National Transportation Safety Board

Washington, DC 20594

Safety Recommendation Report

Addressing Motorcoach Driver Seat Design to Prevent Separation in a Crash

Accident Number:	HWY16MH005
Location:	San Jose, California
Date:	January 19, 2016
Recommendation Number:	H-17-1
Adopted:	February 28, 2017

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in other modes of transportation—railroad, highway, marine, and pipeline. We determine the probable causes of the accidents and issue safety recommendations aimed at preventing future accidents or lessening their severity.

The NTSB is investigating a motorcoach collision that occurred in San Jose, California, on January 19, 2016.[1] During our investigation, we identified a potential problem with the driver seat attachment. This safety recommendation report describes the conditions under which the driver seat detached from the floor. As a result of our findings, the NTSB is issuing one safety recommendation to the motorcoach manufacturer, Motor Coach Industries International, Inc. (MCI).

San Jose Crash

On Tuesday, January 19, 2016, about 6:37 a.m., a 2014 MCI D4505 motorcoach, operated by Greyhound Lines, Inc., was traveling northbound on US Highway 101 (US-101) in San Jose, Santa Clara County, California, when it entered and traveled in a gore area, rather than the intended high-occupancy-vehicle (HOV) lane, and collided with a crash attenuator.[2] The bus was occupied

[1] Throughout this safety recommendation report, the motorcoach involved in this crash is referred to as the "bus."

[2] (a) A gore area is typically a triangular-shaped boundary created by white lines and delineated by diagonal cross-hatching or chevrons. Its purpose is to separate an entrance or exit lane from the main lanes of the highway. The gore at this location was a theoretical gore—that is, a marked area of pavement formed by convergence or divergence of the edges of a main lane and an exit/entrance lane. (b) A crash attenuator is a device intended to reduce the damage to structures, vehicles, and motorists resulting from a motor vehicle collision. It is designed to absorb the colliding vehicle's kinetic energy.

Note: This report was reissued on April 4, 2017, with corrections to page 6.

by the 58-year-old driver and 21 passengers. The weather conditions were dark, with moderate-to-heavy rain and reported winds from the east–southeast at 20 mph, with gusts reaching 28 mph. The traffic conditions on US-101 north were moderate to heavy.

At the US-101–State Route 85 (SR-85) interchange—where the crash occurred—US-101 north consists of (1) a single left exit HOV lane for SR-85, (2) the US-101 HOV lane, (3) three main travel lanes, and (4) two right exit conventional lanes for SR-85. A gore area 990 feet long separates the left exit HOV lane for SR-85 from the US-101 HOV lane. The gore widens to about 22 feet at the point where a reusable energy-absorbing crash terminal (REACT) 350, nine-cylinder crash attenuator is in place, in advance of a 3-foot-high concrete barrier. The barrier physically separates the left exit HOV lane for SR-85 from the US-101 HOV lane.

Video evidence showed that the bus was traveling in the US-101 HOV lane as it approached the interchange. Then, the driver initiated a movement to the left, into the gore area. Instead of entering the left exit HOV lane for SR-85, as he reported to the California Highway Patrol he had intended to do, the driver maintained the vehicle's path in the gore until colliding with the crash attenuator. The bus then rode up on the concrete barrier, yawed counter-clockwise, and rolled 90 degrees to the right. The vehicle came to rest on its right side against the concrete barrier, with its aft section resting on the US-101 HOV lane and its front hanging over the left exit HOV lane for SR-85. The bus had traveled 65 feet from the point of initial impact with the crash attenuator to its final rest position. As a result of the crash, two passengers were ejected and died. The driver, who was partially ejected, and 13 passengers—one of whom was also partially ejected—sustained minor-to-serious injuries.

Driver Seat Separation

The bus was outfitted with a driver seat manufactured by USSC Group, which had an integrated lap/shoulder belt; and with passenger seats manufactured by IMMI, which were equipped with lap/shoulder belts. The first row of passenger seats was positioned higher than the driver seat, but slightly below the second and remaining rows of passenger seats. As a result of this theater-style seating, the passenger seat floor structure was about 5 inches above the floor mounting for the driver seat, as shown in figure 1.

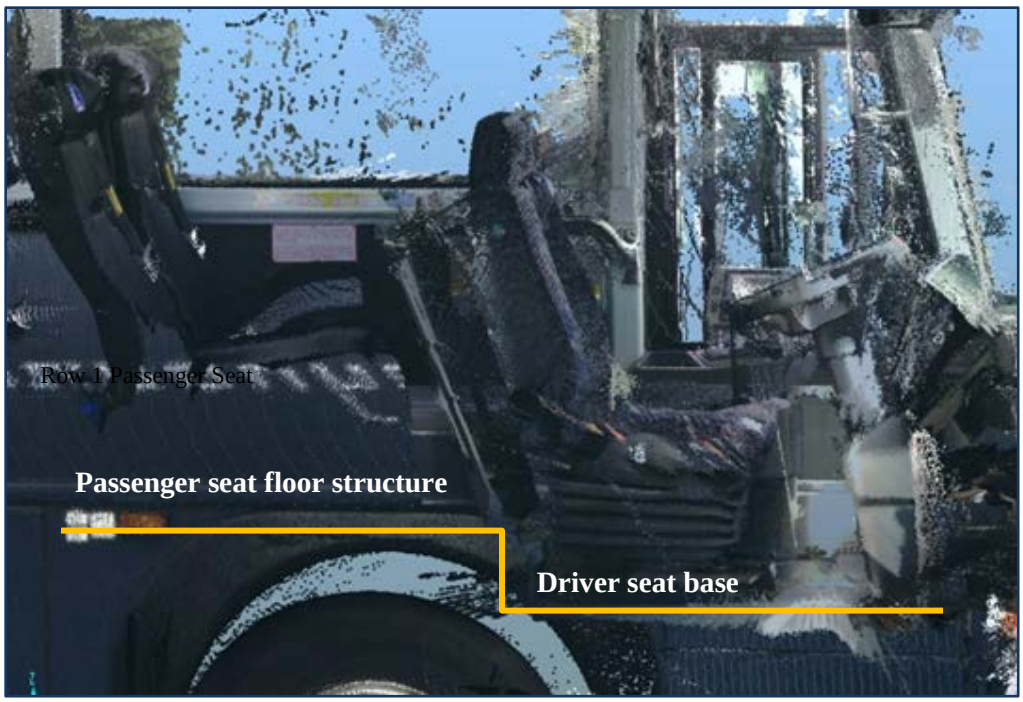

Figure 1. 3D laser scanner image showing view through right side of motorcoach, revealing theater-style seating positions of driver seat and first row of passenger seats, with driver seat base attached to lower section of floor.

Four bolts and nuts with flanges attached the base of the driver seat to the lower section of the floor structure. The back of the driver seat base was located about 3.5 inches from the front of the passenger seat floor structure. During the crash sequence, the driver seat detached from the floor but remained predominantly inside the bus. Broken portions of all four bolts were located after the crash and submitted to the NTSB materials laboratory. The metallurgical evaluation revealed that the bolts were in good condition; met design specifications; and failed in a manner consistent with tension overstress—that is, they fractured while being stretched.[3]

The 5-foot 7-inch tall, 150-pound driver was wearing only the lap portion of the integrated lap/shoulder belt at the time of the collision.[4] Although the restrained driver's body created a load on the seat during the crash sequence, the lack of deformation through the seat belt load path down to the seat base indicated that the loading was insufficient to cause the seat separation.

As a result of the collision with the concrete barrier, the bus sustained significant deformation to the front and right side. However, the postcrash examination of the driver seat floor structure on the left side showed little deformation. Rather, it was pushed about 8 inches rearward and under the forward edge of the passenger seat floor structure—including the floor beam and seat track for the first row of passenger seats—as shown in figure 2. The lap/shoulder belt-equipped passenger seats are attached to the passenger seat floor beam and seat track. These two structural

[3] See the materials laboratory factual report in the NTSB public docket for this investigation.

[4] Because a separate fastener attached the shoulder portion of the belt to the latchplate, the lap belt could be worn with or without the shoulder harness.

components had been redesigned to support the additional load of belted occupants in the event of a crash. Impact points documented on the passenger seat floor beam matched impact points on the driver seat base; and, postcrash, the two rear attachment points for the driver seat base were located rearward of the forward edge of the passenger seat floor beam.

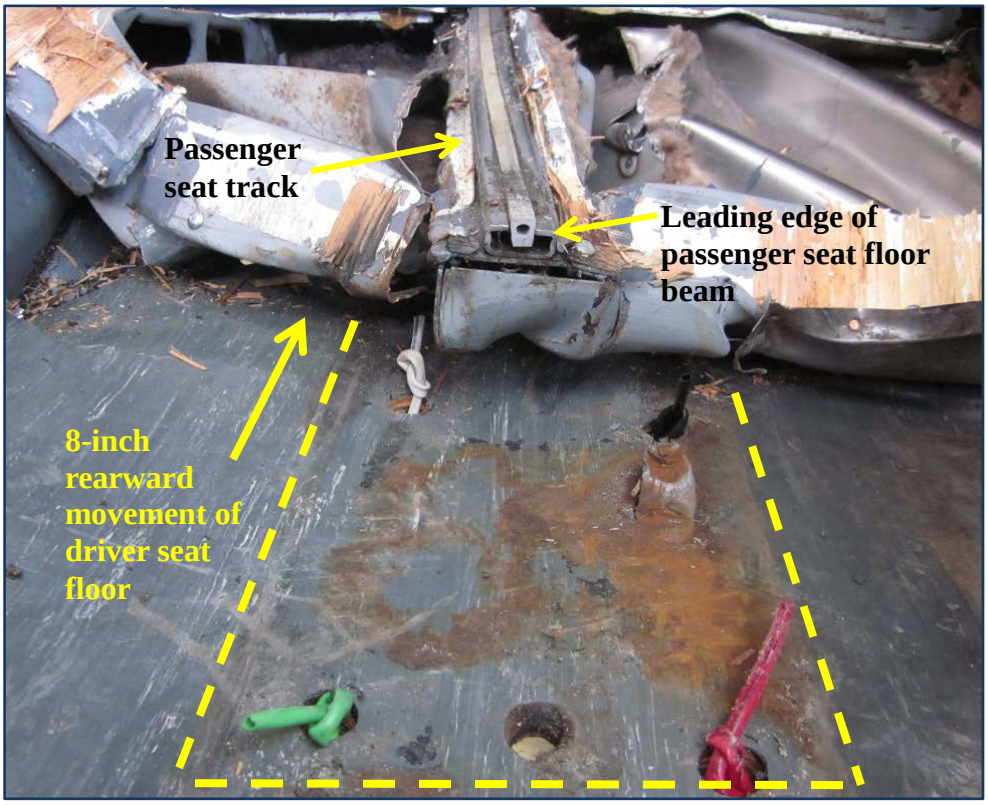

Figure 2. Depiction of extent to which driver seat floor was pushed back and under passenger seat floor beam and seat track for first row of passenger seats, with (a) white, black, red, and green wires denoting each attachment point for driver seat base; (b) two rear attachment points (white and black wires) pushed rearward and under passenger seat floor beam; and (c) yellow dashed lines indicating area where driver seat base was attached.

As a result of the impact between the driver seat base and the passenger seat floor structure, the seat base rotated upward and was displaced forward, resulting in the failure of the four attachment bolts and the complete separation of the driver's seat from the floor structure. As the bus rolled onto its right side, the lap-belted driver—in his seat—fell into the front boarding door area of the bus, with the seat straddling the boarding door. Figure 3 shows the location of the driver seat at final rest. Despite the complete seat separation and partial ejection of the driver, he sustained only minor injuries.

Figure 3. Location of driver seat postcrash, in front boarding door area of bus, with base still attached to seat bottom.

Although, in this crash, the driver seat separated completely—which clearly poses significant risk of injury and ejection—even less severe damage to the seat base could affect a driver's ability to control the vehicle. Therefore, the NTSB recommends that MCI evaluate and, if appropriate, modify the driver and passenger floor structure design on new motorcoaches to prevent driver seat separation during crashes.

Recommendation

To Motor Coach Industries International, Inc.:

Evaluate and, if appropriate, modify the driver and passenger floor structure design on new motorcoaches to prevent driver seat separation during crashes. (H-17-1)

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