognized that the aisle width directly affects ease and speed of egress from a vehicle, no NHTSA standards or compliance requirements address the minimum aisle width for safe bus evacuation. In this accident, the medium-size bus came to rest on its right side, and passengers evacuated via the roof hatch. Consequently, the reduced aisle width due to the side-sliding seats did not negatively affect evacuation following the Davis crash. However, in cases such as the April 2014 bus crash in Orland, California, in which the bus remained upright and was involved in a postcrash fire, reduced aisle width would reduce evacuation speed.[5] The NTSB is concerned that the side-slide seat design could significantly hinder evacuations and result in increased risk of occupant injury or death, especially in crashes involving a postcrash fire or water immersion. Therefore, the NTSB recommends that NHTSA develop requirements addressing the minimum aisle width for safe evacuation from all buses, including those with moveable seats.

Seat belts. The medium-size bus was also equipped with lap belts at all passenger seating positions.[6] After the crash, many aisle-side belts were found with their webbing trapped by the side-slide track (see figure 1), which compromised the belt load path.[7] Further, two belts showed fraying and tears (see figure 2) in locations on the webbing similar to those where other belts were trapped. Most likely, the damage to the belt webbing resulted from previous entrapment by the side-slide track. Although the passengers in the Davis crash were not using the seat belts, both trapped seat belts and frayed/torn seat belt webbing would negatively affect the survivability of belted passengers, due to the reduced load capacity of trapped or damaged belts.

[5] NTSB accident HWY14MH009.

[6] These medium-size buses are not required to be equipped with passenger restraint systems, such as lap belts. The NTSB has previously recommended that all buses other than school buses be equipped with passenger occupant protection systems, such as seat belts (Safety Recommendation H-10-3). In this crash-involved bus, the lap belts had been voluntarily installed.

[7] A compromised belt load path is one in which the forces applied by the occupant to the belt are not transferred directly through the restraint system to the attachment points on the seat or vehicle. A compromised belt load path may result from damage to a component of the system, such as the belt webbing.

Figure 1. Seat belt webbing pinched by the side-sliding seat track.

Figure 2. Seat belt with webbing torn in a location similar to where other belts were trapped.

The design of the Freedman side-slide seat did not provide a mechanism to protect the belt webbing from becoming pinched or trapped by the side-slide track. The NTSB is aware that a large number of buses have been sold with the Freedman side-slide seat option. Some of these buses were originally equipped with passenger lap belts. Other buses may have been equipped with belts as an after-market feature, as was the case with the medium-size bus involved in the Davis crash. Further, Freedman is not the only manufacturer of bus seats with a side-slide design. Several US seating manufacturers design seats that provide the option of flexible lateral seat positioning. The NTSB is concerned that these side-sliding seat designs do not protect the seat belt from becoming trapped by the sliding seat track. This entrapment can result in a compromised load path and damage to the belt webbing. As a result, the NTSB recommends that NHTSA determine whether the design of side-slide seats leads to seat belt entrapment that could result in reduced load capacity due to trapped belts or damage to belt webbing, and, if appropriate, open a defect investigation to address this issue.

Because the side-sliding seat design may affect survivability, the NTSB makes the following safety recommendations to NHTSA to address the reduced aisle width resulting from the use of side-slide seats and the damage and/or compromised load path that may be caused by entrapment of seat belt webbing by the side-slide seat track:

H-15-10

Develop requirements addressing the minimum aisle width for safe evacuation from all buses, including those with moveable seats.

H-15-11

Determine whether the design of side-slide seats leads to seat belt entrapment that could result in reduced load capacity due to trapped belts or damage to belt webbing; if appropriate, open a defect investigation to address this issue.

Chairman HART, Vice Chairman DINH-ZARR, and Members SUMWALT and WEENER concurred in these recommendations.

The NTSB is vitally interested in these recommendations because they are designed to save lives. We would appreciate receiving a response from you within 90 days detailing the actions you have taken or intend to take to implement them. When replying, please refer to the safety recommendations by number. We encourage you to submit your response electronically to correspondence@ntsb.gov.

[Original Signed]

By: Christopher A. Hart,
Chairman