# Motorcoach Run-Off-The-Road Accident
# Tallulah, Louisiana
# October 13, 2003

## Highway Accident Report

**NTSB/HAR-05/01**

**PB2005-916201**
**Notation 7711**

National Transportation Safety Board
Washington, D.C.

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**Adopted April 19, 2005**

**National Transportation Safety Board**
**490 L'Enfant Plaza, S.W.**
**Washington, D.C. 20594**

**National Transportation Safety Board. 2005.** ***Motorcoach Run-Off-The-Road Accident, Tallulah, Louisiana, October 13, 2003.*** **Highway Accident Report NTSB/HAR-05/01. Washington, DC.**

**Abstract:** At 10:50 a.m. on October 13, 2003, a 1992 Neoplan USA Corporation 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 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.

Major safety issues identified in this report include driver fatigue, the adequacy of State and Federal oversight of motor carriers, the identification and appropriate use of speed-restricted tires on motorcoaches, criteria for State and Federal annual inspections of motorcoach passenger seating anchorage points, and performance standards for motorcoach passenger seating anchorages.

As a result of its investigation of this accident, the Safety Board makes safety recommendations to the National Highway Traffic Safety Administration, the Federal Motor Carrier Safety Administration, the American Association of Motor Vehicle Administrators, the Commercial Vehicle Safety Alliance, and Neoplan USA Corporation.

# Contents

# Acronyms and Abbreviations

| | |
|---|---|
| AAMVA | American Association of Motor Vehicle Administrators |
| AASHTO | American Association of State Highway and Transportation Officials |
| BiPAP | Bi-level Positive Airway Pressure |
| CDL | commercial driver's license |
| CFR | *Code of Federal Regulations* |
| church | First Baptist Church of Eldorado, Texas |
| CVSA | Commercial Vehicle Safety Alliance |
| DVIR | Daily Vehicle Inspection Report |
| ECM | electronic control module |
| EDR | event data recorder |
| FDA | U.S. Food and Drug Administration |
| FHWA | Federal Highway Administration |
| FMCSA | Federal Motor Carrier Safety Administration |
| FMCSRs | Federal Motor Carrier Safety Regulations |
| FMVSS | Federal Motor Vehicle Safety Standard |
| HRB | Rockwell B Hardness |
| HRC | Rockwell C Hardness |
| I-20 | Interstate 20 |
| ksi | 1,000 pounds per square inch |
| KUMHO | KUMHO TIRE USA, Inc. |
| LADOTD | Louisiana Department of Transportation and Development |
| LSP | Louisiana State Police |
| MCSAP | Federal Motor Carrier Safety Assistance Program |
| mg | milligram |
| Neoplan | Neoplan USA Corporation |
| SAE | Society of Automotive Engineers |
| SafeStat | Safety Status Measurement System |
| USDOT | U.S. Department of Transportation |

# Executive Summary

At 10:50 a.m. on October 13, 2003, a 1992 Neoplan USA Corporation 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 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 determines 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.

The safety issues identified in this accident are

- Driver fatigue,
- Adequacy of State and Federal oversight of motor carriers,
- Identification and appropriate use of speed-restricted tires on motorcoaches,
- Criteria for State and Federal annual inspections of motorcoach passenger seating anchorage points, and
- Performance standards for motorcoach passenger seating anchorages.

As a result of this accident investigation, the Safety Board makes safety recommendations to the National Highway Traffic Safety Administration, the Federal Motor Carrier Safety Administration, the American Association of Motor Vehicle Administrators, the Commercial Vehicle Safety Alliance, and Neoplan USA Corporation.

# Factual Information

## Accident

### *Synopsis*

At 10:50 a.m.[1] on October 13, 2003, a 1992 Neoplan USA Corporation (Neoplan) 49-passenger motorcoach, owned and operated by the First Baptist Church of Eldorado, Texas, (church) was traveling eastbound on Interstate 20 (I-20) near Tallulah, Louisiana. (See figures 1 and 2.) The motorcoach, carrying a group of 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 interstate on the outside shoulder. (See figure 3.) Eight motorcoach passengers sustained fatal injuries, and the motorcoach driver and six passengers received serious injuries. The Peterbilt driver was not injured.

### *Accident Narrative*

On October 13, 2003, the accident motorcoach was in Shreveport to begin the second day of a planned 16-day multicity sightseeing trip. At 8:00 a.m., the accident driver went to the motorcoach to begin preparing for the drive to the next major destination of the tour. The two drivers for the trip, the accident driver and a codriver,[2] were both members of the church. According to the accident driver, the motorcoach was already running when he arrived because the codriver had arrived earlier and started the engine. He said that the two drivers completed their pretrip inspection of the motorcoach together, checking the tires, water, oil, and external light bulbs. The accident driver then began driving eastbound on I-20.

The driver said he was wearing his lap belt on the morning of the accident, and he recalled that the headlights were on and the climate control was set to vent because the air conditioning was inoperable. The accident driver made one stop at a gasoline station in Ruston, Louisiana, around 9:30 a.m. (about 1 1/2 hours before the accident) for fuel and a rest break. The accident driver told Safety Board investigators that it was normal practice for each driver to drive about 2 to 2 1/2 hours before being relieved. He recalled that he had been planning to stop at a rest stop before Tallulah to switch with the codriver, but he noticed the codriver was sleeping, so the driver decided to wait until he reached Tallulah to stop.

[1] Unless otherwise indicated, all times in this report are central daylight time.

[2] The codriver was fatally injured in the accident. He was seated in the second row on the passenger side of the motorcoach when the accident occurred.

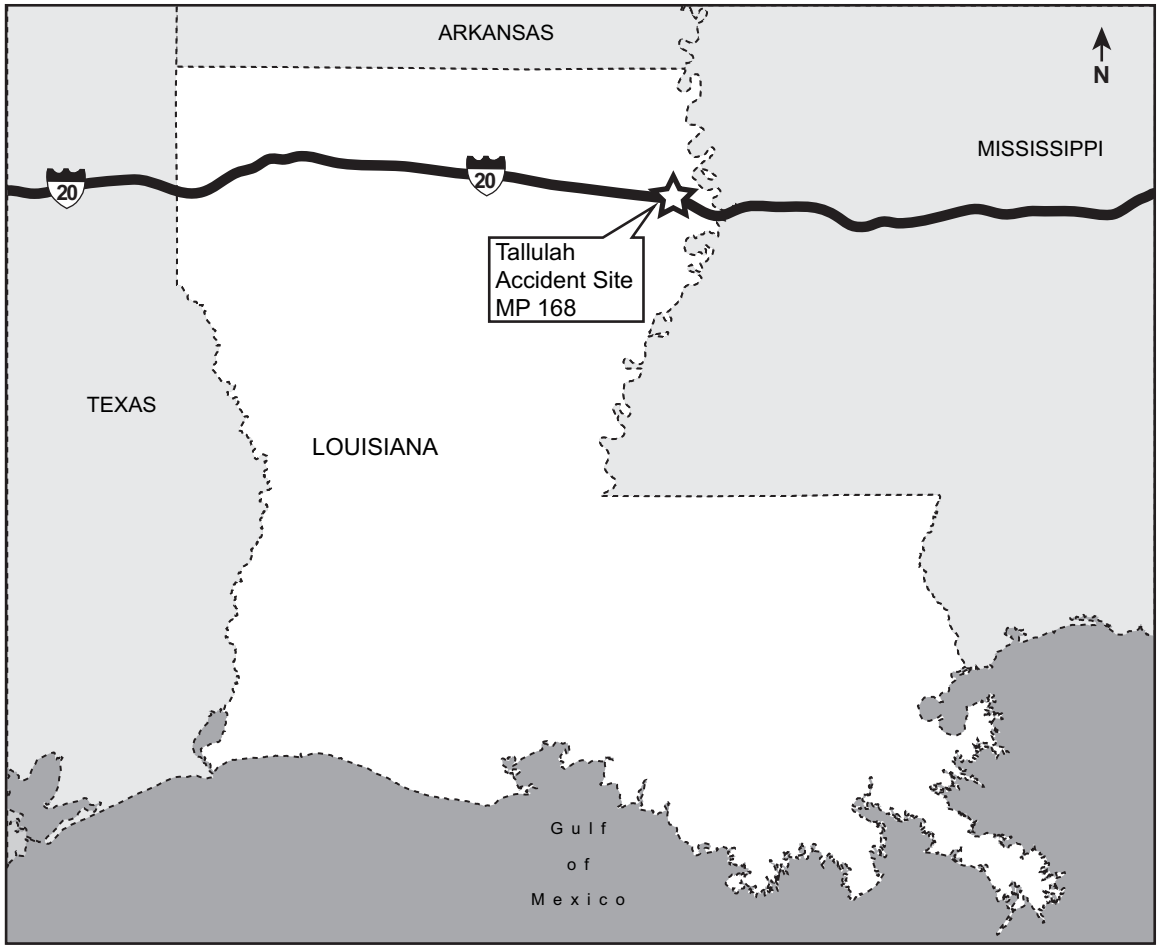


**Figure 1.** Regional view of accident site.

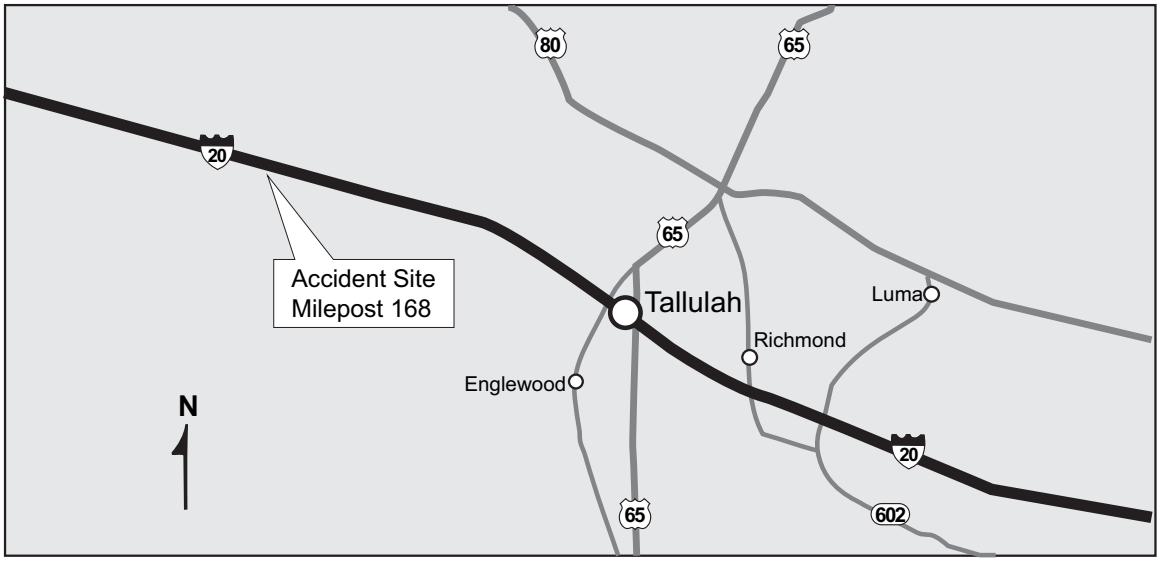


**Figure 2.** Local view of accident site.

**Figure 3.** Damaged motorcoach and tractor semitrailer on shoulder following accident. (Source: Louisiana State Police)

Witnesses who were traveling in vehicles behind the motorcoach for more than 30 miles prior to the accident reported that they noticed the motorcoach speed up, slow down, and drift from lane to lane. In a statement to the Louisiana State Police (LSP), one witness said the motorcoach had been "going side to side" for 2 miles before the collision. A second witness who had been driving eastbound on I-20 described the motorcoach as running off the right side of the road and then coming back and driving into the left lane. The second witness also reported that the motorcoach almost struck her vehicle, ran a pickup truck off the road, and nearly swerved into the path of a tractor semitrailer traveling in an adjacent lane.

One of the motorcoach passengers told Safety Board investigators[3] that he did not notice anything unusual about the driver or the trip before the accident. At the time of the accident, this passenger was seated five or six rows behind the driver. He recalled the sound of the crash but did not hear any noise before the impact.[4] Another passenger, seated behind the driver, reported to Safety Board investigators that she had been reading a map and observing the driver before the accident. She recalled that she felt that the speed of the

[3] The Safety Board conducted postaccident interviews of only two of the surviving six passengers, due to their extensive injuries.

[4] This passenger mentioned that he was hard of hearing.

motorcoach was fine and that everything seemed fine. Then she noticed that the driver began to drift to the right. She said she yelled to the driver that they were about to hit a truck on the shoulder.

As the motorcoach approached milepost 168, it was drifting rightward at an approximate 3° angle from the travel lanes. The motorcoach entered the paved right shoulder. A 1998 Peterbilt tractor semitrailer, owned by Alpha Trucking, Inc., and occupied by a driver, was parked on the right shoulder, facing eastbound, with the left-side trailer tires about 3 feet to the right of the white edgeline.[5]

According to the LSP report,[6] the driver of the Peterbilt tractor semitrailer had left Alpha Trucking headquarters in Utica, Mississippi, about 6:00 a.m. that morning and proceeded to Rayville, Louisiana. At a cotton company in Rayville, the semitrailer was loaded with about 90 bales of unginned cotton for delivery to Jackson, Mississippi. According to the driver, the tractor semitrailer, which left the cotton company around 9:30 a.m., entered I-20 at the Rayville interchange at milepost 138 and proceeded eastbound. As stated in the LSP accident report, the Peterbilt driver told police that at 10:00 a.m., he had stopped for 10 to 15 minutes at an interstate rest area near milepost 150 and performed a "walk around" and a "tire inspection." The vehicle then continued eastbound and traveled for several miles before the driver noticed smoke coming from his trailer's left rear tires. He pulled onto the right shoulder, near milepost 167.9, "to make adjustments to the trailer." He told the LSP that he had been on the shoulder 10 to 15 minutes and that he had just re-entered the cab of his truck, had released the brakes, and was preparing to proceed, when the accident occurred.

The motorcoach traveled about 103 feet on the shoulder and then collided with the back of the semitrailer at milepost 167.9 while traveling at a speed between 60 and 65 mph.[7] Postaccident inspection of the accident scene revealed no evidence of braking or steering by the motorcoach driver. When the collision occurred, the motorcoach's right front tire was about 5 feet to the right of the white edgeline on the shoulder, and the right drive and tag axle tires were also on the shoulder. All the left-side tires were still within the right traffic lane. At impact, the front of the motorcoach was aligned so that the center of the vehicle made contact with the left rear corner of the combination vehicle's semitrailer. 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 interstate on the outside shoulder. (See figures 4 and 5.) The semitrailer's tractor was on the shoulder, but the rear of the semitrailer had been pushed slightly into the grassy right-of-way to the right of the shoulder pavement.

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[5] The edge of the traveled way was the white-painted edgeline dividing the right lane from the right-side shoulder.

[6] The tractor semitrailer driver refused to speak with Safety Board investigators during the investigation.

[7] Using the assumed weights of both vehicles and the calculated postcollision speeds, investigators were able to estimate the collision speed of the motorcoach. Additionally, the motorcoach driver had indicated to the LSP in an interview that he recalled he was driving about 65 mph before the accident.

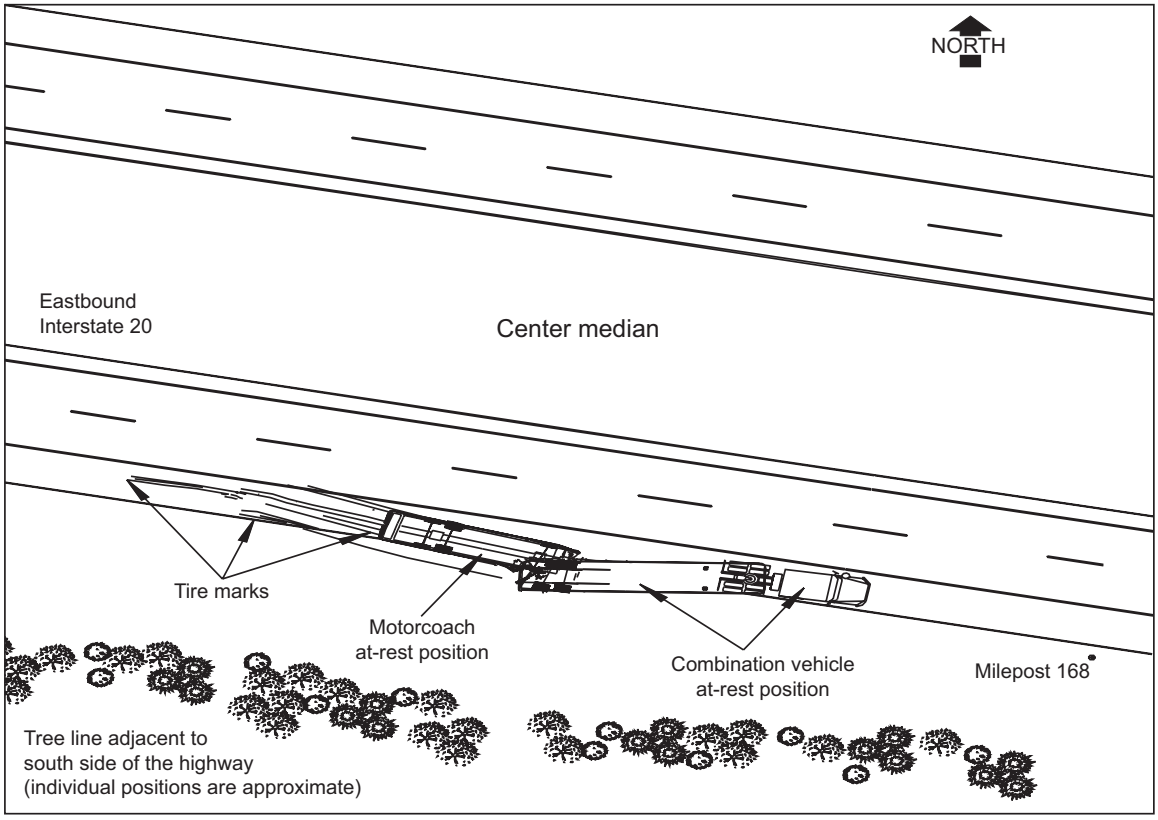


**Figure 4.** Accident site

**Figure 5.** Motorcoach and Peterbilt tractor semitrailer at accident site. (Source: Louisiana State Police)

## Injuries

Eight motorcoach passengers were killed, and six passengers and the motorcoach driver sustained serious injuries. The Peterbilt truck driver was not injured.

**Table 1.** Injuries.

| Injury[A] | Motorcoach Driver | Motorcoach Passengers | Truck Driver | Total |
|---|---|---|---|---|
| Fatal | 0 | 8 | 0 | 8 |
| Serious | 1 | 6[B] | 0 | 7 |
| Minor | 0 | 0 | 0 | 0 |
| None | 0 | 0 | 1 | 1 |
| Total | 1 | 14 | 1 | 16 |

[A] Title 49 *Code of Federal Regulations* (CFR) 830.2 defines a fatal injury as "any injury which results in death within 30 days of the accident" and serious injury as "an injury which: (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, nerve, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burn affecting more than 5 percent of the body surface."

[B] One of the seriously injured passengers died due to accident injuries 35 days after the accident. (He had been seated in the ninth row on the passenger side of the motorcoach.) As indicated in footnote A, only fatalities resulting within 30 days of the accident are included as fatal injuries in Safety Board reports.

The eight passengers who sustained fatal injuries were reportedly found trapped between seats by emergency responders; they received serious injuries to the head, upper torso, internal organs, and extremities. These passengers were seated in rows 1, 2, 3, 5, 6, and 7 on the passenger side and rows 3 and 5 on the driver side. (See figure 6.) The six seriously injured passengers sustained blunt trauma to the head, upper torso, and extremities. Emergency responders reportedly found all six trapped between seats or in the aisle of the accident motorcoach forward of their precrash seating positions. The driver was the only restrained[8] occupant of the motorcoach, and he sustained serious injury to the left shoulder and lower right leg.

[8] The driver's lap belt (two-point restraint) was the only seat belt in the motorcoach.

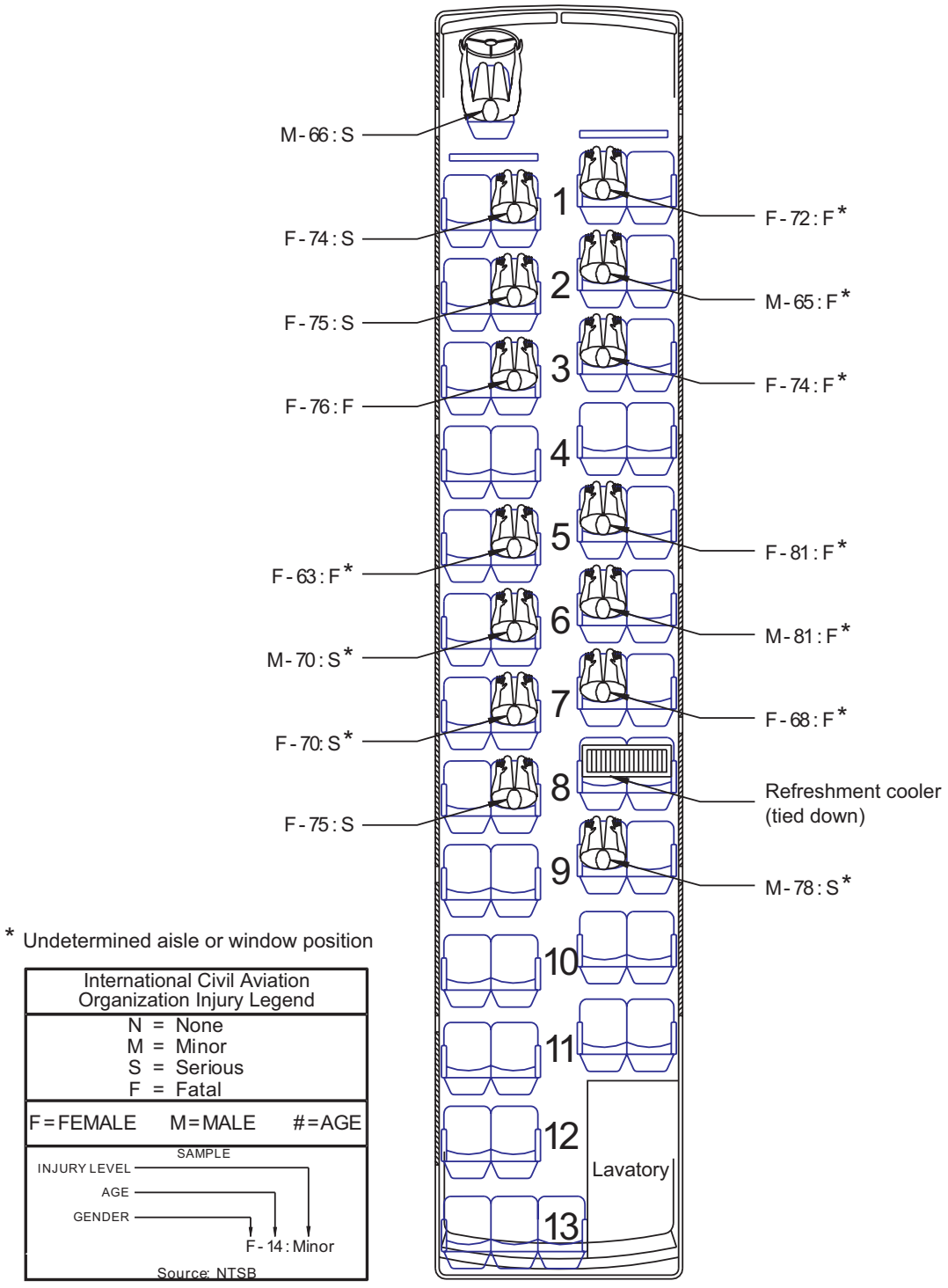


**Figure 6.** Accident motorcoach passenger seating chart.

## Emergency Response

At 10:50 a.m., Madison (Louisiana) Parish Sheriff's Office dispatchers were notified of the accident through 911, and they immediately initiated an emergency response. The LSP was notified of the accident at 10:52 a.m. The first emergency medical personnel and police and fire responders were on the scene by 10:54 a.m. An LSP trooper arrived at 11:00 a.m. and assumed incident command for the scene. More than 30 LSP troopers, local law enforcement and corrections personnel, nurses, and fire personnel were dispatched to the scene. Local ambulance services requested mutual aid, and 13 emergency medical personnel responded to the scene, along with multiple ambulance and emergency personnel from surrounding emergency medical service agencies. Two local hospitals also dispatched registered nurses to the scene as part of the mutual aid response. The accident took place near the Madison Parish Sheriff's Office, and numerous deputies, investigators, and other corrections personnel, including two registered nurses, responded upon hearing the initial report of the accident and the request for mutual aid.

## Damage

### *Motorcoach*

**General.** The motorcoach sustained massive damage and rearward crush to the front end, with most of the crush damage just to the right of the driver's area. The right front wheel and associated suspension system were pushed rearward about 15 inches. The motorcoach frame front cross member support was moved rearward about 64 inches. The main longitudinal frame members that comprised the left- and right-side spines of the motorcoach's monocoque[9] frame were deformed. The accident motorcoach's right-side tubing frame was moved rearward about 38 inches. The interior right-side intrusion, measured at the right-side modesty panel, was 124 inches. The leading edge of the forward, right-side luggage compartment, adjacent to the passenger compartment floor panel, had a rectangular indentation, similar in configuration to the rear of the combination vehicle's semitrailer. The intrusion measured at this location was 155 inches.

In the motorcoach's passenger compartment, the damage was concentrated on the right (passenger) side. The two front modesty panels were deformed; the one on the left (driver) side was deflected forward over the driver's seat area, and the one on the right side was destroyed by the intrusion damage. Six panoramic windows were on the left side of the motorcoach. The first window's glazing was missing; the glazing in the remaining five windows was intact. On the right side, the glazing of the first three and the fifth windows was missing. The fourth and sixth windows' glazing was intact. Windows 2, 4, and 6 on the left side and windows 4 and 6 on the right side were emergency windows.

**Passenger Seats.** Emergency responders removed 32 seats (16 seat frames) from the motorcoach while extricating injured passengers. Emergency personnel told Safety

[9] *Monocoque* refers to a motor vehicle design in which the body and frame are integrated.

Board investigators that upon their arrival immediately after the accident, they found the seats "piled up" near the front of the coach, with passengers trapped among and underneath the seats. The emergency personnel stated that they had to pick the seats up and remove them from the motorcoach to extricate the passengers from the wreckage. Safety Board investigators found 16 seat frames (2 seats per frame) outside the motorcoach. Two seat frames remained inside the motorcoach on the passenger side and 6 frames remained on the driver side, for a total of 17 seats.

The passenger seat assemblies were composed of a seat frame containing two individual seat positions; each position had a seat bottom cushion, a seat back cushion, a headrest, an armrest, and a footrest (attached to the seat frame ahead). The seat frame was attached to an aluminum track on the interior sidewall by two C-clamps. A single pedestal slightly offset from the frame center was attached to a stainless-steel floor track by two T-bolt fasteners. The seating was designed so that the owner of the motorcoach could adjust the seating arrangement (number of seats and distance between rows). To move seats within the coach, the seat pedestal T-bolts had to be turned parallel in the track, the sidewall C-clamps had to be loosened, and the seats had to be removed or slid along the floor track. Then, once placed and arranged as desired, the seats had to be re-secured by tightening the C-clamps and turning the T-bolts nearly perpendicular in the track. (See figure 7.)

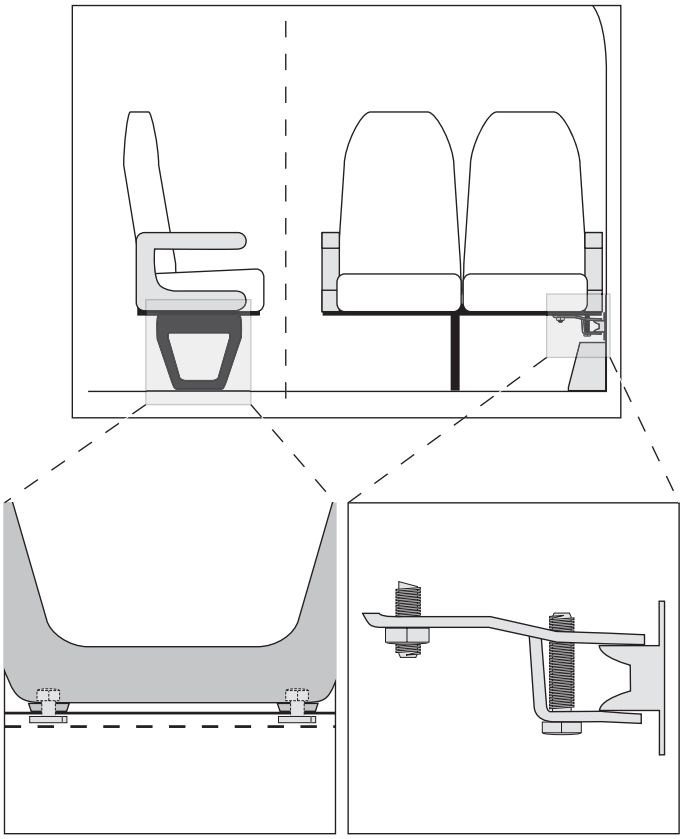

**Figure 7.** Representative diagram of motorcoach passenger seat. On the LEFT: side view with close-up of pedestal, showing T-bolts and floor track attachment. On the RIGHT: front view with close-up of forward C-clamp and sidewall track.

The 16 seat frames found outside the motorcoach had a total of 32 T-bolts, and the heads on 25 of these T-bolts exhibited substantial deformation. The heads on the remaining 7 T-bolts did not exhibit substantial deformation and were found to be aligned approximately parallel to the direction of the floor track. Fifteen of the 32 C-clamps were deformed or missing from the seat frames as a result of accident damage or damage caused while the passengers were extricated. On the 17 seats (8 seat frames) that remained in their original positions within the motorcoach, 5 C-clamps were deformed, 1 frame pedestal was torn from the floor track at the T-bolt, and the rest of the seat C-clamps and T-bolts were intact. (See figures 8, 9, and 10.)

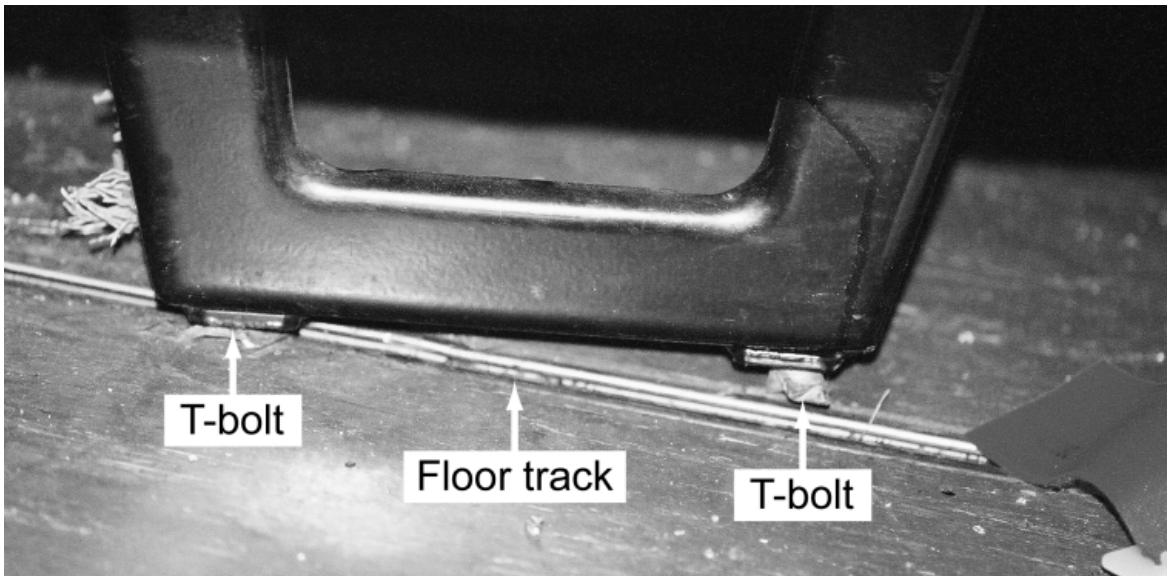


**Figure 8.** Close-up of floor track and T-bolt fasteners.

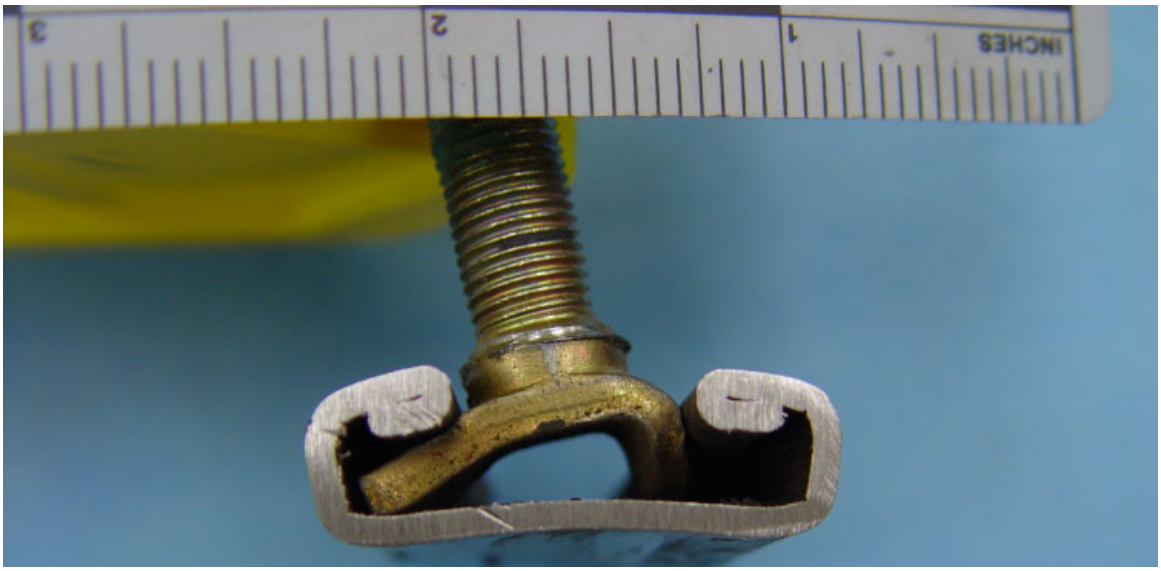


**Figure 9.** Damaged T-bolt in floor track.

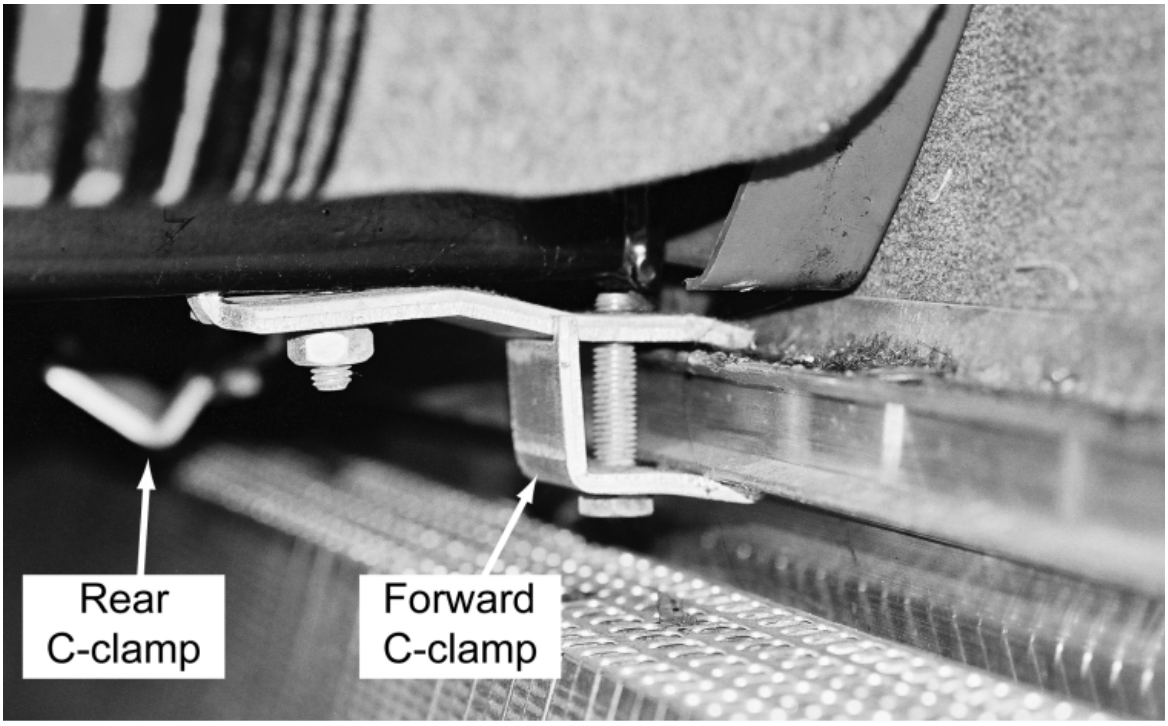


**Figure 10.** C-clamps attaching seat to sidewall track.

### *Peterbilt Tractor Semitrailer*

The Peterbilt tractor sustained no observable collision-related contact damage. The semitrailer sustained damage from being struck by the motorcoach. The semitrailer's left wheel on the number four axle was moved forward 13 inches, and the left wheel on the number five axle was displaced 31 inches. The semitrailer's rear frame cross member on the left side was moved forward about 14 inches. (See figure 11.)

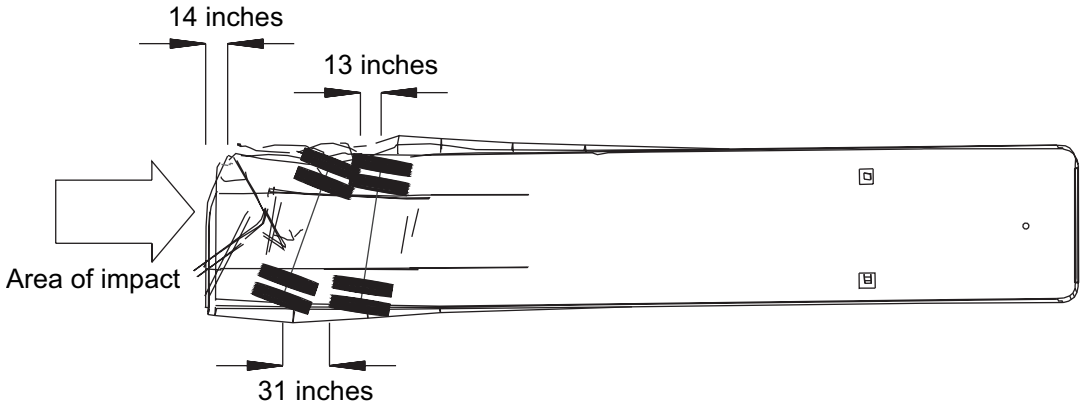


**Figure 11.** Topographic view showing variation between axle assemblies and crush damage to rear of semitrailer.

# Driver Information

## *Motorcoach Driver*

**Certification and Experience.** The 66-year-old accident motorcoach driver held a Texas class "B"[10] commercial driver's license (CDL) with a corrective lenses restriction and a passenger endorsement valid through March 2005. His license had last been renewed in March 1999.[11] The driver did not hold a medical examination certificate in accordance with 49 CFR 391.41. According to remarks made to Safety Board investigators during a postaccident interview, the driver did not think he needed a medical examination certificate to drive for the church.

The motorcoach driver first obtained a license to drive a bus in 1962. He worked as a school bus driver from 1969 through 1974. He also worked as a substitute school bus driver from 1986 until 1996.[12] According to the driver, he had occasionally driven the church's motorcoach as a volunteer since joining the church in 1975. The church had owned (in succession) three motorcoaches in the years before the accident and had owned the accident motorcoach for about 1 year. The driver stated that he had experience with multiday interstate trips, having driven for the church on similar trips in the past.

**Medical.** During an interview with Safety Board investigators, the driver stated that he took the prescription sleep aid medication Ambien (generic name zolpidem) in the evening on Mondays, Wednesdays, and Fridays. Zolpidem is used for the treatment of insomnia.

According to a review of the literature[13] on the drug,

> Zolpidem is a hypnotic[14] that appears to cause less global impairment during peak effect than do benzodiazepine hypnotics. It is free of persistent performance decrement or hangover effects. It has no active metabolites, does not accumulate in the body, and appears to have few interactions with other medications. It has not been reported to cause rebound insomnia in normal individuals. Despite extensive worldwide use, zolpidem has had few adverse events reported.

[10] A Texas class "B" commercial driver's license allows the driver to operate any single vehicle with a gross vehicle weight rating of 26,001 pounds or more, any one of those vehicles towing a vehicle that does not exceed 10,000 pounds gross vehicle weight rating, any vehicle designed to transport 16 passengers or more (including the driver), and any class "C" vehicle.

[11] According to the Texas Department of Public Safety's 2002 *Texas Commercial Motor Vehicle Drivers Handbook*, interstate drivers must certify that they meet the requirements of 49 CFR Part 391, which covers the qualifications of commercial motor vehicle drivers.

[12] The driver's work experience between 1961 and 2000 (when he retired) also included periods of employment as a sports coach, a teacher, a dispatcher/bookkeeper for an oil company, and a dispatcher for a propane company.

[13] C. Ramsey and S. Mcglohn, "Zolpidem as a Fatigue Countermeasure," *Aviation Space and Environmental Medicine*, October 1997, 68 (10): 926-931.

[14] A drug that produces sleep.

The manufacturer of zolpidem has stated that

> Patients should be cautioned against engaging in hazardous occupations requiring complete mental alertness or motor coordination such as operating machinery or driving a motor vehicle after ingesting the drug, including potential impairment of the performance of such activities that may occur the day following ingestion.[15]

The driver stated that he took the prescription medication Ultram (generic name tramadol) for joint pain three times a day. Tramadol is used for the management of moderate to severe pain, and its side effects can include dizziness and sleepiness. At least one study has noted a decrease in the ability to perform complex tasks with the use of the drug.[16]

During the postaccident examination of the motorcoach, investigators found numerous dietary supplements in a box that also contained the motorcoach driver's prescription medications. (See appendix B for a complete list of the supplements found.) The dietary supplements, which the motorcoach driver acknowledged were his, are classified as substances that are unregulated by the U.S. Food and Drug Administration (FDA) under the Dietary Supplement Health and Education Act of 1994. When interviewed, the driver could not recall what dosage of each supplement he was taking or at what times or in what combination he was taking them in the 72 hours before the crash. Among the supplements' ingredients were herbal substances, including valerian, passionflower, Siberian ginseng, hops, and couch grass.

The driver underwent a polysomnography (sleep study) on August 18, 2000. The report of the sleep study noted (in part) the following:

> 2-3 year history of frequent awakening at night feeling short of breath. …without taking an Ambien it typically takes him 1-2 hours to fall asleep, sometimes longer. He awakens 6-8 times during the night, and then takes him 10-15 minutes to fall back to sleep. … Technical Summary: Total recording time was 7 hours with sleep time of 4.7 hours for sleep efficiency of 67%. Slow wave sleep count of 47% of sleep. He had virtually no REM sleep noted during this stay. Sleep latency[17] was approximately 86 minutes. … Apnea is numbered 13 obstructed, 5 central, 61 mixed with 17 hypopneas. Lowest oxygen saturation was 88%. …consistent with mild obstructive sleep apnea [OSA][18] with mild-to-minimal oxygen desaturation. Generally sleep apnea of this degree can be treated clinically with increase in aerobic exercise, refraining from sleeping supine, and avoidance of sedating medications late in the evening.

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[15] *Physician's Desk Reference*, 58th ed. (Oradell, N.J.: Medical Economics Co., 2004).

[16] T. Hummel et al. "Assessment of Analgesia in Man: Tramadol Controlled Release Formula vs. Tramadol Standard Formulation," *European Journal of Clinical Pharmacology*, 1996, 51: 31-38.

[17] *Sleep latency* is the amount of time it takes to fall asleep.

[18] OSA is characterized by repetitive episodes of upper airway obstruction that occur during sleep, usually associated with a reduction in blood oxygen saturation. Although the exact cause remains unclear, OSA usually occurs in the area of the soft palate when the muscles holding the airway open relax too much, allowing the airway to collapse. Symptoms of OSA can include excessive daytime sleepiness, insomnia, snoring, morning headaches, and a dry mouth upon wakening.

The driver was not prescribed use of a Bi-level Positive Airway Pressure (BiPAP)[19] machine for his mild OSA.

According to the driver's medical records, on December 15, 1997, he visited a rheumatologist for "follow-up of degenerative joint disease involving his neck." He was prescribed Ultram on December 30, 1997. The driver's physician's notes from August 30, 2000, stated, "The only time he [the driver] does get sleep is with the use of Ambien 3 times weekly." Notes from an orthopedic surgeon dated November 1, 2001, stated, "Pain frequently awakens him and/or keeps him from sleeping." Medical records dated May 29, 2003, document the driver's visit to a rheumatologist, noting, in part, "Joint pain… still on tramadol 6 a day and can tell it helps…." The rheumatologist prescribed two 50-milligram (mg) Ultram tablets to be taken three times a day and one 10-mg Ambien tablet to be taken every other day.

Just before the accident trip, on October 6, 2003, the driver visited his physician, who noted that the driver had

> Chronic degenerative arthritis, chronic low back pain… sleep disturbance… advised when he is driving bus to be sure that he is not drowsy with the Ambien. Would caution and possibly avoid it. He states he is going to be out of town for 16 days on a bus trip….

**Duty Status.** About 8:00 a.m. on Sunday, October 12, 2003, the accident motorcoach departed Eldorado, Texas, for Shreveport, Louisiana. The motorcoach arrived in Shreveport about 5:00 p.m. According to the accident driver, he went to bed about 9:00 p.m. and slept until 6:00 a.m. on October 13. He told the LSP that he did not take his sleep medication (zolpidem) that evening and that he had slept "off and on" that night.

A 72-hour history for the motorcoach driver appears in table 2. It is based on interviews, the multicity tour itinerary, and evidence recovered from the motorcoach.

[19] A *BiPAP machine* administers air under pressure via a nose mask to keep airways open and unobstructed. BiPAP units track the patient's breathing and lower the pressure during exhalation.

**Table 2.** Motorcoach driver's 72-hour history summary. ( ~ is approximate)

| Date (2003) | Time (24-hour clock) | Activity | Duty Status* | Hours |
|---|---|---|---|---|
| October 10 | 2200 | Driver goes to bed, usual time | Off duty | 9.00 |
| October 11 | 0700-1000 | Driver awakens and eats breakfast | Off duty | 3.00 |
| | 1000-2200 | Church, motorcoach, and personal activities | Off duty and on duty, not driving | 12.00 |
| | 2200 | Driver goes to bed, usual time | Off duty | ~8.00 |
| October 12 | ~0600-0730 | Driver awakens, goes to codriver's home | Off duty | 1.50 |
| | 0730-~0830 | Tour group leaves from Eldorado for Menard, TX (50 miles); codriver drives to Menard | Off duty | ~1.00 |
| | ~0830-1000 | Driver operates motorcoach | On duty, driving | 1.50 |
| | ~1000-1015 | Group stops for break in San Saba, TX (codriver begins driving motorcoach) | Off duty | 0.25 |
| | 1015-1200 | Codriver drives from San Saba to Waco, TX | Off duty | 1.75 |
| | 1200-1245 | Group stops in Waco for lunch | Off duty | 0.75 |
| | 1245-1430 | Driver operates motorcoach from Waco to Tyler, TX | On duty, driving | 1.75 |
| | 1430-1700 | Codriver drives, Tyler to Shreveport, LA | Off duty | 2.50 |
| | 1700-2100 | Group arrives in Shreveport; driver works on motorcoach, eats dinner, watches TV | On duty, not driving | 4.00 |
| | 2100 | Driver goes to bed | Off duty | 9.00 |
| October 13 | 0600-0800 | Driver awakens, eats breakfast, does "walk-around" inspection with codriver | Off duty and on duty, not driving | 2.00 |
| | 0800-0930 | Group leaves Shreveport; driver is operating motorcoach | On duty, driving | 1.50 |
| | 0930-0950 | Stops for 20- to 30-minute break in Ruston, LA | On duty, not driving | 0.50 |
| | 1050 | Accident occurs | On duty, driving | 1.00 |

* The driver and codriver did not keep a logbook of duty hours as required by 49 CFR 395.80. The information in this column is based on the driver's recollections and represents the hours driving and not driving to show what the logbook should have reflected.

**Statements About the Accident.** During his initial interview with the LSP and a Safety Board investigator, the day after the accident, the driver said that he had not been eating, drinking, smoking, reading, using the phone, or tuning the radio at the time of the crash. He also stated that he must have "drifted off" or fallen asleep. He recalled a female voice saying, "You're going to hit it," but he did not recall actually opening his eyes before the impact. The accident driver stated that he did not see a tractor semitrailer parked on the side of the road.

During a second interview, 2 days after the accident, the driver declined to answer Safety Board investigators' questions and only made a statement. The driver stated that he did not see "any flashers or anything" on the tractor semitrailer and that, "If I had seen his lights I would have known he was stopped." He said he had been following the truck at a safe distance.

In a third interview with Safety Board investigators, about 2 months after the accident, the accident driver stated that he recalled that a passenger on the motorcoach had yelled, but he could not see anything and felt "funny." According to the driver, when he did manage to open his eyes, the first thing he saw was the corner of the trailer approaching the motorcoach window; he said the corner was "very close," and he had no time to react before the collision.

### *Peterbilt Tractor Semitrailer Driver*

The 69-year-old tractor semitrailer driver held a Mississippi Class "A" CDL that was issued on September 23, 1999. The driver's license had expired on October 3, 2003, 10 days before the accident. The driver renewed his license the day after the accident, on October 14, 2003, and the newly issued CDL was valid through October 3, 2007. The driver's qualification file contained an application for employment with Alpha Trucking. The application included a copy of the driver's CDL issued on October 14, 2003, and a medical certificate issued on May 15, 2003, with an expiration date of May 15, 2004. It did not include a list of previous employers, a driving record, or information on the driver's driving experience as required under 49 CFR 391.51. Safety Board investigators made several attempts to interview the Alpha Trucking driver but obtained no response from the driver or the company.

## Vehicle Information

### *Motorcoach*

The 1992 49-passenger Neoplan USA Corporation model AN116/3 motorcoach was 40 feet long. It was equipped with a Detroit Diesel Corporation Series 60, 12.7-liter, electronically controlled diesel engine, which had a DDEC II[20] electronic control module

[20] Detroit Diesel Electronic Controls II.

(ECM) and an engine retarder.[21] The motorcoach did not have a dedicated event data recorder (EDR), and the engine's ECM was not designed to capture or monitor any vehicle operational or accident-related data. The motorcoach had an Allison Transmission model HT-748 automatic transmission. When inspected postaccident, the vehicle odometer indicated 3,899.9 miles.

The motorcoach was equipped with a conventional S-cam air mechanical drum brake system on all three axles, with slack adjusters made by Haldex Commercial Vehicle Systems North America. The steer axle was configured with "clamp-type-24" service brake actuators, and inspection of the brake assemblies revealed that both assemblies were within established adjustment limits.[22] The drive axle was equipped with a "clamp-type-30" service brake and "clamp-type-30" park/emergency brake actuators; an examination of the brake assembles revealed that both exceeded the established adjustment limits.[23] The tag axle was equipped with "clamp-type-16" service brake actuators, and inspection of the brake assemblies revealed that both assemblies were within established adjustment limits.[24] The coach was configured with a hydraulic power-assist steering system. Inspection revealed no signs of excessive play or wear, and the steering system range of motion was smooth, without binding or restriction, with the exception of the last 1/4 inch of travel to the left, which was due to accident damage.

The three-axle coach was equipped with eight tires: two on the first (steering) axle, four on the second (drive) axle, and two on the third (tag) axle. No visible damage was observed to the tires or wheel assemblies, with the exception of the right front tire and wheel assembly. KUMHO TIRE USA, Inc., (KUMHO) had manufactured the tires, which were designed to be operated at a maximum speed of 55 mph.[25] The restricted speed information was embossed on each tire's outer sidewall and was clearly visible.

According to information obtained during a Safety Board interview with members of the First Baptist Church of Eldorado, the church purchased the motorcoach on February 2, 2002. On February 8, 2002, R.L. Anderson International, Inc., of San Angelo, Texas, performed initial maintenance on the motorcoach. On February 28, 2002, Anderson performed preventative maintenance on the motorcoach and mounted new KUMHO tires.[26]

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[21] An *engine retarder* is a device that causes the exhaust valves to remain closed during an engine's exhaust stroke, stopping the escape of gases through the exhaust valves. Instead, they are compressed by the piston, causing the piston to slow. Engine brakes or retarders are used on large trucks to assist in slowing the vehicle.

[22] See the Commercial Vehicle Safety Alliance (CVSA) *North American Standard Out-Of-Service Criteria*, Appendix A, Part II, 1a(5).

[23] CVSA *Out-Of-Service Criteria*, Appendix A, Part II, 1a(5).

[24] CVSA *Out-Of-Service Criteria*, Appendix A, Part II, 1a(5).

[25] According to KUMHO technical personnel, the tire's speed restriction of 55 mph was due to its construction, because its designed application was for high-load capacity and durability. The tire's design included heavy sidewall construction, which reduced the tire's heat dispersion capabilities. The use of this particular tire design at highway speeds for extended periods, described by KUMHO as 2 to 3 hours, would subject the tire to elevated operating temperatures and potential catastrophic failure. Therefore, KUMHO recommended against extended use of speed-restricted tires at highway speeds.

[26] The church purchased the tires from the Cheyenne Tire Company on February 25, 2002.

Amaya-Astron Seating of Mexico manufactured the motorcoach seats and the C-clamps that attached the seat frames to the interior wall. According to Neoplan, General Motors Corporation manufactured the T-bolt fasteners that attached the seat frame centers to the floor. Isringhausen Seating manufactured the driver seat. The Neoplan manual found inside the motorcoach provided some guidance concerning the motorcoach seats. For the driver seat, it provided information on maintaining the tightness of the nuts and bolts and on replacing worn or broken parts. For the passenger seats, the information pertained to cleaning and repairing the seat covering (fabric and plastic components).

All pretrip inspections and routine and preventative maintenance were arranged through and documented by the church's transportation committee head, who owned and operated a trucking business in Sonora, Texas. He told investigators that he always had one of his mechanics "look over" the motorcoach before the church used it. In April 2002, the coach was serviced at Motor Coach Industries in Dallas, Texas, and the speedometer, VCR, and stereo were replaced; the wiring in the dash was repaired; and the door locks were repaired or replaced. On June 26, 2003, the coach successfully passed a Texas State annual inspection and was issued a certificate.

### *Peterbilt Tractor Semitrailer*

The 1988 Peterbilt model 379 conventional tractor was equipped with a mechanically controlled Cummins diesel engine, manual transmission, and two speed-tandem drive axles. Alpha Trucking, Inc., of Utica, Mississippi, owned and operated the tractor, which was designed to seat two occupants and was configured with a single-person sleep berth. The tractor's odometer indicated 326,020 miles, and the annual inspection certificate was dated March 2003.

During the postaccident mechanical inspection of the tractor, 49 separate equipment conditions were found, which, if they had been detected during the vehicle's annual inspection, would have been cause for the vehicle's being rejected and disqualified from receiving an inspection certificate. Examination of the tractor tires for tread depth, abnormal wear, proper use, and mounting or loading violations was unremarkable. Inspection of the steering system revealed a loose tie rod at the left steering knuckle. A loose outer torsion bar bolt was found between the second and third axle on the left side, and the suspension system bushings were generally worn. The pneumatically controlled fifth-wheel plate had been disabled, and three fasteners along the right side and two fasteners along the left side of the mounting assembly were missing. The tractor was equipped with conventional air-actuated S-cam mechanical drum brakes on all axles. Disqualifying violations were found at every brake location. See table 3 for the results of the Safety Board's postaccident inspection of the accident tractor's brakes.

**Table 3.** Safety Board inspection of 1988 Peterbilt accident tractor brakes.

| Item Examined | Inspection Revealed |
|---|---|
| **Axle 1. Right Front Brake** | Foundation brake "cammed over"[A] and brake assembly inoperable. |
| Upper and Lower Linings | Lining thickness less than required 1/4 inch. Upper lining covered in debris, worn down to and including fasteners. Upper lining exhibited surface pitting, crumbling, and cracking, with large crack traversed between two fastener points. Lining and backing plate covered in grease and dirt. Lower lining worn down to and including the fasteners, with numerous cracks in the lining material and a large section missing. |
| S-cam Bushing | Axial endplay measured 0.125 inch; exceeded specification of 0.005 to 0.045 inch. |
| Drum | Worn past service life; inside diameter of 15.167 inches exceeded maximum of 15.120 inches. Friction surface contaminated with grease and dirt; exhibited scoring,[B] bell-mouthing,[C] convex wear patterns,[D] and heat-checking.[E] |
| **Axle 1. Left Front Brake** | Assembly out of adjustment. |
| Upper and Lower Linings | Assembly lining thickness less than required 1/4 inch. Worn down to fasteners with surface pitting, cracking, and scratching. Large crack traversed across and through the width of the lining. Lower lining exhibited surface pitting, chunking, and cracking within the lining material; it was worn down to the rivets in several locations. Both linings exhibited varying degrees of glazing.[F] |
| S-cam Bushing | Axial endplay measured 0.093 inch and radial endplay measured 0.026 inch. Both exceeded specifications of 0.005 to 0.045 inch and 0.020 inch, respectively. |
| Drum | Maximum diameter of 15.163 inches exceeded maximum allowable diameter of 15.120 inches. Friction surface exhibited a combination of scoring, bell-mouth wear patterns, grooving, and heat-checking. |
| **Axle 2. Right Brake** | Assembly exceeded maximum allowable stroke of 2 inches by 1/8 inch. |
| Upper and Lower Linings | Upper brake shoe was loose; missing return spring was found resting inside the flange of the lower brake shoe. Both linings exhibited areas of glazing, pitting, grooving, and cracking, and crumbling of lining material. |
| S-cam Bushing | Axial endplay measured 0.191 inch and radial endplay measured 0.106 inch. Both exceeded adjustment and replacement specifications of 0.005 to 0.045 inch and 0.020 inch, respectively. |
| Drum | Friction surface exhibited dark-spotting, color-banding, heat-checking, scoring, and grooving. Broken wheel stud was found. |
| **Axle 2. Left Brake** | |
| Upper and Lower Linings | Both linings exhibited glazing, surface-cracking, flaking, and crumbling of lining material with edge-grooving. Both linings had cracking between fasteners. Upper lining had a small section of lining unburnished.[G] |
| S-cam Bushing | Axial endplay measured 0.196 inch and radial endplay measured 0.107 inch. Both exceeded adjustment and replacement specifications of 0.005 to 0.045 inch and 0.020 inch, respectively. |

| | |
|---|---|
| Drum | Inner diameter measured 16.690 inches, which exceeded maximum permitted diameter of 16.620 inches. Friction surface exhibited heat-checking, dark-spotting, discoloration, convex wear pattern, and edge-grooving. |
| **Axle 3. Right Brake** | Assembly revealed adjustment exceeding maximum allowable stroke of 2 inches by 1/8 inch. Defective service diaphragm with large audible air leak upon application. |
| Upper and Lower Linings | Linings exhibited glazing, cracking, surface-flaking, crumbling, deep-grooving, and scratching. Lower lining edges were damaged, with edges crumbling or breaking off. |
| S-cam Bushing | Axial endplay measured 0.210 inch and radial endplay measured 0.026 inch. Both exceeded adjustment and replacement specifications of 0.005 to 0.045 inch and 0.020 inch, respectively. |
| Drum | Maximum inner diameter measured 16.685 inches, exceeding maximum permitted diameter of 16.620 inches. Friction surface scored with wear-edging, heat-checking, discoloration, and grooving. |
| **Axle 3. Left Brake** | Cammed over; upper and lower shoes were misaligned with S-cam assembly. Brake chamber bracket was bent backward, and slack adjuster clevis bushing was missing. |
| Upper and Lower Linings | Frictional surfaces were contaminated with a substance consistent with a combination of grease and heavy oil. Recessed areas between the lining pads and rivet holes were filled with the grease/oil substance. Once removed, the linings remained grease-soaked.[H] Lining surfaces were cracked and flaking, with deep grooving. |
| S-cam Bushing | Axial endplay measured 0.210 inch, and radial endplay measured 0.026 inch. Both exceeded adjustment and replacement specifications of 0.005 to 0.045 inch and 0.020 inch, respectively. |
| Drum | Maximum inner diameter measured 16.719 inches, exceeding maximum permitted diameter of 16.620 inches. Interior of brake drum was contaminated similarly to linings and was cleaned for inspection. Friction surface exhibited heat-checking, grooving, and areas of discoloration. |
| **Lighting** | Rear brake lights, turn signals, and running lamps were missing. The front headlights were inoperable, and the right front turn signal was inoperable. |

[A] *Cammed over* is a condition in which the S-cam rotates beyond the foundation brake cam rollers and remains lodged in this position. This condition is generally caused by a combination of out-of-adjustment brakes, worn brake shoes, and an excessively worn drum.

[B] *Scoring* is deep scratching or grooving of a brake drum's friction surface.

[C] *Bell-mouthing* is a shape distortion generally caused by extreme heat and braking pressures.

[D] *Convex wear patterns* are shape distortions generally caused by excessive heat or an oversized drum, causing the open end of the drum to distort.

[E] *Heat-checking* consists of small cracks on a brake disc or drum friction surface; the cracks are caused by heat.

[F] *Glazing* refers to a smooth, glossy appearance, generally due to overheating, which causes a hardening of the lining material.

[G] *Brake burnish* is defined by the *Motor Truck Engineering Handbook*, 4th edition, as the conditioning of a brake's friction surfaces by wear and temperature, either by a test procedure or an in-service operation.

[H] *Grease-soaked* means that the lining has been completely exposed to lubricants that have soaked into the linings and have completely immersed the friction material with the contamination.

Alpha Trucking also owned and operated the 1986 Frueheuf semitrailer. The two-axle semitrailer was equipped with eight tires; no accident-related damage was observed to the tires or the wheel assemblies, with the exception of the left rear tire, which showed impact-related damage. All tire tread depths were examined and found to be in compliance with CVSA *North American Standard Out-of-Service Criteria* tread depth of 2/32 inch or more.

The semitrailer was configured with conventional air-actuated S-cam mechanical drum brakes. During the postaccident mechanical inspection of the semitrailer's brakes, 18 separate conditions were found, which, if they had been detected during the vehicle's annual inspection, would have been cause for the vehicle's being rejected and disqualified from receiving an inspection certificate. Disqualifying violations were found at every brake location. See table 4 for the results of the Safety Board's postaccident inspection of the accident semitrailer's brakes.

## Highway Information

### *General*

The accident occurred on eastbound I-20 at milepost 167.9, near Tallulah, Louisiana. I-20, classified as a rural interstate, was a divided, straight, level, four-lane, asphalt roadway. Each travel lane was 12 feet wide, and broken, white retroreflective lines on the road surface separated the lanes. A solid, yellow retroreflective line on the road surface delineated the inner edge of the roadway, and the east and westbound lanes were separated by a 56-foot-wide depressed grassy median.[27] A solid, white retroreflective line on the road surface delineated the outer edge of the traveled way from the 10.8-foot-wide asphalt shoulder. A 30-foot clear zone[28] bordered the outside shoulder and consisted of a grass-covered right-of-way with a 6:1 foreslope.[29] The posted speed limit was 70 mph for I-20 at the accident site.

[27] The distance across this area from yellow-striped line to yellow-striped line was 64 feet.

[28] A *clear zone* is the total roadside border area, starting at the edge of the traveled way, available for use by an errant vehicle. This area may consist of a shoulder, a recoverable slope, a nonrecoverable slope, and/or a clear run-out area. The desired width is dependent upon the traffic volumes and speeds and on the roadside geometry. (From the American Association of State Highway and Transportation Officials (AASHTO) *Roadside Design Guide*, 2002, G-1.)

[29] Ground elevation changes 1 foot vertically for every 6 feet horizontally. See the AASHTO *Roadside Design Guide*, 2002, 3-2.

**Table 4.** Safety Board inspection of 1986 Fruehauf accident semitrailer brakes.

| Item Examined | Inspection Revealed |
|---|---|
| **Axle 4. Right Brake** | Nearly cammed over while in applied position; there was a 1-inch-thick accumulation of grease and dirt on the outer flange of the lower brake shoes. |
| Upper and Lower Linings | Inner edge contamination with deep scratching and cracking of lining. Flaking and crumbling of lining material. Lower linings completely worn with drum and fastener contact; upper lining worn to within 1/32 inch from the fastener head; thickness less than the required 1/4 inch. |
| S-cam Bushing | Axial endplay measured 0.082 inch; exceeded specification of 0.005 to 0.045 inch. Radial endplay measured 0.077 inch; exceeded specification of 0.030 inch. |
| Drum | Inside diameter of 16.634 inches exceeded maximum permitted diameter of 16.620 inches. Friction surface exhibited heat-checking and an area of darkening and discoloration. The drum exhibited a convex wear pattern, deep scratching, grooving, and wear-edging. |
| **Axle 4. Left Brake** | |
| Upper and Lower Linings | Upper lining material exhibited glazing, inner edge contamination, and grease-soaking. Lining exhibited deep scratching, grooving, and cracking. Lining worn to 1/32 inch of the fastener head; thickness less than the required 1/4 inch. Lower lining worn to the point of fastener-to-drum contact and exhibited contamination, grease-soaking, cracking, flaking, and deterioration. |
| S-cam Bushing | Radial endplay measured 0.073 inch; exceeded specification of 0.030 inch. |
| Drum | Maximum diameter of 16.624 inches exceeded maximum allowable diameter of 16.620 inches. Friction surface exhibited heat-checking, dark-spotting, and contamination. There was drum surface scoring and wear-edging to the outer edge. |
| **Axle 5. Right Brake** | Brake assembly was cammed over and inoperable. |
| Upper and Lower Linings | Both linings worn to and included fastener-to-drum contact; thickness less than the required 1/4 inch. Contamination of both linings and drum surface. A 1.25-inch accumulation of grease and dirt was observed on the outer flange of the lower brake shoe. |
| S-cam Bushing | Axial endplay measured 0.055 inch and radial endplay measured 0.051 inch. The radial endplay measurement of 0.051 inch exceeded the 0.030-inch replacement specification. |
| Drum | Inner diameter measured 16.657 inches, which exceeded maximum permitted diameter of 16.620 inches. Friction surface exhibited contamination, heat-checking, scoring, and bell-mouthing patterns with wear-edging. |
| **Axle 5. Left Brake** | |
| Upper and Lower Linings | Upper lining exhibited glazing, cracking, and scratching. Minimum lining thickness measured at 1/32 inch with convex wear pattern, and thickness less than required 1/4 inch. Lower lining exhibited glazing, cracking, flaking, and deterioration of lining surface; worn, with evidence of fastener-to-drum contact; thickness less than the required 1/4 inch. |
| S-cam Bushing | Axial endplay measured 0.043 inch, within the replacement specification of 0.005 to 0.060 inch. Radial endplay measured 0.063 inch, exceeded the 0.030-inch replacement specification. |
| Drum | Inner diameter measured 16.634 inches, which exceeded the maximum permitted diameter of 16.620 inches. Friction surface exhibited heat-checking. Drum exhibited scoring and convex wear pattern with edge-grooving. |

### *Traffic*

Louisiana Department of Transportation and Development (LADOTD) records from 2000 through May 2003 indicated that 21 accidents occurred within 2 miles of the accident scene, from milepost 166 to milepost 171 (in both the east- and westbound directions). The accidents resulted in no fatalities.[30]

According to the LADOTD, the most recent preaccident traffic count in the vicinity of the accident was 17,193 vehicles per day. The count was taken 1 mile west of Tallulah, near milepost 169, on June 23, 2003. The available average daily traffic counts from 1995 through 2000, including both eastbound and westbound traffic lanes, are provided in table 5. The most recent data provided by the LADOTD for vehicle classifications on the interstate near the accident site indicated that buses account for 0.88 percent of vehicles, passenger vehicles and cycles for 37.76 percent, and trucks[31] for 61.36 percent.

**Table 5.** Available average daily traffic counts for accident area from 1995 through 2000. (Note: LADOTD did not provide figures for 1998 and 1999.)

| Year | Vehicles Per Day |
|---|---|
| 2000 | 19,335 |
| 1997 | 18,877 |
| 1996 | 14,738 |
| 1995 | 19,678 |

### *Rumble Strips*

According to the LADOTD, Louisiana is installing shoulder rumble strips on all its National Highway System roadways.[32] The Federal Highway Administration (FHWA) defines a shoulder rumble strip as

> A longitudinal design feature installed on a paved roadway shoulder near the travel lane. It is made of a series of indented or raised elements intended to alert inattentive drivers through vibration and sound that their vehicles have left the travel lane.[33]

On I-20, the rumble strips were rectangular-shaped, 7 inches wide, 16 inches long, and 0.5 inch deep, with a 5-inch space between the individual sections. The strips were milled onto the road surface 6 inches from the edge of the traveled way. In the area of the accident site, the rumble strips were located intermittently from the city of Monroe, Louisiana, east to the Mississippi State line. They were installed from Monroe to

[30] Before this accident, no fatalities were ever recorded in the area of the accident site.

[31] "Trucks" by this definition included 2-axle/4-tire and 2-axle/single units, up to 7-axle/multitrailer trucks.

[32] The LADOTD maintains 800 miles of mainline interstate that are part of the National Highway System.

[33] U.S. Department of Transportation, FHWA, *Roadway Shoulder Rumble Strips*, Technical Advisory T5040.35, Washington, D.C., December 20, 2001.

milepost 138 and from milepost 140 to milepost 149. The roadway sections from milepost 138 to milepost 140 and from milepost 149 to the Mississippi State line did not have rumble strips. The section of roadway including the accident site at milepost 167.9 did not have rumble strips.

According to the LADOTD, at the time of the accident, the State was preparing to begin a project to resurface the roadway and install rumble strips on the shoulder of I-20 beginning near milepost 158 to about milepost 171. The project was to begin with the opening of sealed bids from candidate contractors in November 2003 and to be completed in summer 2004. A resurfacing project had been conducted on the road in the area of the accident scene from 1989 to 1992.

In 2001, the LADOTD implemented a district-wide rumble strip installation project.[34] The section of I-20 from milepost 157 to the Mississippi State line, which included the accident site at milepost 167.9, was not part of the project. According to the LADOTD, this section was omitted because it was scheduled to be resurfaced in 2003 (see above), and installation of the rumble strips was delayed so the job could be included with the resurfacing project.[35] According to the LADOTD, rumble strip installation from milepost 157 to Tallulah (milepost 171) was completed in September 2004.

### *Motorist Service Facility and Weigh Station Locations*

In the eastbound direction, truck stops, fuel stations, and other facilities were located along the interstate between Rayville, Louisiana, (milepost 138) and Tallulah (milepost 171). The facilities provided locations where drivers could stop and inspect the mechanical condition of their vehicles without stopping on the shoulder. (See table 6.)

**Table 6.** Motorist facilities along I-20 from milepost 138 to 171 (all in Louisiana).

| Milepost Number | Facility Name |
|---|---|
| 138 | Rayville Travel Center (Rayville) |
| 138 | Pilot Travel Center (Rayville) |
| 138 | Lee Truck Service (Rayville) |
| 141 | Bee Bayou Truck Stop (Rayville) |
| 150 | Rest Area |
| 153 | Jubilee Truck Stop (Dehli) |
| 157 | Waverly Tiger (Waverly) |
| *167.9* | *accident location* |
| 171 | Fast Lane (Tallulah) |

[34] SP 737-95-0018.

[35] SP 451-08-0065.

Title 32, Article 296, of the Louisiana Revised Statutes[36] pertains to vehicles stopping, parking, or standing upon State highway shoulders; it states

> (A) No person shall stop, park, or leave standing any unattended vehicle on any state highway shoulder when such stopping or parking on the highway shoulder shall obstruct the flow of traffic or is a hazard to public safety, unless such stopping, parking or standing is made necessary by an emergency…. (B) In case of an emergency, the driver of a vehicle may lawfully operate the vehicle on any state highway shoulder in accordance with the normal standards of prudent conduct to protect himself and others from harm. When the emergency ends, the vehicle shall not be operated on the state highway shoulder.

Title 32, Article 369, requires that, between sunrise and sunset, trucks and other large vehicles parked on the shoulder be marked with two red flags, one placed 100 feet behind and the other 100 feet ahead of the parked vehicle, in such a way as to be visible to all approaching traffic during daylight hours. Title 32, Article 471, provides that a vehicle that is inoperable and left on the shoulder of a highway (abandoned) for more than 3 days may be towed.

## Operations Information

### *First Baptist Church of Eldorado*

According to the church pastor, the church owned the accident motorcoach and had provided it to a group called the "Senior Ambassadors." Although the group itself was independent of the church, some group members were church members. The Senior Ambassadors normally took an annual motorcoach trip and, according to the pastor, had been doing so for the past 15 years. The Senior Ambassadors party involved in this particular trip comprised 15 people, including the driver and codriver; 12 were church members and 3 were nonmembers. The group paid the entire cost of the trip, including trip costs for the drivers. The group was responsible for paying for the fuel used on the trip and for returning the motorcoach in good condition. The church was responsible for any motorcoach repairs that might be necessary during the trip. The church did not compensate the motorcoach drivers for driving.

At the time of the accident, the church was not registered as an interstate motor carrier with the Federal Motor Carrier Safety Administration (FMCSA), so it did not have a U.S. Department of Transportation (USDOT) Identification Number, as is required of motor carriers under the FMCSA's Federal Motor Carrier Safety Regulations (FMCSRs).[37] According to the FMCSA, a commercial motor vehicle is defined as a vehicle having (or being):

[36] Title 32 of the Louisiana Revised Statutes, called the "Louisiana Highway Regulatory Act," governs traffic regulation in the State.

[37] Title 49 CFR 385.301.

- A gross vehicle weight, gross vehicle weight rating, gross combination weight, or gross combination weight rating of 10,001 pounds or more;
- Regardless of weight, designed or used to transport eight or more passengers, including driver;
- Regardless of weight, used in the transportation of hazardous materials and required to be placarded under the Federal Hazardous Materials Regulations.

According to the church, it believed before the accident that it was a "not-for-hire" carrier, and it did not consider that its motorcoach was a commercial vehicle. The church also stated that it was not aware of the FMCSA.[38] The church applied for title, registration, and license plates for the accident motorcoach in Texas on March 4, 2002. The Texas title application receipt classified the church's motorcoach as a bus, indicated that the registration class was "Private Bus more than 6,000 pounds," and stated that the receipt was to be carried in all commercial vehicles.

Texas defines a commercial motor vehicle as

A self-propelled or towed vehicle, used to transport persons or property that is used on a public highway to transport passengers or cargo if:

1. The vehicle or combination of vehicles has a gross weight, registered weight, or gross weight rating of more than 26,000 pounds; or
2. The vehicle is a farm vehicle with a gross weight, registered weight, or a gross weight rating of more than 48,000 pounds; or
3. The vehicle is designed to transport more than 15 passengers, including the driver; or
4. The vehicle is used to transport hazardous materials in a quantity requiring placarding by a regulation issued under the Hazardous Materials Transportation Act; or
5. The vehicle or combination of vehicles has a gross weight rating of more than 10,000 pounds and is operated in interstate commerce and registered in the State of Texas; or
6. The vehicle is a school bus that will operate at a speed authorized by the Texas Transportation Code; or
7. The vehicle is a school activity bus that has a gross weight, registered weight, or a gross weight rating of more than 26,000 pounds or is designed to transport more than 15 passengers, including the driver.

According to the church, its insurance company[39] informed it that its insurance coverage for the motorcoach was sufficient because the church was "exempt from regulations dealing with commercial carriers and… the driver regulations only required them to have drivers with commercial driver licenses."[40] The church's pastor stated that

[38] This was in a letter dated December 15, 2004, from the church's attorney to the Safety Board.

[39] Church Mutual Insurance Company, Merrill, Wisconsin.

the insurance company required the church to list its motorcoach drivers for policy coverage, which the church did. This driver list form included a section entitled "Driver Selection Guidelines," which was provided by the insurance company for the church to use in selecting its motorcoach drivers.[41] The church did not maintain driver qualification files for its drivers, did not have a drug or alcohol testing program for its drivers, and did not require its drivers to maintain logbooks while driving the motorcoach, all of which are required by the FMCSRs for a motor carrier.

The FMCSA requires that a motor carrier driver complete a Daily Vehicle Inspection Report (DVIR) at the end of each day and that the report list any defects noted during the operation of the vehicle. A binder containing blank and completed DVIRs was found in the motorcoach during the postaccident inspection. Two completed DVIRs for the accident trip were found. The codriver had signed the DVIR for October 12, 2003; it contained no notations of vehicle defects. The DVIR for October 13, 2003, the day of the accident, had been completed. It reported that a light bulb was needed on the right side of the vehicle. Neither driver had signed this DVIR.

### *Alpha Trucking*

According to its FMCSA registration, Alpha Trucking (USDOT 755390) was an authorized interstate "for-hire" carrier of general freight headquartered in Utica, Mississippi, at the time of the accident. Alpha Trucking incorporated with four officers and began operations in April 1998. (Alpha Trucking chose to take a 4-month operating hiatus from August through November 2002 due to the loss of a contract with a cotton company.)

Just after the accident, Alpha Trucking had four tractor units, two of which were operational, and six trailers, three of which were operational. The company employed four drivers. Alpha Trucking did not have a drug and alcohol testing program for its drivers as required by the FMCSRs. Its driver files contained the employment applications for four drivers and copies of the drivers' CDLs. The files contained medical certificates for three of the company's four drivers. The files contained none of the other records required by the FMCSRs, such as annual inquiries into drivers' records, annual reviews of drivers' driving records, or lists of drivers' violations.[42]

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[40] This statement is in a letter dated December 15, 2004, from the church's attorney to the Safety Board.

[41] These guidelines stated a preference that all drivers be between the ages of 25 and 65. However, they also indicated that drivers outside this recommended age range with no accident and/or no motor vehicle violations might be acceptable. The guidelines stated that drivers should not have any physical or health impairment that significantly limited their ability to drive safely and that drivers should have good driving habits. According to the guidelines, drivers should not have more than one accident or one traffic violation within the last 3 years. They stated that drivers having violations such as careless driving, reckless driving, or driving under the influence should not be allowed to operate vehicles on the church's behalf. The guidance indicated that all drivers should be properly licensed for the size and type of vehicle being driven and stated that a CDL is required in certain circumstances.

[42] See 49 CFR 391.51 for requirements.

## FMCSA Carrier Oversight

### *Compliance Reviews*

FMCSA standards require a motor carrier to have adequate controls in place to ensure compliance with applicable safety requirements. The FMCSA uses a rating formula to determine a motor carrier's safety fitness. The safety fitness rating process begins with an FMCSA-conducted compliance review.[43] A carrier may be selected for a compliance review if it is identified as a high-risk carrier because of (1) its Safety Status Measurement System (SafeStat) score,[44] (2) a complaint against a company, (3) an enforcement follow-up being necessary to ensure that an enforcement action taken has been effective, (4) a fatal accident, or (5) involvement in a major hazardous materials accident.

**First Baptist Church of Eldorado.** With respect to 49 CFR 390.3 and the applicability of the FMCSRs to motor carriers, the FMCSA has stated, "A church that provides bus tours to the general public for compensation is subject to the FMCSRs as a for-hire motor carrier."[45] After the accident, the FMCSA conducted a compliance review of the church.[46]

On December 5, 2003, the FMCSA issued a proposed compliance review safety rating of "Unsatisfactory"[47] for the church, based on the following factors:

- Factor #1: General (Parts 387, 390). "Conditional."
- Factor #2: Driver Qualification (Parts 382, 383, 391). "Unsatisfactory."
- Factor #3: Operational/Driving (Parts 392, 395). "Unsatisfactory."
- Factor #4: Vehicle/Maintenance (Parts 393, 396). "Unsatisfactory."
- Factor #5: Hazardous Materials (Parts 397, 171, 177, 180). "Not Applicable."
- Factor #6: Crash Rate. "Cannot be less than Satisfactory because the carrier has only one crash on record."[48]

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[43] Title 49 CFR Part 385, appendix A.

[44] The SafeStat analysis program uses data from Federal and State sources, including roadside inspections, accident data, and enforcement actions for all carriers, to develop a safety fitness assessment of a motor carrier.

[45] See <http://www.fmcsa.dot.gov/rulesregs/fmcsr/regs/interp390.3.htm>.

[46] See appendix C for the list of compliance review violations for the First Baptist Church of Eldorado.

[47] The result of a compliance review is a safety rating. A rating of "Satisfactory" for a carrier means the carrier has sufficient safety management controls in place to meet the safety fitness standards of the FMCSRs. A "Conditional" safety rating means the carrier does not have sufficient safety management controls in place and could be in violation of the safety fitness standards. An "Unsatisfactory" rating means the carrier does not have adequate safety management controls in place and has violated the safety fitness standards. If a carrier receives an "Unsatisfactory" rating, within 30 days of being issued the Suspension Order, the carrier must take the necessary corrective actions specified in the order or the carrier's provisional operating authority will be revoked.

[48] Factor 5: Hazardous Materials (Parts 397, 171, 177, 180), was not applicable and did not receive a rating, and Factor 6: Crash Rate, was not rated.

When the FMCSA issues a final[49] "Unsatisfactory" safety rating to a carrier, the owner or operator is deemed unfit to operate.[50] Owners or operators of commercial motor vehicles that are designed or used to transport passengers and that have been declared "unfit" may not operate in interstate commerce beginning on the 46th day after the date of such safety fitness determination and may not reestablish interstate operations until they become fit for such transportation.

**Alpha Trucking.** The FMCSA did not have a compliance review of Alpha Trucking on file.[51]

### *Roadside Inspections and Recordkeeping Requirements*

**First Baptist Church of Eldorado.** The FMCSA did not have any records of roadside inspections for the church's motorcoach.

**Alpha Trucking.** When a roadside inspection is conducted, a copy of the inspection is given to the vehicle's driver. The last page of the inspection form has signature lines, which are to be signed by the driver upon receipt of the report and by a motor carrier official to "certify" that the necessary repairs have been made to the inspected vehicle. According to Federal Motor Carrier Safety Assistance Program (MCSAP) procedures, this certification is then returned to the State MCSAP inspection office (in this case, the Mississippi Public Service Commission Office of Motor Carriers) to reflect and record that repairs to the defects, violations, or out-of-service orders were completed within 15 days of the inspection. A review of recent preaccident MCSAP inspection reports for the Alpha Trucking accident tractor revealed that the certification signature lines had been signed "Alpha Trucking, Inc.," to certify that all the noted defects/violations had been repaired.

Alpha Trucking's accident tractor underwent three roadside inspections in the 5 months before the accident. The State of Mississippi conducted the inspections as part of the MCSAP. A May 28, 2003, roadside inspection report for the Alpha Trucking tractor noted the following defects/violations: "Inoperative speedometer; discharged fire extinguisher; inoperable left low beam; emergency warning device missing; tire-ply or belt material exposed second axle right side outer tire; and an inoperative horn." None of the violations placed the tractor out of service, and Alpha certified that all the repairs were completed by June 6, 2003.

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[49] A safety rating will be issued to a motor carrier within 30 days following the completion of a compliance review. A proposed safety rating of "Unsatisfactory" is a notice to the motor carrier that the FMCSA has made a preliminary determination that the motor carrier is "unfit" to continue operating in interstate commerce and that the prohibitions in 49 CFR 385.13 will be imposed after 45 or 60 days if necessary safety improvements are not made.

[50] According to 49 CFR 385.13(a), an owner or operator receiving a notice of a proposed "Unsatisfactory" safety rating from the FMCSA must improve that rating to "Conditional" or "Satisfactory" within 45 days from the date of the notice. Owners or operators who fail to improve their rating within this 45-day period are prohibited from operating in interstate commerce beginning on the 46th day after the date of the rating notice. Owners or operators are "fit" when the FMCSA issues a final "Conditional" or "Satisfactory" safety rating.

[51] Alpha Trucking, Inc., has been out of business since March 9, 2004.

A June 3, 2003, roadside inspection of the same tractor found the following defects/violations: "Inoperable right front clearance lamp; oil/grease leak; inoperable/defective brakes on right front steer axle; brakes out of adjustment on left steering axle; and audible air leak." The inoperative brakes, brakes out of adjustment, and audible air leak were all noted as out-of-service violations and required immediate repair before the vehicle could return to the road. Alpha Trucking certified the other violations as having been repaired by June 6, 2003. Alpha Trucking's Inspection, Repair, and Maintenance Record[52] for the accident tractor did not list any of the above repairs as having been carried out between May 28 and July 4, 2003. The record stated that on July 4, 2003, the four rear tires and the low-beam headlights were inspected or repaired.

An August 14, 2003, roadside inspection of the accident tractor revealed the following defects/violations: "Tire tread depth less than 2/32 inch inside right #3 axle and noncompliance with headlamp requirements left side inoperative low beam." These two defects were not cited as out-of-service violations, and Alpha Trucking certified on August 18, 2003, that all the repairs to correct the violations had been completed. The Inspection, Repair, and Maintenance Record for the accident tractor did not cite any related repairs until, on October 3, 2003, it stated that the four front axle tires were replaced (and the brakes were adjusted).

Alpha Trucking's accident semitrailer underwent three roadside inspections in the 7 months preceding the accident. During a March 18, 2003, roadside inspection, the following defects/violations were cited: "Replace lamp covers for both clearance lamps and one of the rear ID lamps; inoperable left rear red side marker lamp; and retroreflective sheeting missing." Alpha Trucking certified on March 18, 2003, that the repairs to correct these defects had been completed. A roadside inspection report for May 28, 2003, noted an inoperable license plate lamp. Alpha Trucking certified on June 6, 2003, that the repair to correct this problem had been completed. A June 3, 2003, roadside inspection report showed the following defects/violations: "Brake out of adjustment, axle five right side and retroreflective sheeting not affixed." On June 6, 2003, Alpha Trucking certified that the repairs to these items had been completed. During the Safety Board's investigation, Alpha Trucking did not produce the Inspection, Repair, and Maintenance Record or the Annual Periodic Inspection Report for the accident semitrailer, which investigators requested. (See table 7 for Alpha Trucking's 24-month roadside inspection history.)

[52] This record is required by FMCSR 396.3.

**Table 7.** Alpha Trucking's 24-month roadside inspection history.[53]

| Inspection Type | Vehicle | Driver |
|---|---|---|
| Number of roadside inspections | 6 | 7 |
| Placed out of service | 4 | 0 |
| Alpha Trucking's out-of-service rate | 66.7% | 0% |
| 2003 National out-of-service rate (average) | 22.9% | 6.78% |

## Meteorological Information

The Vicksburg Tallulah Regional Airport Automated Surface Observing System, about 12 miles west of the accident site, was the closest official weather-observing system. At 10:53 a.m. on October 13, 2003, it reported clear conditions, a temperature of 75° F, and a 3-knot wind. On that day, the skies were cloudy, and the roadway was dry.

## Toxicological Information

Within 2 1/2 hours of the accident, a blood specimen was drawn from the motorcoach driver at the emergency room where he was treated. The LSP laboratory results were negative for alcohol, marijuana, cocaine, phencyclidines, amphetamines, and opiates. The Safety Board also tested a specimen of blood from the driver.[54] The test results were positive only for the pain medication tramadol at a level of 0.023 µg/ml.

The tractor semitrailer driver consented to a postaccident breath alcohol test. The LSP administered the test at 12:25 p.m. using an Intoxilyzer 5000. The test resulted in a blood alcohol content percentage reading of 0.000. According to 49 CFR 382.303, the employer of a driver of a commercial motor vehicle operating on a public road in commerce is required to conduct alcohol and controlled substance testing on that driver if the vehicle is involved in a fatal accident. Safety Board investigators found no indication that Alpha Trucking completed any postaccident controlled substance testing on the tractor semitrailer driver.

[53] Based on FMCSA inspection results for the 24 months preceding March 11, 2005 (March 11, 2003, to March 11, 2005).

[54] The specimen was tested at the Federal Aviation Administration Civil Aerospace Medical Institute toxicology laboratory for a wide range of licit and illicit substances, including amphetamines, opiates, marijuana, antihistamines, meprobamate, methaqualone, and nicotine.

## Tests and Research

### *Motorcoach Seat Anchorages*

Multiple passenger seat frames, including those outside the intrusion area, were found separated from the floor and sidewall following the accident. Components of the seating system, including the sidewall and floor anchorage systems, a seat frame pedestal, and pieces of sidewall and floor track, were sent to the Safety Board's Materials Laboratory for testing and comparison with exemplars. In addition, Neoplan sent new exemplar T-bolts to the Materials Laboratory for testing and comparison purposes. Hardware from another seating manufacturer, National Seating, was also obtained for comparison. The hardware from National Seating provided a good basis for comparison because this manufacturer's seats were involved in a motorcoach accident in Burnt Cabins, Pennsylvania,[55] which was similar to the Tallulah accident. The two accidents involved motorcoaches of similar sizes and weights, which departed the roadway at similar speeds, and then impacted parked semitrailers. The passenger loading and the amount of intrusion were similar in the Tallulah and Burnt Cabins accident motorcoaches. Yet in the Burnt Cabins accident, unlike the Tallulah accident, all the seats outside the intrusion area remained secured. (See figures 12 and 13.)

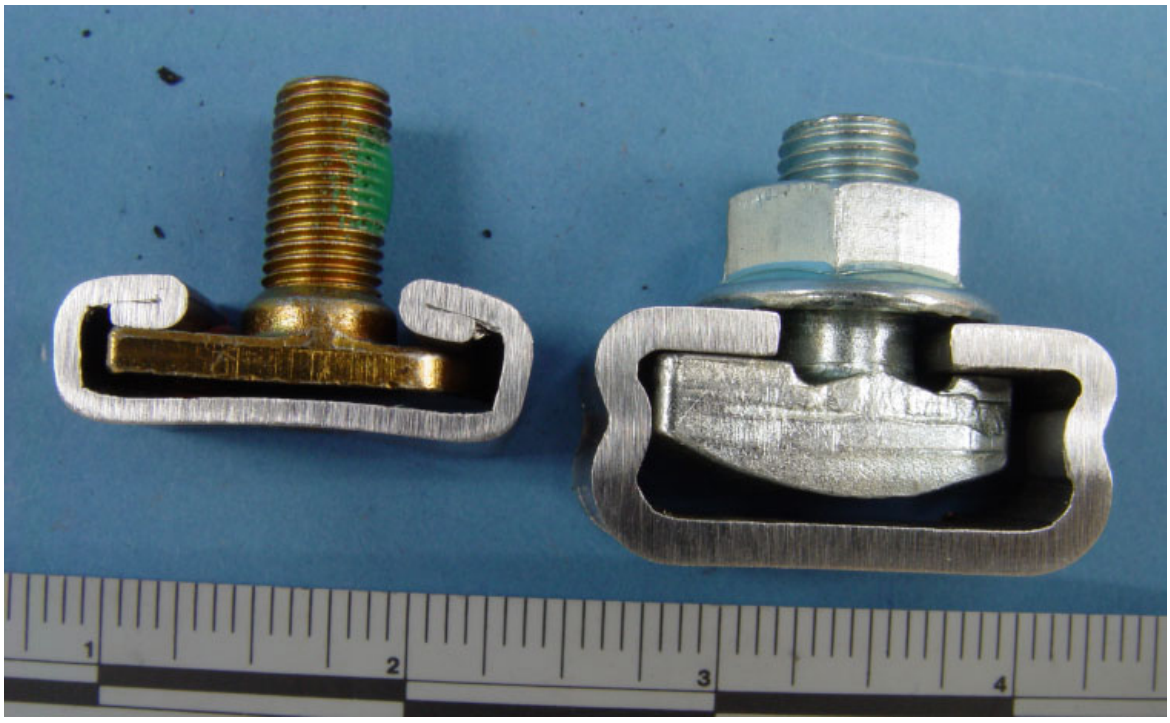


**Figure 12.** Exemplar T-bolt and floor track hardware for Neoplan (left) and National Seating (right).

[55] 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).

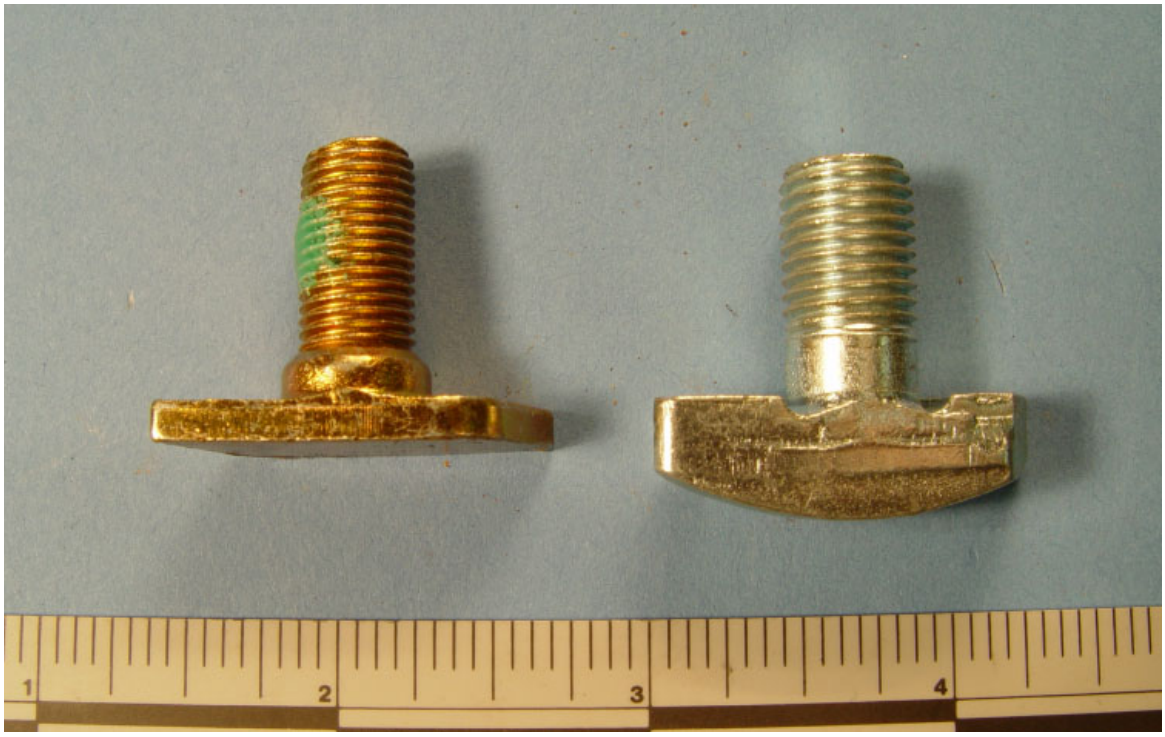


**Figure 13.** Exemplar T-bolt top section and length measurement for Neoplan (left) and National Seating (right).

The Neoplan motorcoach seat assemblies were attached to the floor by a single pedestal, slightly offset from the center of the two bottom cushions, which was attached to the seat frame and fastened into the floor track with two T-bolts that were typically 6.5 inches apart on the base of the pedestal. The T-bolts flare out at the lower (head) end and, once inserted into the track, the bolts were turned slightly less than 90° to engage, then torqued down to secure the seat location. The seat frame was attached to a sidewall track using C-clamps at the front and rear of the seat frame, located about 9.75 inches apart. Each C-clamp was attached to the seat frame by a single bolt and secured to the wall by two separate pieces of metal clamped together, with another bolt just inboard of the aluminum sidewall rail.

Examination of the accident T-bolts showed that one or both sides of many of the bolts' heads were deformed downward, allowing the bolts to be pulled upward through the floor track. The National Highway Traffic Safety Administration's Federal Motor Vehicle Safety Standard (FMVSS) 207, "Seating Systems," establishes the requirements for seats, their attachment assemblies, and their installation to minimize the possibility of seat failure caused by forces acting on the seat during an accident. The standard applies to passenger cars, multipurpose passenger vehicles, trucks, and buses.[56] The seating system

[56] The FMVSSs (49 CFR 571.3) define "bus" as a motor vehicle designed to carry more than 10 persons. Although Federal regulations specify the minimum construction standards for all buses, industry builds the various types of buses based on anticipated uses and service life. For the purposes of this report, the term "bus" is synonymous with "motorcoach."

safety standard for buses applies only to the driver seat position; it does not apply to passenger seats. No FMVSSs are in place that relate to hardness or other aspects of motorcoach passenger seating anchorages.

Macroscopic hardness readings were taken for the accident hardware and the exemplar hardware provided by Neoplan and National Seating. (See appendix D for detailed T-bolt testing data.) Overall, the Materials Laboratory data indicate that the three National Seating exemplar hardware T-bolts that were tested had an average hardness ranging from HRC[57] 28 to 29 (equivalent to 131 to 135 thousand pounds per square inch (ksi) strength). The four Neoplan accident T-bolts, reportedly made of 1010 steel, had an average hardness ranging from HRB[58] 39 to 71 (equivalent to less than 56 to 62, ksi strength). The single Neoplan exemplar (newer) T-bolt tested, reportedly made from 1015 steel, had a hardness of HRB 88 (equivalent to about 86 ksi strength). The Materials Laboratory also compared the thicknesses of the Neoplan T-bolts and track with those of National Seating exemplar T-bolts and track. The National Seating T-bolts and track were nearly twice as thick as the Neoplan accident and exemplar hardware.[59]

The crash pulse from the Safety Board's Vehicle Performance Division simulation of the motorcoach accident in Burnt Cabins was used to estimate the knee and head forces for a 50th percentile adult male striking the back of the seat. These knee and head impact forces were used to evaluate the loading on both the Neoplan seat anchorages and the exemplar anchorages provided by National Seating. The Materials Laboratory then used a simplified finite element model to represent the seat and a detailed finite element model to represent the T-bolts and track to calculate the tensile force applied to the pedestal T-bolts in an accident.

The results from the finite element models indicate that when subjected to crash forces similar to those in the Tallulah accident, the Neoplan T-bolts would have been expected to pull out of their track as a result of impact from an occupant in any seating position. Because of the differences in the dimensions and material properties between the Neoplan exemplar T-bolts and the National Seating exemplar T-bolts, another detailed three-dimensional finite element model was used to calculate the force required to pull a National Seating T-bolt out of its track. The results showed that the National Seating exemplar hardware would not have failed under the loading conditions from the Burnt Cabins accident.

[57] Rockwell C Hardness.

[58] Rockwell B Hardness.

[59] For example, the National Seating T-bolt head was 0.30-inch thick, and the Neoplan exemplar T-bolt head was 0.126-inch thick. The National Seating floor track was 0.123-inch thick, and the Neoplan floor track was 0.074-inch thick.

### *Motorcoach Crashworthiness in Other Countries*

In Canada, every new motorcoach built or imported must comply with the applicable Canada Motor Vehicle Safety Standards. The requirement in Canada Motor Vehicle Safety Standard 217 that is intended to reduce the frequency and severity of injuries caused by seat anchorage failures applies only to the driver seat; passenger seats do not have to meet this requirement.

In Europe, directives (regulations) are in place that relate to the strength of motorcoach superstructures, seats, and anchorages. Adherence to these regulations is not compulsory;[60] manufacturers consider them when developing, approving, and testing new motorcoaches.

Australia, following some severe motorcoach collisions in the late 1980s and early 1990s, and in response to significant public pressure, introduced regulations[61] to address seat anchorage and seat strength, along with rollover strength and the fitting of lap/torso belts for motorcoaches. The Australian and European regulations regarding the strength of motorcoach seat attachments, bus superstructure, and seat belts generally reflect real-world collision data.[62]

## Other Information

### *Selected Guidance to CDL Examiners on Medical Qualifications*

According to the FMCSA's regulations pertaining to medical certification of CDL holders, 49 CFR 391.41(b),

> A person is physically qualified to drive a commercial motor vehicle if that person has no established medical history or clinical diagnosis of rheumatic, arthritic, orthopedic, muscular, neuromuscular or vascular disease which interferes with his/her ability to drive a commercial motor vehicle safely.

[60] The United Nations Economic Commission for Europe details a list of regulations known as the "Geneva Regulations." European countries may voluntarily adhere to each of these regulations, which are mandatory in a particular country only if the regulations are explicitly incorporated into the country's regulations. The European directives are mandatory for all European Union members when the directives are included in Directive 70/156-2001/116/CE. The European Parliament Council or the European Commission, depending on the case, issues those directives, and they are approved in Brussels.

[61] These regulations, called the Australian Design Rules, were promulgated under the authority of the Motor Vehicle Standards Act of 1989. They are the means whereby mandatory new vehicle safety features are incorporated for vehicles sold in Australia. Locally constructed and assembled vehicles, as well as imported fully built-up vehicles, are required to conform to the regulations. (See the Introduction to *Bus Crashes and Occupant Protection. A Brief Summary and Analysis of Crashes Involving Long Distance Coaches, Australia 1988 to 1994*, published by the Federal Office of Road Safety, Canberra, Australia, in July 1998.)

[62] RONA Kinetics and Associates, Ltd., *Evaluation of Occupant Protection in Buses*, Report RK02-06, North Vancouver, British Columbia, Canada, June 4, 2002. Prepared for Road Safety and Motor Vehicle Regulation Transport, Canada.

No additional guidance is provided to assist examiners in determining whether an arthritic condition is disqualifying.

With respect to respiratory conditions, 49 CFR 319.41(b)(5) states,

> A person is physically qualified to drive a commercial motor vehicle if that person: has no established medical history or clinical diagnosis of a respiratory dysfunction likely to interfere with his/her ability to control and drive a commercial motor vehicle safely.

In guidance provided to commercial driver medical examiners,[63] the FMCSA cited OSA as a condition interfering with oxygen exchange, and therefore falling under 49 CFR 391.41(b)(5). It recommended that drivers with OSA be referred to a specialist for further evaluation and therapy. The FMCSA suggested examiners consider the severity of the condition, the degree of limitation, the likelihood of progressive limitation, and the likelihood of sudden incapacitation. The FMCSA provides no regulatory language or guidance that specifically defines diagnosed, but untreated, OSA as a disqualifying condition, nor does the FMCSA define the specific circumstances under which a driver with OSA would be considered effectively treated.

The FMCSA does not provide any regulatory or nonregulatory guidance regarding insomnia, with the exception of a nonbinding report[64] to the FMCSA, which suggests that individuals requiring hypnotics should use only short-acting drugs (those with half lives of less than 5 hours) and only at the lowest effective dose. It also suggests that use of hypnotics should be under medical supervision and restricted to short terms (less than 2 weeks).

The FMCSA also does not provide any regulatory or nonregulatory guidance regarding the use of specific medications, except to note that disqualifying offenses for commercial drivers include: "Driving a commercial motor vehicle under the influence of a 21 CFR 1308.11 Schedule I identified controlled substance,[65] an amphetamine, a narcotic drug, a formulation of an amphetamine, or a derivative of a narcotic drug." (See 49 CFR 391.15.) FMCSA regulations note that a driver is qualified who

> Does not use a controlled substance identified in 21 CFR 1308.11, Schedule I, an amphetamine, a narcotic, or any other habit-forming drug. Exception: A driver may use such a substance or drug, if the substance or drug is prescribed by a licensed medical practitioner who is familiar with the driver's medical history and assigned duties; and has advised the driver that the prescribed substance or drug will not adversely affect the driver's ability to safely operate a commercial motor vehicle.[66]

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[63] See the FMCSA document "Medical Examination Report for Commercial Driver Fitness Determination," 65 *Federal Register* 59363, October 5, 2000.

[64] USDOT, FHWA, Office of Motor Carriers, "Conference on Psychiatric Disorders and Commercial Drivers," Publication No. FHWA-MC-91-006, Washington, D.C., May 1991.

[65] Neither tramadol nor zolpidem is a Schedule I-identified controlled substance.

[66] See 49 CFR 391.41.

### *Commercial Vehicle Inspection Programs*

Both accident vehicles, the motorcoach and the tractor semitrailer, had undergone State inspections. The motorcoach had undergone a Texas inspection, and the tractor semitrailer bore a Mississippi inspection sticker.

**State of Texas.** The inspection of motor vehicles, including motorcoaches, in Texas is conducted in State-approved privately owned and operated garages and repair facilities, which are designated by the Texas Department of Public Safety under the Texas Vehicle Inspection Act. All authorized inspection facilities are required to operate according to the *Rules and Regulations Manual for the Operation of Official Vehicle Inspection Stations*, which is issued and maintained by the Texas Department of Public Safety.[67]

Chapter 4 of this manual pertains to vehicle tire inspection procedures; it does not include inspection criteria that address or require a procedure for ensuring the proper use of "speed-limited" tires. There are no guidelines pertaining to speed-limited tires on private or commercial vehicles in 49 CFR Part 393; in the FMCSRs appendix G to subchapter B, *Minimum Periodic Inspection Standards*; in the CVSA *North American Standard Out-of-Service Criteria*; or in the American Association of Motor Vehicle Administrators (AAMVA)[68] *Vehicle Inspection Handbook: Trucks, Buses, and Trailers*.

**State of Mississippi.** Mississippi does not have a mandatory annual or periodic inspection program for commercial vehicles,[69] so motor carriers in the State may use one of three different inspection methods to comply with the Federal annual inspection

[67] *Texas Transportation Code*, "Compulsory Inspection of Vehicles," Chapter 548.

[68] Founded in 1933, the AAMVA is a voluntary, tax-exempt, nonprofit, educational organization that develops model programs affecting motor vehicle administration, police traffic services, and highway safety and provides information concerning these disciplines. It also represents the U.S. and Canadian State and provincial officials who administer and enforce motor vehicle laws. The AAMVA has a Vehicle Registration and Title Committee, which conducts projects affecting vehicle titling issues and promotes AAMVA titling policies. (See the AAMVA Web site at <http://www.aamva.org/> for more information.)

[69] According to the Mississippi State Code of 1972, SEC. 63-13-15, *Licensing of Official Inspection Stations*: "The commissioner of public safety will annually issue permits for and furnish instructions and all necessary forms to official inspection stations for the inspection of vehicles as required in the issuance of official certificates of inspection and approval. Application for permit shall be made on an official form and shall be granted only when the commissioner of public safety is satisfied that the station is properly equipped and has competent personnel to make such inspections and that such inspections will be properly conducted. The person making the actual inspection for the station or under whose immediate personal supervision such an inspection is made shall have not less than one year's practical experience as an automotive mechanic. The commissioner of public safety shall properly supervise and cause inspections to be made of such stations and may, after reasonable notice, suspend or revoke and require the surrender of the permit issued to a station which he finds is not properly equipped or conducted. The commissioner of public safety shall maintain and post at the office of the department of public safety lists of all stations holding permits and of those whose permits have been suspended or revoked."

requirement.[70] [71] [72] First, motor carriers may meet the Federal inspection requirement by passing a State's or other jurisdiction's roadside inspection program, as long as the inspection was conducted during the preceding 12 months and was performed in accordance with the standards set in the FMCSRs. Second, the motor carrier may employ a commercial garage, fleet leasing company, truck stop, or other similar business to conduct the inspection, provided the business operates and maintains facilities appropriate for commercial vehicle inspections and employs qualified inspectors as required by the FMCSRs.[73] Finally, the motor carrier may choose to perform the required inspection itself and certify its own vehicles; the inspector must be certified in accordance with FMCSRs requirements.

Alpha Trucking chose to self-inspect and certify its own vehicles. In appendix G to subchapter B,[74] the FMCSRs list the minimum periodic inspection standards for commercial motor vehicles.[75] According to appendix G, a vehicle does not pass an inspection if it has one of the following defects or deficiencies:

1. ***Brake System.***
   (Appendix G criteria reject vehicles with any defective brakes, any air leaks, etc.)
   a. Service Brakes.
      (6) Brake linings or pads.
         (b) Saturated with oil, grease, or brake fluid;
   c. Brake Drum or Rotors.
      (2) Any portion of the drum or rotor missing or in danger of falling away.

***5. Lighting Devices.***
All lighting devices and reflectors required by Section 393 shall be operable.

[70] Title 49 CFR 396.17.

[71] A vehicle will meet the Federal requirements if inspected under a mandatory State inspection program in Alabama, California, Connecticut, Hawaii, Louisiana, Maine, Maryland, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, West Virginia, Wisconsin, or the District of Columbia. Of these, Alabama, California, Connecticut, Michigan, Minnesota, New Jersey, New York, Ohio, and Wisconsin have inspection programs that do not cover all commercial motor vehicles. In three other States—Arkansas, Illinois, and Oklahoma—the inspection is not mandatory, but the inspection will satisfy the Federal requirements.

[72] Title 49 CFR 396.23.

[73] Title 49 CFR 396.19.

[74] The vehicle portion of the FHWA's *North American Uniform Driver Vehicle Inspection Procedure* requirements, the CVSA's *North American Commercial Vehicle Critical Safety Inspection Items and Out-Of-Service Criteria*, and the FMCSRs appendix G to subchapter B, *Minimum Periodic Inspection Standards*, are similar documents and follow the same inspection procedures. The same items are required to be inspected by each document. The appendix G inspection procedure requires that all items required to be inspected be in proper adjustment, not be defective, and function properly prior to the vehicle's being placed in service.

[75] See appendix E of this report for the FMCSRs appendix G to subchapter B, *Minimum Periodic Inspection Standards*.

***10. Tires.***

a. Any tire on any steering axle of a power unit.

(2) Has body ply or belt material exposed through the tread or sidewall.

(5) Labeled "Not for Highway Use" or displaying other marking which would exclude use on steering axle.

b. All tires other than those found on the steering axle of a power unit:

(3) Has body ply or belt material exposed through the tread or sidewall.

(7) Is marked "Not for highway use" or otherwise marked and having like meaning.

The accident tractor displayed an inspection certificate dated March 2003. Alpha Trucking gave a corresponding annual inspection report to the Safety Board; the report indicated that the inspection was conducted on March 28, 2003, and that the tractor had passed all inspection points. A review of the tractor's repair and maintenance records indicated that the inspection was actually conducted 3 days earlier, on March 25, 2003, by the owner and president of Alpha Trucking. The company was unable to provide the Safety Board with documentation regarding the owner's qualifications for conducting annual inspections as required by 49 CFR 396.19.

Alpha Trucking's Inspection, Repair, and Maintenance Record indicated that on April 9, 2003 (15 days after certifying, on March 28, 2003, that the tractor had passed all the annual inspection requirements, including a complete check of the brake system), the company had conducted a complete brake job on the tractor. The record also indicated that on April 18 (24 days after the annual inspection), Alpha replaced all the belts and hoses on the tractor. The record further indicated that on April 20 (26 days after the annual inspection), Alpha replaced the torque rods and bushings on the accident tractor.

# Analysis

In this analysis, the Safety Board will first exclude those factors that neither caused nor contributed to the accident. Next, the Safety Board will consider the circumstances of the accident and those factors that may have been causal. The analysis will also discuss the safety issues identified during the accident investigation: driver fatigue, the adequacy of State and Federal oversight of motor carriers, the identification and appropriate use of speed-restricted tires on motorcoaches, the criteria for State and Federal annual inspections of motorcoach passenger seating anchorage points, and performance standards for motorcoach passenger seating anchorages.

## Exclusions

The weather was clear and dry at the time of the accident. Postaccident inspection of the motorcoach did not indicate mechanical problems affecting the vehicle's operation. The pavement markings were visible, and no defects in the highway design were found that would have caused or contributed to the crash.

Following the accident, a blood sample taken from the motorcoach driver tested negative for alcohol and controlled substances. Appropriate emergency response resources were dispatched to the accident scene; responders and medical personnel arrived quickly; and the injured received medical care on scene and were transported to local hospitals in a timely manner.

The Safety Board concludes that the weather, the design and condition of the roadway, and the mechanical condition of the motorcoach did not contribute to the accident; test results showed no evidence of illicit drug or alcohol use by the motorcoach driver; and the emergency response was timely and effective.

Results of the breath alcohol test for the tractor semitrailer driver were negative for alcohol. Although Federal regulation requires it,[76] Alpha Trucking did not conduct postaccident testing for controlled substances on the tractor semitrailer driver. The Safety Board had no information to determine whether the driver was under the influence of controlled substances at the time of the accident. Because the tractor semitrailer was stationary on the shoulder at the time of the accident, the driver, whether impaired or unimpaired, probably could not have taken any action that might have prevented or mitigated the accident. Nevertheless, the Safety Board is concerned that Alpha Trucking failed to fulfill its responsibility to ensure that its driver was tested for controlled substances following the accident.

[76] See 49 CFR Part 382, "Controlled Substances and Alcohol Use and Testing."

## Accident Discussion

The Safety Board identified several factors that indicate that the motorcoach driver was in a state of greatly reduced alertness due to fatigue at the time of the accident. These factors include physical evidence from the scene, witness statements, and the motorcoach driver's own statements after the accident. The Safety Board also examined the possibility that a medical condition impaired the driver's performance and that his use of nonregulated dietary supplements might have contributed to his lack of alertness.

### *Motorcoach Driver Performance*

Postaccident examination of the roadway and the accident vehicle showed no evidence of braking or steering by the motorcoach driver, consistent with the driver's description of the accident sequence. Based on the physical evidence, the angle of the motorcoach's departure from the roadway was about 3°. A lack of braking and steering input and a shallow angle of departure from the roadway are often indicators of a distracted, drowsy, or asleep driver.[77] In fact, rumble strips, which are a countermeasure intended to warn drowsy drivers that they are leaving the roadway, are designed for a 3° angle of departure from the roadway.[78]

There were no rumble strips on the section of the interstate where the accident occurred; however, had rumble strips been present, the proximity of the parked tractor semitrailer to the edge of the right travel lane would have so reduced the motorcoach driver's available recovery time that he would still have been unable to avoid a collision with the parked semitrailer. Rumble strips in other sections of I-20 were 7 inches wide and were located 6 inches from the traveled roadway. The left-side tires of the accident semitrailer were parked 36 inches from the edge of the traveled way. The motorcoach traveled 103 feet on the highway shoulder at 60 mph (88 feet per second) and, at the point of collision with the semitrailer, the motorcoach's right front tire was about 5 feet outside the travel lane, while the left tires were still within the right traffic lane. The travel speed of 88 feet per second and the distance traveled, 103 feet, meant that the motorcoach driver would have had only 1.1 seconds to react before the collision.

[77] J. Hickey, "Shoulder Rumble Strip Effectiveness: Drift-Off-Road Accident Reductions on the Pennsylvania Turnpike," *Transportation Research Record 1573* (Washington, DC: National Research Council, 1997), 105-109.

[78] "Shoulder Rumble Strip Effectiveness: Drift-Off-Road Accident Reductions on the Pennsylvania Turnpike," 105-109.

Witnesses who observed the motorcoach before the collision stated that the vehicle was not maintaining its lane, was swerving from side to side, and was almost involved in collisions with other vehicles. Such behavior has been observed in previous fatigue-related accidents,[79] and research has demonstrated an association between poor lane tracking and drowsiness (fatigue).[80]

In his initial postaccident interview, the day after the accident, the motorcoach driver stated that he must have "drifted off" or fallen asleep before the accident occurred. He said he recalled a female passenger yelling, "You're going to hit it," but he did not recall opening his eyes before impact. He also said he did not recall seeing the tractor semitrailer parked on the side of the road. In a statement made by the driver 2 days after the accident, he said he had not seen any flashers on the tractor semitrailer. He further stated that if he had seen the truck's lights, he would have known the truck was stopped. Safety Board investigators again interviewed the driver about 2 months after the accident. During this interview, the driver stated that he recalled that a passenger on the motorcoach had yelled something before the collision, but he could not see anything and felt "funny." According to the driver, when he did manage to open his eyes, the first thing he saw was the corner of the trailer approaching the motorcoach window, and he had no time to react before the collision. This suggests a state of reduced alertness, if not sleep, on the part of the motorcoach driver as the accident took place.

The accident occurred because the motorcoach driver failed to maintain his lane and then could not recover before striking the parked tractor semitrailer. The motorcoach driver's inability to track within his lane of travel was due, as evidenced by the motorcoach's angle of departure from the travel lane, witness statements, and the driver's own postaccident statements, to drowsy driving. Although the motorcoach driver could possibly have drifted out of his lane either prior to this point or farther down the interstate and recovered without incident, recovery was impossible at this particular location. Because a tractor semitrailer was parked on the shoulder at this point, the accident motorcoach driver could not return to his lane in time to avoid colliding with the parked vehicle. The Safety Board concludes that the accident motorcoach left the right travel lane and entered the shoulder, striking the parked tractor semitrailer, because of the motorcoach driver's reduced state of alertness resulting from fatigue.

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[79] See (a) 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); (b) National Transportation Safety Board, *Motorcoach Run-off-the-Road and Rollover off Interstate 90, Victor, New York, June 23, 2002*, Highway Accident Report NTSB/HAR-04/03 (Washington, DC: NTSB, 2004); and (c) National Transportation Safety Board, *Factors that Affect Fatigue in Heavy Truck Accidents. Volume I: Analysis*, Safety Study Report NTSB/SS-95/01 (Washington, DC: NTSB, 1995).

[80] See (a) U.S. Department of Transportation, FHWA, *Commercial Motor Vehicle Driver Fatigue and Alertness Study: Project Report*, FHWA-MC-97-002 (Washington, DC: FHWA, 1998); (b) A. Stein, "Detecting Fatigued Drivers with Vehicle Simulators," ed. L. Hartley, *Fatigue and Driving* (Bristol, PA: Taylor & Francis, Inc., 1995), 133-148; and (c) M. Ramini-Doering, D. Manstetten, T. Altmueller, U. Ladstaetter, and M. Mahler, "Monitoring Driver Drowsiness and Stress in a Driving Simulator," *Proceedings, International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design*, August 14-17, 2001 (University of Iowa, 2001).

### *Medical Factors*

The accident motorcoach driver's medical history, obtained from his medical records, revealed that the driver had experienced medical conditions, including insomnia, chronic degenerative arthritis, joint pain, chronic low back pain, and mild OSA for years before the accident. It is well documented that he typically experienced poor quality sleep due to these conditions.

In August 2000, the driver underwent a polysomnography (sleep study). The results stated, in part, that he reported requiring 1 to 2 hours, and sometimes longer, to fall asleep. He said he woke up 6 to 8 times during the night and then needed 10 to 15 minutes to fall back to sleep. The sleep study recorded that the driver took nearly 1 1/2 hours to fall asleep and that during the 7 hours of sleep time tested, he experienced only 4.7 hours of actual sleep, with virtually no restful REM sleep noted.

The driver suffered from chronic degenerative arthritis and low back pain. The chronic pain from these conditions probably exacerbated his longstanding insomnia. He had been routinely taking the prescription pain-reliever tramadol at nearly the maximum recommended daily dosage to treat his chronic pain. Postaccident, the drug was found in the driver's blood at a level below the minimum therapeutic level. The very low level in the driver's blood suggests that he did not take the medication as prescribed (three times daily) on the day before the accident. Not taking the tramadol might have created further difficulty in the driver's obtaining satisfactory sleep, because he would have experienced less relief from his osteoarthritis pain during the night.

In addition, the August 2000 sleep study noted that the driver had mild OSA. OSA is characterized by excessive daytime sleepiness, despite an apparently sufficient period of night sleep.[81] To deal with his chronic sleep problems, the driver had been regularly taking the prescription sleep aid zolpidem (Ambien). The driver reported to his physician that the only time he got satisfactory sleep was with the use of Ambien three times a week. On October 6, 2003, just 7 days before the accident, the motorcoach driver visited his physician, and the physician advised him, "When he is driving the bus to be sure that he is not drowsy with the Ambien. Would caution and possibly avoid it." This advice is not consistent with the known properties of zolpidem when used as directed, but it is consistent with information provided by the manufacturer of the medication. After the accident, the motorcoach driver told police that he did not take his zolpidem the evening before the accident. The driver's not taking the sleep aid during the trip would probably have made it even more difficult than usual for him to obtain satisfactory sleep.

The combination of the driver's chronic insomnia, chronic pain, and mild OSA made him extremely susceptible to poor sleep on a regular basis, as documented by his sleep study results. Then, on the night before the accident, the driver, acting on his physician's advice, probably did not take his sleep aid medication, further increasing the likelihood that his sleep that night would be inadequate. In addition, postaccident blood

[81] C. Guilleminault, "Clinical Features and Evaluation of Obstructive Sleep Apnea," eds. M. Kryger, T. Roth, and W. Dement, *Principles and Practice of Sleep Medicine*, 2nd ed. (Philadelphia, PA: W.B. Saunders Co., 1994).

test results suggest that he had not taken his pain-relieving medication as prescribed, which would have made it still more difficult for the driver to obtain satisfactory sleep due to his unalleviated joint pain. In fact, the driver acknowledged that he had only slept "off and on" the night before the accident.

Although the need for sleep varies among individuals, losing as little as 2 hours of sleep a night can negatively affect alertness and performance, resulting in degraded judgment, decision-making, and memory; slowed reaction time; lack of concentration; fixation; and irritability.[82] In this case, the motorcoach driver's chronic insomnia, chronic pain, and mild OSA symptoms resulted in a reduced quality and quantity of sleep on a regular basis, increasing the driver's cumulative sleep debt and level of fatigue while reducing his alertness. Moreover, the driver had been advised to avoid the use of his sleep aid medication during the motorcoach trip and by so doing most likely experienced even poorer sleep quality than was usual for him during the trip. He also may not have taken his pain medication as prescribed. The Safety Board concludes that the motorcoach driver's chronic insomnia, chronic pain, mild OSA, and history of interrupted sleep contributed to the accident by reducing the quality and quantity of his sleep, which increased his level of fatigue and reduced his alertness.

Although the bulk of the evidence found by the Safety Board indicates that this was a fatigue-induced accident, some facts are not typical of such a scenario. For instance, the accident occurred in the late morning, not a time of day likely to induce sleepiness. Also, the driver had not been on duty an excessive length of time when the accident occurred. Finally, the driver's 72-hour history shows that he had the opportunity to obtain sufficient sleep during the 3 nights preceding the accident. However, the Safety Board considers that, given the driver's well-documented history of sleep problems, evidence provided by the driver and witnesses concerning the driver's preaccident behavior, and the absence of other likely causes, driver fatigue caused by poor sleep is the likeliest reason for the accident.

### *Dietary Supplements*

During the postaccident inspection of the motorcoach, investigators found numerous dietary supplements in a box containing the motorcoach driver's prescription medications. The motorcoach driver acknowledged that the supplements were his, but he could not recall what dosage of each supplement he was taking. Nor could he recall at what times or in what combination he was taking them. The Safety Board could not establish whether the driver had taken any supplements on the day of the accident. The dietary supplements found are classified as substances not regulated by the FDA.

The *Pharmacist's Letter/Prescriber's Letter Natural Medicines Comprehensive Database* was identified through consultation with the FDA and the American Medical Association as a reference concerning these substances. Although this database was

[82] Fatigue Resource Directory Web site <http://human-factors.arc.nasa.gov/zteam/fredi/>. Compiled in conjunction with the NASA/NTSB symposium, "Managing Fatigue in Transportation: Promoting Safety and Productivity," which was managed by the USDOT.

suggested by a number of different sources in the medical and prescription medicine field as a comprehensive resource, little research has been done on some of the herbal substances found in the motorcoach driver's dietary supplements. Consequently, little is known about their effects and interactions, both with other dietary supplements and with prescription medicines. There is no objective evidence that these substances are effective in the treatment of pain, insomnia, arthritis, or other medical conditions. Because little work has been done on standardized testing for these substances in the blood, most herbal supplements cannot be detected through routine toxicological testing.

According to the information available on these supplements, some are intended to treat conditions, or reportedly have effects, relevant to the driving task. Valerian, an herbal ingredient in two of the supplements, is described as a sedative-hypnotic for treating insomnia and sleeping disorders. Valerian reportedly can impair alertness and information processing, and users are warned against driving or operating dangerous machinery after taking valerian. Available information indicates that it may also enhance the effects of other herbs or drugs with sedating properties.[83] Another herbal supplement taken by the driver, passionflower, is marketed as a treatment for insomnia, and it reportedly can cause dizziness and confusion. Information indicates that it may also enhance the effects of other herbs with sedating properties (such as valerian) and tranquilizers. Passionflower was formerly approved in the United States as an over-the-counter sedative and sleep aid, but it lost its approval as a medication in 1978 because its safety and effectiveness had not been proven.[84] Three other herbal ingredients found in the dietary supplements taken by the driver were hops, Siberian ginseng, and couch grass, all of which purportedly can enhance the effects of other herbs or drugs with sedating properties and may cause drowsiness.[85]

The FDA requires that a dietary supplement list any ingredients not included on the product's Supplement Facts panel, as well as the net quantity of the contents. It does not require manufacturers of most dietary supplements to provide evidence of product safety and effectiveness to the FDA before marketing it, unless the supplement was not marketed in the United States before October 15, 1994.[86] Also, there is no guarantee that the substances on a dietary supplement's label are even in the pills or that unlisted substances are not present. Additionally, regardless of the labeling, each pill may contain more or less of an individual ingredient, creating the potential for the supplement to have unknown or unintended properties.

The FDA plans to publish a final rule on regulations for dietary supplement "current good manufacturing practices." The FDA considers that this regulation will help

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[83] J. Jellin, P. Gergory, F. Btaz, K Hitchens, et al., *Pharmacist's Letter/Prescriber's Letter Natural Medicines Comprehensive Database* (Stockton, CA: Therapeutic Research Faculty, 2003), 1310-1312.

[84] *Pharmacist's Letter/Prescriber's Letter Natural Medicines Comprehensive Database*, 1014-1015.

[85] *Pharmacist's Letter/Prescriber's Letter Natural Medicines Comprehensive Database*, 718-720, 620-622, and 423-424.

[86] Statement by R. Brackett of the FDA's Center for Food Safety and Applied Nutrition before the Committee on Governmental Affairs Subcommittee on Oversight of Government Management, the Federal Workforce, and the District of Columbia during a U.S. Senate hearing entitled "Dietary Supplement Safety Act: How is the FDA Doing 10 Years Later," which took place on June 8, 2004: 2.

ensure product quality and consistency and give consumers greater confidence that dietary supplements have the identity, strength, purity, and composition they are represented to have. The FDA published a proposed rule on March 13, 2003, and, as of January 28, 2005, was still evaluating the more than 1,600 responses it received from the public before issuing its final rule. On November 4, 2004, the FDA announced three major regulatory initiatives designed to further implement the Dietary Supplement Health and Education Act of 1994. The actions announced included providing a regulatory strategy, holding an open house meeting (held on November 15, 2004), and providing a draft guidance document for the industry entitled "Substantiation for Dietary Supplement Claims Made Under Section 403(r)(6) of the Federal Food, Drug, and Cosmetic Act."[87]

The Tallulah accident driver was advised by his physician not to take zolpidem while driving the motorcoach. Toxicological testing indicates that he probably was not taking his typical dose of tramadol at the time of the accident. He may have been using unproven herbal supplements as a substitute for zolpidem.

Although the Safety Board has concerns about the properties and possible interactions of herbal dietary supplements and how drivers' use of such substances as alternative treatments for medical conditions may affect their driving performance, it considers that, given the lack of information from the driver about when and how he was taking these supplements and the lack of available research concerning these substances, it is not possible to draw a definitive conclusion regarding their role in this accident. In addition, due to the nonregulation of the supplement industry, exact percentages and/or levels of the ingredients per supplement pill cannot be determined. The Safety Board therefore concludes that there is insufficient scientific research on, or standardization of, herbal dietary supplements to determine whether or how they might have contributed to this accident.

### *CDL Medical Examination*

The accident motorcoach driver told Safety Board investigators that he renewed his CDL every 4 years,[88] but he had not received a medical examination since his employment in 1996 as a substitute bus driver with a local school system in Texas. Title 49 CFR 391.41 requires that motorcoach drivers undergo a physical examination for medical certification in order to drive a commercial motor vehicle. The motorcoach driver indicated he did not need a medical examination to drive the First Baptist Church of Eldorado's motorcoach. However, under FMCSA rules, the church was a for-hire carrier in commerce, and, therefore, the driver was required to undergo medical examination to drive the church's motorcoach.

According to 49 CFR 319.41(b)(5), if a person has an established medical history or clinical diagnosis of a respiratory dysfunction likely to interfere with his or her ability to control and safely drive a commercial motor vehicle, that person should not be certified

[87] U.S. Food and Drug Administration, "Regulatory Initiatives for Dietary Supplements," *FDA Consumer Magazine*, January-February 2005: 1.

[88] The date of his last preaccident CDL renewal was March 1999.

as a commercial driver. In guidance provided to commercial driver medical examiners,[89] the FMCSA stated that, because OSA is a condition interfering with oxygen exchange, it is covered by this regulation. The advisory recommended that drivers with OSA be referred to a specialist for further evaluation and therapy. However, the FMCSA did not specifically define untreated OSA as a disqualifying condition and did not detail the specific circumstances under which a driver with OSA would be considered effectively treated.

The accident motorcoach driver's medical records showed that he had undergone a sleep study and received formal recommendations regarding treatment for OSA. However, nothing suggests that either the sleep specialist who treated him or his private physician considered the driver's motorcoach-driving responsibilities in the course of prescribing treatment or follow-up options, other than that the driver's physician advised him to make sure he was not drowsy from the sleep aid Ambien when driving.

The motorcoach driver also suffered from chronic degenerative arthritis and chronic joint and back pain, for which he was taking the pain-reliever tramadol at nearly the maximum recommended dosage. According to 49 CFR 391.41(b), if a person has an established medical history or clinical diagnosis of rheumatic, arthritic, orthopedic, muscular, neuromuscular, or vascular disease that interferes with his/her ability to drive a commercial motor vehicle safely, that person should not be qualified to drive such a vehicle.

Had the accident motorcoach driver undergone a routine medical examination, he might have been denied certification by a careful and knowledgeable CDL medical examiner. Such an examiner would, however, have to have been well informed about occupational safety issues and the potential risks posed by the symptoms of, or medications used to treat, the driver's chronic degenerative arthritis, chronic low back pain, sleep disturbance, and mild OSA. Unfortunately, as was noted in the Safety Board's New Orleans highway accident report,[90] medical examiners for CDLs often do not have sufficient training about these risks and have only limited guidance that would assist them in making such decisions. Medical examiners are not adequately supported by the current CDL medical examination system in making these decisions. For example, during a commercial driver medical examination, examiners are placed in the difficult position of having to disqualify some drivers, thereby depriving them of their livelihoods. Such an action can be especially difficult for an examiner who is also the driver's personal physician. In addition, concern about possible legal action by drivers may put pressure on examiners to certify drivers who have serious conditions that regulations do not clearly establish as disqualifying.

The current system does not provide enough guidance to examiners emphasizing that the CDL medical examination is critical to maintaining the effectiveness of the commercial driver licensing system by keeping dangerously unfit drivers from obtaining CDLs. In the New Orleans report, the Safety Board issued eight safety recommendations urging that the FMCSA develop a comprehensive medical oversight program for interstate

[89] See 65 *Federal Register* 59363, October 5, 2000.

[90] National Transportation Safety Board, *Motorcoach Run-off-the-Road Accident, New Orleans, Louisiana, May 9, 1999*, Highway Accident Report NTSB/HAR-01/01 (Washington, DC: NTSB, 2001).

commercial drivers; each recommendation addressed a specific program element.[91] Safety Recommendation H-01-17 stated that the program must ensure that

> Individuals performing medical examinations for drivers are qualified to do so and are educated about occupational issues for drivers.

On September 17, 2004, the FMCSA awarded a contract to a firm to establish a national registry of qualified medical examiners and a certification program. The national registry is intended to facilitate specific training and provide an opportunity for continuous national monitoring of medical examiners on the registry. The certification program is intended to ensure that medical examiners are qualified and educated about drivers' occupational issues. Pending receipt of more specific information about how the FMCSA plans to qualify medical examiners and about the establishment of the national registry and certification process, the Safety Board classified Safety Recommendation H-01-17 "Open—Acceptable Response" on March 25, 2005.

In addition to other weaknesses of the current CDL medical examination and certification process, it allows "doctor shopping;" that is, an individual who has been denied certification by one examiner can seek certification from another. Nothing prohibits the individual from continuing this process until he or she finds an examiner willing to certify the individual as medically qualified to be a commercial driver. Had he attempted to obtain CDL medical certification and had his own physician denied him certification, the Tallulah motorcoach driver could have taken such a course of action.[92]

The Safety Board concludes that had the accident motorcoach driver undergone a medical examination for certification as required by the FMCSRs, such an examination still might not have resulted in denial of medical certification on the basis of the driver's medical conditions.

## First Baptist Church of Eldorado Motor Carrier Operations

After the accident, when the FMCSA conducted a compliance review of the First Baptist Church of Eldorado, it issued the church a USDOT number and a safety rating of "Unsatisfactory" because of the church's failure to adhere to the FMCSRs. According to the church, it had been unaware before the accident that its motorcoach was defined by the Federal regulations as a commercial vehicle. Furthermore, the church said it had been unaware of the FMCSA, of the need to obtain a USDOT number for its motorcoach, and of the FMCSRs that applied to its motorcoach and drivers. When the church applied for title, registration, and license plates from the State of Texas, the State classified the vehicle as a "private bus," and the church thought its motorcoach was not a commercial vehicle.

[91] See appendix F for a list of the safety recommendations the Safety Board issued to the FMCSA in the New Orleans accident report concerning elements necessary for a comprehensive CDL medical oversight program.

[92] The Safety Board addressed this issue in Safety Recommendation H-01-18. See appendix F for the recommendation's text and its classification status.

Information about the Federal definition of a commercial vehicle, which would have indicated that the church's accident motorcoach was a commercial vehicle, did not appear on the Texas title or registration application forms.

All vehicle owners must apply for a State title, registration, and license plates if they wish to operate their vehicle on public roads. Given that all vehicle owners in every State are subject to this rule, the application process provides an opportunity to educate all vehicle owners on whether their vehicle is a commercial vehicle by Federal definition and to give them guidance on how to contact the appropriate officials. Including specific guidance concerning the Federal definition of a commercial vehicle on State applications would ensure that all vehicle owners have access to this important information. It could help prevent the type of misunderstanding alleged to have occurred in this accident, in which the church was unaware of its standing as a commercial vehicle operator and of the need to adhere to Federal safety regulations affecting its vehicle and drivers.

Because many State applications do not provide any information on the FMCSA and the Federal rules for commercial vehicles, some motorcoach and bus owners may not be aware of the need to contact the FMCSA for guidance. (See appendix G for examples of language from State applications that do reference the FMCSRs for commercial vehicle owners.) As a result, not only are these owners not registered with the FMCSA, they may also be unwittingly operating unsafely as commercial motor carriers on the Nation's highways and not abiding by the Federal safety regulations that pertain to commercial vehicles and drivers. The Safety Board concludes that the Texas vehicle title and registration applications, which classified the accident motorcoach as a private bus, did not inform the vehicle's owner of its Texas or Federal classification as a commercial vehicle and the requirement to meet Federal safety regulations for this classification. The AAMVA provides guidance concerning vehicle titling (among other issues) to its membership, and all State motor vehicle administrators are AAMVA members. The Safety Board believes the AAMVA should develop, and disseminate to the States, model language for title and registration applications to alert applicants to the Federal definition of a commercial vehicle and to the need to contact the FMCSA for guidance on obtaining a USDOT number and on determining the applicability of Federal safety regulations to their vehicle.

The FMCSA hosts a page on its Web site called "Safe Transportation of Passengers by Motorcoach - and What It Means to You."[93] It provides access to educational and outreach information on issues such as bus and truck driver wellness programs, sharing the road safely, and the FMCSA National Training Center. In addition, the FMCSA has created a link to a Web page that provides detailed information on passenger carrier safety and on the FMCSA and its mission. It also provides information to assist users in evaluating the safety practices of interstate motorcoach companies before chartering a company. Topics such as driver qualifications, limitations on driving, vehicle standards, subcontracting agreements, insurance requirements, requesting carrier operating authority information, and researching carrier insurance and safety information are covered as well. The site contains FMCSA contact information.

[93] See <http://www.fmcsa.dot.gov/safetyprogs/bus.htm>.

This FMCSA Web page could also provide valuable information to commercial vehicle owners unfamiliar with the requirements they must meet when transporting passengers. Churches, colleges, charter schools, associations, and other groups may not be aware of all the regulations to which they must adhere as providers of passenger transportation via commercial vehicles. The Safety Board concludes that the FMCSA's Web page "Safe Transportation of Passengers by Motorcoach - and What It Means to You" is an educational outreach mechanism well suited to provide information to commercial vehicle owners unfamiliar with the FMCSA and the Federal regulations that apply to transporting passengers safely on commercial vehicles. The Safety Board believes the FMCSA should develop and distribute educational materials for nontraditional commercial vehicle owners, such as church groups, on how to comply with the FMCSRs; at a minimum, the materials should be posted on the FMCSA Web site.

## Federal and State Inspections of Commercial Vehicles

### *Speed-Limited Tires*

The postaccident mechanical inspection of the motorcoach by Safety Board investigators did not reveal any mechanical conditions that would have contributed to the accident. However, during the vehicle inspection, investigators discovered that the motorcoach had been equipped with speed-limited tires. The restricted speed information was clearly visible on the tires' outer sidewalls. The tires were designed for use at speeds not to exceed 55 mph; the motorcoach was being operated on the interstate at speeds exceeding 55 mph at the time of the accident. According to the manufacturer, the tires' speed restriction was dictated by their construction. They were designed to provide high-load capacity and durability and are normally (and appropriately) used on inner city transit-bus-type vehicles, which typically do not exceed speeds of 55 mph. The use of speed-limited tires on vehicles that routinely operate at higher speeds is not an industry-recommended practice because of the propensity of this type of tire to generate excessive heat, which is the leading cause of abrupt tire failures.

The First Baptist Church of Eldorado had the tires installed on the accident motorcoach in February 2002 and, on June 26, 2003, the motorcoach passed a State of Texas inspection. The inspection of motor vehicles (including motorcoaches) in Texas is conducted in approved, privately owned and operated garages and repair facilities, which are designated by the Texas Department of Public Safety. A review of the State inspection manual revealed that the inspection procedures do not include instructions concerning the identification and proper use of speed-limited tires. The Safety Board also reviewed additional State and Federal regulatory and vehicle inspection guidelines.[94] Information concerning the identification of, or the procedures for ensuring the proper use of, speed-

[94] The guidance documents reviewed included 49 CFR Part 393; the FMCSRs appendix G to subchapter B, *Minimum Periodic Inspection Standards*; the CVSA *North American Standard Out-of-Service Criteria*; and the AAMVA *Vehicle Inspection Handbook*: *Trucks, Buses, and Trailers.*

limited tires does not appear in any of these State and Federal inspection guidelines or regulations for private or commercial vehicles.

If a speed-restricted tire is used in service at speeds above 55 mph for extended periods, a catastrophic failure can result. Consequently, when passenger-carrying vehicles are equipped with such tires, the vehicles must not be used for highway travel. Without specific inspection criteria addressing this issue, these tires can escape inspectors' scrutiny and be permitted to remain on passenger vehicles intended for prolonged use at speeds above 55 mph, which would cause an unsafe situation. The Safety Board concludes that because the commercial vehicle inspection criteria used by the State of Texas, the CVSA, the FMCSA, and the AAMVA do not address the identification and appropriate use of speed-limited tires, they overlook an important vehicle safety factor and can result in commercial vehicles intended for highway use being operated with tires not suited for highway speeds.

The Safety Board believes the FMCSA should revise the FMCSRs appendix G to subchapter B, *Minimum Periodic Inspection Standards,* Part 10: "Tires," Sections A(5) and B(7), to include inspection criteria and specific language to address a tire's speed rating to ensure that it is appropriate for a vehicle's intended use. The Safety Board further believes that the CVSA should revise the *North American Standard Out-of-Service Criteria* to provide guidance on inspecting and examining tires to ensure that they have the proper speed rating for a vehicle's intended use. The Safety Board also believes that the AAMVA should revise its *Vehicle Inspection Handbook: Trucks, Buses, and Trailers* to provide guidance on inspecting and examining tires to ensure that they have the proper speed rating for a vehicle's intended use.

### *Motor Carrier Self-Inspection and Certification*

The FMCSA and Mississippi, the State in which Alpha Trucking was headquartered, allow motor carriers to self-inspect and certify their own vehicles as a means of complying with the annual inspection requirements of the FMCSRs, provided the inspector is qualified and certified. Alpha Trucking's owner/president carried out the annual inspections and maintenance of the commercial vehicles owned and operated by his company. Alpha Trucking did not have any of the required documentation of the owner's certification or qualifications to perform annual inspections or maintenance of commercial vehicles.

The Safety Board's postaccident inspection of the Alpha Trucking tractor and semitrailer revealed numerous brake conditions that contributed to the vehicle's mechanical problems on the day of the accident, which led to its being on the shoulder of the interstate when the accident motorcoach approached. The accident tractor and semitrailer were being operated in a serious state of disrepair, as evidenced by the extensive brake problems identified, including the right front and right rear brake assemblies being inoperative, the brake linings being covered in debris and worn down to the fasteners, the friction surfaces being contaminated with dirt and grease, and the S-cam bushing measurements exceeding adjustment and replacement measurements.

Investigators found evidence that Alpha Trucking's maintenance of its vehicles was consistently deficient. The significant degree of wear and grease contamination, affecting most of the foundation brake components, discovered during postaccident inspection of the tractor semitrailer would normally have been addressed by an effective maintenance program. The smoke from the semitrailer that the Alpha Trucking tractor semitrailer driver said caused him to pull to the shoulder on the day of the accident was almost certainly caused by worn and contaminated brakes that Alpha Trucking had failed to maintain properly. The numerous recorded defects and violations listed by the MCSAP inspectors in their roadside inspection reports in the months before the accident also indicated routine poor maintenance practices on Alpha Trucking's part. Therefore, the Safety Board concludes that the smoking brakes on the Alpha Trucking tractor semitrailer resulted from mechanical problems that were caused by habitual and progressive mechanical neglect.

Further, the company apparently did not conduct its self-inspection program in accordance with Federal and State requirements. MCSAP inspectors cited numerous roadside inspection violations for this accident vehicle over a period of several months preceding the accident, and some of these violations were probably present when the company's president signed and issued the vehicle's annual inspection certificate in March 2003. Moreover, according to its records, Alpha Trucking carried out its annual inspection for the accident vehicle before conducting a complete brake repair job and replacing belts and hoses, as well as the torque rods and bushings, on the tractor. According to Alpha Trucking's records, all this essential work took place within a month after the issuance of the annual self-inspection certificate, indicating that when the company president certified the vehicle in March 2003, it actually still required considerable repair and maintenance.[95]

The company's self-inspection and certification procedures are suspect in other areas. For example, Alpha Trucking's Inspection, Repair, and Maintenance Record for the accident tractor does not correspond with the repairs certified by the company as having been conducted following the May 28 and June 3, 2003, roadside inspections. Further, Alpha Trucking could not produce the Annual Inspection Record or the required Inspection, Repair, and Maintenance Record for the accident semitrailer.

The company's failures to provide proof of qualification for the inspector performing the vehicle self-inspections (the owner), to schedule or perform proper maintenance and repair of vehicles, to complete necessary repairs before issuing certifications, and to maintain vehicle inspection and repair records all indicate that Alpha Trucking did not meet the intent of self-inspection program requirements. Therefore, the Safety Board concludes that Alpha Trucking misused the motor carrier vehicle self-inspection program by failing to employ the services of a qualified inspector and by misrepresenting the completion of vehicle repairs, thereby compromising the safety of the traveling public.

[95] The Safety Board has no evidence, beyond Alpha Trucking's own records, that the company conducted any of the maintenance it claimed to have done in the months preceding the accident.

In addition, the Safety Board notes that Alpha Trucking did not have adequate safety management controls in place in several other areas. For instance, the company failed to maintain complete driver records, did not provide a drug and alcohol testing program for its drivers, and did not conduct controlled substance testing of its driver following the Tallulah accident. All these activities are required under Federal safety regulations.

In the case of Alpha Trucking, the motor carrier vehicle self-inspection and repair certification process permitted by the State of Mississippi and by the FMCSRs failed. This motor carrier used the self-inspection and repair certification procedure to circumvent measures intended to ensure safety, thereby reducing the program's adequacy and effectiveness. Nothing currently prevents other motor carriers from similarly abusing the system. The Safety Board is unaware of any studies designed to measure the safety effectiveness of the self-inspection process that the FMCSA has performed as part of its oversight duties. Therefore, the Safety Board concludes that the current method of motor carrier vehicle annual self-inspection and certification accepted by the State of Mississippi and the FMCSA does not ensure that safety defects are repaired and can result in unsafe conditions for the traveling public. The Safety Board believes the FMCSA should conduct a study on the safety effectiveness of the self-inspection and certification process used by motor carriers to comply with annual vehicle inspection requirements and take corrective action, as necessary.

## Seating 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 concludes 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.

Shortly before the accident, the motorcoach had passed a State inspection and received a valid inspection certificate. As has been noted, the Safety Board's postaccident inspection of the motorcoach revealed that some of the seats had not been properly secured into place, allowing these seats to come loose. In reviewing the State of Texas inspection procedures; the FMCSRs appendix G to subchapter B, *Minimum Periodic Inspection Standards*; and the AAMVA *Vehicle Inspection Handbook: Trucks, Buses, and Trailers*, the Safety Board found that they contain no procedures or criteria for the inspection of seat anchorage securement in motorcoaches. The Safety Board concludes that improperly secured motorcoach passenger seats are not likely to be identified during commercial vehicle inspections because no criteria or procedures are available for the inspection of motorcoach passenger seating anchorage systems. Therefore, the Safety Board believes that the FMCSA should develop a method for inspecting motorcoach passenger seat mounting anchorages and revise the FMCSRs appendix G to subchapter B, *Minimum Periodic Inspection Standards*, to require inspection of these anchorages. The Safety Board further believes that the AAMVA should develop a method for inspecting motorcoach passenger seat mounting anchorages and revise its *Vehicle Inspection Handbook: Trucks, Buses, and Trailers* to include the inspection procedures.

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.[96] (See table 8.) 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

[96] See appendix H for information on these accident investigations.

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 8.** Previous Safety Board investigations involving motorcoach passenger seat anchorage problems.

| Location/Date | Injured/Fatalities | Failed Seat Units | Seat System Manufacturer |
|---|---|---|---|
| Nelson Township, New York<br>September 7, 1996 | 5 Injuries<br>0 Fatalities | 9 | Prevost |
| Santa Fe, New Mexico<br>January 5, 1998 | 22 Injuries<br>1 Fatality | 15 | Amaya-Astron |
| Burnt Cabins, Pennsylvania<br>June 20, 1998 | 16 Injuries<br>6 Fatalities | 0 | National Seating |
| New Orleans, Louisiana<br>May 9, 1999 | 21 Injuries<br>22 Fatalities | 4 | National Seating |
| Hewitt, Texas<br>February 14, 2003 | 29 Injuries<br>5 Fatalities | 3 | Amaya-Astron |
| North Hudson, New York<br>February 22, 2004 | 47 Injuries<br>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 concludes 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. The Safety Board believes the National Highway Traffic Safety Administration should 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,[97] 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 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 the seat anchorage hardware provided 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, SAE[98] grade 1, has a minimum tensile strength of 70 ksi and a hardness of HRB 70 to 100.[99] 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. (Bolts increase in strength and hardness as their grades increase.) 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.

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

[97] Highway Accident Report NTSB/HAR-00/01.

[98] Society of Automotive Engineers.

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

protection is not occupant safety-oriented design. Occupant safety should be of paramount importance when designing and manufacturing passenger vehicles. The Safety Board concludes 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.

# Conclusions

## Findings

1. The weather, the design and condition of the roadway, and the mechanical condition of the motorcoach did not contribute to the accident; test results showed no evidence of illicit drug or alcohol use by the motorcoach driver; and the emergency response was timely and effective.

2. The accident motorcoach left the right travel lane and entered the shoulder, striking the parked tractor semitrailer, because of the motorcoach driver's reduced state of alertness resulting from fatigue.

3. The motorcoach driver's chronic insomnia, chronic pain, mild obstructive sleep apnea, and history of interrupted sleep contributed to the accident by reducing the quality and quantity of his sleep, which increased his level of fatigue and reduced his alertness.

4. There is insufficient scientific research on, or standardization of, herbal dietary supplements to determine whether or how they might have contributed to this accident.

5. Had the accident motorcoach driver undergone a medical examination for certification as required by the Federal Motor Carrier Safety Regulations, such an examination still might not have resulted in denial of medical certification on the basis of the driver's medical conditions.

6. The Texas vehicle title and registration applications, which classified the accident motorcoach as a private bus, did not inform the vehicle's owner of its Texas or Federal classification as a commercial vehicle and the requirement to meet Federal safety regulations for this classification.

7. The Federal Motor Carrier Safety Administration's Web page "Safe Transportation of Passengers by Motorcoach - and What It Means to You" is an educational outreach mechanism well suited to provide information to commercial vehicle owners unfamiliar with the Federal Motor Carrier Safety Administration and the Federal regulations that apply to transporting passengers safely on commercial vehicles.

8. Because the commercial vehicle inspection criteria used by the State of Texas, the Commercial Vehicle Safety Alliance, the Federal Motor Carrier Safety Administration, and the American Association of Motor Vehicle Administrators do not address the identification and appropriate use of speed-limited tires, they overlook an important vehicle safety factor and can result in commercial vehicles intended for highway use being operated with tires not suited for highway speeds.

9. The smoking brakes on the Alpha Trucking, Inc., tractor semitrailer resulted from mechanical problems that were caused by habitual and progressive mechanical neglect.

10. Alpha Trucking, Inc., misused the motor carrier vehicle self-inspection program by failing to employ the services of a qualified inspector and by misrepresenting the completion of vehicle repairs, thereby compromising the safety of the traveling public.

11. The current method of motor carrier vehicle annual self-inspection and certification accepted by the State of Mississippi and the Federal Motor Carrier Safety Administration does not ensure that safety defects are repaired and can result in unsafe conditions for the traveling public.

12. 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.

13. Improperly secured motorcoach passenger seats are not likely to be identified during commercial vehicle inspections because no criteria or procedures are available for the inspection of motorcoach passenger seating anchorage systems.

14. 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.

15. The inadequate seat anchorage hardware used by Neoplan USA Corporation failed during the accident and resulted in more severe injuries to passengers.

## Probable Cause

The National Transportation Safety Board determines 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.

# Recommendations

As a result of its investigation, the National Transportation Safety Board makes the following safety recommendations:

**To the National Highway Traffic Safety Administration:**

Develop performance standards for passenger seat anchorages in motorcoaches. (H-05-01)

**To the Federal Motor Carrier Safety Administration:**

Develop and distribute educational materials for nontraditional commercial vehicle owners, such as church groups, on how to comply with the Federal Motor Carrier Safety Regulations; at a minimum, the materials should be posted on the Federal Motor Carrier Safety Administration Web site. (H-05-02)

Revise the Federal Motor Carrier Safety Regulations appendix G to subchapter B*, Minimum Periodic Inspection Standards,* Part 10: "Tires," Sections A(5) and B(7), to include inspection criteria and specific language to address a tire's speed rating to ensure that it is appropriate for a vehicle's intended use. (H-05-03)

Conduct a study on the safety effectiveness of the self-inspection and certification process used by motor carriers to comply with annual vehicle inspection requirements and take corrective action, as necessary. (H-05-04)

Develop a method for inspecting motorcoach passenger seat mounting anchorages and revise the Federal Motor Carrier Safety Regulations appendix G to subchapter B, *Minimum Periodic Inspection Standards*, to require inspection of these anchorages. (H-05-05)

**To the American Association of Motor Vehicle Administrators:**

Develop, and disseminate to the States, model language for title and registration applications to alert applicants to the Federal definition of a commercial vehicle and to the need to contact the Federal Motor Carrier Safety Administration for guidance on obtaining a U.S. Department of Transportation number and on determining the applicability of Federal safety regulations to their vehicle. (H-05-06)

Revise your *Vehicle Inspection Handbook: Trucks, Buses, and Trailers* to provide guidance on inspecting and examining tires to ensure that they have the proper speed rating for a vehicle's intended use. (H-05-07)

Develop a method for inspecting motorcoach passenger seat mounting anchorages and revise your *Vehicle Inspection Handbook: Trucks, Buses, and Trailers* to include the inspection procedures. (H-05-08)

**To the Commercial Vehicle Safety Alliance:**

Revise the *North American Standard Out-of-Service Criteria* to provide guidance on inspecting and examining tires to ensure that they have the proper speed rating for a vehicle's intended use. (H-05-09)

**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)

## BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Member

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Member

**Adopted: April 19, 2005**

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# Appendix A

## Investigation

The National Transportation Safety Board was notified of the Tallulah, Louisiana, motorcoach accident on October 13, 2003. An investigative team was dispatched with members from the Washington, D.C.; Denver, Colorado; Atlanta, Georgia; Arlington, Texas; and Parsippany, New Jersey, offices. Groups were established to investigate human performance aspects; motor carrier operations; and highway, vehicle, and survival factors.

Participating in the investigation were representatives of the Federal Motor Carrier Safety Administration, the Louisiana State Police, the Louisiana Department of Transportation and Development, Neoplan USA Corporation, the First Baptist Church of Eldorado, and the United Motorcoach Association.

No public hearing was held; no depositions were taken.

# Appendix B

## Dietary Supplements Found in Accident Motorcoach

Congress defined the term "dietary supplement" in the Dietary Supplement Health and Education Act of 1994 as a product taken by mouth that contains a "dietary ingredient" intended to supplement the diet. The "dietary ingredients" in these products may include vitamins; minerals; herbs or other botanicals; amino acids; and substances such as enzymes, organ tissues, glandulars, and metabolites.[1] Dietary supplements do not require approval from the U.S. Food and Drug Administration (FDA) before they may be marketed. Manufacturers do not need to register themselves or their products with the FDA before producing or selling such products. No FDA regulations specific to dietary supplements establish a minimum standard of practice for manufacturing dietary supplements.[2]

The following dietary supplements (with the contents as listed by the manufacturer) were found in the Tallulah accident motorcoach:

- *Douglas Laboratories Chelated Magnesium* - Magnesium
- *Nature's Sunshine Chewable Stomach Comfort* - Calcium carbonate, alginic acid, papaya, guar gum, slippery elm bark, ginger rhizome, licorice, xylitol, caseinate powder, fructose, stearic acid, magnesium stearate
- *Nature's Way Black Elderberry Extract* - Black elderberry
- *Zygest Dietary Supplement for Proper Digestion* - Acid protease, papain, protease, amylase, lipase, bromelain, lactase, cellulose, hemicellulase
- *Nature's Way Bifidophilus Flora Force Probiotic Dietary Supplement* - Bifidophilus
- *Nature's Sunshine Skeletal Strength* - Vitamin A, vitamin C, vitamin D, vitamin B6, vitamin B12, calcium, iron, phosphorus, magnesium, zinc, copper, manganese, potassium, boron, horsetail, betaine HC1, papaya, parsley, pineapple, valerian root, licorice root concentrate, cellulose, stearic acid
- *Nature's Sunshine Black Walnut* - Black walnut
- *Nature's Sunshine Pau D'Arco Taheebo Tea* - Pau d'arco
- *Nature's Sunshine Food Enzymes* - Betaine HC1, bile salt, bromelain, lipasem alpha amylase (mycozyme), pancreatin, papain, pepsin

[1] U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, "Overview of Dietary Supplements," January 3, 2001 <http://www.cfsan.fda.gov/~dms/ds-oview.html>.

[2] See <http://www.cfsan.fda.gov/~dms/ds-oview.html>.

- *Nature's Sunshine Herbal Sleep* - Valerian root, passionflower, hops flowers, gelatin, water
- *Nature's Sunshine Seasonal Defense* - Andrographis paniculata, thyme herb, bitter orange fruit, eleuthero root, oregano, magnesium stearate, silicon dioxide, gelatin, water
- *Vitaminerals, Inc., Decelacid* - Glutamic acid HC1, papain, pepsin
- *Spring Valley Natural Potassium* - Potassium
- *Nature's Sunshine Defense Maintenance* - Vitamin A, vitamin C, vitamin E, zinc, selenium, barley grass juice powder, asparagus powder, astragalus root, broccoli powder, cabbage powder, ganoderma, parthenium root, pau d'arco bark, schizandra, eleuthero/Siberian ginseng root, wheat grass juice powder, myrrh gum, magnesium, silicon dioxide, gelatin, water
- *KAL Pure Stevia Extract Liquid* - Stevia
- *Nature's Sunshine LBS II* - Cascara sagrada bark, buckthorn bark, licorice root, capsicum fruit, ginger root, Oregon grape root, turkey rhubarb root, couch grass, red clover tops, gelatin, water
- *Nature's Sunshine High Potency Garlic* - Garlic
- *Nature's Sunshine EverFlex* - Glucosamine hydrochloride, methylsulfonylmethane (MSM), chondroitin sulfate, devil's claw root, cellulose, stearic acid, silicon dioxide, magnesium stearate

# Appendix C

## Compliance Review Violations for the First Baptist Church of Eldorado

382.115(a) Violation.

- Failing to implement an alcohol and/or controlled substances testing program.

387.31(a) Violation.

- Operating a passenger-carrying vehicle without having in effect the required minimum levels of financial responsibility.

390.3(e)(1) Violation.

- Failing to be knowledgeable of the Federal Motor Carrier Safety Regulations.

390.19(a)(1) Violation.

- Failing to file a Motor Carrier Identification Report, form MCS-150, before beginning operations.

391.45(a) and 391.11(a) Violation.

- Using a driver not medically examined and certified.

391.51(a) Violation.

- Failing to maintain a driver qualification file on each driver employed.

392.9a(a) Violation.

- Operating a motor vehicle providing transportation requiring registration under 49 U.S.C. 13902 without the required registration, or beyond the scope of that registration.

395.8(a) Violation.

- Failing to require driver to make a record of duty status.

395.8(j)(2) Violation.

- Failing to obtain from driver used for the first time or intermittently, a signed statement giving the total time on duty during the preceding 7 days and time at which last relieved from duty.

396.3(b) Violation.

- Failing to keep minimum records of inspection and vehicle maintenance.

396.3(b)(4) Violation.

- Failing to keep a record of tests conducted on pushout windows, emergency doors, and emergency door marking lights on buses.

396.17(a) Violation.

- Using a commercial motor vehicle not periodically inspected.

# Appendix D

## Safety Board T-Bolt Testing Data

### *Components*

The 1992 Neoplan USA Corporation (Neoplan) accident motorcoach seat anchorage systems, including:

1) Four T-bolts that attach the seat frame pedestal to floor track.

2) Section of floor track into which the T-bolt is secured.

The Neoplan exemplar components, including:

1) Exemplar T-bolt that attaches the pedestal to the floor track.

National Seating-submitted exemplar seat anchorage systems, including:

1) Five new-make T-bolts that attach the pedestal to the floor.

2) New-make section of floor track.

## Examination and Testing Results

The T-ends of the accident motorcoach T-bolts were bent downward, consistent with upward tensile loading.

The National Seating-supplied floor track was of a constant thickness, compared to the Neoplan track, which was made thicker adjacent to the opening of the track by folding the material over on itself.

The Neoplan accident T-bolts were made of 1010 steel, while the Neoplan exemplar bolt was made of 1015 steel.

See table 1 for general information about the tested components and table 2 for information concerning hardness and strength testing.

**Table 1.** General information on tested components.

| Item Examined | Company That Supplied Component | Thickness (Inches) | Length (Inches) | Bolt Head Width (Inches) | T-Bolt Diameter Threaded (Inches) |
|---|---|---|---|---|---|
| Floor track | National Seating | 0.123 | N/A | N/A | N/A |
| Floor track | Neoplan | 0.074 | N/A | N/A | N/A |
| T-bolt | National Seating | 0.300 | 1.035 | 0.475 | 0.366 |
| T-bolt | Neoplan | 0.126 | 0.925 | 0.432 | 0.430 |

**Table 2.** Hardness and strength information for tested components.

| Item Examined | Company That Supplied Component | Average Hardness | Raw Hardness Data | Approximate Strength (ksi) |
|---|---|---|---|---|
| Exemplar Floor track | National Seating | HRC 26 | HRC 26, 26, 25, 25, 25 | 125 |
| Accident Floor track | Neoplan | HRB 90 | HRB 90, 90, 91, 88, 92 | 89 |
| Exemplar T-bolt 1 | National Seating | HRC 28 | HRC 28, 28, 28 | 131 |
| Exemplar T-bolt 2 | National Seating | HRC 29 | HRC 29, 27, 30 | 135 |
| Exemplar T-bolt 3 | National Seating | HRC 29 | HRC 30, 28, 26, 32 | 135 |
| Exemplar T-bolt 1 | Neoplan | HRB 88 | HRB 88, 88, 89, 88 | 86 |
| Accident T-bolt 1 | Neoplan | HRB 71 | HRB 70, 70, 72, 78, 65 | 62 |
| Accident T-bolt 2 | Neoplan | HRB 39 | HRB 40, 38, 40 | <<56 * |
| Accident T-bolt 3 | Neoplan | HRB 56 | HRB 52, 71, 62, 52, 43 | <<56 * |
| Accident T-bolt 4 | Neoplan | HRB 64 | HRB 72, 65, 69, 54, 52, 74, 65 | 55 |

* A good correlation between hardness and strength in steels is only valid down to HRB 65. Below this number, no good correlation is available.

A longitudinal cross-sectional metallographic mount was made through one of the Neoplan accident T-bolts and one of the National Seating-supplied T-bolts. The microstructure of the Neoplan bolt consisted mostly of ferrite with bands of spherodized cementite and the National Seating-supplied T-bolt had a through-hardened tempered martensitic structure. Both T-bolts were forged/worked to the final shape. The structure indicated that the 1010 steel Neoplan T-bolt was not heat-treated to produce a hardened structure, compared to the National Seating-supplied T-bolts, which were.

# Appendix E

## FMCSA Appendix G to Subchapter B, *Minimum Periodic Inspection Standards*

(The material for this appendix was obtained from the FMCSA Web site at <http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/appng.htm.>)

A vehicle does not pass an inspection if it has one of the following defects or deficiencies:

*1. Brake System.*

a. Service Brakes.

(1) Absence of braking action on any axle required to have brakes upon application of the service brakes (such as missing brakes or brake shoe(s) failing to move upon application of a wedge. S cam, cam, or disc brake).
(2) Missing or broken mechanical components including: shoes, lining pads, springs, anchor pins, spiders, cam rollers, push rods, and air chamber mounting bolts.
(3) Loose brake components including air chambers, spiders, and cam shaft support brackets.
(4) Audible air leak at brake chamber (Example ruptured diaphragm, loose chamber clamp, etc.).
(5) Readjustment limits. The maximum stroke at which brakes should be readjusted is given below. Any brake 1/4, or more past the readjustment limit or any two brakes less than 1/4, beyond the readjustment limit shall be cause for rejection. Stroke shall be measured with engine off and reservoir pressure of 80 to 90 psi with brakes fully applied.

BOLT TYPE BRAKE CHAMBER DATA

| Type | Effective area (sq. in.) | Outside dia. (in.) | Maximum stroke at which brakes should be readjusted |
|---|---|---|---|
| A | 12 | 6 15/16 | 1 3/8 |
| B | 24 | 9 3/16 | 1 3/4 |
| C | 16 | 8 1/16 | 1 3/4 |
| D | 6 | 5 1/4 | 1 1/4 |
| E | 9 | 6 3/16 | 1 3/8 |
| F | 36 | 11 | 2 1/4 |
| G | 30 | 9 7/8 | 2 |

ROTOCHAMBER DATA

| Type | Effective area (sq. in.) | Outside dia. (in.) | Maximum stroke at which brakes should be readjusted |
|---|---|---|---|
| 9 | 9 | 4 9/32 | 1 1/2 |
| 12 | 12 | 4 13/16 | 1 1/2 |
| 16 | 16 | 5 13/32 | 2 |
| 20 | 20 | 5 15/16 | 2 |
| 24 | 24 | 6 13/32 | 2 |
| 30 | 30 | 7 1/16 | 2 1/4 |
| 36 | 36 | 7 5/8 | 2 3/4 |
| 50 | 50 | 8 7/8 | 3 |

CLAMP TYPE BRAKE CHAMBER DATA

| Type | Effective area (sq. in.) | Outside dia. (in.) | Maximum stroke at which brakes should be readjusted |
|---|---|---|---|
| 6 | 6 | 4 1/2 | 1 1/4 |
| 9 | 9 | 5 1/4 | 1 3/8 |
| 12 | 12 | 5 11/16 | 1 3/8 |
| 16 | 16 | 6 3/8 | 1 3/4 |
| 20 | 20 | 6 25/32 | 1 3/4 |
| 24 | 24 | 7 7/32 | 1 3/4[1] |
| 30 | 30 | 8 3/32 | 2 |
| 36 | 36 | 9 | 2 1/4 |
| [1] (2" for long stroke design). | | | |

WEDGE BRAKE DATA. -- Movement of the scribe mark on the lining shall not exceed 1/16 inch.

(6) Brake linings or pads.

(a) Lining or pad is not firmly attached to the shoe;

(b) Saturated with oil, grease, or brake fluid; or

(c) Non steering axles: Lining with a thickness less than 1/4 inch at the shoe center for air drum brakes, 1/16 inch or less at the shoe center for hydraulic and electric drum brakes, and less than 1/8 inch for air disc brakes.

(d) Steering axles: Lining with a thickness less than 1/4 inch at the shoe center for drum brakes, less than 1/8 inch for air disc brakes and 1/16 inch or less for hydraulic disc and electric brakes.

(7) Missing brake on any axle required to have brakes.

(8) Mismatch across any power unit steering axle of:

(a) Air chamber sizes.

(b) Slack adjuster length.

b. Parking Brake System. No brakes on the vehicle or combination are applied upon actuation of the parking brake control, including driveline hand controlled parking brakes.

c. Brake Drum or Rotors.

(1) With any external crack or cracks that open upon brake application (do not confuse short hairline heat check cracks with flexural cracks).

(2) Any portion of the drum or rotor missing or in danger of falling away.

d. Brake Hose.

(1) Hose with any damage extending through the outer reinforcement ply. (Rubber impregnated fabric cover is not a reinforcement ply). (Thermoplastic nylon may have braid reinforcement or color difference between cover and inner tube. Exposure of second color is cause for rejection.

(2) Bulge or swelling when air pressure is applied.

(3) Any audible leaks.

(4) Two hoses improperly joined (such as a splice made by sliding the hose ends over a piece of tubing and clamping the hose to the tube).

(5) Air hose cracked, broken or crimped.

e. Brake Tubing.

(1) Any audible leak.

(2) Tubing cracked, damaged by heat, broken or crimped.

f. Low Pressure Warning Device missing, inoperative, or does not operate at 55 psi and below, or 1/2 the governor cut out pressure, whichever is less.

g. Tractor Protection Valve. Inoperable or missing tractor protection valve(s) on power unit.

h. Air Compressor.

(1) Compressor drive belts in condition of impending or probable failure.

(2) Loose compressor mounting bolts.

(3) Cracked, broken or loose pulley.

(4) Cracked or broken mounting brackets, braces or adapters.

i. Electric Brakes.

(1) Absence of braking action on any wheel required to have brakes.

(2) Missing or inoperable breakaway braking device.

j. Hydraulic Brakes. (Including Power Assist Over Hydraulic and Engine Drive Hydraulic Booster).

(1) Master cylinder less than 1/4 full.

(2) No pedal reserve with engine running except by pumping pedal.

(3) Power assist unit fails to operate.

(4) Seeping or swelling brake hose(s) under application of pressure.

(5) Missing or inoperative check valve.

(6) Has any visually observed leaking hydraulic fluid in the brake system.

(7) Has hydraulic hose(s) abraded (chafed) through outer cover to fabric layer.

(8) Fluid lines or connections leaking restricted, crimped, cracked or broken.

(9) Brake failure or low fluid warning light on and/or inoperative.

k. Vacuum Systems. Any vacuum system which:

(1) Has insufficient vacuum reserve to permit one full brake application after engine is shut off.

(2) Has vacuum hose(s) or line(s) restricted, abraded (chafed) through outer cover to cord ply, crimped, cracked, broken or has collapse of vacuum hose(s) when vacuum is applied.

(3) Lacks an operative low vacuum warning device as required.

*2. Coupling Devices.*

a. Fifth Wheels.

(1) Mounting to frame.

(a) Any fasteners missing or ineffective.

(b) Any movement between mounting components.

(c) Any mounting angle iron cracked or broken.

(2) Mounting plates and pivot brackets.

(a) Any fasteners missing or ineffective.

(b) Any welds or parent metal cracked.

(c) More than 3/8 inch horizontal movement between pivot bracket pin and bracket.

(d) Pivot bracket pin missing or not secured.

(3) Sliders.

(a) Any latching fasteners missing or ineffective.

(b) Any fore or aft stop missing or not securely attached.

(c) Movement more than 3/8 inch between slider bracket and slider base.

(d) Any slider component cracked in parent metal or weld.

(4) Lower coupler.

(a) Horizontal movement between the upper and lower fifth wheel halves exceeds 1/2 inch.

(b) Operating handle not in closed or locked position.

(c) Kingpin not properly engaged.

(d) Separation between upper and lower coupler allowing light to show through from side to side.

(e) Cracks in the fifth wheel plate. Exceptions: Cracks in fifth wheel approach ramps and casting shrinkage cracks in the ribs of the body of a cast fifth wheel.

(f) Locking mechanism parts missing, broken, or deformed to the extent the kingpin is not securely held.

b. Pintle Hooks.

(1) Mounting to frame.

(a) Any missing or ineffective fasteners (a fastener is not considered missing if there is an empty hole in the device but no corresponding hole in the frame or vice versa).

(b) Mounting surface cracks extending from point of attachment (e.g., cracks in the frame at mounting bolt holes).

(c) Loose mounting.

(d) Frame crossmember providing pintle hook attachment cracked.

(2) Integrity.

(a) Cracks anywhere in pintle hook assembly.

(b) Any welded repairs to the pintle hook.

(c) Any part of the horn section reduced by more than 20%.

(d) Latch insecure.

c. Drawbar/Towbar Eye.

(1) Mounting.

(a) Any cracks in attachment welds.

(b) Any missing or ineffective fasteners.

(2) Integrity.

(a) Any cracks.

(b) Any part of the eye reduced by more than 20%.

d. Drawbar/Towbar Tongue.

(1) Slider (power or manual).

(a) Ineffective latching mechanism.

(b) Missing or ineffective stop.

(c) Movement of more than 1/4 inch between slider and housing.

(d) Any leaking, air or hydraulic cylinders, hoses, or chambers (other than slight oil weeping normal with hydraulic seals).

(2) Integrity.

(a) Any cracks.

(b) Movement of 1/4 inch between subframe and drawbar at point of attachment.

e. Safety Devices.

(1) Safety devices missing.

(2) Unattached or incapable of secure attachment.

(3) Chains and hooks.

(a) Worn to the extent of a measurable reduction in link cross section.

(b) Improper repairs including welding, wire, small bolts, rope and tape.

(4) Cable.

(a) Kinked or broken cable strands.

(b) Improper clamps or clamping.

f. Saddle Mounts.

(1) Method of attachment.

(a) Any missing or ineffective fasteners.

(b) Loose mountings.

(c) Any cracks or breaks in a stress or load bearing member.

(d) Horizontal movement between upper and lower saddle mount halves exceeds 1/4 inch.

*3. Exhaust System.*

a. Any exhaust system determined to be leaking at a point forward of or directly below the driver/sleeper compartment.

b. A bus exhaust system leaking or discharging to the atmosphere:

(1) Gasoline powered -- excess of 6 inches forward of the rearmost part of the bus.

(2) Other than gasoline powered -- in excess of 15 inches forward of the rearmost part of the bus.

(3) Other than gasoline powered -- forward of a door or window designed to be opened. (Exception: emergency exits).

c. No part of the exhaust system of any motor vehicle shall be so located as would be likely to result in burning, charring, or damaging the electrical wiring, the fuel supply, or any combustible part of the motor vehicle.

*4. Fuel System.*

a. A fuel system with a visible leak at any point.

b. A fuel tank filler cap missing.

c. A fuel tank not securely attached to the motor vehicle by reason of loose, broken or missing mounting bolts or brackets (some fuel tanks use springs or rubber bushings to permit movement).

*5. Lighting Devices.*

All lighting devices and reflectors required by Section 393 shall be operable.

*6. Safe loading.*

a. Part(s) of vehicle or condition of loading such that the spare tire or any part of the load or dunnage can fall onto the roadway.

b. Protection Against Shifting Cargo -- Any vehicle without a front end structure or equivalent device as required.

*7. Steering Mechanism.*

a. Steering Wheel Free Play (on vehicles equipped with power steering the engine must be running).

STEERING WHEEL FREE PLAY
(on vehicles equipped with power steering the engine must be running).

| Steering wheel diameter | Manual steering system | Power steering system |
|---|---|---|
| 16" | 2" | 4 1/2" |
| 18" | 2 1/4" | 4 3/4" |
| 20" | 2 1/2" | 5 1/4" |
| 22" | 2 3/4" | 5 3/4" |

b. Steering Column.

(1) Any absence or looseness of U bolt(s) or positioning part(s).

(2) Worn, faulty or obviously repair welded universal joint(s).

(3) Steering wheel not properly secured.

c. Front Axle Beam and All Steering Components Other Than Steering Column.

(1) Any crack(s).

(2) Any obvious welded repair(s).

d. Steering Gear Box.

(1) Any mounting bolt(s) loose or missing.

(2) Any crack(s) in gear box or mounting brackets.

e. Pitman Arm. Any looseness of the pitman arm on the steering gear output shaft.

f. Power Steering. Auxiliary power assist cylinder loose.

g. Ball and Socket Joints.

(1) Any movement under steering load of a stud nut.

(2) Any motion, other than rotational, between any linkage member and its attachment point of more than 1/4 inch.

h. Tie Rods and Drag Links.

(1) Loose clamp(s) or clamp bolt(s) on tie rods or drag links.

(2) Any looseness in any threaded joint.

i. Nuts. Nut(s) loose or missing on tie rods pitman arm, drag link, steering arm or tie rod arm.

j. Steering System. Any modification or other condition that interferes with free movement of any steering component.

*8. Suspension.*

a. Any U bolt(s), spring hanger(s), or other axle positioning part(s) cracked, broken, loose or missing resulting in shifting of an axle from its normal position. (After a turn, lateral axle displacement is normal with some suspensions. Forward or rearward operation in a straight line will cause the axle to return to alignment).

b. Spring Assembly.

(1) Any leaves in a leaf spring assembly broken or missing.

(2) Any broken main leaf in a leaf spring assembly. (Includes assembly with more than one main spring).

(3) Coil spring broken.

(4) Rubber spring missing.

(5) One or more leaves displaced in a manner that could result in contact with a tire, rim, brake drum or frame.

(6) Broken torsion bar spring in a torsion bar suspension.

(7) Deflated air suspension, i.e., system failure, leak, etc.

c. Torque, Radius or Tracking Components. Any part of a torque, radius or tracking component assembly or any part used for attaching the same to the vehicle frame or axle that is cracked, loose, broken or missing. (Does not apply to loose bushings in torque or track rods.)

*9. Frame*

a. Frame Members.

(1) Any cracked, broken, loose, or sagging frame member.

(2) Any loose or missing fasteners including fasteners attaching functional component such as engine, transmission, steering gear, suspension, body parts, and fifth wheel.

b. Tire and Wheel Clearance. Any condition, including loading, that causes the body or frame to be in contact with a tire or any part of the wheel assemblies.

c. (1) Adjustable Axle Assemblies (Sliding Subframes). Adjustable axle assembly with locking pins missing or not engaged.

*10. Tires.*

a. Any tire on any steering axle of a power unit.

(1) With less than 4/32 inch tread when measured at any point on a major tread groove.

(2) Has body ply or belt material exposed through the tread or sidewall.

(3) Has any tread or sidewall separation.

(4) Has a cut where the ply or belt material is exposed.

(5) Labeled "Not for Highway Use" or displaying other marking which would exclude use on steering axle.

(6) A tube type radial tire without radial tube stem markings. These markings include a red band around the tube stem, the word "radial" embossed in metal stems, or the word "radial" molded in rubber stems.

(7) Mixing bias and radial tires on the same axle.

(8) Tire flap protrudes through valve slot in rim and touches stem.

(9) Regrooved tire except motor vehicles used solely in urban or suburban service (see exception in Section 393.75(e)).

(10) Boot, blowout patch or other ply repair.

(11) Weight carried exceeds tire load limit. This includes overloaded tire resulting from low air pressure.

(12) Tire is flat or has noticeable (e.g., can be heard or felt) leak.

(13) Any bus equipped with recapped or retreaded tire(s).

(14) So mounted or inflated that it comes in contact with any part of the vehicle.

b. All tires other than those found on the steering axle of a power unit:

(1) Weight carried exceeds tire load limit. This includes overloaded tire resulting from low air pressure.

(2) Tire is flat or has noticeable (e.g., can be heard or felt) leak.

(3) Has body ply or belt material exposed through the tread or sidewall.

(4) Has any tread or sidewall separation.

(5) Has a cut where ply or belt material is exposed.

(6) So mounted or inflated that it comes in contact with any part of the vehicle. (This includes a tire that contacts its mate.)

(7) Is marked "Not for highway use" or otherwise marked and having like meaning.

(8) With less than 2/32 inch tread when measured at any point on a major tread groove.

*11. Wheels and Rims.*

a. Lock or Side Ring. Bent, broken, cracked, improperly seated, sprung or mismatched ring(s).

b. Wheels and Rims. Cracked or broken or has elongated bolt holes.

c. Fasteners (both spoke and disc wheels). Any loose, missing, broken, cracked, stripped or otherwise ineffective fasteners.

d. Welds.

(1) Any cracks in welds attaching disc wheel disc to rim.

(2) Any crack in welds attaching tubeless demountable rim to adapter.

(3) Any welded repair on aluminum wheel(s) on a steering axle.

(4) Any welded repair other than disc to rim attachment on steel disc wheel(s) mounted on the steering axle.

*12. Windshield Glazing.*

(Not including a 2 inch border at the top, a 1 inch border at each side and the area below the topmost portion of the steering wheel.) Any crack, discoloration or vision reducing matter except: (1) coloring or tinting applied at time of manufacture; (2) any crack not over 1/4 inch wide, if not intersected by any other crack; (3) any damaged area not more than 3/4 inch in diameter, if not closer than 3 inches to any other such damaged area; (4) labels, stickers, decalcomania, etc. (see Section 393.60 for exceptions).

*13. Windshield Wipers.*

Any power unit that has an inoperative wiper, or missing or damaged parts that render it ineffective.

*Comparison of Appendix G, and the new North American Uniform Driver Vehicle Inspection Procedure (North American Commercial Vehicle Critical Safety Inspection Items and Out Of Service Criteria)*

The vehicle portion of the FHWA's North American Uniform Driver Vehicle Inspection Procedure (NAUD VIP) requirements, CVSA's North American Commercial Vehicle Critical Safety Inspection Items and Out Of Service Criteria and Appendix G of subchapter B are similar documents and follow the same inspection procedures. The same items are required to be inspected by each document. FHWA's and CVSA's out of service criteria are intended to be used in random roadside inspections to identify critical vehicle inspection items and provide criteria for placing a vehicle(s) out of service. A vehicle(s) is placed out of service only when by reason of its mechanical condition or loading it is determined to be so imminently hazardous as to likely cause an accident or breakdown, or when such condition(s) would likely contribute to loss of control of the vehicle(s) by the driver. A certain amount of flexibility is given to the inspecting official whether to place the vehicle out of service at the inspection site or if it would be less hazardous to allow the vehicle to proceed to a repair facility for repair. The distance to the repair facility must not exceed 25 miles. The roadside type of inspection, however, does not necessarily mean that a vehicle has to be defect free in order to continue in service.

In contrast, the Appendix G inspection procedure requires that all items required to be inspected are in proper adjustment, are not defective and function properly prior to the vehicle being placed in service.

*Differences Between the Out Of Service Criteria & FHWA's Annual Inspection*

*1. Brake System.*

Appendix G criteria reject vehicles with any defective brakes, any air leaks, etc. The out of service criteria allow 20% defective brakes on non steering axles and a certain latitude on air leaks before placing a vehicle out of service.

*2. Coupling Devices.*

Appendix G rejects vehicles with any fifth wheel mounting fastener missing or ineffective. The out of service criteria allow up to 20% missing or ineffective fasteners on frame mountings and pivot bracket mountings and 25% on slider latching fasteners. The out of service criteria also allow some latitude on cracked welds.

*3. Exhaust System.*

Appendix G follows Section 393.83 verbatim. The CVSA out of service criteria allow vehicles to exhaust forward of the dimensions given in Section 393.83 as long as the exhaust does not leak or exhaust under the chassis.

*4. Fuel System.*

Same for appendix G and the out of service criteria.

*5. Lighting Devices.*

Appendix G requires all lighting devices required by section 393 to be operative at all times. The out of service criteria only requires one stop light and functioning turn signals on the rear most vehicle of a combination vehicle to be operative at all times. In addition one operative head lamp and tail lamp are required during the hours of darkness.

*6. Safe Loading.*

Same for both Appendix G and the out of service criteria.

*7. Steering Mechanism.*

Steering lash requirements of Appendix G follow the new requirements of Section 393.209.

*8. Suspension.*

Appendix G follows the new requirements of Section 393.207, which do not allow any broken leaves in a leaf-spring assembly. The out of service criteria allow up to 25% broken or missing leaves before being placed out of service.

*9. Frame.*

The out of service criteria allow a certain latitude in frame cracks before placing a vehicle out of service. Appendix G follows the new requirements of Section 393.201, which do not allow any frame cracks.

*10. Tires.*

Appendix G follows the requirements of Section 393.75, which requires a tire tread depth of 4/32 inch on power unit steering axles and 2/32 inch on all other axles. The out of service criteria only require 2/32 inch tire tread depth on power unit steering axles and 1/32 inch on all other axles.

*11. Wheel and Rims.*

The out of service criteria allow a certain amount of latitude for wheel and rim cracks and missing or defective fasteners. Appendix G meets the requirements of the new Section 393.205, which do not allow defective wheels and rims non effective nuts and bolts.

*12. Windshield Glazing.*

The out of service criteria place in a restricted service condition any vehicle that has a crack or discoloration in the windshield area lying within the sweep of the wiper on the driver side and does not address the remaining area of the windshield. Appendix G addresses requirements for the whole windshield as specified in Section 393.60.

*13. Windshield Wipers.*

Appendix G requires windshield wipers to be operative at all times. The out of service criteria only require that the windshield wiper on the driver side be inspected during inclement weather.

# Appendix F

## Safety Recommendations From the New Orleans Accident Investigation Report Pertaining to a Comprehensive Medical Oversight Program for Commercial Drivers

In the New Orleans motorcoach accident investigation report,[1] the Safety Board issued eight safety recommendations to the Federal Motor Carrier Safety Administration (FMCSA) recommending that the FMCSA develop a comprehensive medical oversight program for interstate commercial drivers. Each recommendation addressed a specific program element. The status of each recommendation is provided below.[2]

### To the FMCSA:

Develop a comprehensive medical oversight program for interstate commercial drivers that contains the following program elements:

Safety Recommendation H-01-17

- Individuals performing medical examinations for drivers are qualified to do so and are educated about occupational issues for drivers. **(Open—Acceptable Response)**

Safety Recommendation H-01-18

- A tracking mechanism is established that ensures that every prior application by an individual for medical certification is recorded and reviewed. **(Open—Unacceptable Response)**

Safety Recommendation H-01-19

- Medical certification regulations are updated periodically to permit trained examiners to clearly determine whether drivers with common medical conditions should be issued a medical certificate. **(Open—Acceptable Response)**

Safety Recommendation H-01-20

- Individuals performing examinations have specific guidance and a readily identifiable source of information for questions on such examinations. **(Open—Acceptable Response)**

[1] National Transportation Safety Board, *Motorcoach Run-off-the-Road Accident, New Orleans, Louisiana, May 9, 1999*, Highway Accident Report NTSB/HAR-01/01 (Washington, DC: NTSB, 2001).

[2] The Safety Board reclassified the status of all these safety recommendations, as reflected in this appendix, on March 25, 2005.

Safety Recommendation H-01-21

- The review process prevents, or identifies and corrects, the inappropriate issuance of medical certification. **(Open—Unacceptable Response)**

Safety Recommendation H-01-22

- Enforcement authorities can identify invalid medical certification during safety inspections and routine stops. **(Open—Unacceptable Response)**

Safety Recommendation H-01-23

- Enforcement authorities can prevent an uncertified driver from driving until an appropriate medical examination takes place. **(Open—Unacceptable Response)**

Safety Recommendation H-01-24

- Mechanisms for reporting medical conditions to the medical certification and reviewing authority and for evaluating these conditions between medical certification exams are in place; individuals, health care providers, and employers are aware of these mechanisms. **(Open—Unacceptable Response)**

# Appendix G

## Examples of Language From State Applications That Reference the FMCSRs for Commercial Vehicle Owners

**State of Maryland, Application for Certificate of Title, Form VR-005 (07/04)**

*For vehicles registered over 10,000 lbs. By signing this application, I/we certify knowledge of the Federal and State Motor Carrier Safety Laws and certify this vehicle is maintained in compliance with the Maryland Preventative Maintenance Program.*

**State of Louisiana, Vehicle Application, Form DPSMV 1799 (R12/03)**

*If the vehicle being registered is defined as a commercial motor vehicle by the Federal Motor Carrier Safety Regulations and/or Federal Hazardous Material Regulations, by signature below registrant declares knowledge of those federal regulations.*

**State of Minnesota, Application to Title/Register a Vehicle, Form PS2000-29**

*I (we) certify I (we) are of legal age, have bought this vehicle subject to liens shown and no other. This vehicle is and will continue to be insured while operating upon the public streets and highways. The vehicle will be operated in compliance with the laws which apply to its class of registration, have received a copy of this application and all of my (our) declarations are true and correct. I (we) have knowledge of State and Federal regulations applicable to commercial vehicle operation, Minnesota statutes, chapter 221, public service commission rules 1 through 48, and Code of Federal Regulations, Title 49, Parts 390 through 399, and if a transporter of hazardous materials, Code of Federal Regulations, Title 49, Parts 171 to 199.*

**State of Rhode Island, Application for Registration and Title Certificate, Form TR-1 Rev. 01/02**

*Declaration of Knowledge; Commercial vehicles with a gross vehicle weight of 10,000 pounds or more or transporting hazardous material. 'I hereby certify knowledge of applicable Federal and state motor carrier safety regulations and laws and declare that all operations will be conducted in compliance with such requirements.'*

# Appendix H

## Six Previous Motorcoach Accidents Involving Seat Anchorage Problems

| **CASE 1** | **NORTH HUDSON, NEW YORK** |
|---|---|
| Date and time | February 22, 2004; 2:40 p.m. |
| Accident no. | HWY-04-FH-015 |
| Location | North Hudson, New York |
| Vehicle | 1998 Prevost/Volvo Model H345 |
| Occupancy | 58-passenger coach, 47 on board |
| Seat manufacturer | Prevost |
| Motorcoach passenger injuries | 8 serious, 39 minor to none |
| Type of crash | Motorcoach rear-end collision into semitrailer |

The 1998 Prevost 58-passenger motorcoach was traveling southbound on Interstate Highway 87 to a point at which traffic had become stopped due to a Homeland Security immigration checkpoint. The motorcoach approached the stopped traffic at a recorded speed of 64 mph in the posted 65 mph zone. The motorcoach's electronic engine recorder showed that a recording event was triggered by a 0.3 G deceleration rate of the bus. The bus braked for 2 to 3 seconds and collided with the rear of a 1997 Kenworth tractor-trailer combination unit at a speed of about 46 mph. The driver indicated that he swerved to the left as he struck the back of the trailer.

The motorcoach's seat design consisted of two seats per frame, with the steel frame supported in the center by an aluminum pedestal. A carriage bolt fixed the seat frame and pedestal to the rail, sheet metal screws fixed the floor rail to the floor structure, and square blocks held the carriage bolt to the rail. The bolt through the pedestal fixed the pedestal to a floor track rail. The rail was screwed to the floor structure of the motorcoach. The pedestal was made of aluminum, and the floor rail was made of stainless steel.

The following damage was noted to the bus interior seats. Rows 2 to 7 on the left of the motorcoach were detached from the floor anchorages. The rail was detached from the floor at rows 2 and 3. On the right side of the bus, rows 1 to 3, the floor rail was pulled upward from the floor and had been cut. The row 8 seat pedestal had been pulled up from the floor but remained attached to the rail. Row 12 was partially detached from the floor. According to the emergency responders, most of the seat attachment damage in the floor area was caused by Border Patrol agents clearing the seats out of the way to extricate passengers.

**CASE 2** **SANTA FE, NEW MEXICO**

| | |
|---|---|
| Date and time | January 5, 1998; 1:30 a.m. |
| Accident no. | HWY-98-FH-012 |
| Location | Santa Fe, New Mexico |
| Vehicle | 1998 Dina AutoBus, Viaggio 1000, Marcopolo |
| Occupancy | 52-passenger coach, 58 on board[1] |
| Seat manufacturer | Amaya-Astron Seating Group (Mexico) |
| Motorcoach passenger injuries | 1 fatal, 22 serious to minor |
| Type of crash | Loss-of-control and run-off-the-road, rollover |

The 1998 Dina motorcoach was traveling north on Interstate Highway 25 en route from El Paso, Texas, to Denver, Colorado. There were 60 occupants on-board, a driver, a codriver (in a sleeper area), and 58 passengers. The driver lost control of the vehicle and went off the right side of the roadway. The vehicle struck 350 feet of guardrail and came to a stop, rolling over onto its right side. One person received fatal injuries and 22 other people received injuries ranging from serious to minor.

There were 14 rows of seats: 12 rows of 2 each on either side of a center aisle and 2 rows of 2 each on the left side at the rear of the vehicle. In the right rear interior of the vehicle was an enclosed restroom, and at the very rear of the coach was a 24-inch-wide shelf with a mattress for the codriver. The vehicle sustained major body damage to the front and left side. The steps in the step well entrance to the vehicle were deformed upward and rearward.

Fifteen sets of seats, on both sides of the center aisle, became detached from their securement points. Seven of the 15 sets of seats also detached from the floor mountings and were found loose throughout the interior of the vehicle. The seats were secured at two points: at the sidewall and at a track along the floor. The sidewall securement points consisted of a bracket mounted to the bottom of the seat and a C-clamp, which was adjusted using a bolt. The C-clamp was fitted over a black plastic sleeve, which covered a flat 3-inch-wide metal flange. The plastic sleeve was one continuous piece, which ran the length of the seating area. The continuous metal flange was part of the inner wall construction. The floor attachment point consisted of a threaded bolt at the baser of the seat leg (pedestal) and a metal track in the floor with an opening at the top. The end of the bolt consisted of a circular flange that fit into the opening of the slot. The bolt was then tightened to secure the seat from movement. An inspection of the wall securement mechanisms showed that most of the C-clamps had pulled away from the plastic sleeves, leaving the metal flange exposed. In some cases, the black plastic sleeve broke away with the seat, as evidenced by the broken piece of plastic still attached to the C-clamp. An inspection of the floor mountings showed that the metal flanges were pulled upward and out of the track, as evidenced by the upward deformation of the track metal.

[1] Although the number of passengers exceeded the rated seating capacity of the motorcoach, many of the extra passengers were children seated on their parents' laps or young persons seated two to a seat. There were five children 13 years old or younger on the bus. Due to the conflicting accounts of how many people were in the bus and whether people were seated in the aisle, no certain determination could be made as to the seating arrangements at the time of the collision. No Federal or State regulations address the seating arrangements on this type of vehicle, except to prohibit interference with the driver.

**CASE 3** **HEWITT, TEXAS**

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| Date and time | February 14, 2003; 9:30 a.m. |
| Accident no. | HWY-03-MH-022 |
| Location | Hewitt, Texas |
| Vehicle | 1996 Dina Viaggio |
| Occupancy | 52-passenger coach, 34 on board |
| Seat manufacturer | Amaya-Astron Seating Group (Mexico) |
| Motorcoach passenger injuries | 5 fatal, 29 serious to minor |
| Type of crash | Median crossover and rollover |

The motorcoach was traveling about 60 mph northbound on Interstate Highway 35 in reduced visibility conditions with fog, haze, and heavy rain. As the motorcoach crested a hill, the driver slowed for traffic ahead and attempted to change lanes from the right to the left lane to avoid stopped traffic. As he did so, another vehicle also moved left and the driver braked, lost control of the motorcoach, and went off the roadway into the grassy median. The vehicle then crossed the grassy median and entered the southbound lanes, where it struck a sport utility vehicle. Then it overturned onto its right side.

There were 12 rows of 4 seats, 2 on the right and 2 on the left, as well as 2 seats each on the left in rows 13 and 14. The seat frame unit was fastened to the sidewall by a clamp that fit over and under a horizontal rail running the length of the passenger compartment on the right and left sidewalls, about 10 inches above the floor, adjacent to the seat frame lower edge. The seat clamp allowed for a friction fit when the bolts were tightened (1 bolt per clamp, 2 clamps per seat unit). The manufacturer's service manual for the motorcoach provided the following information: "Passenger Seats Dina 1N1-1, the passenger seat mounting bolts should be checked routinely for proper tightness."

Postaccident examination of the seats showed that the sidewall seat anchorage points at rows 3 right, 5 left, and 11 left were not attached. No passengers were seated in row 3 on the right. Behind, in row 4, the passenger seated at the window (ejected) was fatally injured due to blunt force trauma to the left side of the head, and the passenger seated at the aisle position sustained contusions and lacerations. In row 5 on the left, the passenger seated at the window was fatally injured (ejected), having sustained blunt force trauma to the left side of the head. The aisle-seated passenger sustained contusions and abrasions to the right shoulder, lower back, and left tibia (this passenger was reportedly standing at the time of the accident). In seat row 6 on the left, the window passenger (ejected) sustained serious injuries (lacerated spleen and multiple rib fractures). The passenger seated in this row at the aisle position (ejected) sustained a hand contusion. At seat row 11 on the left, the passenger seated at the window sustained a serious injury (dislocated left shoulder), and the passenger at the aisle position sustained serious injuries (fractured vertebrae). At row 12 on the left, the passenger at the window position was fatally injured due to blunt force trauma to the upper chest and left temple. The passenger seated in this row at the aisle position sustained contusions.

**CASE 4** **NELSON TOWNSHIP, NEW YORK**

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| Date and time | September 7, 1996; 10:30 p.m. |
| Accident no. | NRH-96-FH-014 |
| Location | Nelson Township, New York |
| Vehicle | 1993 Prevost Le Mirage XL |
| Occupancy | 47-passenger coach, 38 on board |
| Seat manufacturer | Prevost |
| Motorcoach passenger injuries | 2 serious, 3 minor |
| Type of crash | Pedestrian strike and run-off-the-road |

The motorcoach was traveling eastbound on Route 20 about 53 mph when the driver observed a pedestrian jump onto the roadway in front of the bus. The driver steered to the right of the pedestrian, but the left front of the motorcoach struck the pedestrian. The motorcoach then drove off the right side of the roadway and traveled along a drainage ditch that ran parallel to the right travel lane. The bus entered the ditch, struck a culvert, traveled up and over the driveway and back into the ditch on the other side, and then continued along the ditch before coming to rest leaning to the right side.

The bus was configured with 13 rows of passenger seats; the first 12 rows were arranged with 4 seats per row, 2 on each side of the center aisle. The last row on the left had three seats, two on the left and a third seat located in the center aisle. With the exception of the last row of seats, the passenger seats were attached to the interior sidewall track by two C-brackets. A bolt was placed through a hole in the edge of the seat frame and threaded into a nut in the middle of the C-clamp. With the bolt tightened, the seat frame and the C-bracket formed a clamp to secure the seat to the sidewall track. A small vertical portion on the track prevented the C-clamp from moving laterally off the interior edge. The seat frame at the aisle position was supported by a pedestal and, in each seat pedestal, there were two threaded vertical rods. The top of the rod was visible only with the seat cushion removed. The bottom end of the rods was coated with “Loc-tite” and threaded into a steel block that slid in the floor track. When the seat was installed, the tops of the two threaded rods were aligned with, and placed through, two “guide holes” located on the bottom of the seat frame. The guide holes allowed about 1 inch of lateral seat adjustment. Once the seat was aligned, it was secured with a nut and two washers.

Two of the seat pedestals buckled as a result of the metal track pulling away from the floor of the bus. Examination of the fasteners attaching the track to the floor found that they were corroded and that the rear of the fasteners was located in the wheel well, exposed to the elements. Seven of the seats had separated from the interior sidewall of the bus. On six of the seats, the C-clamp attaching the seat to the interior sidewall was bent. Examination of the brackets revealed that bending was significant enough to have allowed the seat to move laterally away from the interior sidewall. Examination of the seventh seat revealed that the C-clamp on the seat had been tightened against the seat pan, indicating that the seat had not been attached to the interior sidewall when the accident occurred.

**CASE 5** **BURNT CABINS, PENNSYLVANIA**

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| Date and time | June 20, 1998; 4:05 a.m. |
| Accident no. | HWY-98-MH-033 |
| Location | Burnt Cabins, Pennsylvania |
| Vehicle | 1997 Motor Coach Industries |
| Occupancy | 47-passenger coach, 22 on board |
| Seat manufacturer | National Seating |
| Motorcoach passenger injuries | 6 fatal, 1 serious, 15 minor |
| Type of crash | Run-off-the-road/semitrailer collision |

*SEATS - Left Side*

- Driver seat was missing because of crush deformation rearward to 2nd row of passenger seats.
- Row 2 was severely deformed, although still located on the floor of the vehicle.
- Rows 3 through 5 were missing due to passenger extrication; they were found in the luggage compartment.
- In row 6 on the left, the aisle seatback sustained inward deformation.
- In row 7, the aisle seat was rotated clockwise 10°.
- Row 8 did not show evidence of impact marks on the rear of the seatback cushions.
- In rows 8 through 11, numerous seats were deflected forward and downward.
- In row 9, a window seatback cushion was broken with evidence of impact marks on rear.
- In row 10, there were impact marks on the aisle seatback cushions.
- In row 11, the three-seat bench location was intact.

*SEATS - Right Side*

- Loading door was missing because of crush rearward to 2nd row of seats.
- Row 2 was missing due to passenger extrication; it was found in the lower luggage compartment.
- Row 3 was crushed rearward into row 4.
- The row 4 through 11 seat frames were intact with some deflection of the seatback cushions.
- The row 4 through 8 window seats were pushed forward/outward and deformed rear of the seat below bight.
- In rows 4 and 5, seatback deformation below bight was evident.
- The row 7 seatback was pushed forward at deformation and bowed below both the seatbacks.
- Rows 9 through 11 were found relatively intact, without rear seatback deformation.

A 30-year-old female passenger, who was a physician, stated that she was sitting on the right side of the bus, perhaps in the fifth or sixth row from the front in either seat number 20 or 24. When the accident occurred, she was thrown "very forcefully" into the seat in front of her, hit her head on the seat and window, and fell to the left and onto the floor. She sustained multiple facial lacerations and contusions, a deep chin laceration, and a left arm sprain.

Another passenger was a 25-year-old male seated alone on the right side of the bus in row 8 or 9 in seat 32 or 36 next to the window. He was sleeping fully reclined in his seat with his head toward the window before the accident. He recalled having fallen to the left and forward, striking his head on the aisle seat handle during the accident sequence, although his seat remained intact. He sustained a laceration/abrasion to the left side of his face and cheek area and small injuries to his hands and legs.

| **CASE 6** | **NEW ORLEANS, LOUISIANA** |
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| Date and time | May 9, 1999; 9:00 a.m. |
| Accident no. | HWY-99-MH-017 |
| Location | New Orleans, Louisiana, Interstate 610 |
| Vehicle | 1997 Motor Coach Industries MCI-102 |
| Occupancy | 55-passenger coach, 43 on board |
| Seat manufacturer | National Seating |
| Motorcoach passenger injuries | 22 fatal, 15 serious, 6 minor |
| Type of crash | Run-off-the-road/embankment collision |

The vehicle sustained massive frontal deformation and crush, with the driver area, stairwell area, and forward passenger compartment compromised by front axle upward intrusion into the floorboard. The dashboard instrument panel, steering wheel, driver seat, and partition had been crushed downward and rearward, while the forward passenger compartment floorboard had been deformed upward toward the interior roof from seat rows 1 through 3. Emergency responders removed the following seats to extricate surviving and deceased passengers: 9, 10, 13, 14, 15, 16, 17, 18, 21, 22, 25, and 26. The following seats sustained separations at the base due to vehicle crush deformation and intrusion: 1, 2, 7, and 8. The remaining seats rearward of row 3 sustained frame damage, and the seatbacks were deflected forward at different angles.

National Seating manufactured the bus passenger seats; the model was a 4210-A with a "Centre-T" pedestal mounting. The driver seat had a three-point seat belt restraint manufactured by Indiana Mills and Manufacturing, Inc. The bus had been designated as having 55 passenger seats, with 13 rows of 2 seats on the left and 13 rows on the right, offset by about 11 inches. The 14th, or last, row on the left had 3 seats. The right first row seat bottom cushion front edge was about 11 inches forward of the seat bottom cushion front edge for the left side first row. The first seat next to the window behind the driver was designated as seat 1 and the aisle seat as seat 2. On the right side of the bus, the first row seat next to the aisle was designated as seat 3 and the window seat as seat 4. In the second row behind the driver, the window seat was designated as seat 5, and the remaining seats were numbered in this same order. The second to last row on the left, row 13,

consisted of two rear-facing seats. On the right, the second to last row, designated row 12, had two rear-facing seats. The passenger restroom was behind the last row on the right.

The seat bottom cushions were 18.5 inches wide; the front of the seat pan was 17 inches from the floor, and the back of the seat pan was 14.5 inches from the floor. The seatback cushions were 21 inches high and 18 inches wide. The headrest cushions were 7 inches high and 11 inches wide. The front of the seat bottom cushion was 11 inches from the rear of the forward seatback cushion. The window seat armrest was 3.5 inches from the bus sidewall window. The footrest at the back of the seat was 20 inches from the front of the seat cushion. The aisle between the seat rows was 14.5 inches wide.

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