# Motorcoach Fire on Interstate 45 During Hurricane Rita Evacuation Near Wilmer, Texas September 23, 2005


**ACCIDENT REPORT**

NTSB/HAR-07/01
PB2007-916202

National Transportation Safety Board

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# Highway Accident Report

## Motorcoach Fire on Interstate 45 During Hurricane Rita Evacuation Near Wilmer, Texas September 23, 2005

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**PB2007-916202**
**Notation 7774C**
**Adopted February 21, 2007**

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

**National Transportation Safety Board. 2007.** ***Motorcoach Fire on Interstate 45 During Hurricane Rita Evacuation Near Wilmer, Texas, September 23, 2005.*** **Highway Accident Report NTSB/HAR-07/01. Washington, DC.**

**Abstract:** On September 23, 2005, a 1998 Motor Coach Industries, Inc. (MCI), 54-passenger motorcoach, operated by Global Limo Inc., of Pharr, Texas, was traveling northbound on Interstate 45 (I-45) near Wilmer, Texas. The motorcoach, en route from Bellaire to Dallas, Texas, as part of the evacuation in anticipation of Hurricane Rita, was carrying 44 assisted living facility residents and nursing staff. The trip had begun about 3:00 p.m. on September 22. Fifteen hours later, about 6:00 a.m. on the following day, a motorist noticed that the right-rear tire hub was glowing red and alerted the motorcoach driver, who stopped in the left traffic lane and then proceeded to the right shoulder of I-45 near milepost 269.5. The driver and nursing staff exited the motorcoach and observed flames emanating from the right-rear wheel well. As they initiated an evacuation of the motorcoach, with assistance from passersby, heavy smoke and fire quickly engulfed the entire vehicle. Twenty-three passengers were fatally injured. Of the 21 passengers who escaped, 2 were seriously injured and 19 received minor injuries; the motorcoach driver also received minor injuries.

Major safety issues identified in this investigation include vehicle fire reporting and inconsistent data within Federal accident databases, the ineffective compliance review program of the Federal Motor Carrier Safety Administration (FMCSA), emergency egress from motorcoaches, fire resistance of motorcoach materials and designs, manufacturer maintenance information on wheel bearing components, transportation of partially pressurized aluminum cylinders, and emergency transportation of persons with special needs. As a result of this accident investigation, the Safety Board makes recommendations to the FMCSA, the National Highway Traffic Safety Administration, the Pipeline and Hazardous Materials Safety Administration, the Fraternal Order of Police, the International Association of Chiefs of Police, the International Association of Fire Chiefs, the International Association of Fire Fighters, the National Association of State EMS Officials, the National Sheriffs' Association, the National Volunteer Fire Council, MCI and other motorcoach manufacturers, the United Motorcoach Association, and the American Bus Association. The Safety Board reiterates two recommendations to the U.S. Department of Transportation.

# Contents

# Acronyms and Abbreviations

| | |
|---|---|
| AASHTO | American Association of State Highway and Transportation Officials |
| ABS | antilock brake system |
| ADA | Americans With Disabilities Act |
| ANSI | American National Standards Institute |
| ASTM | American Society for Testing and Materials |
| CAPRI | Compliance Analysis and Performance Review Information System |
| CDL | commercial driver's license |
| CFR | *Code of Federal Regulations* |
| CGA | Compressed Gas Association |
| CMS | Centers for Medicare and Medicaid Services (HHS) |
| CSA | Comprehensive Safety Analysis 2010 Initiative |
| CUSA | Coach USA, LLC |
| CVSA | Commercial Vehicle Safety Alliance |
| DDEC | Detroit Diesel Electronic Controls |
| DHS | U.S. Department of Homeland Security |
| DOT | U.S. Department of Transportation |
| DVIR | driver vehicle inspection report |
| ECM | electronic control module |
| EMS | emergency medical services |
| ESF | emergency support function (NRP) |
| F | Fahrenheit |
| FAA | Federal Aviation Administration |
| FARS | Fatality Analysis Reporting System (NHTSA) |
| FEMA | Federal Emergency Management Agency |
| FHWA | Federal Highway Administration |
| FM | Farm-to-Market |
| FMCSA | Federal Motor Carrier Safety Administration |
| FMCSRs | *Federal Motor Carrier Safety Regulations* |
| FMVSS | Federal Motor Vehicle Safety Standard |
| FOP | Fraternal Order of Police |
| FR | *Federal Register* |
| FRA | Federal Railroad Administration |
| GAO | U.S. Government Accountability Office |

| | |
|---|---|
| GES | General Estimates System (NHTSA) |
| HHS | U.S. Department of Health and Human Services |
| HM | hazardous materials |
| HMR | *Hazardous Materials Regulations* |
| HVAC | heating, ventilating, and air conditioning |
| I-45 | Interstate 45 |
| IACP | International Association of Chiefs of Police |
| IAFC | International Association of Fire Chiefs |
| IAFF | International Association of Fire Fighters |
| ISS | inspection selection system |
| MCI | Motor Coach Industries, Inc. |
| MCMIS | Motor Carrier Management Information System (FMCSA) |
| MCT | MCT Charter Tours |
| MP | milepost |
| NASEMSO | National Association of State EMS Officials |
| NDMS | National Disaster Medical System |
| NFIRS | National Fire Incident Reporting System (NFPA) |
| NFPA | National Fire Protection Association |
| NHTSA | National Highway Traffic Safety Administration |
| NIST | National Institute of Standards and Technology |
| NPRM | Notice of Proposed Rulemaking |
| NRP | National Response Plan |
| NSA | National Sheriffs' Association |
| NVFC | National Volunteer Fire Council |
| OOS | out-of-service |
| PHMSA | Pipeline and Hazardous Materials Safety Administration |
| psig | pounds per square inch gage |
| PVC | polyvinyl chloride |
| SafeStat | Safety Status Measurement System (FMCSA) |
| SAFETEA-LU | Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users |
| SEA | safety evaluation area (FMCSA) |
| TBPC | Texas Building and Procurement Commission |
| TxDOT | Texas Department of Transportation |
| TxDPS | Texas Department of Public Safety |
| UL | Underwriters Laboratories Inc. |
| VIN | vehicle identification number |

# Executive Summary

On September 23, 2005, a 1998 Motor Coach Industries, Inc. (MCI), 54-passenger motorcoach, operated by Global Limo Inc., of Pharr, Texas, was traveling northbound on Interstate 45 (I-45) near Wilmer, Texas. The motorcoach, en route from Bellaire to Dallas, Texas, as part of the evacuation in anticipation of Hurricane Rita, was carrying 44 assisted living facility residents and nursing staff. The trip had begun about 3:00 p.m. on September 22. Fifteen hours later, about 6:00 a.m. on the following day, a motorist noticed that the right-rear tire hub was glowing red and alerted the motorcoach driver, who stopped in the left traffic lane and then proceeded to the right shoulder of I-45 near milepost 269.5. The driver and nursing staff exited the motorcoach and observed flames emanating from the right-rear wheel well. As they initiated an evacuation of the motorcoach, with assistance from passersby, heavy smoke and fire quickly engulfed the entire vehicle. Twenty-three passengers were fatally injured. Of the 21 passengers who escaped, 2 were seriously injured and 19 received minor injuries; the motorcoach driver also received minor injuries.

The National Transportation Safety Board determines that the probable cause of the accident was insufficient lubrication in the right-side tag axle wheel bearing assembly of the motorcoach, resulting in increased temperatures and subsequent failed wheel bearings, which led to ignition of the tire and the catastrophic fire. Global Limo Inc. had failed to conduct proper vehicle maintenance, to do pretrip inspections, and to complete posttrip driver vehicle inspection reports, thereby allowing the insufficient wheel bearing lubrication to go undetected. Contributing to the accident was the Federal Motor Carrier Safety Administration's ineffective compliance review system, which resulted in inadequate safety oversight of passenger motor carriers. Contributing to the rapid propagation and severity of the fire and subsequent loss of life was the lack of motorcoach fire-retardant construction materials adjacent to the wheel well. Also contributing to the severity of the accident was the limited ability of passengers with special needs to evacuate the motorcoach.

The following safety issues were identified in this investigation:

- Vehicle fire reporting and inconsistent data within Federal accident databases,
- Federal Motor Carrier Safety Administration's ineffective compliance review program,
- Emergency egress from motorcoaches,
- Fire resistance of motorcoach materials and designs,
- Manufacturer maintenance information on wheel bearing components,
- Transportation of partially pressurized aluminum cylinders, and
- Emergency transportation of persons with special needs.

As a result of this accident investigation, the Safety Board makes recommendations to the Federal Motor Carrier Safety Administration, the National Highway Traffic Safety Administration, the Pipeline and Hazardous Materials Safety Administration, the Fraternal Order of Police, the International Association of Chiefs of Police, the International Association of Fire Chiefs, the International Association of Fire Fighters, the National Association of State EMS Officials, the National Sheriffs' Association, the National Volunteer Fire Council, Motor Coach Industries, Inc., and other motorcoach manufacturers, the United Motorcoach Association, and the American Bus Association. The Safety Board reiterates two recommendations to the U.S. Department of Transportation.

# Factual Information

## Preaccident Events

On September 20, 2005, the Governor of Texas issued a proclamation of an imminent hurricane threat and urged residents living in coastal areas to evacuate prior to landfall by Hurricane Rita.[1] On September 21, the mayor of Galveston, Texas, issued a mandatory evacuation order for the coastal city and surrounding areas. Also on that day, staff at the Brighton Gardens of Bellaire (Brighton Gardens) senior assisted living center, located in a Houston suburb approximately 50 miles inland from Galveston (and within the projected path of the hurricane), began the process of evacuating residents to two facilities in Dallas and Arlington, Texas.

Brighton Gardens was operated by Sunrise Senior Living Services, Inc. (Sunrise), headquartered in McLean, Virginia. Sunrise contacted the BusBank[2] and negotiated a contract to transport residents from Bellaire to Dallas, an expected 4-hour trip, beginning about 9:00 a.m. on September 22.[3] The BusBank contracted with Global Limo Inc. (Global) to provide two motorcoaches[4] for evacuation of the Brighton Gardens residents and nursing staff. On September 22, the President of the United States issued a Declaration of Emergency for the State of Texas because Hurricane Rita was expected to make landfall near Galveston on September 24.

## Accident Narrative

On September 22, 2005, the accident motorcoach driver departed Pharr, Texas, about 5:00 a.m., drove approximately 360 miles, and arrived at Brighton Gardens in Bellaire about 11:00 a.m. While Brighton Gardens staff prepared residents for the evacuation, the driver napped in the vehicle for about 2 hours. About 1:30 p.m., 37 assisted living facility residents, 6 nursing staff, and 1 staff parent were loaded into the motorcoach. Firefighters assisted in boarding passengers with special needs, a process that

[1] Hurricane Rita was one of the strongest storms on record for the Atlantic Basin. By the afternoon of September 21, 2005, Rita had reached category 5 strength on the Saffir–Simpson scale, with winds of 165 mph. The storm brought hurricane-strength winds more than 150 miles inland and caused significant damage along the coast. Rita made landfall along the Texas–Louisiana border early on September 24 as a category 3 storm with sustained winds of 120 mph. See <www.ncdc.noaa.gov/oa/climate/research/2005/rita.html#met>, November 8, 2006.

[2] According to the BusBank website, the company is a "group and event transportation specialist." See <www.busbank.com/aboutus.aspx>, September 20, 2006.

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

[4] The contract requested two motorcoaches. The second motorcoach, transporting 16 ambulatory passengers, departed Brighton Gardens about 6:00 p.m. on September 22, 2005. It arrived at its destination about 9:30 a.m. on the following day.

took 1.5 to 2 hours. In addition, Brighton Gardens staff loaded 22 wheelchairs, 5 walkers, and 18 medical oxygen cylinders[5] into the luggage compartments.

According to the 37-year-old motorcoach driver, he departed Brighton Gardens between 3:00 and 3:30 p.m. When he attempted to head north on Interstate 45 (I-45), he found it to be closed. Alternatively, he traveled east on Interstate 610 to U.S. Route 59 north, then headed west on State Highway 105. About 4:00 p.m., the nursing staff asked the driver to pull over so they could retrieve two full oxygen cylinders for the passengers who needed oxygen. The driver stated that the vehicle entered I-45 about 7:00 p.m. and exited at Huntsville, Texas, to refuel. Ten minutes after returning to the interstate, the driver was asked by the nursing staff to pull over so they could retrieve an additional four full oxygen cylinders; the driver then continued north on I-45. (See figure 1.)

On September 23, the accident motorcoach was still traveling north on I-45 about 3:15 a.m. when, just prior to the Farm-to-Market (FM) 1126 overpass, near exit 239, the right-side tag axle wheel locked and began to produce 1,500 feet of dragging tire marks on the roadway. The driver said that he then heard the right-rear tire blow out, and he pulled off the roadway near the FM 1126 entrance ramp, which was about 400 feet from the location of the tire blowout. The driver exited the motorcoach and checked the tire. He saw that the right tag axle tire was flat, returned to the vehicle, and continued driving north to try and find a suitable location to pull off for a tire change. The driver operated the vehicle a total of 6,800 feet from the initial tire lockup to the location where he pulled over on the right shoulder, partially blocking the right lane and impeding traffic.

The Navarro County Sheriff's Office received a cellular telephone call at 3:22 a.m. from a nurse passenger, who reported the flat tire and requested assistance. A Rice Police Department officer was dispatched; a tow truck mechanic was delayed 1 hour because of heavy evacuation-related traffic. By 4:30 a.m., the towing service arrived on scene. The mechanic removed the flat tire and replaced it with the spare, estimating that the entire tire change took less than 5 minutes; the motorcoach driver had already placed the spare tire next to the flat tire, and he subsequently placed the flat tire in the spare compartment. Once the tire was changed, the Rice police officer advised the driver and the mechanic to drive their vehicles to the next exit to complete payment. About 4:40 a.m., just off exit 242, the nursing supervisor paid the service repair bill. According to the mechanic, he was unaware of the long tire marks leading to the location where he replaced the flat tire. He also reported that he did not see anything unusual about the tire and wheel and that he and the driver did not have any discussion regarding the vehicle while he was changing the tire.

The motorcoach driver reentered I-45 about 5:00 a.m. and continued north. Less than 1 hour later, about 2,100 feet south of the Mars Road exit, a motorist also traveling north on I-45 noticed that the right-rear wheel of the motorcoach was glowing red hot, with sparks emanating from the wheel. The motorcoach was traveling in the left lane. The motorist maneuvered his vehicle in front of the motorcoach and slowed down until the motorcoach came to a stop. He exited his vehicle and approached the driver's window to tell him that the right-rear wheel was glowing orange-red. The motorist later told Safety

[5] Because two residents required medical oxygen, two of the cylinders were loaded into the seating area.

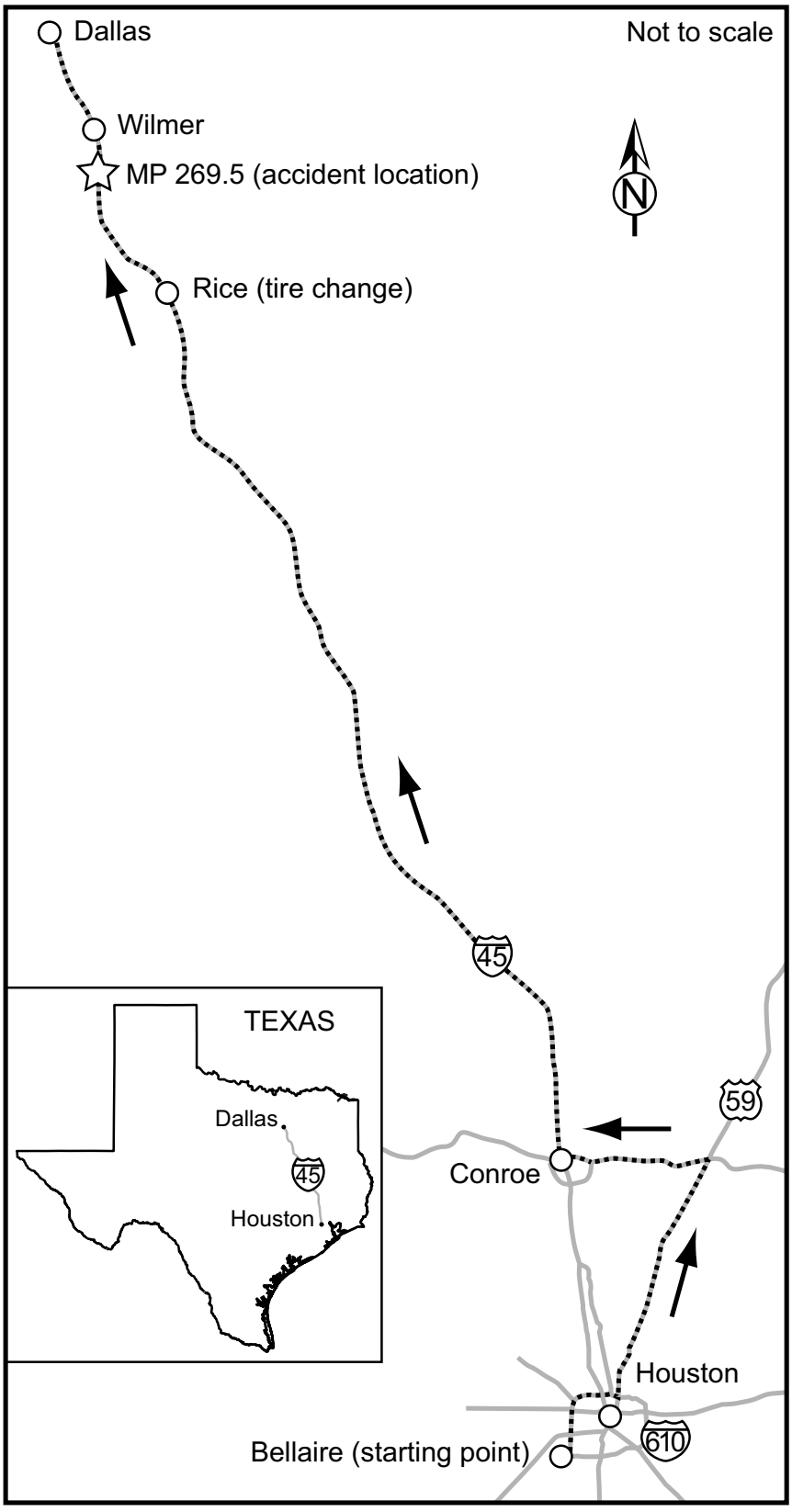



**Figure 1.** Regional map and accident motorcoach evacuation route.

Board investigators that he was unsure whether the motorcoach driver understood him because the driver never responded verbally. The motorist then returned to his vehicle and drove away. The supervising nurse reported hearing the motorist approach the motorcoach driver and report a problem with the right-rear wheel. The driver began to move the motorcoach across the crowded lanes of travel and pulled off onto the right shoulder north of the Mars Road exit, at milepost (MP) 269.5. (See figure 2.)

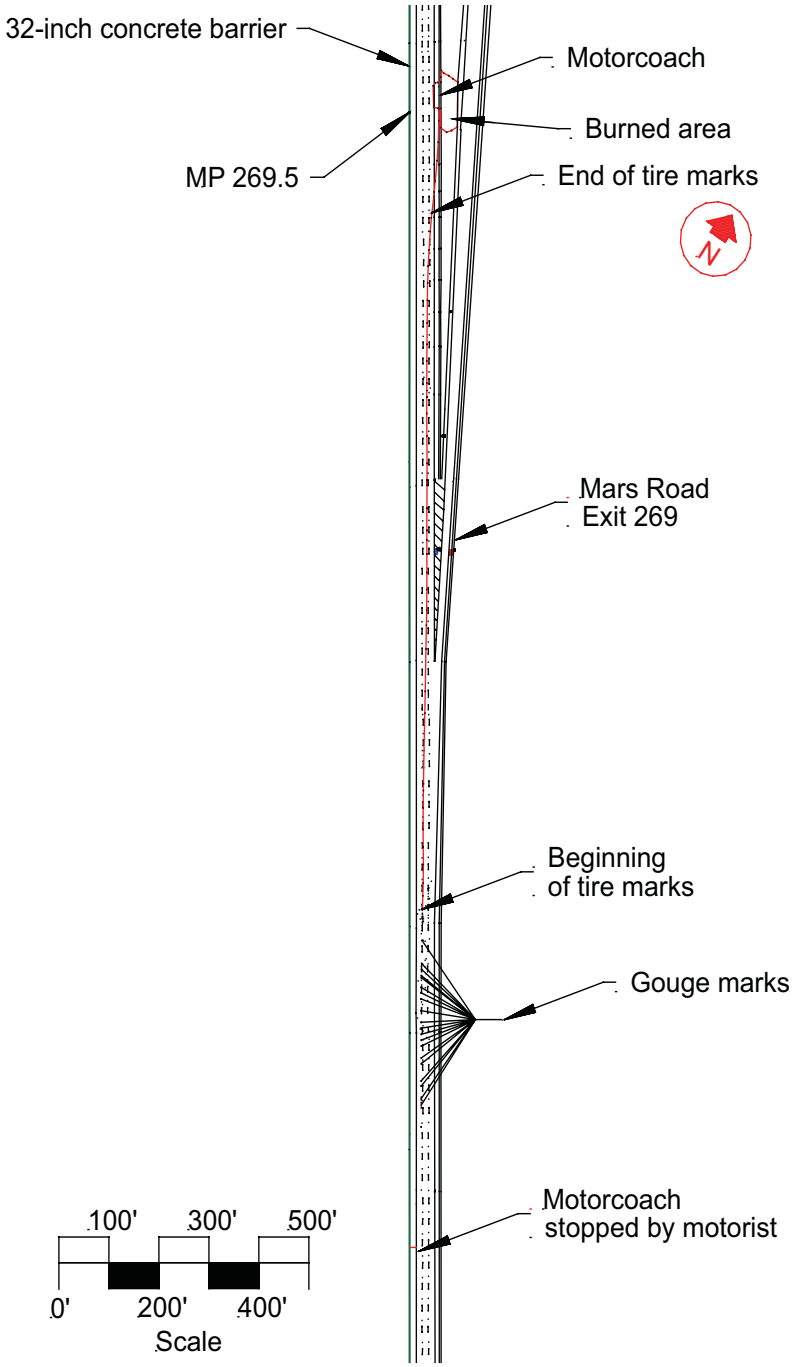



**Figure 2.** Accident scene diagram.

The driver, nurse supervisor, and another nurse exited the motorcoach and observed the right-rear wheel well on fire. As the driver began trying to extinguish the flames with his shirt and by throwing dirt and grass, the nurses immediately went back into the vehicle and urged the passengers to quickly exit. As the nursing staff was evacuating the nonambulatory passengers, the driver had reentered the motorcoach and attempted to unlatch the fire extinguisher from its bracket under the right (passenger)-side second row seat. He was unable to unlatch it and reported opening a roof hatch vent instead; he tried opening a few windows on the driver's side but said that they would not stay open.

About 6:07 a.m., Dallas County and the city of Wilmer dispatchers received a 911 call reporting the fire. Two Wilmer Police Department officers had arrived on scene by 6:12 a.m., and one officer, along with motorists who had stopped to help, entered the motorcoach to help the nonambulatory passengers evacuate. Witnesses interviewed by the Safety Board reported trying unsuccessfully to pry open the motorcoach windows from outside; two passersby broke the glass in two windows, but they were unable to rescue anyone through the broken windows. (See figure 3.)

**Figure 3.** Damaged motorcoach on I-45 following fire.

At the time of the accident, local media were in the vicinity filming the heavy interstate traffic. In addition to a photograph provided by a witness (see figure 4), KTVT television, a CBS affiliate in Dallas–Fort Worth, provided the Safety Board with a video of the motorcoach fire, with elapsed time recorded in the upper left corner of the images. The Safety Board constructed the following sequence of events from the images:

- About 6:08 a.m., approximately 3 minutes after the motorcoach pulled onto the right shoulder of I-45 (the 911 call was placed at 6:07 a.m.), fire is visible from the rear on the right side of the vehicle. (See figure 5.)

- Less than 15 seconds later, the entire rear of the vehicle is engulfed in flames.
- An intense burst of fire is visible about 3 minutes later. (See figure 6.)
- By 6:15 a.m., 6.5 minutes into the video, the motorcoach is almost completely engulfed in flames. (See figure 7.)

**Figure 4.** Motorcoach tire on fire, witness photo from I-45 frontage road.
(Courtesy of Dallas County Sheriff's Office)

**Figure 5.** Video image 1 of accident motorcoach. (Courtesy of KTVT, Dallas–Fort Worth)

**Figure 6.** Video image 2 of accident motorcoach. (Courtesy of KTVT, Dallas–Fort Worth)

**Figure 7.** Video image 3 of accident motorcoach. (Courtesy of KTVT, Dallas–Fort Worth)

## Emergency Response

The second Wilmer police officer who had arrived on scene about 6:12 a.m. began to direct traffic away from the burning vehicle. By 6:15 a.m., two deputies from the Dallas County Sheriff's Office arrived on scene; fire within the motorcoach prevented them from entering the vehicle to assist in the passenger evacuation. The Wilmer and Hutchins Fire Departments arrived on scene from opposite directions by 6:24 a.m. and reported that the motorcoach was completely engulfed in flames. Thirteen local emergency service agencies responded to the fire, along with nine ambulances from four agencies and a private ambulance service.

A grass fire had occurred approximately 3.2 miles south (near exit 266) of the site of the motorcoach fire, in the median between the northbound and southbound lanes. This fire was reported to the Ferris Volunteer Fire Department at 6:04 a.m., approximately 3 minutes prior to the 911 call reporting the motorcoach fire. The Safety Board examined the location of the grass fire and recovered two metal objects similar in appearance to objects removed from the accident motorcoach tag axle wheel and hub assembly during a Safety Board postaccident inspection.[6]

The Safety Board interviewed several of the first responders and dispatchers, who reported some delays in emergency response to the motorcoach fire. Interviewees stated: the initial 911 calls reported the vehicle fire location north of the actual accident site; hurricane evacuation traffic was extremely congested; the Wilmer Fire Department was staffed with only two firefighter/emergency medical technician personnel at night; and the Wilmer dispatch office had only one dispatcher on duty, who handled all incoming and outgoing emergency calls, including the dispatching of personnel and equipment. Subsequently, on March 15, 2006, the city of Wilmer dispatch office installed two four-channel CD loggers with digital voice recorders to handle 911 calls.

## Injuries

Twenty-three passengers died in the motorcoach fire. According to medical examiner autopsy reports from the Southwestern Institute of Forensic Sciences in Dallas, Texas, the causes of death were smoke inhalation and thermal injuries. Six nursing staff personnel, 1 parent of a nursing staff member, and 14 passengers escaped. Of these survivors, 2 passengers were seriously[7] injured, and 19, along with the driver, sustained minor injuries. The driver and 14 passengers were transported to two local hospitals for treatment of smoke inhalation, an arm fracture, minor lacerations, contusions, and burns. (See table 1.)

[6] These objects were examined by the Safety Board metallurgy laboratory and determined to be rollers from the accident motorcoach right-side tag axle outer wheel bearing.

[7] One passenger sustained a right arm fracture, and one passenger was hospitalized with a second-degree facial burn and smoke inhalation injury.

**Table 1.** Injuries.

| Injury[A] | Motorcoach driver | Motorcoach passengers | Staff and parent | Total |
|---|---|---|---|---|
| Fatal | 0 | 23 | 0 | 23 |
| Serious | 0 | 2 | 0 | 2 |
| Minor | 1 | 12 | 7 | 20 |
| None | 0 | 0 | 0 | 0 |
| Total | 1 | 37 | 7 | 45 |

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

## Motorcoach Evacuation

Most of the 37 patient-passengers had moderate-to-severe mobility or cognitive impairments[8] and were not able to evacuate during the fire without assistance. Twenty-two passengers had occupied nursing facility beds at Brighton Gardens, at least 13 of who did not walk at all, and 5 required extensive assistance to walk; 7 of these passengers had "moderately impaired" decision-making skills.[9] Of the 15 passengers who had not occupied nursing facility beds, 9 required a walker or wheelchair for ambulation, and 4 were diagnosed or described as having dementia, forgetfulness, or hysteria.

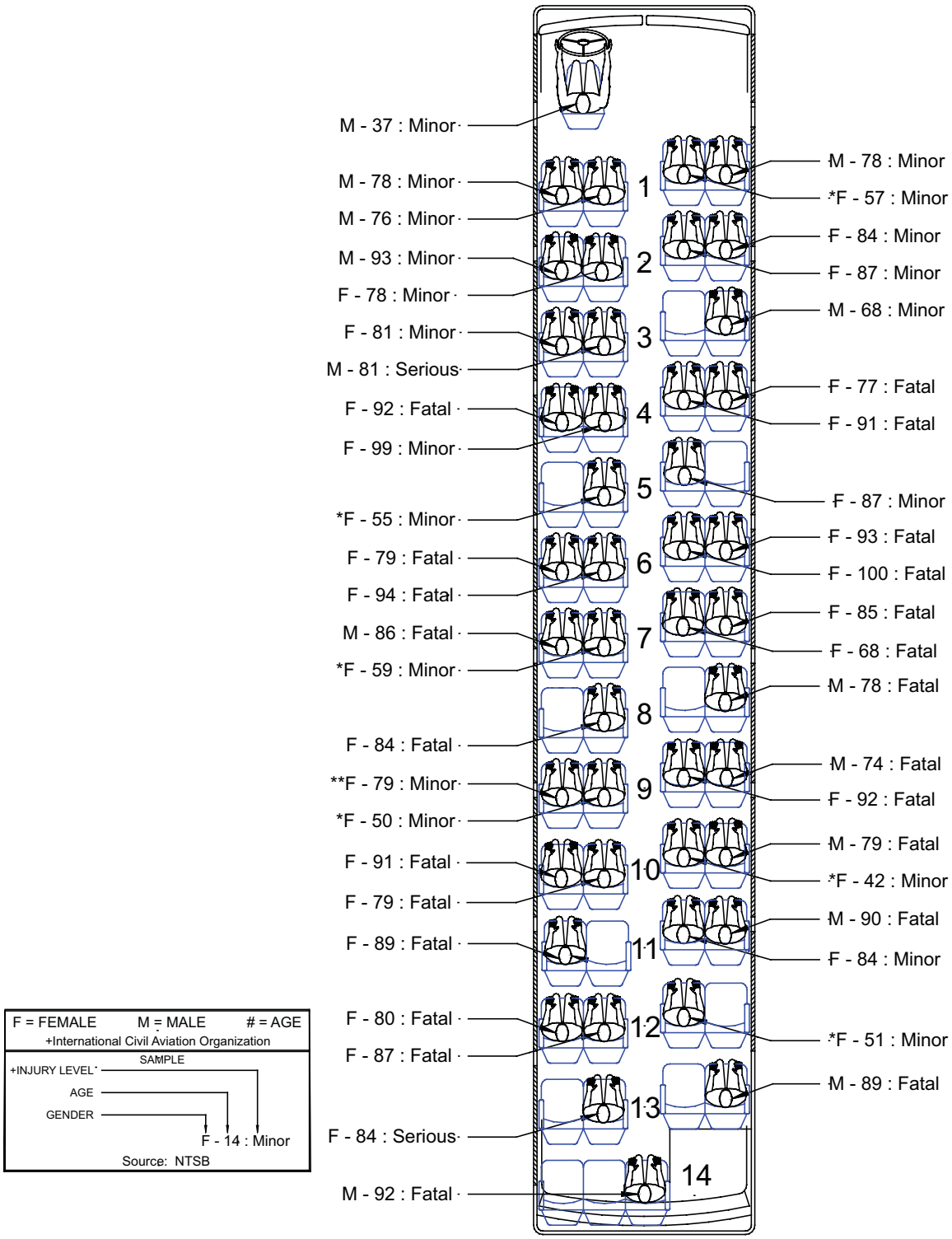
According to the nursing staff on board the motorcoach, many of the passengers refused to evacuate, did not understand the urgency of escaping the approaching fire, or actively fought efforts to physically move them from the motorcoach. Of the 14 passengers who evacuated, many had to be pulled, pushed, or dragged out the front loading door by nurses or rescuers.

The 23 passengers who died in the fire ranged from 68 to 100 years old. Eighteen individuals were found still seated, and 5 were found in the center aisle. One of these passengers had reportedly been seated in row 10 and was found near the front of the motorcoach in the aisle adjacent to row 1. (See figure 8.[10])

[8] Based on State and federally required Minimum Data Set reports and State-required Individual Service Plans.

[9] These patients required reminders, cues, and supervision in decision-making.

[10] The seating chart shown in figure 8 is based on interviews with nursing staff and patients; it may not depict the exact seating locations immediately prior to the fire.




* Indicates Nursing Staff
** Indicates Nursing Staff Parent

**Figure 8.** Passenger seating chart and postfire injury information.

The Safety Board interviewed the nursing staff regarding evacuation of the motorcoach. The nursing supervisor reported that when she informed the staff they needed to get the passengers off the motorcoach, she and other nursing team members and even bystanders began assisting passengers. She did not recall anyone opening windows during the evacuation, and other nursing staff reported not being able to open the side windows because they could not see the latches. The nursing staff reported that the flames began entering the motorcoach through the last window on the right side and spread to the newspapers that had been placed on the windows to help shade the interior during the day. Several of the passengers who were able to walk and understood the need to evacuate waited at the front loading door for assistance down the steps.

The Safety Board also interviewed emergency responders and passersby who stopped to aid in the rescue of passengers. The interviewees explained that almost as soon as they observed the fire in the wheel well of the motorcoach and pulled over to assist, thick black smoke began to accumulate inside the vehicle and could be seen coming out the front door.

The Wilmer Police Department received notification of the fire at 6:08 a.m. An officer arrived on scene within 1–2 minutes and observed flames already past the wheel well area and moving up the side of the motorcoach, smoke pouring out the front door, and the rear windows covered by flames and smoke. He assisted in evacuating one person seated in the first row and then assisted in evacuating several more, by which time smoke was present from the ceiling to the floor level, and fire debris was falling from the ceiling.

A passerby explained that when he and a coworker stopped to help, the smoke made him sick after one rescue attempt inside the motorcoach, and he instead tried to reach inside through an open window to pull out a passenger. His coworker stated that he was able to rescue two passengers but then had to stop because the smoke was too thick to reenter the motorcoach, and he instead tried to open a window. Another passerby stated that he had made up to four trips into the front of the motorcoach to assist passengers in evacuating, but then it became too smoky to proceed beyond the first several rows of seats, and he had to crawl back to the front door to escape. A fourth passerby stated that he pulled over to assist at the same time as the police officer, but he moved only about 10 feet into the motorcoach before he had to retreat because of the smoke. The interviewees reported hearing several “explosions” from the rear of the motorcoach and then ceased rescue attempts.

## Damage

The body panels below the side windows and above and below the floor line of the accident motorcoach were constructed of fiberglass-reinforced plastic,[11] except for the painted aluminum baggage door panels. The fire destroyed the majority of the fiberglass

[11] Motor Coach Industries, Inc., *MCI 102E Series Maintenance Manual* (Schaumburg, IL: MCI, 1997) 3A-1.

body; the chassis steel frame, rear engine compartment, and aluminum cargo compartment doors were intact. Only the tubular frame structure remained from the base of the windows upward toward the roof.

Two fiberglass-covered access panels were located under the motorcoach in the wheel well area. The rearmost cover panel was consumed by fire, and the forward cover was charred. Fire consumed the flexible thermoplastic fuel line tubing from the engine compartment to less than 1 foot from the fuel tank, in addition to most of the combustible materials[12] in the wheel well area.

The windshield and all side window glass were missing. According to witness statements, the windshield right pane and several windows along both sides of the motorcoach were broken out by some of the bystanders who assisted in the evacuation effort. The interior of the motorcoach was destroyed by fire. The fire consumed all nonsteel seating materials and combustible component sections, in addition to the plywood and vinyl center aisle flooring in the rear of the compartment above the service tunnel. The heating, ventilating, and air conditioning (HVAC) system was largely destroyed by fire. The recirculation duct in the right-rear wheel area was missing, and sections of the aluminum return ducts were destroyed and missing; adjoining parts showed signs of severe heat exposure. The missing sections had been located above the wheel well areas on both sides of the coach.

## Driver Information

### *Certification and Experience*

The 37-year-old motorcoach driver held a country of Mexico licencia Federal de Conductor (commercial driver's license [CDL]) permitting him to transport passengers in Mexico.[13] The driver's license was issued on September 2, 1998, with an expiration date of September 2, 2006.[14]

The driver had first received a Mexican CDL on September 2, 1988. During an interview with the Safety Board, the driver said, through an interpreter, that he began working for his family's motorcoach service in Mexico as a mechanic helper. He eventually began driving motorcoaches on trips within Mexico and between Mexico and the United States. The driver had begun his recent employment with Global in February 2005.[15]

[12] These items included six tires, six air bags used for load leveling, mud flaps, six bump stops, and bushings on the stabilizer bar and torque rods.

[13] This endorsement is similar to the U.S. CDL class "B" passenger endorsement.

[14] The Mexican CDL is issued for 10 years; the driver is required to renew the license and provide a valid medical certificate every 2 years during that period. The accident driver's license was issued in 1998; it showed an embossed "04," indicating that the license required the 2-year renewal by September 2, 2006. The plastic license packet is embossed over the appropriate expiration year to certify that the license is valid.

[15] Previous to his current employment, the driver had worked for Global temporarily from February 2002–August 2003.

The back of the Mexican license contains an area for the driver to respond with a "yes" or "no" for diabetes, hypertension, and corrective lenses. The driver had indicated negative responses on his license; when interviewed by the Safety Board,[16] he stated that he did have type 2 diabetes.[17] The driver reported that he had been under the care of a doctor in Monterrey, Nuevo Leon, and that his wife picked up his oral diabetes prescription in Mexico. During a postaccident examination of the motorcoach contents, an opened container of metformin tablets was found in the driver's belongings.[18]

On March 7, 2005, Global had referred the driver to a physician in the United States for a U.S. Department of Transportation (DOT) medical examination. The examining physician refused to issue a U.S. medical certificate because the driver had been diagnosed with type 2 diabetes in 1998. The physician wrote on the medical examination form that the driver "needs to show proof of diabetic control" before he could be certified fit for duty. He then issued the driver a prescription for diabetes medical testing. The accident driver did not report for the medical tests.

According to the Dallas County Sheriff's Office, in an accident supplemental report dated October 5, 2005, the motorcoach driver did not possess a Texas driver's license. The driver had been living in Pharr, Texas, since February 2005, 7 months prior to the date of the accident. According to *Texas Transportation Code* 521.029, a new resident moving into Texas, who has a valid CDL from his home State or country, has 30 days after entry to secure a Texas CDL. Applicants must visit a local Texas Driver License Office and present proof of identity, social security number, and vehicle registration and liability insurance, if applicable; submit the required forms and fee; pass the vision exam; and surrender the valid out-of-State license (CDL).[19]

According to the Federal Motor Carrier Safety Administration (FMCSA), CDLs issued by the United Mexican States meet established U.S. standards, and all Mexican drivers operating in the United States must have an appropriate license from their country.[20] On September 23 and 25, 2005, and April 5, 2006, the Safety Board conducted three interviews with the accident motorcoach driver using Spanish–English interpreters provided by the Texas Department of Public Safety (TxDPS), because the driver was unable to converse in English.[21]

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[16] This interview took place on September 25, 2005, in Dallas, Texas. The Safety Board did not obtain copies of the driver's medical records from Mexico to verify his statements regarding medical care.

[17] According to 49 CFR 391.41(b)(3), a person is physically qualified to drive a commercial motor vehicle if he or she has no established medical history or clinical diagnosis of diabetes mellitus that requires insulin.

[18] Metformin, an oral antidiabetic medication, is sold in Mexico as metformina.

[19] See <www.txdps.state.tx.us/administration/driver_licensing_control/faq/answers_dl_id.htm#q34>, December 11, 2006.

[20] See <www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/fmcsrruletext.asp?rule_toc=752&section=383.23&section_toc=1315&guidence=Y>, January 16, 2007.

[21] A nursing staff member spoke limited Spanish and was able to communicate with the driver.

Prior to the accident, on February 12, 2005, the driver had been pulled over for a roadside inspection while driving a commercial vehicle (motorcoach) on Interstate 10 in Harris County, Texas. The inspector noted (as a discrepancy) on the roadside inspection report that the driver was non-English-speaking.[22] Title 49 CFR 391.11(b) defines the qualifications for commercial vehicle drivers, specifying the requirement that the driver "can read and speak the English language sufficiently to converse with the general public, to understand highway traffic signs and signals in the English language, to respond to official inquires, and to make entries on reports and records."

### *Duty Status*

The following information was provided to the Safety Board by the motorcoach driver during three postaccident interviews. The driver awoke about 8:00 a.m. on September 21 and reported for work at 9:30 a.m. He changed the air conditioning filters on the accident motorcoach and was informed by his employer that he would be on call for a possible Federal Emergency Management Agency (FEMA) transportation charter. The driver said that he went shopping with his wife at 10:30 a.m. and returned home by 2:30 p.m. He was called by his employer at 5:00 p.m. and told to report to Bellaire, Texas, by noon on September 22 for an evacuation charter of elderly persons from a nursing home to Dallas. The driver went to work, fueled the motorcoach, ran an errand, and returned home by 7:30 p.m. He went to bed between 9:30 and 10:00 p.m.

On September 22, the driver awoke at 4:30 a.m. and departed Pharr, Texas, about 5:00 a.m. He arrived at Brighton Gardens in Bellaire at 11:00 a.m. The driver then took a 2-hour nap in the motorcoach and awoke when the nursing staff began loading the passengers around 1:30 p.m. The driver departed the nursing home between 3:00 and 3:30 p.m. He continued driving for over 15 hours, in heavy evacuation traffic, until the fire occurred about 6:00 a.m. the following morning. (See figure 9.[23])

The FMCSA, in 49 CFR 395.5, requires that no motor carrier shall permit or require any driver to drive a passenger-carrying commercial motor vehicle, nor shall any such driver drive a passenger-carrying commercial motor vehicle: (a)(1) more than 10 hours following 8 consecutive hours off duty; or (a)(2) for any period after having been on duty 15 hours following 8 consecutive hours off duty. Title 49 CFR 395.1 guidance states that, under 395.1(b)(2), in case of any emergency, a driver may complete his/her run without being in violation of the provisions of the regulations in this part, if such run reasonably could have been completed absent the emergency. The Governor of Texas issued a proclamation on September 23, 2005, exempting the hours-of-service violations for all carriers and drivers involved in, and caught in, the hurricane evacuation.

[22] The FMCSA requires that a discrepancy noted on the inspection report be corrected by the motor carrier within 15 days (49 CFR 396.9(d)). The owner of Global stated to the Safety Board that he did not furnish the FMCSA with documentation of correction to discrepancies noted during roadside inspections, as required.

[23] This 72-hour history is based on the three interviews with the accident driver and interviews with Brighton Gardens staff.

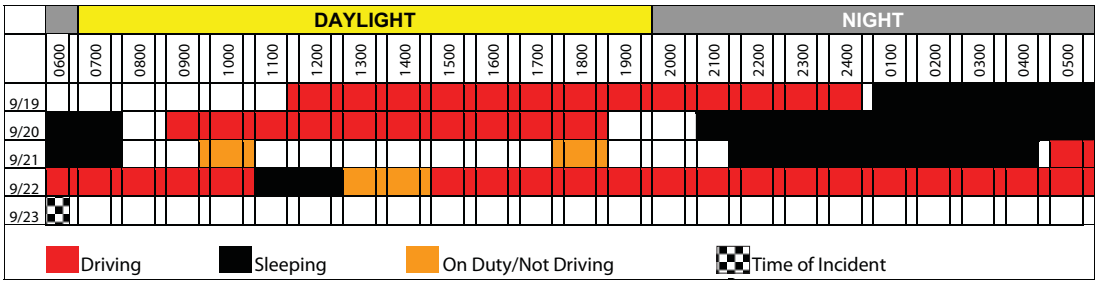


**Figure 9.** Motorcoach driver's 72-hour history.

## Vehicle Information

The 1998 54-passenger Motor Coach Industries, Inc. (MCI), model 102EL3 "Renaissance" motorcoach was 45 feet long. It was equipped with a Detroit Diesel Corporation Series 60, 6-cylinder electronically controlled diesel engine and a Detroit Diesel Electronic Controls (DDEC)[24] IV electronic control module (ECM). The ECM was damaged by the fire, which destroyed the recorded information. The motorcoach had an Allison Transmission model B-500R automatic transmission. A repair invoice for the motorcoach, dated September 14, 2005—9 days before the accident—showed an odometer reading of 505,608 kilometers[25] (313,477 miles). The fire destroyed the odometer.

The motorcoach was equipped with three ArvinMeritor-manufactured axles: the front or steering axle, the second or drive axle, and the tag axle. The motorcoach had air brakes at all six wheel positions. The brakes were D-LISA air disc brakes, also manufactured by ArvinMeritor, while the six-channel antilock brake system (ABS) was manufactured by Meritor WABCO.

Seven windows were located along each side of the motorcoach. The windows were double-glazed safety glass; the exterior pane was tempered safety glass, and the interior pane was laminated safety glass. Six windows on each side were designed for emergency egress. Interlocking extrusions at the top frame provided hinge action for the

[24] The DDEC IV ECM is capable of recording vehicle speed, brake application, engine rpm, and other information for more than 1 minute prior to a final stop of the vehicle.

[25] The odometer recorded kilometers because this vehicle was originally built for, and owned by, a Canadian company.

window sash assembly. The motorcoach was equipped with a 5-pound dry chemical ABC[26] fire extinguisher, as required by 49 CFR 393.95.[27]

The motorcoach fuel tank was located aft of the luggage compartment and forward of the (rear) wheel well area. Two flexible thermoplastic fuel lines served as the supply and return paths from the fuel tank to the engine compartment. The fuel lines were made of Synflex composite fuel tubing, which is a flexible thermoplastic product with a nylon liner. The fuel lines, along with the power steering and coolant lines, ran within a centerline trench located between the left- and right-rear wheel wells, beneath the passenger cabin floor. Each fuel line is a nonreinforced seamless tube, designed and tested for use with noncrimp barbed fittings and rated for use with diesel fuel at a temperature range of –50º to +250º Fahrenheit (F).

The motorcoach seats consisted of upholstery-covered, foam-padded backs and cushions over steel seat frames. The floor was 0.5-inch-thick plywood with a 0.1-inch-thick vinyl covering. Overhead luggage racks were constructed of aluminum, acrylonitrile butadiene styrene, and polyvinyl chloride (PVC) extruded handles. The ceiling at the front and rear window areas was fiberglass-reinforced plastic, and the main ceiling was Xorel FR[28] over acrylonitrile butadiene styrene. The HVAC system was symmetrical along the centerline of the motorcoach. The return ducts were located at floor level, spanning the length of the vehicle; vent grills drew air into the return ducts.

### *Tag Axle*

The third axle is mounted to the frame of the motorcoach by means of an adjustable air suspension system. This auxiliary weight-bearing axle is commonly referred to as the tag axle. A hub affixed to both the left and right sides of the outer axle assembly serves as the interface, allowing the wheels to rotate. (See figure 10.) In vehicles equipped with a disc brake rotor, such as the accident motorcoach, the brake rotor is also mounted on the hub. At the Safety Board public hearing on this accident, on August 8–9, 2006, in Washington, D.C. (see appendix A),[29] a chief engineer with Timken Company (a bearing manufacturer) explained that a vehicle's wheel bearings have three functions: to allow rotation with minimum friction (between wheel assembly parts), to carry the vehicle load

[26] A class A fire involves ordinary combustibles, such as wood, paper, cloth, rubber, and many plastics; a class B fire involves flammable liquids, oils, greases, tars, oil-based paints, and flammable gases; and a class C fire involves energized electrical equipment. A multipurpose dry chemical ABC fire extinguisher covers these types of fires and works by blanketing the fuel (burning materials) and interrupting the chemical chain reaction at the fuel's surface. To a lesser extent, it dilutes the oxygen content of the air around the fire and absorbs heat. See <www.ehs.umb.edu/drychm.htm>, October 23, 2006.

[27] A power unit that is not used to transport hazardous materials (HM) must be equipped with either a fire extinguisher having an Underwriters Laboratories Inc. (UL) rating of 5 B:C or greater, or two fire extinguishers, each with a UL rating of 4 B:C or greater.

[28] Xorel FR is a fabric woven from polyethylene and treated with a fire retardant.

[29] "Motorcoach Accident and Selected Federal Motor Carrier Safety Administration Oversight Issues, Wilmer, Texas." The Safety Board may hold a public hearing as part of its investigation into an accident to supplement the factual record. Technical experts are called as witnesses to testify, and Board investigative staff and designated representatives from the parties to the investigation ask questions to obtain additional factual information. A hearing is not intended to analyze factual information for cause.

or transfer the load (the weight of the motorcoach), and to concentrically position and align rotating and stationary components within the hub and wheel assembly. The wheel bearing rollers are evenly spaced and held within a circular wheel bearing cage, both of which are located inside a wheel bearing cup. The inner wheel bearing cup is fixed on the axle spindle (see figure 11), and the outer bearing cup is pressed into the hub. The inner cup remains stationary while the outer cup rotates with the hub and wheel.

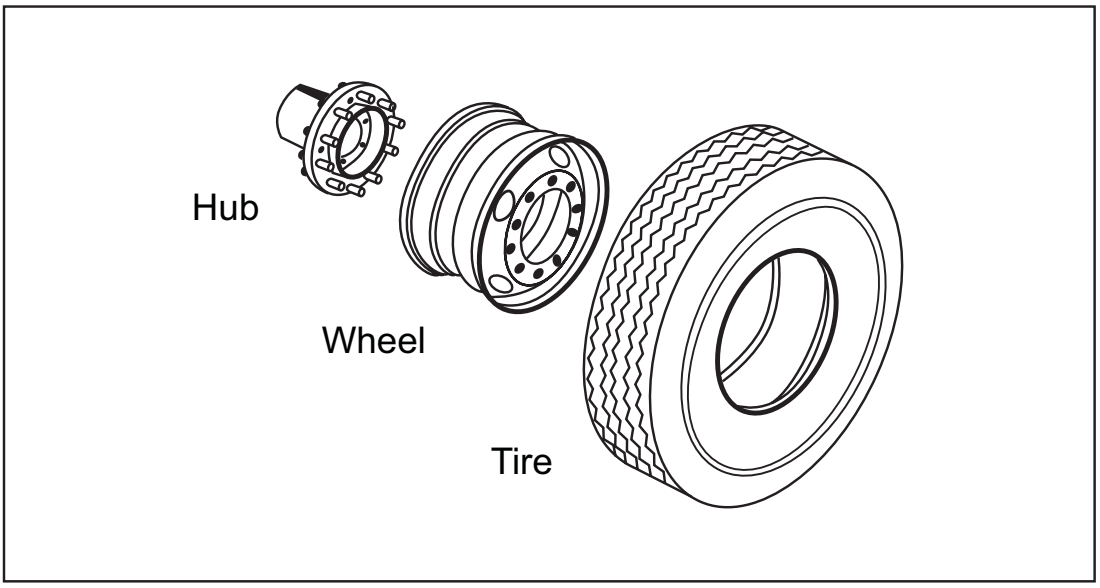


**Figure 10.** Simplified hub and wheel diagram.

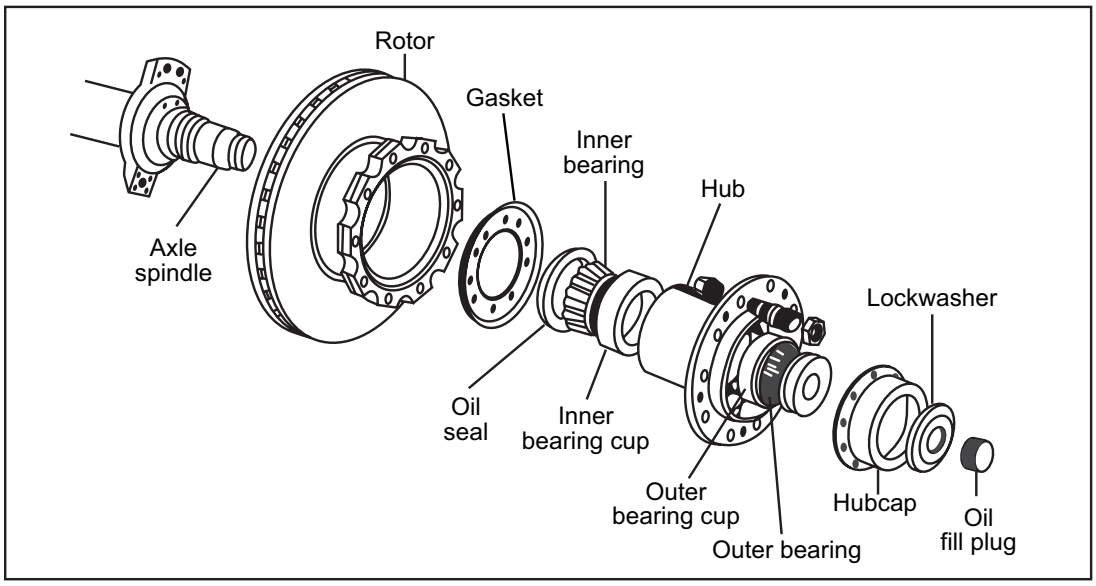


**Figure 11.** Hub and wheel bearing diagram.

The accident motorcoach had oil bath bearings; in this type of wheel bearing configuration, the individual bearing components are partially immersed in an oil lubricant (rather than being "packed" with grease) contained in a sealed reservoir within the wheel and hub. Oil is distributed to the bearings and throughout the reservoir cavity only when the vehicle is in motion. This distribution of oil provides both lubrication and cooling to the bearing rollers. A wheel bearing seal keeps the lubricant inside the bearing and the contamination outside.

The hubcap,[30] the outer component on the axle assembly, contains a sight glass and filler plug and also functions as part of the reservoir for the wheel lubrication fluid. A mechanic or driver uses the sight glass to check the lubrication oil level for the wheel bearings. Oil is added by removing the filler plug. A wheel bearing may fail prematurely as a result of loss of lubrication, contamination of lubricant, improper wheel bearing adjustment, or incorrect adjustment during servicing or installation of new bearings. The most common reason for loss of lubrication is a worn-out or defective wheel seal; other causes may be a defective gasket between the hubcap and hub or a missing or improperly secured filler cap.

According to MCI, other than checking oil lubrication levels using the sight glass, oil leaks from wheel seals in the tag axle can be observed only from underneath the motorcoach because the wheel is mounted to the vehicle with its convex center facing outside.[31] The MCI maintenance manual for the accident motorcoach specifies that the wheel bearing lubricating oil levels should be checked daily, and oil should be added if it is not visible at the sight glass level mark.[32] The manual provides additional instructions for maintenance of wheel bearings, including specific warnings in text boxes to exercise caution when providing vehicle maintenance. (See figure 12.)

During a Safety Board interview, the motorcoach driver stated that he knew how wheel bearings were lubricated, though he had never lubricated them himself and had never checked the wheel bearing oil level on any motorcoach.

### *Vehicle Ownership*

The accident motorcoach was titled (and registered) in British Columbia, Canada, to the owners of R&J McMynn Leasing (McMynn). MCT Charter Tours (MCT), of Beltsville, Maryland, leased the accident motorcoach. According to McMynn, the lessee is responsible for all vehicle repairs and maintenance, and the lease requires maintenance at specific mileage intervals. The lease also prohibits the sublease of the vehicle without authorization. MCT subleased the motorcoach to Global in May 2005; according to McMynn, the company was unaware of the sublease. U.S. Customs documents indicate that the motorcoach entered the United States from Canada near Buffalo, New York, on May 28, 2005. The motorcoach was not registered in the United States at the time of the accident, though registration was required.

[30] According to MCI, this model of motorcoach is originally equipped with aluminum hubcaps on the tag axle; on the accident motorcoach, the 3R hubcap was aluminum, and the 3L hubcap was steel.

[31] The concave outside wheel mounting is common for steer axles in trucks and motorcoaches and for the tag axle in all motorcoaches.

[32] *MCI 102E Series Maintenance Manual*.


**Figure 12.** Example of MCI maintenance manual warning text box.

During a Safety Board interview with Global's owner on September 26, 2005, he stated that he had an insurance card (required) for the accident motorcoach and that it did undergo a commercial vehicle inspection on June 9, 2005, at Valley Volvo in Pharr, Texas. The owner reported that he used a 144-hour temporary permit[33] for the motorcoach during its operation in Louisiana in post-Katrina relief efforts, as well as during the Brighton Gardens evacuation trip from Bellaire to Dallas. The permit had expired during the post-Katrina relief operations in Louisiana. According to the motorcoach driver, who had driven the same vehicle in Louisiana, he removed a tag (license plate) from another Global vehicle and attached it to the accident motorcoach[34] to avoid being stopped for an expired registration.

**Accident Motorcoach Maintenance.** The following maintenance information is available for the accident vehicle beginning in May 2005 with the sublease arrangement between MCT and Global. The owner of Global said that he does not have a mechanic or brake inspector on staff full-time and that he normally takes his vehicles to a dealership or service center for repairs. About 3 weeks prior to the accident, he had hired a mechanic to perform oil changes, minor repairs, and belt changes, but the mechanic worked only part-time on Saturdays. Global did not have a brake inspector qualification file for the mechanic, as required by 49 CFR 396.25. The motorcoach had undergone preventative maintenance[35] August 8–12, 2005, at Valley Volvo, in Pharr, Texas. According to the mechanic who performed the maintenance, he checked the oil level in the hubs and checked for oil around the wheels but did not find any leaks.

[33] The Texas 144-hour permit specifies: "this permit is issued to vehicles owned by residents of the United States, Mexico, or Canada subject to registration by the State of Texas and which are not authorized to travel on the public roads of the State for lack of registration."

[34] Postaccident, inside a luggage compartment, police found a Texas temporary license plate, expiring September 8, 2005, with a vehicle identification number (VIN) matching the accident motorcoach VIN.

[35] The preventative maintenance included oil change and filter, fuel filter change, check of air cleaner, greasing of fittings, and check of rear differential oil level and other fluid levels, in addition to a transmission fluid and filter change, winterization and repair of radiator, and compressor head gasket repair.

The FMCSA requires motor carriers to ensure that every driver prepare a written driver vehicle inspection report (DVIR) at the completion of each day on each vehicle operated and further requires that the report list any defects noted during operation of the vehicle.[36] When interviewed by the Safety Board on September 26, 2005, Global's owner stated that he paid drivers by the mile and did not pay them to conduct pretrip or posttrip vehicle inspections.

**Postaccident Inspection of Tag Axle.** During the Safety Board's postaccident investigation, the left and right tag axle wheel components were inspected because the fire had originated in the right-side tag axle wheel well. The left-side tag third (3L) axle wheel, hub, and brake assembly and other related components were examined. The rubber fill cap or fill plug, where oil is put into the hub cavity to lubricate the wheel bearings, was missing, and a significant amount of water was found in the hub cavity. The 3L wheel bearing hub cavity was low on lubricant, with only residual traces of oil on the bearing elements, though the bearings were intact, in good condition, and did not show signs of wear or excessive heat. The 3L ABS tone ring component and adjoining axle torque plate were encrusted with oil, which, along with the low oil level in the hub cavity, is an indication of oil leaking from the wheel seal. At the Safety Board public hearing, the senior technical advisor for MCI said that inspection of the accident motorcoach left tag axle knuckle and torque plate showed that they were heavily coated in oil and dirt, indicating "that there had been at least for some considerable period of time, a fairly heavy oil leak."

The inspection revealed that the right-side tag axle (3R) aluminum hubcap melted during the fire; several small fragments were still present around the hubcap mounting bolts. (Aluminum melts at approximately 1,150º F.) The 3R tire was burned, and no rubber remained. The 3R brake rotor was skewed outward and was in contact with the torque plate and the brake caliper housing. Normally, the brake rotor does not make contact with either of these components. This abnormal contact caused grinding marks on the underside of the caliper housing, as well as on the torque plate and brake rotor. Additionally, the brake pad retaining clips, which are normally round, had flat spots from contact with the rotor; the 3R outside brake pad was worn more on the top, and the 3R inside pad was worn heavier at the bottom, consistent with wear from the displaced and tilted rotor.

As originally installed, the outer wheel bearing contains 19 rollers evenly spaced and held within a bearing cage. (See figure 13.) Inspection of the 3R wheel bearing revealed four flattened rollers in the hub. Two other flattened rollers were found in the area of the grass fire, near MP 266. The inner wheel bearing, as originally installed, contained 17 rollers. Eight or nine rollers were discovered fused together, two other rollers were found severely flattened, and the bearing cage was destroyed. (See figure 14.) The inner wheel seal was destroyed. According to a chief engineer with Timken Company, the

[36] In accordance with 49 CFR 396.11, the DVIR shall cover at least the following parts and accessories: service brakes, including trailer brake connections; parking (hand) brake; steering mechanism; lighting devices and reflectors; tires; horn; windshield wipers; rear vision mirrors; coupling devices; wheels and rims; and emergency equipment. The report shall identify the vehicle and list any defect or deficiency discovered by or reported to the driver that would affect safe operation of the vehicle or result in its mechanical breakdown.

strength of wheel bearing roller material is a function of temperature. At a temperature as low as 1,000º F, the roller material can begin to lose metal strength. Further, the amount of roller deformation is dependent on the loading (weight) from the motorcoach and the length of time the roller is exposed to this weight and increased temperatures.

**Figure 13.** Left tag axle outer wheel bearing assembly.


**Figure 14.** Damaged right tag axle spindle and inner bearings.

## Vehicle Fires

### *Motorcoach Fire Data Sources*

During the investigation of this accident, the Safety Board compiled data in an attempt to examine the scope of motorcoach fires in the United States. The Safety Board examined two insurance company databases and two passenger motor carrier company reports for vehicle fire information. In addition, the Safety Board gathered motorcoach and bus fire data from several sources, including Federal accident reporting databases such as the National Highway Traffic Safety Administration (NHTSA) Fatality Analysis Reporting System (FARS)[37] and General Estimates System (GES) and other sources, including the FMCSA Motor Carrier Management Information System[38] (MCMIS) and the National Fire Protection Association (NFPA) vehicle fire database. Vehicle reporting requirements for each source (MCMIS, FARS, GES, and the National Fire Incident Reporting System [NFIRS]) are different and do not allow the correlation of comprehensive and statistically accurate data on motorcoach fires. Each DOT agency defines "bus" and "motorcoach" differently for data collection and analysis, and this terminology is also different in the NFIRS database.

The *Federal Motor Carrier Safety Regulations* (FMCSRs) and the vehicle classification in the MCMIS database define a bus in two ways: as any motor vehicle, including taxicabs, designed, constructed, or used for the transportation of passengers (49 CFR 390.5) and as any vehicle designed to carry more than 15 passengers, including the driver (49 CFR 393.5). NHTSA's FARS database uses five body type classifications for buses: intercity/cross-country bus, school bus, transit bus, other bus, and unknown bus. The FARS and GES databases are populated with police-reported accident data.[39]

The FMCSA reports[40] that FARS data from 1994–2004 include 24 motorcoach fires with fatalities; GES data from 1995–2003 include two motorcoach accidents that involved fires. The FMCSA also reports that its MCMIS data from 1995–2005 include 265 motorcoach fires, of which 4 involved fatalities, 49 involved injuries, and 212 involved property damage. On March 2, 2006, the then-FMCSA Administrator, during

[37] FARS was established in 1975 and contains data on fatal traffic accidents in the 50 States, the District of Columbia, and Puerto Rico. To be included in FARS, an accident must involve a motor vehicle traveling on a road open to the public and result in the death of a person within 30 days.

[38] The MCMIS is a database of motor carrier census information, inspections, accidents, and enforcement history.

[39] Police agencies use the American National Standards Institute (ANSI) definitions of motor vehicle accidents and traffic accidents. ANSI defines a motor vehicle accident as a transport accident that involves a motor vehicle in transport and a traffic accident as a road vehicle accident in which the unstabilized situation originates on a trafficway or a harmful event occurs on a trafficway. American National Standards Institute, *Manual on Classification of Motor Vehicle Traffic Accidents*, ANSI D16.1-1996 (Washington, DC: ANSI, 1996) Sections 2.4.12 and 2.4.18.

[40] U.S. Department of Transportation, Research and Innovative Technology Administration, Volpe National Transportation Systems Center, *Motorcoach Fire Safety Analysis Work Plan*, Project No. CV702 (Cambridge, MA: Volpe National Transportation Systems Center, 2006) 1.

testimony to the House Committee on Transportation and Infrastructure Subcommittee on Highways, Transit, and Pipelines, explained that bus fires have been found to be a chronic problem throughout the entire industry.[41]

During the Safety Board's public hearing, the NFPA's manager of fire analysis services stated that the NFIRS data from 1999–2003 indicated an average of 2,200 bus fires each year (including transit[42] and school buses), or about 6 per day. A National Interstate Insurance Company representative testified that insurance data from 2003–2006 showed 74 bus fire claims, including school buses, transit buses, and motorcoaches. A Lancer Insurance Company representative reported 220 bus fire claims from 1998–2005. During the week of October 23, 2006, the Safety Board had access to additional information on 80 of these claims (29 wheel/tire fires, 37 engine fires, and 14 other).[43] Of the 29 wheel/tire fires, 5 were wheel bearing failures.

Two large self-insured passenger carrier companies volunteered information to the Safety Board regarding their experiences with vehicle fires. From 2004–2005, one company reported 24 motorcoach fires (6 axle/wheel, 14 engine compartment, 1 brake system, 2 tire, and 1 battery); the other company reported 49 motorcoach fires from January 2004–April 2005 (9 wheel bearing, 12 turbocharger, 14 electrical system, 11 brake system, and 3 fuel system).

### *Volpe National Transportation Systems Center*

The Volpe National Transportation Systems Center (Volpe Center) is conducting a motorcoach fire safety analysis for the FMCSA.[44] The objectives of the study are

- To gather information on the causes, frequency, and severity of motorcoach fires and to identify ways to prevent, reduce, or mitigate their severity and frequency,
- To investigate and qualitatively assess fire suppression systems and their adequacy based on the type and location of fire,
- To assess the adequacy of current motorcoach operational inspection practices (both daily and periodic) as they relate to detecting and remedying situations that may lead to a fire,

[41] See <testimony.ost.dot.gov/test/Sanberg1.htm>, May 4, 2006.

[42] A transit bus is a vehicle that frequently loads and unloads passengers and operates primarily in local, scheduled route service at lower-than-highway speeds. These buses are manufactured with space and accommodations, such as support bars or hand-hold straps, for standing passengers.

[43] Following the public hearing, Lancer invited the Safety Board to review a portion of its claim files for fire data.

[44] *Motor Coach Fire Safety Analysis Work Plan*.

- To consider and recommend fire prevention and mitigation techniques, to include revisions to both inspection and maintenance procedures, use of active fire suppression systems, use of passive systems to mitigate fire spread and release of toxic gases, and methods to facilitate the exit of passengers and drivers, and
- To set up a database for a broad population of motorcoach fires, identifying the characteristics and outcomes of incidents; the operational, usage, maintenance, and inspection characteristics of vehicles; and the correlating contributing and mitigating factors.

The Volpe Center expects to complete the final report in March 2007.

### *Tire Fires and Fire Suppression Systems*

At the public hearing on this accident, the manager of the product analysis department of Bridgestone Americas Holding, Inc. (Firestone),[45] stated that little information is available in the public domain about whole tire autoignition temperatures, and Firestone's limited testing indicates that the tire temperature would approach 800º F before autoignition. He further stated that when a tire is subjected to an increasing amount of heat, approaching 350º–400º F, its rubber begins to break down and the tire does not maintain the desired material properties for adhesion, strength, or tear resistance. As long as the heat cycle continues, the tire will accelerate toward failure.

The vehicle fire suppression systems product manager with Amerex Corporation reported that rubber burns very hot, and modern tires generally have a steel cord that retains heat. In addition, the metal mass from the wheel itself (axles and brakes) retains heat, which can cause a reflash, even if the fire on the rubber portion of the wheel assembly is extinguished. He further added that if the sidewall is compromised as a tire burns, it is quite likely that the inside of the tire will get fresh air, and the tire will burn on both the outside and the inside. A fire extinguisher agent applied to the exterior of the tire may never reach the interior and will not fully extinguish the fire.

Automatic fire detection and suppression systems for engine compartment and electrical equipment fires have been installed on some transit and intercity motorcoaches.[46] According to the senior technical advisor for MCI, the number of motorcoaches being sold with fire suppression systems has increased.[47] Generally, these systems, typically located in the engine compartment, employ spot heat detectors and a fire suppression agent distribution network with individual nozzles. The systems are not designed to protect against and extinguish a tire fire.

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[45] Bridgestone Americas Holding, Inc., is the parent corporation to Bridgestone Firestone North American Tire, LLC, and other subsidiaries that manufacture tires in North America.

[46] For example, New Jersey Transit has been using fire detection and suppression systems in its fleet since 1994.

[47] In 2005, MCI also introduced the SmarTire pressure temperature monitoring system as an option for its motorcoaches. Although not a suppression system, it aids in the identification of high temperatures.

The vice president of Daecher Consulting Group stated at the public hearing that some types of fires severely affect a motorcoach. He explained that engine fire suppression systems "tend to work fairly well in terms of recognizing the fire, controlling it." However, he stated that "there is no way" motorcoach equipment will have any effect in putting out a tire fire or a fire that originates in a wheel well. He added that motorcoaches "go up very quickly" as a fire propagates.

The vehicle fire suppression systems product manager with Amerex Corporation explained that vehicle fires are of an "uncontrollable nature," and the purpose of a suppression system is to delay or prevent the spread of a fire to give the occupants a reasonable amount of time to escape. He added that "the current thinking on tire fire protection, instead of extinguishment, is to prevent ignition, working toward a heat monitoring system that will give a prewarning to a driver in the event of elevated heat in one or more wheel wells."

In July 2006, the FMCSA announced its fiscal year 2006 research grants program, as specified in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Section 5513(a), and provided funding of $1.4 million for a roadside thermal imaging inspection system project. As reported in 71 *Federal Register* (FR) 42438–42439, the project

> uses a thermal imaging inspection system that leverages state-of-the-art thermal imaging technology, integrated with signature recognition software, providing the capability to identify, in real-time, faults and failures in tires, brakes, and bearings mounted on commercial motor vehicles.

The objectives of the demonstration project are to employ the system in a field environment (such as along an interstate) to further assess its capability of identifying faults in tires, brakes, and bearings mounted on commercial motor vehicles; to establish the probability of failure; and to develop and integrate a predictive tool to identify an impending tire, brake, or wheel bearing failure and provide a timeframe in which the failure may occur.

In September 2006, the FMCSA awarded a grant for the demonstration project to the International Electronic Machine Corporation of New York; the period of performance is expected to be 24 months.

## Highway Information

### *General*

The motorcoach fire occurred on I-45 north, approximately 1,000 feet north of the exit ramp to Mars Road, at MP 269.5, near Wilmer, Texas. I-45 is classified as a rural principal arterial road; it is a divided, straight, and level six-lane concrete roadway. Each travel lane is 12 feet wide, and the lanes are separated by broken white retroreflective lines on the road surface. A solid yellow retroreflective line delineates

the inner edge of the roadway. A 24-foot-wide concrete median with a permanent 32-inch-high median barrier separates the northbound and southbound lanes. A solid white retroreflective line delineates the outer edge of the roadway from the 10-foot-wide outer shoulder and the 12-foot-wide inner shoulder. The posted speed limit in the vicinity of the fire location was 60 mph.

### *Traffic*

According to records of the Texas Department of Transportation (TxDOT),[48] the most recent traffic count in the vicinity of the accident was 44,000 vehicles per day in 2003. During evacuation in advance of Hurricane Rita, TxDOT instituted contra-flow lanes[49] on I-45 north of Houston in anticipation of the estimated 2 million evacuees traveling to other locations for safety. "Contra-flow" converted all lanes of I-45 to northbound-only travel.

On September 22, 2005, all lanes on I-45 from Conroe to Fairfield, Texas (90 miles), were designated one-way northbound. The contra-flow lanes did not extend as far north as the location of the motorcoach fire, at MP 269.5. Witnesses reported that traffic in the vicinity of the accident was moving freely, with vehicles traveling northbound at 40–50 mph. Table 2 shows a chronology of the date, time, and limits of the one-way northbound operation for I-45.

**Table 2.** Contra-flow history on I-45 during Hurricane Rita evacuation.

| Date (2005) | Time | I-45 traffic lane operation |
|---|---|---|
| Sept 22 | 12:00 noon | TxDOT working to improve traffic flow from Houston |
| | 2:00 p.m. | All lanes from Conroe to Fairfield, Texas (90 miles), routed one-way northbound |
| Sept 23 | 6:07 a.m. | Time of motorcoach fire |

## Operations Information

### *Global Limo Inc.*

According to the FMCSA registration, Global was an authorized interstate for-hire passenger motor carrier[50] headquartered in the State of Texas. At the time of the accident, Global operated with four motorcoaches (not including the accident motorcoach) and six drivers. According to Global's owner, the company was established in 1980; the FMCSA

[48] TxDOT records from 1998–2001 indicate that 201 accidents occurred within 5 miles of the site of the motorcoach fire. The accidents (overturn, hit motor vehicle, pedestrian, parked car, animal, and fixed object) resulted in 6 fatalities and 190 injuries.

[49] Reverse-flow operation on a divided highway is termed "contra-flow." American Association of State Highway and Transportation Officials, *A Policy on Geometric Design of Highways and Streets* (Washington, DC: AASHTO, 2004) 492.

[50] DOT No. 1031282.

records show that interstate operating authority was granted to Global on June 30, 1987. The owner changed the company name from Global Tours and Charters to Global Limo Inc. on November 20, 2003.

**Company History.** Global's inspection selection system (ISS) value[51] was 92, falling in the ISS-2 "inspection recommended" range of values. For the 2 years prior to the accident (September 23, 2003–September 23, 2005), Global's drivers had been subjected to eight roadside inspections, which showed serious violations of the FMCSRs and resulted in four drivers being placed out of service (OOS); thus, the company's OOS rate was 50 percent (the 2005 national OOS rate was 6.6 percent).[52] The accident driver himself had undergone three roadside inspections[53] prior to September 23 and had been placed out of service in two of the three inspections.

The four drivers were cited for multiple violations,[54] which included:

- Failing to retain record of duty status (also known as a driver's log) for the previous 7 days (OOS),
- Failing to maintain current record of duty status (OOS),
- Failing to meet CDL restrictions (OOS),
- Failing to show required information for total hours (violation), and
- Failing to have an English-speaking driver (violation).

Also during the 2 years prior to the accident, four of Global's vehicles were subjected to roadside inspections, and vehicle defects[55] were found. None of Global's vehicles were placed out of service during this period (the 2005 national OOS rate was 23.4 percent).

**Compliance Reviews.** On April 10, 2002, the TxDPS conducted an intrastate educational review of Global; this review is similar to the FMCSA compliance review. At the time of the review, the State of Texas did not issue safety ratings to intrastate carriers; it began doing so in early 2004.[56] (The FMCSA is the only agency that issues safety ratings to interstate carriers.)

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[51] The FMCSA's ISS program is designed to aid roadside inspectors in selecting vehicles for individual inspection. Inspections are optional for carriers with inspection values from 50–74; carriers with inspection values less than 50 are not considered for inspection under normal circumstances.

[52] According to the FMCSA, the fiscal year 2004 OOS rate for commercial bus drivers was 5.1 percent, and the OOS rate for commercial buses was 9.5 percent.

[53] February 12, March 1, and August 19, 2005.

[54] A "violation" is a violation of the FMCSRs found during the inspection and recorded. A serious violation results in an OOS order because the violation must be corrected before the affected driver or vehicle can return to service.

[55] These defects included inoperable tail lamp, no required vehicle markings, no fire extinguisher, insufficient tire tread depth on steer axle, inoperable marker lamp, defective brake warning device, operating a commercial motor vehicle without a periodic inspection, and damaged windshield.

[56] The TxDPS issues OOS orders to carriers that are rated "unsatisfactory." Shutdown orders are issued after 60 days for passenger carriers and HM carriers and after 75 days for property carriers.

The TxDPS procedures used in the safety review process mirror the FMCSA compliance review process. The educational review of Global listed the following deficiencies:

- No drug and alcohol testing program,
- No driver background investigation,
- No driver employment application,
- No driver record inquiry,
- Failure to require driver to make a record of duty status,
- Failure to require form and manner on driver's log,
- Failure to maintain vehicle inspection and maintenance records, and
- Failure to maintain evidence of brake inspector qualifications.

The April 2002 educational review resulted in five specific recommendations for compliance in the areas of driver qualifications, driver logs, and vehicle maintenance. Global was directed to notify the TxDPS of its actions to comply with the FMCSRs. The narrative section of the review included additional comments describing the discrepancies in each area. The reviewing TxDPS officer recommended compliance monitoring of Global and a followup review. The followup review did not take place.

The FMCSA conducted an on-site compliance review of Global on February 6, 2004, noting seven violations of 49 CFR Parts 382, 391, 395, and 396.[57] (See appendix B for a list of these violations.) The FMCSA issued a satisfactory rating to Global on February 12, 2004. Following this review, Global's vehicles and drivers underwent seven roadside inspections prior to the accident, which resulted in three driver OOS violations (the accident driver accounted for two of the three) of the FMCSRs for logbook and duty status.

After the accident, the FMCSA conducted another compliance review of Global, which included inspection of Global's four remaining motorcoaches. Two of the motorcoaches were placed out of service, resulting in a 50 percent OOS rate. The national OOS rate in 2005 was 23.4 percent. The FMCSA issued an unsatisfactory rating to Global on October 7, 2005, stating that the compliance review uncovered violations of the FMCSRs (49 CFR Parts 382, 391, 395, and 396) "so widespread as to demonstrate a continuing and flagrant disregard for compliance" and a management philosophy "indifferent" to motor carrier safety. Table 3 summarizes the violations common to both compliance reviews. (See appendix B for a full list of the violations found in each compliance review.)

[57] Prior to 2004, the FMCSA reported that Global had been identified as a category B carrier within the Safety Status Measurement System (SafeStat), which is used to identify and prioritize carriers for FMCSA safety improvement and enforcement programs, such as compliance reviews. SafeStat places carriers in categories A–H, with "A" as the lowest safety fitness assessment. At the time of the accident, Global had been categorized as an "E" carrier, which indicated that the company had a driver safety evaluation area (SEA) value of 75 or greater (Global's value was 96.96) and all other SEA values were less than 75. (See appendix C for more details on SafeStat values.)

**Table 3.** Global compliance review violations, February 2004 and October 2005.

| FMCSR violation | Feb 6, 2004 | Oct 7, 2005 | CFR |
|---|---|---|---|
| Failure to provide drivers with drug and alcohol policies | X | X | 49 CFR 382.601(a) |
| Failure to have persons trained for reasonable suspicion testing | X | X | 49 CFR 382.603 |
| False reports of records of duty status | X | X | 49 CFR 395.8(e) |
| Failure to maintain a note relating to annual review of driver's driving record | X | X | 49 CFR 391.51(b)(5) |

In Global's postaccident compliance review, the FMCSA declared that the company presented an "imminent hazard" to public safety and issued an operations OOS order on October 7, 2005. The FMCSA had determined that the violations detected in the compliance review both individually and cumulatively were likely to result in serious injury or death to Global's drivers and the motoring public. The OOS order was based on determinations that Global's vehicles were mechanically unsafe due to lack of vehicle maintenance, inspections, and repairs and that the company failed to comply with Federal regulations on drug and alcohol testing, driver qualifications, and hours of service.

### *Federal Motor Carrier Safety Administration*

**General.** The FMCSA was established as a separate administration within the DOT on January 1, 2000, pursuant to the Motor Carrier Safety Improvement Act of 1999. Its primary mission is to reduce accidents, injuries, and fatalities involving large trucks and buses. According to the FMCSA, the agency develops and enforces data-driven regulations and uses safety information systems to focus on higher risk carriers. The FMCSA requires a motor carrier to have management controls that comply with applicable safety requirements and uses a rating formula to determine a motor carrier's safety fitness. The FMCSA mission is primarily accomplished through on-site compliance reviews and roadside program inspections of a carrier's vehicles and drivers.

**Compliance Reviews.** The FMCSA standards require a motor carrier to have adequate controls in place to ensure compliance with the FMCSRs. In accordance with 49 CFR Part 385, appendix B, one step in the safety rating process is an FMCSA-conducted compliance review. (See appendix D for more details.)

During a compliance review, the FMCSA uses the computer program CAPRI[58] to organize and record compliance information and determine the proposed safety rating.[59] The compliance review applies six factors (general, driver, operational, vehicle, hazardous materials [HM], and accident rate) to determine the degree to which a carrier complies with the FMCSRs and meets the Federal safety fitness standard. Within each factor, the

[58] Compliance Analysis and Performance Review Information System.

[59] The compliance review itself is conducted at the carrier's business location; the actual safety rating is determined and issued by the FMCSA headquarters in Washington, D.C.

FMCSRs are rated as either acute[60] or critical[61] regulations, in accordance with 49 CFR Part 385, appendix B II(b); the carrier's noncompliance results in an assessment of one point for that factor.[62] According to the FMCSA, noncompliance with acute regulations and patterns of noncompliance with critical regulations are quantitatively linked to inadequate safety management controls and usually higher-than-average accident rates.[63] (On May 28, 1997, the FMCSA published a request for comments on a change to the safety fitness ratings in appendix B to Part 385 and made it an interim measure. In November 1997, the appendix was made an interim final rule pertaining to the compliance review process.[64]) Once the compliance review is finished and violations or deficiencies (the number of acute or critical regulations not complied with by the carrier) are tallied, a safety rating is computed for each applicable factor. As defined below, each factor is rated "satisfactory," "conditional," or "unsatisfactory," except the accident factor, which is rated either "satisfactory" or "unsatisfactory":

- A satisfactory rating indicates that the carrier has not violated any acute regulations or shown a pattern of noncompliance with critical regulations.
- A conditional rating indicates that the carrier has violated one acute regulation or has a pattern of noncompliance with critical regulations.
- An unsatisfactory rating indicates that the carrier has violated two or more acute regulations or has a pattern of noncompliance with two or more critical regulations.

According to the FMCSA, an accident rate below 1.5 per million miles is considered satisfactory; anything higher is rated "unsatisfactory."[65] The ratings for all six factors are given equal weight and entered into a rating table. Table 4 summarizes the FMCSA rating process.

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[60] Acute violations of the FMCSRs (or HM regulations) are defined as those that demand immediate corrective action, such as requiring or permitting the operation of an OOS vehicle before repairs are made, regardless of the motor carrier's overall safety posture.

[61] Critical violations indicate deficiencies in the motor carrier's management controls, such as requiring or permitting a driver to drive after having been on duty for 15 hours (49 CFR 396.9(c)(2)).

[62] Two points are assessed for noncompliance with a "critical" regulation in 49 CFR Part 395 for hours of service.

[63] See <www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/385appnb.htm>, December 13, 2006.

[64] By this interim final rule, the Federal Highway Administration (FHWA) publishes its safety fitness rating methodology as appendix B to 49 CFR Part 385 to be used as an interim measure until a notice of proposed rulemaking (NPRM) becomes final (Docket No. MC-94-22 changed to FHWA-97-2252). See 62 FR 28807.

[65] The rating for the accident factor is based on the number of recordable accidents in relation to the carrier's annual mileage for the 12 months leading to the compliance review. The FMCSA defines a recordable accident as an occurrence involving a commercial motor vehicle operating on a public road in interstate or intrastate commerce that results in a fatality, a bodily injury, or a vehicle incurring disabling damage that requires it to be towed from the scene (49 CFR 390.5). The accident threshold for a satisfactory rating is 1.7 per million miles for carriers operating within 100 air miles of their home terminal (49 CFR Part 385, appendix B, (B) accident factor (d)).

**Table 4.** Motor carrier safety ratings.

| No. of factors with unsatisfactory ratings | No. of factors with conditional ratings | Safety rating |
|---|---|---|
| 0 | 2 or less | Satisfactory |
| 0 | More than 2 | Conditional |
| 1 | 2 or less | Conditional |
| 1 | More than 2 | Unsatisfactory |
| 2 or more | 0 | Unsatisfactory |

The rating table establishes the motor carrier's overall final safety rating: satisfactory, conditional, or unsatisfactory. A safety rating is issued to a motor carrier within 30 days of the completion of a compliance review. When the FMCSA issues a proposed safety rating of unsatisfactory, it is a notice to the motor carrier that the FMCSA has made a preliminary determination that it is "unfit" to continue operating in interstate commerce and that the prohibitions in 49 CFR 385.13 will be imposed after 45 days for passenger-carrying operations, if necessary safety improvements are not made. According to 49 CFR 385.13(a), an owner or operator receiving notice of a proposed unsatisfactory safety rating from the FMCSA must improve that rating to conditional or satisfactory within 45 days of the date of notice. Owners or operators who fail to improve their ratings within this 45-day period are prohibited from operating in interstate commerce beginning on the 46th day following the date of the rating notice and may not reestablish interstate operations until they become fit for such transportation. (See appendix C for more information.)

According to the FMCSA, 910,866 motor carriers were operating in the United States in calendar year 2005, and the agency conducted compliance reviews on 8,097 carriers. Table 5 shows the results of these reviews. Overall, of 61,924 violations discovered during the 8,097 compliance reviews, 53,064 were noncritical and nonacute and are not used to rate the carrier.

In September 2005 and again in June 2006, the Safety Board met with the FMCSA to discuss FMCSA plans for evaluating the compliance review process as part of the Comprehensive Safety Analysis (CSA) 2010 Initiative. According to the FMCSA, the CSA 2010 Initiative is an effort to evaluate the effectiveness of current Federal safety compliance and enforcement programs, such as compliance reviews and roadside inspections, and to identify better methods of achieving an accident-free environment. The FMCSA indicated that the evaluation is still in its early stages, no conclusions have been reached, and it is too soon to speculate on what specific changes may be made in the safety rating process. Full implementation of any changes proposed by the initiative is not expected until 2010.

**Table 5.** FMCSA compliance review data, 2005.

| Safety rating | No. of reviews[A] | Percent of total reviews |
|---|---|---|
| Satisfactory | 5,234 | 64.6 |
| Conditional | 2,117 | 26.1 |
| Unsatisfactory | 531 | 6.6 |
| Not rated | 215 | 2.7 |
| Total | 8,097 | 100 |

[A]See MCMIS March 31, 2006, snapshot, <ai.fmcsa.dot.gov/ProgramMeasures/CR/NR/NSR/Report.asp?FC=C&RF=T.>, October 20, 2006.

The FMCSA has posted on its website information explaining the CSA 2010 Initiative.[66] According to the posting, the initiative is "a comprehensive review and analysis of FMCSA's current commercial motor vehicle safety compliance and enforcement programs." The FMCSA's objective is to develop and deploy a new operational model to identify drivers and operators that pose safety problems and to intervene to address those problems.[67] The FMCSA acknowledges that the present compliance review program is resource-intensive and reaches only a small percentage of motor carriers[68] and that increased attention needs to be given to commercial vehicle drivers.

**Roadside Inspection.** According to the FMCSA, in this program, qualified safety inspectors carry out roadside inspections in accordance with the *North American Standard Inspection Program Guidelines*, which were developed by the Commercial Vehicle Safety Alliance (CVSA) and the FMCSA. The ISS-2 "value" based on safety is derived from a carrier's roadside inspections and accident history. According to the program, vehicles with an inspection value of 75–100 (maximum value is 100) should be inspected.[69]

During roadside inspections,[70] an inspector examines commercial motor vehicles and their drivers to determine whether they meet the FMCSRs. Under the North American Standard inspection criteria, a leaking wheel seal alone is not an OOS item; it is an OOS item if the hubcap is missing or broken, allowing an open view into the hub assembly, or if the wheel is smoking due to bearing failure.[71] Serious violations found during roadside

[66] See <www.fmcsa.dot.gov>, December 12, 2006.

[67] See <www.fmcsa.dot.gov/safety-security/safety-initiatives/csa2010/csa2010listening.htm?>, December 12, 2006.

[68] In calendar year 2005, less than 1 percent of the 910,866 registered motor carriers underwent compliance reviews (8,097 reviews conducted).

[69] Inspections are optional for carriers with inspection values from 50–74; carriers with inspection values less than 50 are not considered for inspection under normal circumstances.

[70] Most roadside inspections are conducted by States through the FMCSA-administered grant Motor Carrier Safety Assistance Program.

[71] Commercial Vehicle Safety Alliance, *North American Standard Inspection Program Guidelines*, Out-of-Service Criteria, sections 12.i(1), (2) (Washington, DC: CVSA, 2005).

inspections result in the issuance of driver or vehicle OOS orders; these violations must be corrected before the affected driver or vehicle can return to service. According to the FMCSA, 3,022,286 roadside inspections were conducted in 2005;[72] 2,960,849 driver inspections resulted in 195,667 driver OOS violations, and 2,198,718 vehicle inspections resulted in 513,439 vehicle OOS orders.

## Nursing Home Information

The Brighton Gardens senior assisted living center, located in Bellaire, Texas, offers assisted living services, nursing and rehabilitation services, and hospice care. Sunrise operates more than 420 senior living communities in 37 States, the District of Columbia, Canada, the United Kingdom, and Germany, with a combined resident capacity of 52,000. Sunrise offers at-home assisted living, independent living, assisted living, Alzheimer's care, and nursing and rehabilitative care.[73]

During the public hearing for this accident, Sunrise officials stated that the company had originally planned to use a shelter-in-place strategy at Brighton Gardens during the Hurricane Rita emergency. Sunrise made the decision to evacuate in the evening hours of September 21, 2005, at the urging of the Bellaire fire marshal. Those residents who could not be accommodated locally were to be transferred to facilities in Arlington and Dallas, Texas.

Several Sunrise nursing home and assisted living facilities in the Gulf region required evacuation in advance of Hurricane Katrina, which made landfall in New Orleans, Louisiana, on August 29, 2005. During those preparations, Sunrise had contacted BusBank to secure motorcoach transportation to evacuate residents in two coastal Louisiana communities. According to Sunrise representatives at the public hearing, the company did not encounter any problems with the buses provided by BusBank.[74]

Sunrise owned small wheelchair-accessible shuttle buses that were normally used for short day trips but were not equipped with restrooms. After watching media coverage of the heavy evacuation traffic, which showed evacuee vehicles running out of gasoline, Sunrise representatives made the decision to charter a diesel-powered motorcoach with restrooms because of the number of residents being evacuated and the anticipated 4-hour drive to Dallas.

The Sunrise vice president for sales and marketing and the vice president for operations contacted BusBank on September 21 to arrange transportation for the Brighton Gardens residents. BusBank first informed Sunrise that it did not have any motorcoach

[72] These inspections included 2,309,258 trucks and 71,464 buses. See <www.ai.fmcsa. dot.gov/ stateprofile/profile.asp>, November 27, 2006.

[73] See <www.sunriseseniorliving.com>, September 13, 2006.

[74] Global Limo Inc. was not the passenger carrier provided by BusBank for the Hurricane Katrina contract.

operators available to provide charter evacuation services because FEMA had contracted approximately 275 motorcoaches for posthurricane operations. Shortly thereafter, BusBank informed Sunrise that it found two motorcoaches to transport Brighton Gardens residents from Bellaire to Dallas. According to Sunrise, it was not given the name of the motorcoach operator. The accident motorcoach, which carried 37 residents, was staffed with 3 nurses and 3 nurses' aides (and 1 parent of a nurse). Global's second motorcoach completed the trip as outlined in the contract and trip itinerary; it transported 16 ambulatory passengers and arrived at its destination on the morning of September 23.

Brighton Gardens is a licensed facility and did have a preparedness plan.[75] At the time of the Hurricane Rita evacuation,[76] the Sunrise Senior Living plan, titled *Preparing the Community for a Complete Evacuation*, stated, "If the evacuation is decided: Transportation arrangements will be confirmed." There were no other written procedures for arranging transportation for residents.

## Bus Brokers

A bus broker is an entity or business that arranges bus or motorcoach transportation between a client and a passenger motor carrier for a fee. Bus brokers are not required to obtain a DOT registration or operating authority from the FMCSA. An FMCSA official testified at the public hearing that the agency does not have the authority to regulate brokers for motor carriers of passengers. In addition, on September 15, 2006, the FMCSA informed the Safety Board that 49 *United States Code* 13506(a)(14) exempts the Secretary of Transportation from jurisdiction over brokers for motor carriers of passengers. According to the FMCSA, the statute does give the DOT

> authority to require brokers for motor carriers of passengers to maintain a bond or insurance as needed to protect passengers and carriers dealing with such brokers. The DOT, like the ICC before it, has not imposed an insurance requirement because, without the ability to register these brokers, the agency has no way to identify passenger brokers that are operating and monitor their compliance with an insurance requirement.

[75] "Under current Texas law, only licensed facilities are required to maintain a written emergency preparedness and response plan; however, the law does not address the quality or currentness of a licensed facility's plan. Unlicensed facilities are not required by law to maintain an evacuation plan." State of Texas, *Governor's Task Force on Evacuation Transportation and Logistics* (Austin, TX: Office of the Governor, February 14, 2006) 5.

[76] Sunrise followed its written disaster plan in making evacuation arrangements. A section on "Hurricane Preparedness" included guidance covering such issues as keeping medical records and identification with evacuees; maintaining adequate supplies of food, medication, and other medical necessities; and securing the evacuated property.

Global Charter Services, Ltd,[77] doing business as The BusBank,[78] is a Delaware corporation headquartered in Chicago, Illinois. BusBank was one of the vendors used by FEMA during the Hurricane Katrina evacuations. The BusBank website describes the corporation as

> transportation and event specialists with local knowledge of bus availability, bus quality, the best routes, and seasonal events that impact bus transportation in hundreds of markets—thousands of cities—across North America. . . . Working with independent operators rather than owning buses, we maintain the flexibility to create customized group transportation solutions that fit the specific needs of the customer and situation.

BusBank maintains a registry of motorcoach companies and contacts them to arrange charters when needed. When a company agrees to the charter contract, the operator is given the itinerary and completes the trip. The group requesting the charter pays BusBank, which then pays the motorcoach company for its transportation services.

According to BusBank, the agreement requires that the motorcoach operator's drivers be properly licensed. The carrier must comply with all applicable Federal, State, and local laws and regulations. Global did not have a formal contract with BusBank; its registration information was taken via telephone 1 year before the accident, and it had completed one prior charter for BusBank.

## Oxygen Cylinders

The director of risk management for Sunrise stated in a Safety Board interview that Brighton Gardens employees placed medical oxygen[79] cylinders both inside the passenger compartment and inside the luggage bay during passenger loading of the motorcoach. Initially, two cylinders were hooked up to nasal canulas[80] and used to provide medical oxygen to two passengers inside the motorcoach. Fifteen cylinders, contained in metal racks, were placed in the luggage bay in the lower portion of the coach, along with passenger wheelchairs. During the trip, the oxygen within the cylinders in the passenger compartment was depleted, and the nursing staff requested that the driver pull over to retrieve additional cylinders from the luggage bay.

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[77] Global Limo Inc., the operator of the accident motorcoach, and Global Charter Services, Ltd, are two distinct and separate commercial entities.

[78] See <www.busbank.com>, December 1, 2006.

[79] Oxygen is an atmospheric gas. It is transported as a compressed or liquefied gas; it is not flammable but supports and enhances combustion. An oxygen-enriched atmosphere lowers the ignition temperatures of certain combustible materials and increases the intensity of a fire. Oxygen is also reactive with combustible materials and can cause a fire. Title 49 CFR Subchapter C 172.101 classifies oxygen as a nonflammable compressed gas, and 173.301(a) requires oxygen to be shipped in DOT specification cylinders.

[80] A canula is a tube inserted into the nasal cavity to administer medical oxygen.

During the Safety Board's postaccident inspection, 18 cylinders,[81] or parts thereof, were found in the cargo and passenger areas of the motorcoach; 15 cylinders were aluminum, and 3 were steel. Seven cylinders found in the luggage bay had limited fire damage. All 11 cylinders found inside the passenger compartment showed fire damage; 5 were extensively damaged and had been found near the rear of the motorcoach. Of these five, the pressure-relief plated brass medical post valves on three aluminum cylinders were intact; two of these cylinders had evidence of melting, and one had fractured and burst just below the cylinder neck.[82]

According to the manufacturer of one of these cylinders, aluminum melts at 1,020º–1,206º F and loses its strength at temperatures well below this range. A fully pressurized aluminum cylinder would maintain its integrity for only minutes at temperatures of about 600º F. These cylinders are designed to hold large quantities of gas by compressing it into a small volume, which results in high levels of pressure. When a cylinder fails, the rapid expansion of the compressed gas creates a pressure surge that radiates from the container and can carry along portions of the cylinder as projectiles. The Safety Board examined the three aluminum cylinders to determine how the structural failure occurred.

According to the manufacturer of several plated brass valves found on the accident motorcoach, the typical pressure relief device installed on this type of valve includes a burst disk[83] set to actuate at 3,025–3,360 pounds per square inch gage (psig). These pressure relief devices are designed to open to relieve pressure within the cylinder before an exposure to high temperatures can cause the cylinder to fail.[84] Examination of the three valves at the Safety Board's laboratory revealed that one burst disk had actuated as designed, and two had not.[85] One of the two that had not actuated was on the cylinder that had fractured and burst. The disks within these cylinders were examined, and no defects were found.

The Safety Board studied the effect of heating aluminum cylinders containing various quantities of oxygen, from fully charged at 2,015 psig to minimally charged at 500 psig. The study revealed that the pressure-relief device on a fully charged cylinder

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[81] The director of risk management was unable to explain why an additional cylinder was found in the motorcoach postfire.

[82] Two other melted cylinders were found without the valves attached. One had holes melted through on the top head, and the other was only a base with attached resolidified aluminum.

[83] A burst disk is a pressure-actuated device used to prevent the pressure in a normally charged cylinder from rising above a predetermined maximum, thereby preventing rupture of the cylinder when subjected to high temperatures.

[84] Fire tests performed for the Compressed Gas Association (CGA) to establish standards for these pressure relief devices proved that they operated as designed when the cylinders were fully charged with gas. In accordance with 49 CFR Subchapter C and the CGA S-1.1 standard, these are the minimum requirements for pressure relief devices considered to be appropriate for use on cylinders with capacities of 1,000 pounds of water or less; 49 CFR 173.301(f) requires that pressure relief devices be sized, selected, and tested in accordance with the CGA S1.1 standard and that they be capable of preventing rupture of a normally filled cylinder when subjected to a fire test conducted in accordance with the CGA C-14 standard.

[85] In all, the plated brass medical post valves were still installed on 16 of the 18 recovered cylinders. Each cylinder was examined to determine whether the pressure relief device had actuated as designed.

actuates, relieving its internal pressure before failure, at temperatures of 260º–315º F. However, it was also determined that the exposure of an aluminum cylinder with less than 78 percent of its original quantity of gas (about 1,570 psig at room temperature) to temperatures exceeding 400º F reduces the strength of the aluminum to a point where the cylinder structurally fails before the pressure within the cylinder is great enough to activate the burst disk. It was also found that as the quantity of gas in the cylinder decreases, the temperature required to increase the internal pressure above the rupture pressure of the burst disk increases.

Federal HM regulations in 49 CFR Subchapter C 171.8 define materials of trade as those materials carried on a motor vehicle to protect the health and safety of the motor vehicle operator or passengers; section 173.6 states that when materials of trade (such as the medical oxygen cylinders) are transported by a motor vehicle, they are not subject to DOT shipping requirements, with certain provisions. On September 26, 2005, 3 days after the accident, the Pipeline and Hazardous Materials Safety Administration (PHMSA) issued guidance for the safe transportation of medical oxygen for personal use on buses and trains. This guidance was updated and rereleased on June 30, 2006.[86] It suggests, in part, that the number of cylinders to be transported in a vehicle be limited to the extent practicable and, except in emergency situations, that bus or train operators consider limiting the number of passengers who require medical oxygen. The guidance specifies that each cylinder be equipped with a valve protection cap and be secured away from sources of heat or potential sparks. PHMSA also suggests that the total weight of oxygen cylinders permitted in a bus cargo compartment not exceed 99 pounds, though a carrier may elect to transport up to 440 pounds in the cargo compartment if the oxygen is required for passenger health or safety.

When a new cylinder design or technology is developed, manufacturers apply to the DOT for a special permit[87] to use the new technology. Prior to 1981, aluminum cylinders were manufactured, tested, inspected, and placed on the market as exempt from DOT regulations, which applied to steel cylinders. In 1981, aluminum exemption cylinders became subject to 49 CFR 178.46, specification 3AL seamless aluminum cylinders.

## Meteorological Information

The Lancaster Airport in Lancaster, Texas, about 4 miles west of the accident site, was the closest official weather-observing system. At 6:03 a.m. on September 23, 2005, it reported visibility unrestricted at 10 statute miles, a temperature of 72º F, and scattered clouds above 9,500 feet.

[86] U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, *Guidance for the Safe Transportation of Medical Oxygen for Personal Use on Buses and Trains* (Washington, DC: PHMSA, 2006).

[87] The Hazardous Materials Safety and Security Reauthorization Act of 2005 (Public Law 109-59), Stat. 1144 (August 10, 2005), amended the Federal HM transportation law by changing the term "exemption" to "special permit."

## Toxicological Information

Toxicological specimens were not collected from the accident motorcoach driver. According to 49 CFR 382.303, the employer of a driver of a commercial motor vehicle operated 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.[88] Global did not test the driver postaccident for alcohol or illicit drugs. When interviewed by the Safety Board, the Dallas County Sheriff's officer who responded to the fire stated that he lacked reasonable suspicion of intoxication to require the driver to submit to toxicological testing. [89]

## Other Information

### *Commercial Vehicle Inspections*

According to Global's owner, the accident motorcoach underwent a commercial vehicle inspection for the State of Texas on June 9, 2005, at Valley Volvo in Pharr, Texas. In Texas, the inspection of motor vehicles, including motorcoaches, is conducted in State-approved privately owned and operated garages, inspection-only facilities, and vehicle repair facilities,[90] which are designated by the TxDPS under the Texas Vehicle Inspection Act.[91] Under 49 CFR 396.17, the FMCSA requires that "every commercial vehicle shall be inspected as required . . . the inspection shall include, at a minimum, the parts and accessories set forth in appendix G of subchapter B."[92]

[88] Title 49 CFR 390.5 defines an accident as an occurrence involving a commercial motor vehicle operating on a highway in interstate or intrastate commerce that results in: "(i) a fatality; (ii) bodily injury to a person who, as a result of the injury, immediately receives medical treatment away from the scene of the accident; or (iii) one or more motor vehicles incurring disabling damage as a result of the accident, requiring the motor vehicle(s) to be transported away from the scene by a tow truck or other motor vehicle."

[89] *Texas Transportation Code* 724.012(b) states that: "[a] peace officer shall require the taking of a specimen of the person's breath or blood if: (1) the officer arrests the person for an offense under Chapter 49, Penal Code, involving the operation of a motor vehicle or a watercraft; (2) the person was the operator of a motor vehicle or a watercraft involved in an accident that the officer reasonably believes occurred as a result of the offense; (3) at the time of the arrest the officer reasonably believes that a person has died or will die as a direct result of the accident; and (4) the person refuses the officer's request to submit to the taking of a specimen voluntarily."

[90] According to 49 CFR 396.23, a vehicle meets Federal requirements if inspected under a mandatory State inspection program, such as the State of Texas vehicle inspection program.

[91] All inspection-authorized 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 TxDPS. *Texas Transportation Code*, "Compulsory Inspection of Vehicles," chapter 548.

[92] As specified in 49 CFR 396.17(f), vehicles passing roadside or periodic inspections performed under the auspices of any State government or equivalent jurisdiction or the FMCSA, and meeting the minimum standards contained in appendix G of this subchapter, are considered to have met the requirements of an annual inspection for a period of 12 months commencing from the last day of the month in which the inspection was performed, except as provided in 396.23(b)(1).

Title 49 CFR Parts 393 and 396 set forth FMCSR guidelines pertaining to commercial vehicle tires, wheels, and lubrication. (See appendix D.) In appendix G of subchapter B,[93] the FMCSRs list the minimum periodic inspection standards for commercial motor vehicles. According to the standards, "a vehicle does not pass an inspection if it has several defects or deficiencies for tires." Wheel bearings or wheel seal leaks are not specifically addressed.

Title 49 CFR 396.3 specifies that every motor carrier shall systemically inspect, repair, and maintain, or cause to be systematically inspected, repaired, and maintained, all motor vehicles subject to its control.[94] Parts and accessories are to be kept in safe and proper operating condition at all times, including "those specified in Part 393 of this subchapter and any additional parts and accessories" that may affect safety of operation, "including but not limited to, frame and frame assemblies, suspension systems, axles and attaching parts, wheels and rims, and steering systems." Section 396.5 states: "Every motor carrier shall ensure that each motor vehicle subject to its control is: (a) properly lubricated; and (b) free of oil and grease leaks." Section 396.7 states:

> (a) General–A motor vehicle shall not be operated in such a condition as to likely cause an accident or a breakdown of the vehicle. (b) Exemption–Any motor vehicle discovered to be in an unsafe condition while being operated on the highway may be continued in operation only to the nearest place where repairs can be safely affected. Such operation shall be conducted only if it is less hazardous to the public than to permit the vehicle to remain on the highway.

Title 49 CFR 393.205 addresses parts and accessories for the safe operation of wheels, stating: "(a) Wheels and rims shall not be cracked or broken. (b) Stud or bolt holes on the wheels shall not be elongated (out of round). (c) Nuts or bolts shall not be missing or loose."

### *Motorcoach Tire Fire Testing*

To better understand the events surrounding the outbreak of a tire fire and the characteristics that account for the severity of this type of fire, the Safety Board conducted three tire fire tests[95] by

- Running a tire at various levels of inflation below the operating pressure specified by the manufacturer,

[93] 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 of subchapter B, Minimum Periodic Inspection Standards, are similar documents and follow the same inspection procedures. Appendix G requires that all items to be inspected be in proper adjustment, not be defective, and function properly prior to the vehicle being placed in service.

[94] FMCSA interpretation guidance assigns responsibility for inspecting and maintaining leased vehicles and for maintaining records to the motor carrier that has the vehicle subject to its control for 30 consecutive days or more, and the motor carrier is solely responsible for ensuring that the vehicles under its control are in safe operating condition and that defects have been corrected. See <www.fmcsa.dot.gov>, November 22, 2006.

[95] Participants and witnesses to the tests included staff from the Safety Board, the FMCSA, Greyhound Bus Lines, MCI, Lancer Insurance, and Bridgestone.

- Inducing failure of a wheel bearing from lack of lubrication, and
- Inducing failure of a wheel bearing by removing the bearing rollers.

A 2003 MCI G4500 model motorcoach, fitted with a nonsteering tag axle and Firestone FS400 tires, was used in the tests, which were run on a 7.7-mile circumference oval track at the Firestone proving grounds, Fort Stockton, Texas, on August 26–27, 2006.

Test results indicated that

- The underinflated tire test temperatures did not increase enough to ignite the tire.
- The dry wheel bearing caused a tire fire after about 1.5 laps around the track.
- The failed outer bearing led to a fire, which was not permitted to continue and ignite the tire.

A portable 20-pound dry chemical ABC fire extinguisher was used in an initial attempt to extinguish the two fires. In the second test, the fire restarted and was temporarily extinguished with a hose line and water; the fire restarted two more times and was finally extinguished with the repeated use of a firefighting hose line and water application. The third test resulted in a fire between the brake shoe and brake drum components; a chemical extinguisher was used to knock down the fire, which reignited. The fire was put out again with the chemical extinguisher and did not reignite.

### *Federal Railroad Administration Research*

At the Safety Board public hearing, a Federal Railroad Administration (FRA) specialist for passenger train system safety and emergency preparedness testified that, in 1999, the FRA concluded a series of rulemakings on requirements to prevent fire ignition, minimize fire spread and smoke emissions, and maximize the time available for passenger and crew egress, as codified in 49 CFR Part 238 and appendix B. Most combustible materials used in passenger railcars and locomotive cabs, organized by categories and functions, are required to be tested and meet certain flammability and smoke emission criteria. In addition, a structural floor fire endurance test is required.

The FRA also submitted the following written testimony:

> Currently, under the FRA sponsorship, the Volpe (National Transportation Systems) Center is conducting emergency evacuation and fire safety research to assist in determining whether the amount of time available to evacuate a passenger railcar is sufficient, given the amount of time occupants actually need to evacuate safely using the available emergency egress features in a car. The Volpe Center's research approach is two-pronged. Fire safety-related research findings can assist in determining the amount of available time for evacuation before conditions onboard become untenable due to smoke and fire, and emergency evacuation simulations can be used to predict the amount of time it takes to evacuate cars under various circumstances and in different operating environments. Findings from this research may be used to supplement existing emergency egress standards.

Appendix E provides additional excerpts from the FRA public hearing submission on passenger railcar fire and safety regulation history.

### *Motorcoach Fires and Research Studies in Germany and Finland*

On behalf of the German Ministry of Transport, the consulting group DEKRA[96] studied 55 motorcoach fires from 1999–2004.[97] The study included review of existing regulations for fire testing of materials used in motorcoaches and testing of motorcoach components. DEKRA reported that information on fire testing could be adopted from the railroad sector for use in testing motorcoach construction materials. The study emphasized the importance of early detection and recommended a system of thermodetectors, automatic fire suppression systems, and optical smoke detectors within the passenger compartment.

On February 13, 1999, the Accident Investigation Board of Finland began its investigation of a fire in a coach near Tampere, Finland. In autumn 2000, the Accident Investigation Board initiated a bus fire project to obtain bus fire statistics and determine the reasons for recurring fires.[98] The study found that a fire that begins outside the passenger compartment may spread into the passenger compartment very quickly and, in the worst case, prevent passenger egress. "Normally the fire moves into the passenger compartment from outside after the flames have broken either the rear window or the side window next to the engine." The report found no difficulties experienced during the evacuations investigated but acknowledged that "the situation could change significantly if, for example, there are disabled passengers in the vehicle." Another conclusion, based on the fire incidents reviewed, was that "if the driver has not extinguished the fire, or has not prevented it from spreading, and the firefighters' arrival time is more than 10 minutes, then the fire will already have moved to the passenger compartment."

The study found that fixed fire-extinguishing/suppression systems are rare in Finland; according to bus company owners and bus body manufacturers, the system's price is considered to be the main obstacle to its widespread use. The study determined that the extra cost of the system installed in a new bus added about 1.0 percent to the purchase price. One report recommendation was that all new buses be equipped with an automatic or semiautomatic fixed fire-extinguisher system, and another called for bus company owners to provide every driver with first-hand fire-extinguishing training and at regular intervals arrange practice in the use of fire extinguishers and in passenger evacuations.[99]

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[96] See <www.dekra.com/english/auto.htm.>, November 14, 2006.

[97] Markus Egelhaaf and F. Alexander Berg, *Motor Coach Fires: Analysis and Suggestions for Safety Enhancement*, Paper Number 05-0094 (Berlin, Germany: Ministry of Transport, 2005).

[98] Accident Investigation Board, *Bus Fires in Finland During 2000*, translation from shortened Finnish version (Helsinki, Finland: 2001).

[99] Recommendation numbers D1/00Y/S1 and D1/00Y/S4, respectively.

### *DOT Evacuation Research Studies*

**Intercity Buses.** On December 1, 1976, the FHWA contracted with the University of Oklahoma to study the evacuation of intercity buses.[100] The study was the third in a series to "document the problems with evacuation or escape from automobiles and buses after a crash."[101] Part of the study included a literature review of accident reports, published materials, and research reports. One report recommendation was that emergency exit time standards be developed under different collision configurations and possibly be patterned after existing Federal Aviation Administration (FAA) aircraft exit standards.

The evacuation study analyzed three evacuation simulations with a full complement of passengers[102] and noted "that there is a great disparity in the total time [in] which each window exit was used for escape and the number of persons escaping." In comparing escape times to vehicle positioning and lighting conditions, the study explained that "the overall escape times are not comparable because the use of the front door as an exit caused a significant reduction in escape time, particularly for removal of the [injured] passengers." The study concluded that the

> maximum time to permit for a bus evacuation cannot be fully determined with the data currently available. However, the standard used by the FAA for aircraft evacuation should be carefully considered, i.e., 90 seconds time [*Federal Aviation Administration Regulations* 25 CFR Part 803] with one-half the available exits being used.

Also included in the report was information about comments submitted to the DOT when Federal Motor Vehicle Safety Standard (FMVSS) 217 was proceeding through the rulemaking phases prior to becoming effective in 1973. One problem noted was the potential for injury to motorcoach passengers when the escape exit used was 7–8 feet above ground level. The Oklahoma University Research Institute suggested the following changes to the proposed FMVSS 217:

> The maximum allowable force of 60 pounds for opening an emergency exit should be reviewed and push-out windows serving as emergency exits should be required to include a method for keeping them open after they have been initially opened. The reason for the suggestion was that windows falling back on passengers egressing impede egress and can also produce injuries.

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[100] U.S. Department of Transportation, Federal Highway Administration, *Evacuation of Intercity Buses*, Oklahoma University Research Institute (Washington, DC: FHWA, 1977).

[101] The first two studies focused on all vehicles, including passenger cars and buses. (a) U.S. Department of Transportation, Federal Highway Administration, *Escape Worthiness of Vehicles and Occupant Survival, First Part: Research Program*, Oklahoma University Research Institute, FH-11-7303 (Washington, DC: FHWA, 1970). (b) *Escape Worthiness of Vehicles for Occupancy Survivals and Crashes*, Oklahoma University Research Institute, FH-11-7512 (Washington, DC: FHWA, 1972).

[102] The three conditions were: the motorcoach in an upright condition in darkness with and without the front door accessible, the motorcoach overturned onto its right side in darkness with the front loading door blocked, and the motorcoach turned on its right side with on-board emergency illumination.

**Paratransit Buses and Vans.** In 1984, the DOT published a report on the evacuation and rescue of elderly and disabled passengers from paratransit vans and buses.[103] According to the report:

> To ensure the safety of passengers on paratransit vans and buses, efficient and safe methods of rescuing them are needed. Standard methods are not always useful for these patrons as a result of their physical and mental condition and their insufficient ability to manage self-evacuation.

The scope of the research program included the preparedness of emergency rescue personnel and transit operators. The report recognized that "if the vehicle catches fire, the passengers and the driver may have to rely on the immediate help of nearby motorists before professional rescue personnel arrive." In discussing emergency exits, the report states that push-out windows severely limit use by the elderly and disabled because the "release forces can be high," and the windows "are not easily releasable from the outside."

Report data from 1984 indicate that 70 percent of all fires in intercity motorcoaches developed in the rear of the bus, particularly in the wheel well and engine compartment (accounting for 40 percent of fires); and that these fires, because of their locations, often grew before they were detected. The report also recognized that motorcoaches contain large amounts of materials capable of supporting combustion and producing smoke and flames.[104]

**FMCSA Stakeholder Forums.** In February–March 2003, the FMCSA held a series of five forums to gather stakeholder input regarding the agency's research agenda and to educate stakeholders about the Office of Research and Technology and ongoing projects. More than 150 recommendations were made by stakeholders to the FMCSA, one of which pertained to vehicle-related research to "study the adequacy of motor coach evacuation plans for disabled and/or wheelchair dependent riders."[105] To date, no research or further information on this proposal has been published.

**Emergency Evacuation of Civil Aircraft.** In July 1977, the FAA published a report on emergency escape of handicapped air travelers,[106] which included discussion of a Civil Aeromedical Institute investigation of potential problems related to the emergency evacuation of civil aircraft carrying persons with special needs. The study included an analysis of the movement of individual subjects in an aircraft cabin and the results of

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[103] U.S. Department of Transportation, *Evacuation and Rescue of Elderly and Disabled Passengers From Paratransit Vans and Buses*, Report UMTA-MA-06-0152-84-3 (Washington, DC: 1984).

[104] Such materials include wooden floors with rubberized coverings, foam insulation and upholstery, fiberglass-reinforced polyester resin body panels and components, and plastic-coated trim panels and wiring harnesses.

[105] See<www.fmcsa.dot.gov/facts-research/research-technology/report/forum-report-digital-version-all.htm>, July 20, 2006.

[106] U.S. Department of Transportation, Federal Aviation Administration, *Emergency Escape of Handicapped Air Travelers*, Report FAA-AM-77-11 (Washington, DC: FAA, 1977).

evacuation tests in which a portion of the test subjects either were disabled or had simulated disabilities. The report concluded:

> Assisting handicapped passengers in an aircraft cabin is difficult because of space limitations generated by the seat configurations. Fixed armrests, restrictive seat pitch (distance between similar points on seats), and restrictive aisle widths made assistance difficult and interfered with movement.

The evacuation tests showed that 96 percent of ambulatory disabled persons reached the exit in 30 seconds or less, though only 37 percent of nonambulatory persons reached the exit in that time. These latter subjects would probably require assistance from other passengers or crew during a critical evacuation; this conclusion, according to the FAA, is in agreement with the results of previous evacuation demonstrations and analyses of accident data, which indicate that passenger movement at a rate of at least 1 foot per second is the minimum required for a successful evacuation.

### *Federal Motor Vehicle Safety Standards*

The purpose of the DOT's FMVSSs is to reduce the risk of a vehicle crash by specifying minimum performance levels for brakes, lights, and other components; and to reduce the risk of injury, should a crash occur, by specifying minimum requirements for vehicle performance as related to occupant protection, occupant restraints, roof and body joint strength, fuel system integrity, and child safety systems.

FMVSS 301, Fuel System Integrity, was issued to reduce the risk of fatalities and injuries due to fires from motor vehicle crashes. The standard applies to passenger cars, light trucks, and school buses with applicable fuel (boiling point above 32º F). It prescribes impact test requirements to strengthen and protect the vehicle's fuel system and to reduce the likelihood of fuel-fed fires caused by fuel system breaches into the vehicle. FMVSS 301 does not apply to buses with a gross vehicle weight rating over 10,000 pounds or to motorcoaches.

FMVSS 302, Flammability of Interior Materials, was issued to reduce the deaths and injuries to motor vehicle occupants caused by vehicle fires, especially those originating in the interior of the vehicle from sources such as matches and cigarettes. This standard specifies burn resistance requirements for materials used in the occupant compartments of motor vehicles. It applies to passenger cars, multipurpose passenger vehicles, trucks, and buses.

### *Emergency Evacuation of Persons With Special Needs*

Federal, State, and local governments, as well as individual health care facilities, have plans for responding to emergencies such as hurricanes. At the Federal level, the National Response Plan (NRP)[107] provides the framework for how the Federal government

[107] As established by Homeland Security Presidential Directive 5, the NRP is intended to provide a single comprehensive approach to domestic incident management to prevent, prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies.

will assist States and localities in managing domestic incidents. The National Disaster Medical System (NDMS),[108] an NRP program, includes assistance to State and local governments specifically with evacuation of hospital residents. Neither the NRP nor the NDMS addresses the evacuation of residents in nursing homes or assisted living centers, rehabilitation facilities, or hospice care.

Nursing home residents fall within the broad category of populations that face particular challenges during emergencies. Nursing homes that participate in Medicare and Medicaid must comply with standards established by the HHS Centers for Medicare and Medicaid Services (CMS), which include requirements that they have plans to meet potential emergencies and disasters; the interpretive guidelines do not specifically refer to evacuation of residents. According to a July 2006 Government Accountability Office (GAO) report to Congress on evacuation of health facilities during disasters, CMS officials have established a working group to review hospital and nursing home requirements for emergency preparedness, including issues related to evacuation.[109]

At the Safety Board public hearing, participants discussed a range of issues concerning emergency preparedness for persons with special needs. The director of the emergency preparedness initiative for the National Organization on Disability, a witness at the hearing, defined persons with special needs as "people with disabilities, mobility impairments, sensory impairments, [or] cognitive or mental health impairments." The senior director of the Florida Health Care Association Quality Credentialing Foundation explained at the public hearing that sheltering in place is often preferable to evacuating nursing home residents because of the risk of transporting the medically frail.

Other hearing participants also stressed the difficulty of obtaining appropriate evacuation transportation in an emergency. Once the decision to evacuate is made, numerous factors have to be considered, such as the medical, mobility, and mental conditions of each individual. These factors affect the optimum mode of transportation, which in some cases will be ambulance. During a large-scale evacuation, such as those typical of a hurricane response, hospitals and other facilities for acutely ill individuals are prioritized for the limited number of ambulance and similar transportation assets in the community. Included in the public hearing was discussion of how the lack of coordination among State emergency response agencies and the lack of interstate emergency mutual aid agreements could hamper the effectiveness of evacuating persons with special needs.

**Texas Evacuation of Persons With Special Needs.** When Hurricane Rita approached the Texas Gulf Coast, government and private entities began considering the evacuation of coastal areas. According to the Texas Building and Procurement

[108] The NDMS—a partnership of the U.S. Department of Homeland Security (DHS), U.S. Department of Defense, U.S. Department of Health and Human Services (HHS), and U.S. Department of Veterans Affairs—can be activated to assist in medical response and patient evacuations. Within the NDMS, the DOT is responsible for patient evacuation from mobilization centers (airfields) to Federal coordination centers and medical facilities.

[109] Government Accountability Office, *Disaster Preparedness Limitations in Federal Evacuation Assistance for Health Facilities Should be Addressed*, GAO-06-826 (Washington, DC: GAO, 2006) 17. See <www.gao.gov/cgi-bin/getrpt?GAO-06-826>, September 26, 2006.

Commission (TBPC), it was tasked during a September 19, 2005, State Operations Center meeting with procuring 1,100 buses and motorcoaches for the evacuation of persons in levels 1 through 3 of special needs assistance.[110] The TBPC contacted the American Bus Association, the United Motorcoach Association, and the Texas Bus Association for assistance in fulfilling this procurement. The TBPC eventually contracted with 48 charter bus and motorcoach companies, which provided 307 charters; it had attempted to obtain handicap-accessible buses and motorcoaches, with the objective of having one-third of the vehicles be compliant with the Americans With Disabilities Act (ADA).[111]

When a government or private entity requested evacuation transportation assistance via the State of Texas Emergency Operations Center, the TBPC was contacted to dispatch motorcoaches from one of the three staging areas under TxDPS control. Some specialty buses and motorcoaches were available to accommodate passengers with special needs. The TBPC stated that it was able to meet all transportation requests made through the operations center during the emergency. Sunrise management stated that they were not aware of the State's TBPC transportation assistance when they chartered through BusBank.

Since Hurricane Rita, the TBPC has entered into contingency contracts with carriers for 1,020 buses and motorcoaches.[112] It has also awarded a contingency contract for bus transportation management services[113] to Coach USA, LLC (CUSA).[114] In the event of an emergency, CUSA is to provide logistical support, dispatch services, and an additional 80 motorcoaches. CUSA representatives will work from the State Emergency Operations Center 24 hours a day and provide support at staging areas. CUSA will have direct technical supervision over carriers during the evacuation process and is responsible for ensuring that buses and motorcoaches are appropriately equipped for the assigned mission, including having necessary ADA accommodations, sufficient fuel, functioning air conditioning, and on-board toilets and safety equipment.

**Texas Task Force on Evacuation, Transportation, and Logistics.** In October 2005, the Governor of Texas appointed a 14-member task force to document lessons learned from the hurricane evacuation and to make recommendations for improving

[110] Texas categorizes special needs individuals under five levels of increasing assistance. Level 1: dependent on others for routine care, such as eating, walking, and toileting; level 2: disabilities such as hearing or vision impairment; level 3: assistance with medical care administration or dependent on equipment; level 4: living outside an institutional facility care setting but requiring extensive medical oversight, such as needing a ventilator or life support assistance; and level 5: needing the highest level of care and living in an institutional setting.

[111] The TBPC said that it considered using school buses and municipal mass transit but determined that this was not feasible because of the long distances likely to be traveled during a major evacuation, as well as fueling considerations.

[112] The State of Texas has identified the need for 1,100 motorcoach-type buses to evacuate its special needs populations. One-third of the contracted vehicles must be ADA compliant.

[113] The motorcoach contracts require that contractors provide copies of their insurance and have a satisfactory FMCSA safety rating. The contractors may not have existing contingency contracts that would take precedence over the State of Texas contract.

[114] CUSA, operating under the Coach USA brand name, is one of the Nation's leading providers of motorcoach services.

evacuation plans and execution. On February 14, 2006, the task force issued its final report,[115] including information from public hearings held with stakeholders such as evacuees, local and State officials, charitable organizations, relief and hospital workers, medical personnel, and individuals with special needs and their caregivers.

The task force found that Texas does not clearly assign responsibility for identifying, transporting, and sheltering individuals with special needs. To address this problem, it recommended that the Governor "direct the development and implementation of a statewide special needs evacuation and shelter plan." The task force noted that care should be taken to ensure that the plan includes citizens with special needs who do not live in an institutional environment and that officials should maintain a database of citizens with specials needs to ensure proper planning and execution of their evacuation. Officials should also document those facilities or residences where medical or handicap-accessible vehicles will be required during an evacuation.

The report indicated that some Texas facilities in which individuals with special needs reside do not have evacuation plans, and some that do have plans may not have ensured that they are adequate and up to date. The task force recommended that the Governor "direct all licensed and unlicensed special needs facilities to maintain evacuation plans that have been approved by the local jurisdiction and the Regional Unified Command" and update them annually. Governor Executive Order RP-57, issued on March 21, 2006,[116] directed the implementation of the task force recommendations.

### *Federal Evaluation of Catastrophic Hurricane Evacuation Plan*

After Hurricanes Katrina and Rita struck the Gulf Coast in 2005, Congress asked the DOT, in cooperation with the DHS, to "review and assess Federal and State evacuation plans . . . for catastrophic hurricanes and other catastrophic events impacting the Gulf Coast region." The DOT issued its report to Congress on June 1, 2006.[117] The report covered the evacuation of persons with special needs and the broader topic of the roles of Federal, State, and local governments in evacuations.

Based on its evaluation of State and local evacuation plans in each of the five Gulf Coast States (Alabama, Florida, Louisiana, Mississippi, and Texas), the DOT determined that "a significant majority of the evacuation plans were judged to be either marginally or partially effective regarding provisions for evacuating persons with various special needs."[118] In particular, the report noted that the plans do not have detailed information on precisely how to evacuate special needs populations or what additional resources are necessary to do so. Furthermore, the evacuation plans of residential facilities are often not coordinated with emergency management authorities and may not function adequately within the larger evacuation framework.

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[115] See <www.governor.state.tx.us/divisions/press/files/EvacuationTaskForceReport.pdf>, September 26, 2006.

[116] See <www.governor.state.tx.us/divisions/press/exorders/rp57>, September 26, 2006.

[117] See <www.fhwa.dot.gov/reports/hurricaneevacuation/rtc_chep_eval.pdf>, September 26, 2006.

[118] U.S. Department of Transportation and U.S. Department of Homeland Security, *Catastrophic Hurricane Evacuation Plan Evaluation: A Report to Congress* (Washington, DC: DOT, 2006) 4-3.

The DOT is developing a primer on evacuating populations of persons with special needs, which is intended to include essential information and technical assistance for State and local authorities, as well as for nongovernment entities charged with evacuating and sheltering people with special needs. A DOT inventory of more than 100,000 buses and motorcoaches nationwide is available for evacuation use. The DOT is working with the American Bus Association to index the capabilities of this inventory, including wheelchair compatibility, as well as the number and location of evacuation-ready vehicles and drivers.

The DOT report to Congress made several recommendations to improve mass evacuation planning and implementation, including joint development of regional mass evacuation plans by State and local authorities, with Federal agency input; involvement of nursing homes and other representatives of persons with special needs, as well as transportation agencies and operators, in the development of regional plans; and cooperation of State and local authorities in working with communities to develop systems to provide specialized transport or shelter during such events.[119] (See appendix F for Federal special needs evacuation recommendations.)

### *GAO Report on Disaster Preparedness*

On July 20, 2006, the GAO issued a report on the evacuation of hospitals and nursing homes during disasters,[120] indicating that the 2005 Hurricane Katrina response propelled the study. The report focused on the deficiencies of the NRP and the NDMS with respect to evacuating nonhospital health facilities, such as nursing homes and long-term care facilities. One of the main problems the GAO identified was the difficulty of arranging evacuation transportation. Even when facilities had contracts with transportation providers, "competition for the same pool of vehicles created supply shortages."[121] Neither the NRP nor the NDMS was designed to help State and local governments evacuate healthcare facilities other than hospitals.

The report also noted two limitations of the NDMS that negatively affect its capability of assisting State and local governments with patient evacuation:

- NDMS evacuation efforts begin at a mobilization center, such as an airport, and do not provide for ambulances or other means of short-distance transportation necessary to move residents from healthcare facilities.
- The NDMS was not set up to handle the emergency transportation of persons with special needs who are not hospitalized, including nursing home residents.[122]

The GAO report called for executive action to clearly delineate how the Federal Government would assist State and local authorities in transporting hospital and nursing home occupants to mobilization centers (such as airports), where NDMS transportation

[119] *Catastrophic Hurricane Evacuation Plan Evaluation: A Report To Congress*, ES-11 and ES-12.

[120] *Disaster Preparedness: Limitations in Federal Evacuation Assistance for Health Facilities*.

[121] *Disaster Preparedness: Limitations in Federal Evacuation Assistance for Health Facilities*, 4–5.

[122] *Disaster Preparedness: Limitations in Federal Evacuation Assistance for Health Facilities*, 15–17.

responsibilities begin. It further recommended that the NDMS Federal partner agencies work together to determine how best to address the needs of nursing home residents during emergency evacuations. (See appendix F for Federal special needs evacuation recommendations.)

### *Lessons Learned From Federal Response to Hurricane Katrina*

Following Hurricane Katrina, the Federal Government formally reviewed its response to this natural disaster. The Assistant to the President for Homeland Security and Counterterrorism submitted to the President *The Federal Response to Hurricane Katrina: Lessons Learned* report in late February 2006.[123] The report included a section on the evacuation of populations of persons with special needs. Among FEMA's critical challenges, as listed in the report, was providing buses and motorcoaches in coordination with the DOT, as provided in the NRP's Emergency Support Function (ESF) #1, Transportation.[124]

The White House report made 125 recommendations for improving future Federal responses to disasters, 3 of which concern evacuation, as summarized below:

- Because of shortcomings in the Federal Government's coordination of transportation during the Hurricane Katrina evacuations, the DOT should be designated as the primary Federal agency for conducting evacuations when State and local government resources are overwhelmed, and the DOT should conduct drills for undertaking this responsibility.
- The DHS should require State and local governments to "develop, implement, and exercise" plans for emergency evacuations.
- The DHS should also evaluate the evacuation plans of all States, as well as of the 75 largest urban areas in the United States.

See appendix F for Federal special needs evacuation recommendations.

[123] The White House, *The Federal Response to Hurricane Katrina: Lessons Learned* (Washington, DC: 2006). See <www.whitehouse.gov/reports/katrina-lessons-learned/>, September 26, 2006.

[124] *The Federal Response to Hurricane Katrina: Lessons Learned*, 56.

# Analysis

The Safety Board considered the circumstances of the accident and several factors that may have been causal to the motorcoach fire, in addition to identifying safety issues related to vehicle fire reporting and inconsistent data within Federal accident databases, the FMCSA compliance review program, emergency egress from motorcoaches, fire resistance of motorcoach materials and designs, manufacturer maintenance information on wheel bearing components, transportation of partially pressurized aluminum cylinders, and emergency transportation of persons with special needs. Following a brief discussion of factors that were determined *not* to be causal to the accident, this analysis discusses causal factors and other safety issues.

## Exclusions

The weather was clear and dry at the time of the accident. No defects in the highway or road design were found that would have caused or contributed to the accident. Although the hurricane evacuation was the reason for the trip, the Safety Board concludes that neither the weather conditions at the time nor the design and condition of the roadway caused or contributed to the accident. Following the accident, the motorcoach driver was not tested for alcohol because the Dallas County Sheriff's officers detected no evidence of alcohol use or impairment. Although 49 CFR Part 382 required Global to conduct postaccident testing for alcohol and illicit drugs, the company failed to do so; therefore, the Safety Board could not determine whether the driver was under the influence of alcohol or illicit drugs at the time of the accident. Because the motorcoach driver had been on duty for over 24 hours and had been driving consistently in heavy traffic for about 12 hours, it is highly unlikely that he had the time or the means by which to consume alcohol or illicit drugs. According to the FMCSA, Global is no longer in operation; nevertheless, the Safety Board is disappointed that the company failed to fulfill its responsibility for testing the driver for alcohol or illicit drugs following the accident.

Although the motorcoach driver stated that he had been diagnosed with type 2 diabetes and was under a physician's care in Mexico, neither he nor his employer provided the Safety Board with objective documentation regarding his condition. Therefore, the Safety Board concludes that a determination could not be made regarding the potential impact of the motorcoach driver's medical condition on his response to the emergency.

When the fire occurred about 6:07 a.m. on September 23, 2005, the motorcoach driver had been on duty for just over 25 hours, and 21 hours of this time was spent driving. In addition, the fire occurred at a time of day when even well-rested individuals with daytime work hours (such as the accident driver) experience the lowest levels of alertness

and performance. Scientific research has shown that fatigue is related to much more than just the time spent on a task,[125] such as driving. Researchers have studied factors that affect fatigue, such as duration and quality of sleep,[126] shift work, work schedules,[127] circadian rhythms,[128] and time of day.[129] Cumulative sleep loss and circadian disruption, which the accident driver may have experienced during the Hurricane Rita evacuation emergency, can lead to a physiological state characterized by impaired performance and diminished alertness.[130] Nonetheless, investigators determined that the wheel bearing fire occurred independent of the driver's condition or actions. The Safety Board therefore concludes that the motorcoach driver was fatigued at the time of the tire fire, but his fatigue was not a causal factor in the accident.

When the driver arrived in Bellaire at 11:00 a.m. on September 22, from Pharr, Texas, he had been driving for 6 hours. He began driving again between 3:00 and 3:30 p.m., when he left Bellaire, heading to Dallas. By 7:00 p.m., the motorcoach driver had reached the FMCSA-permitted hours-of-service threshold of 10 hours of driving. Thus, during the remainder of the time that he was driving, from 7:00 p.m. on September 22 until 6:00 a.m. on September 23, when the accident occurred, the driver exceeded the hours of service by 11 hours. Title 49 CFR 395.5 prohibits a passenger-carrying driver from driving more than 10 hours until being off duty for at least 8 consecutive hours; however, the regulations also state that a driver, in case of any emergency, may complete his or her run without being in violation of the provisions of the regulations, if such run reasonably could have been completed absent the emergency. The expected trip from Bellaire to Dallas was 4 hours, which would have concluded (absent the emergency situation of the hurricane evacuation) within the driver's hours of service. Further, the Governor of Texas issued a proclamation on September 23, 2005, exempting all carriers and drivers involved in, and caught in, the hurricane evacuation from the hours-of-service regulations violations. Suspending the trip until the driver could obtain sufficient rest was

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[125] M. H. Kryger, T. Roth, and W. C. Dement, eds., *Principles and Practice of Sleep Medicine* (Philadelphia, PA: W. B. Saunders Company, 1994).

[126] (a) L. C. Johnson and P. Naitoh, *The Operational Consequences of Sleep Deprivation and Sleep Deficit*, AGARD-AG-193 (London, U.K.: North Atlantic Treaty Organization, 1974). (b) M. R. Rosekind, P. H. Gander, L. J. Connel, and E. L. Co, *Crew Factors in Flight Operations, X: Alertness Management in Flight Operations*, NASA/FAA Technical Memorandum DOT/FAA/RD-93/18 (Washington, DC: National Aeronautics and Space Administration, 1994). (c) National Transportation Safety Board, *Factors That Affect Fatigue in Heavy Truck Accidents*, Safety Study NTSB/SS-95/01 and /02 (Washington, DC: NTSB, 1995).

[127] (a) S. Folkard, T. H. Monk, and M. C. Lobban, "Towards a Predictive Test of Adjustment to Shiftwork," *Ergonomics*, Vol. 21 (1979): 785–799. (b) G. R. Thomas, T. G. Raslear, and G. I. Kuehn, *The Effects of Work Schedules on Train Handling Performance and Sleep of Locomotive Engineers: A Simulator Study*, DOT/FRA/ORD-97-09 (Washington, DC: Federal Railroad Administration, 1997).

[128] M. H. Kryger, T. Roth, and M. Carskadon, "Circadian Rhythms in Humans: An Overview," *Principles and Practice of Sleep Medicine* (Philadelphia, PA: W. B. Saunders Company, 1994) 301–308.

[129] C. D. Wylie, T. Schultz, J. C. Miller, and others, *Commercial Motor Vehicle Driver Fatigue and Alertness Study: Project Report*, FHWA-MC-97-002 (Washington, DC: Federal Highway Administration, 1996).

[130] M. R. Rosekind, R. C. Graeber, D. F. Dinges, and others, *Crew Factors in Flight Operations, IX: Effects of Planned Cockpit Rest on Crew Performance and Alertness in Long-Haul Operations*, NASA Technical Memorandum 108839, DOT/FAA/92/94 (Washington, DC: National Aeronautics and Space Administration, 1993).

not a viable option due to the impending hurricane and immense traffic delays and the lack of facilities for parking a motorcoach occupied by persons with special needs, including two who were reliant on a limited supply of medical oxygen.

The initial 911 calls provided an inaccurate location for the motorcoach accident, the Wilmer dispatch office had only one dispatcher on duty to handle all emergency calls, and the route to the accident was heavily congested with evacuation traffic. Nonetheless, several officers and deputies from the Wilmer Police Department and the Dallas County Sheriff's Office were on scene within minutes. The first emergency call was received at 6:07 a.m., and by 6:15 a.m., within 8 minutes, the fire had spread so extensively that the motorcoach was inaccessible for evacuation of the remaining passengers.

Despite the initial setback to the arrival of the Wilmer Fire Department, the emergency dispatch of personnel and equipment and the arrival of law enforcement officers on scene were not unduly delayed. Once the firefighters arrived about 6:24 a.m., they promptly began to extinguish the fire, thereby preventing its spread to surrounding areas and vehicles. Postaccident, the city of Wilmer installed an updated automated dispatch system to more effectively handle heavy call volumes and dispatching in emergencies. Although only a few minutes were available for the rescue of passengers from the motorcoach, the on-scene medical care and preparation for transport to hospitals were prompt and efficient. Therefore, the Safety Board concludes that appropriate resources were dispatched to the accident scene, that responders and medical personnel arrived as quickly as possible, considering the heavily congested roadways and the initially erroneous information about the accident location, and that the injured received medical care and were transported to local hospitals in a timely manner.

## Accident Discussion

The Safety Board identified several factors indicating that the motorcoach caught on fire because of a lack of lubrication of the right-side tag axle wheel bearing, wheel bearing failure, and subsequent ignition of the tire. Among these factors were physical evidence from the scene and vehicle, along with interviews of Global's owner and the accident motorcoach driver.

The Safety Board examined why the accident motorcoach driver, and the mechanic who provided roadside assistance on the day of the accident, did not recognize the first flat tire as an indication of an underlying mechanical issue with the vehicle. The motorcoach driver was initially alerted to the flat tire when he heard the tire blow out, and he took prudent action in pulling the motorcoach onto the interstate shoulder for the tire change. Because the flat tire occurred during the nighttime and in the middle of hurricane evacuation traffic congestion, the driver and the mechanic would not necessarily have been aware of the tire marks left by a locked wheel. When the driver assisted the mechanic by taking the flat tire and placing it into the spare tire compartment, the flat spot on the tire and wheel should have been noticeable under proper lighting conditions.

However, in the circumstances that existed at the time of the tire change, even a careful driver may not have made the connection that the flat wheel rim was caused by a locked wheel dragging—and not by pulling off onto the shoulder with an already flattened tire that was exposed to contact between the rim and the road surface. The Safety Board does not believe that a motorcoach driver, when involved in the same evacuation situation with similar environmental conditions as were present at the time of the tire change, would necessarily suspect a potentially hazardous mechanical malfunction beyond a flat tire. Moreover, given the 5 minutes during nighttime hours in which the mechanic changed the tire, as well as the urgency to move the motorcoach, which was partially blocking hurricane evacuation lanes, the mechanic did not have the opportunity to assess what conditions may have led to the flat tire.

The Safety Board also considered whether construction of the motorcoach contributed to the rapid propagation of the fire and whether motorcoach emergency egress systems afforded safe evacuation to occupants.

### *Heat Source and Fire Ignition*

The Navarro County Sheriff's Department received a call for the motorcoach flat tire at 3:22 a.m. on September 23, 2005, near Rice, Texas. Postaccident examination of the motorcoach and roadway revealed that the right-side tag axle (3R) tire locked just south of FM 1126, leaving 6,800 feet of tire marks on the I-45 road surface. When the 3R tire locked, the portion of the tire contacting the pavement was being pulled—not rolling—which caused the blown tire. Once the tire flattened, the weight of the vehicle caused contact between the pavement and wheel rim, wearing a flat spot on the rim. The driver heard the right-rear tire blow out, and he pulled off the roadway.

The mechanic who responded to the call for roadside assistance finished the tire change by about 4:30 a.m.; however, he did not notice the locked wheel and replaced the blown tire with the motorcoach spare tire. Once the tire was changed, the Rice police officer advised the driver and the mechanic to drive their vehicles to the next exit to complete payment. Afterward, the motorcoach driver reentered I-45 and continued driving north.[131] Less than 1 hour later, a motorist observed that the right-rear wheel was glowing orange-red and stopped the motorcoach driver to inform him of the problem. The driver moved the motorcoach across the lanes of travel, pulled off onto the shoulder, exited the vehicle, and immediately observed flames in the right wheel well. The Safety Board determined that the accident sequence of events began with a lack of lubrication in the right-side tag axle wheel bearings, which ultimately led to the tire fire.

A wheel bearing unit can fail when it lacks lubrication, which prevents the bearing rollers from rotating freely and leads to friction, which in turn begins to generate heat. The

[131] When wheel bearings seize and lock a wheel, it is possible that after a short period of cooling (such as might have taken place while waiting for the mechanic) the bearing rollers will reposition, allowing the hub and wheel to rotate again. The 3R wheel may also have rolled again due to the rollers being jarred when the motorcoach was placed on jacks, thereby allowing the applied spring brake to reposition both the 3R wheel and the rollers enough to allow the vehicle to move forward. Once the motorcoach reentered I-45 north, the temperature in the 3R wheel components, including the hub assembly, began to rise again.

heat increases metal temperatures, causing deformation of the bearing rollers. The wheel bearings on the accident motorcoach were subjected to increased temperatures as they continued to support the weight (load) of the vehicle. As the roller metal began to degrade, the rollers started to flatten, disintegrate, and break down metallurgically. To deform and flatten, the rollers had to be subjected to temperatures of at least 1,000º F. The flattening of the rollers allowed them to be expelled from the bearing cages; the rollers then began to slide around within the bearing cup, and the bearing components lost concentricity around the axle spindle.

Because the flattened rollers no longer supported the weight of the motorcoach and no longer maintained evenly spaced wheel assembly parts, they continued to degrade and caused the wheel, hub, and rotor assembly to shift out of position. The outer edge of the brake rotor made contact with the underside of the disc brake carrier and caliper bridge. Heat and deformation caused some of the rollers to fuse, preventing the rotation of the wheel and hub and changing the orientation of the brake rotor and hub assembly, which caused contact with the foundation brakes. One witness at the Safety Board public hearing, the senior director of the North American brake business unit for ArvinMeritor, explained that as the wheel bearings continued to deform and increase friction within the wheel, the out-of-position brake rotor and hub assembly caused contact between the brake parts. With the rotor, carrier, and caliper bridge now in contact, the rotor began to grind against the stationary disc brake carrier and caliper bridge. This contact then increased the friction, which caused an increase in metal component temperatures and a rise in air temperatures within the wheel well surrounding the rubber tire. Friction from the grinding transferred heat to the wheel hub, which became visible as the bright red glow seen by the witness who stopped the motorcoach and warned the driver. This friction, coupled with the frictional forces generated by the turning rotor contacting the brake shoes, was enough to lock and prevent turning (rolling) of the 3R wheel (also referred to as "seizing") at highway speeds.[132]

At some time in this sequence, the aluminum hubcap melted off the hub end; this event would have occurred when the hubcap reached an approximate temperature of 1,150º F, at which point some of the hot and deformed rollers from the outer bearing cup were expelled from the hub and landed on the pavement.[133] As noted by the ArvinMeritor representative, when the motorcoach came to rest, the now deflated tire came in contact with an area that "clearly had metal temperature in excess of the temperature required to ignite the rubber tire" (greater than 800º F). Safety Board tire fire testing conducted in August 2006 produced similar results when a motorcoach was run on a test track with wheel bearings lacking lubrication. The bearings failed, and the brake components overheated and subsequently came in contact with a blown tire, causing it to ignite.

Thus, the Safety Board postaccident investigation showed that the right-side tag axle (3R) wheel hub assembly was the cause of the motorcoach fire. The Safety Board concludes that the accident motorcoach was mechanically unsafe because the right-side

[132] In effect, this action binds the wheel to the axle.

[133] These rollers were found by Safety Board investigators on the pavement in the area of the grass fire, approximately 3.2 miles south of the accident location.

tag axle wheel bearing assembly lacked sufficient lubrication, which resulted in high frictional forces and high temperatures, causing the wheel bearings to fail and igniting the tire.

### *Motorcoach and Bus Fire Data*

After this accident, the Safety Board was given access to insurance data from two companies and to the analyses performed by two large self-insured passenger-carrying motor carriers. Although these sources provided considerable data on motorcoach and bus fires, the databases do not cover the entire spectrum of bus fires. Local fire departments report vehicle fires to the States, and the States then report the data to the NFPA. However, the reporting requirements vary; and the definition of buses is broad, thus making it difficult even to search the NFPA data for information on motorcoach fires. Further, police agencies use the ANSI *Manual on Classification of Motor Vehicle Traffic Accidents*, which defines traffic accidents as involving motor vehicles in transport on a trafficway.[134] Motorcoach or bus fires that are not caused by vehicle collisions or do not originate while the vehicle is on the roadway are often not included in these databases. As a result, major highway safety accident data files, such as NHTSA's FARS and GES, which collect data from police reports, do not capture the entire motorcoach or bus fire problem.

Other inconsistencies in fire reporting data are apparent as well. For example, the GES database listed only two motorcoach accidents from 1995–2003 that involved fires. The FARS data for 1994–2004 revealed 24 fatal motorcoach fires, a finding inconsistent with the GES data. Further, the FMCSA's MCMIS data from 1995–2005 reported 265 motorcoach fires, of which 4 involved fatalities.

The MCMIS accident file was developed to allow research on motor carrier safety problems and to potentially provide a census of all trucks and buses involved in traffic accidents. In 2002, the Safety Board noted the FMCSA's acknowledgement that not all accidents were reported for inclusion in the MCMIS,[135] even though the accident file is intended to be a census of fatal injury- and property damage-only accidents. Although the accident file contains State-supplied data from police reports involving drivers and vehicles of all motor carriers operating in the United States, an FMCSA evaluation of the database found that the overall reporting level of fatal and nonfatal involvements was lower than expected for both trucks and buses, at 63 percent and 44 percent, respectively. As a result, the FMCSA has contracted with the University of Michigan Transportation Research Institute to monitor and evaluate improvements in accident reporting by the States and resulting effects on the quality of MCMIS data.

At the Safety Board public hearing, the FMCSA reported that it has recognized the difficulty in obtaining meaningful motorcoach and bus fire data and has contracted with the Volpe Center to gather data and studies relating to motorcoach fires, set up a database or spreadsheet system to structure the data, and analyze the motorcoach and bus fire

[134] *Manual on Classification of Motor Vehicle Traffic Accidents*, section 2.4.18.

[135] National Transportation Safety Board, *Analysis of Intrastate Trucking Operations*, Safety Report NTSB/SR-02/01 (Washington, DC: NTSB, 2002).

problem, including causes, frequency, and severity.[136] Although the Safety Board supports this initiative and looks forward to the anticipated completion of the Volpe study in March 2007, the Board is concerned that the gathering and analysis of bus and motorcoach fire data by the FMCSA Volpe contract will not provide for ongoing statistical compilation and study. The Safety Board concludes that continuing analysis of motorcoach and bus fire data is vital to understanding not only the trends in these vehicle fires, but also the success or shortcomings of measures taken by the Government and private industry to address this problem. Therefore, the Safety Board believes that the FMCSA should establish a process to continuously gather and evaluate information on the causes, frequency, and severity of bus and motorcoach fires and conduct ongoing analysis of fire data to measure the effectiveness of the fire prevention and mitigation techniques identified and instituted as a result of the Volpe National Transportation Systems Center fire safety analysis study.

### *Fire Propagation Into Fuel Sources*

When fire burns in a confined space, the heat feedback from surroundings causes the material to burn more intensely. In this accident, the heat radiated by the glowing hub components and the confinement of the rubber tire within the wheel well significantly increased the rate at which the fire burned. From the burning 3R tire, the fire spread to adjacent tires, to other combustible wheel well area components,[137] and to the composite exterior of the motorcoach. In addition, significant amounts of diesel fuel from the fuel delivery system became involved and accelerated the spread of the fire during the incipient stage.

In the accident motorcoach, the fuel lines were routed through a centerline tunnel in the undercarriage. Two small access panels made of a combustible material separated the fuel lines from the wheel well. One access panel was completely consumed by fire, and the other was partially melted and deformed. The thermoplastic fuel lines were completely consumed by fire from the engine compartment to a point within 1 foot of the fuel tank. In motorcoaches, fuel lines located near engine compartments and service tunnels can burn through and provide volatile fuel to an existing fire, causing a significant increase in the fire hazard. In this accident, burnthrough occurred once the tire fire breached the two combustible access panels to the service tunnel and the fuel lines in the engine compartment. Therefore, the Safety Board concludes that, because of the proximity of the combustible access panels to the tire wheel well, where the fire originated, the fuel delivery system contributed to acceleration of the fire.

Replacement of the combustible access panel with a fire-resistant barrier might preclude the early involvement of fuel in a fire in the wheel well area and thereby limit the rate of fire spread. NHTSA has developed a fuel system crashworthiness standard (FMVSS 301) to limit the amount of fuel spill as a result of an accident and thus reduce the chance of a catastrophic postcrash fire. However, this FMVSS does not apply to motorcoaches. Therefore, the Safety Board believes that NHTSA should develop an

[136] *Motor Coach Fire Safety Analysis Work Plan*.

[137] These components include bushings, mud flaps, and suspension system air bags.

FMVSS to provide enhanced fire protection of the fuel system in areas of motorcoaches and buses where the system may be exposed to the effects of a fire. During the Safety Board's public hearing, the office director for the rulemaking section of NHTSA's Crashworthiness Standards Division stated that FMVSS 302[138] is a performance (not design) requirement that "allows the latitude of the manufacturers so that the motorcoach, or any other type of a motor vehicle manufacturer, has the latitude to develop any innovative technologies." Accordingly, until NHTSA has developed a performance standard for enhanced fire protection of fuel systems in newly manufactured motorcoaches and included it in the FMVSSs, as requested in Safety Recommendation H-07-4, the Safety Board believes that manufacturers of motorcoaches for use in the United States should use materials and designs for fuel system components that are known to provide fire protection for the system.

### *Fire Propagation Into Passenger Compartment*

The most likely point of initial entry of a fire into a motorcoach is burnthrough of the combustible exterior composite materials just above the passenger-side rear wheel well area, followed by movement into the passenger compartment via both the HVAC system and the windows. In the case of a tire fire, the geometry of the wheel well and the buoyant nature of fire cause the flames to impinge on the sidewall; this exposure to severe heat is what leads to burnthrough of the combustible sidewall materials. In the accident motorcoach, the panels inside the wheel well area (those facing the roadway) were lined with stainless steel, which acted as a barrier to the fire. However, as the fire intensified above the wheel well, it burned through the exterior composite material and underlying sidewall foam insulation. The HVAC ventilation ductwork that ran along the sides of the motorcoach at the floor level opened a path for the fire and smoke, as evidenced by the destroyed recirculation duct in the right-rear wheel area and the aluminum return ducts and adjoining parts that showed signs of severe heat exposure. The missing sections had been located above the wheel well areas on both sides of the motorcoach.

During the public hearing, the senior technical advisor for the motorcoach manufacturer MCI noted that body panels on coaches have been made of aluminum, steel, or fiberglass for many years and that both aluminum and fiberglass are combustible materials. The MCI representative further stated, "We provide an interior inner fender barrier between the tire area and the passenger compartment. It is always made out of stainless steel." He explained that the exterior of the vehicle is the most prominent path of fire into the interior as flames travel up the outside and past the windows, superheating the windows and causing them to break, allowing entry into the passenger compartment.

The burnthrough of the exterior wall allowed the fire's intense heat and smoke—byproducts of the burning tires, foam, and fiberglass—to enter the passenger compartment, where interior components also began to catch on fire. The propagation of the fire into the passenger compartment and the burning of interior components caused an exponential increase in the production of smoke and heat and accelerated the fire. The

[138] This standard specifies burn resistance requirements for materials used in the occupant compartment of motor vehicles.

Safety Board concludes that the tire fire, caused by an overheated right-side tag axle wheel bearing assembly, which ignited the tire, spread up the side of the motorcoach and burnt through the fiberglass sidewall above the wheel well and through the motorcoach windows, creating an entry path for the smoke and fire into the passenger compartment.

The Federal standard for flammability of interior materials, FMVSS 302, does not apply to the exterior of motor vehicles.[139] The standard evaluates a material's capability of resisting ignition and flame spread when exposed to a small ignition source, such as a match or a lit cigarette. It does not represent fire conditions where significant preheating of the material occurs and the ignition source is large. Additionally, the standard only tests materials in the horizontal orientation, which is a far less challenging test than the vertical orientation.

MCI's senior technical advisor stated during the public hearing that MCI uses materials throughout the coach, including exterior sidewall components, that comply with FMVSS 302. However, as is clear from this accident, the compliance of the exterior sidewall materials to this standard was inconsequential to resisting the rapid propagation of the fire, which impeded the passengers' ability to safely evacuate. Therefore, the Safety Board concludes that the exterior of the motorcoach had not been fire-hardened in fire-prone areas, such as around the wheel wells, and was not required to be by regulation, thereby limiting the time available for safe egress in the event of a fire. The Safety Board believes that NHTSA should develop an FMVSS to provide fire-hardening of exterior fire-prone materials, such as those in areas around wheel wells, to limit the potential for flame spread into a motorcoach or bus passenger compartment.

### *Tire Fires and Fire Suppression Systems*

As several witnesses at the Safety Board public hearing explained, and as documented during the motorcoach tire fire testing in August 2006, it is extremely difficult, and beyond the capacity of any practical, currently available hand-held chemical extinguisher or automatic fire suppression system, to completely extinguish a burning tire. Although the accident motorcoach driver was not able to unlatch the 5-pound dry chemical fire extinguisher, this type of fire extinguisher, as noted during the public hearing and the tire fire testing, cannot extinguish a tire fire and therefore would not have made a difference in this accident.

Various manufacturers currently sell automatic fire detection and suppression systems for transit and intercity motorcoaches[140] that target engine compartment and electrical system fires. According to the testimony of an MCI senior technical advisor at the public hearing, the number of MCI motorcoaches being sold with fire suppression systems has increased.[141] These systems generally employ spot heat detectors and a fire suppression agent distribution network with individual nozzles near the heat sensors.

[139] Title 49 CFR 571.302 applies to passenger cars, multipurpose passenger vehicles, trucks, and buses.

[140] New Jersey Transit has been using vehicles with fire detection and suppression systems since 1994.

[141] In addition, MCI has introduced the SmarTire pressure temperature monitoring system as an option in its motorcoaches.

However, none of these systems have been specifically designed to protect against and extinguish a tire fire. As the vehicle fire suppression systems product manager with Amerex Corporation stated at the public hearing, one way to prevent a fire may be to use a heat monitoring system to provide the driver with a prefire warning alert to elevated heat in a wheel well. In addition, future wheel well fire suppression systems might be designed to preempt the outbreak of a fire by monitoring the tires to detect dangerously high temperature conditions, at which point a fire suppression agent could be used to cool the tire.

In July 2006, the FMCSA announced a demonstration project initiative that will use state-of-the-art thermal imaging technology, integrated with signature recognition software, to identify faults and failures in tires, brakes, and bearings mounted on commercial motor vehicles. The contract for this 2-year project was awarded in September 2006. Additionally, the FMCSA is working with the Volpe Center to identify ways to prevent, reduce, or mitigate the severity and frequency of motorcoach fires, including the assessment of available fire suppression systems.

The Safety Board concludes that because tire fires are difficult to extinguish, early detection of potentially hazardous conditions in a wheel well area is critical, as demonstrated by the sequence of events in this accident, to eliminating the fire hazard. The Safety Board believes that NHTSA should develop detection systems to monitor the temperature of wheel well compartments in motorcoaches and buses to provide early warning of malfunctions that could lead to fires. Additionally, the Safety Board believes that NHTSA should evaluate the need for an FMVSS that would require installation of fire detection and suppression systems on motorcoaches.

## Vehicle

Global did not retain vehicle maintenance and repair records as required by the FMCSRs. Although Global had been subleasing the motorcoach for a few months prior to the accident and had conducted some repairs and one preventative maintenance servicing, it did not have in place any maintenance program to properly service the vehicle. Without pretrip inspections or the required DVIRs, Global could not ensure that the vehicle was safe to operate on a daily basis.

The absence of maintenance and repair records prevents verification that vehicles are properly inspected and maintained. For several years before the accident, Global had failed to properly maintain repair records and provide routine maintenance servicing for its motorcoaches. On April 10, 2002, the TxDPS conducted an intrastate educational review of Global and found the company to be in violation for failing to maintain vehicle inspection and maintenance records. When the FMCSA conducted a 2004 compliance review, Global was cited for violating 49 CFR 396.3(b)(2) because the carrier did not have a means of indicating the nature and date of inspection and maintenance operations that were performed on its vehicles. When the FMCSA conducted a postfire compliance review on October 7, 2005, Global was cited for failing to inspect and maintain vehicles to

ensure safe and proper operating conditions. Based on this compliance review, the FMCSA served Global with an operations OOS order, stating: "Global Limo has a grossly ineffective or nonexistent inspection, repair, and maintenance program."

The accident motorcoach had received preventative maintenance service once while being operated by Global. When interviewed, the accident driver stated that he did not conduct pretrip inspections and did not check the oil level in the hub cavity. Global's owner stated that he did not pay drivers to conduct pretrip or posttrip vehicle inspections. Because they did not conduct posttrip inspections and complete the DVIRs, as required by the FCMSA, neither the driver nor the carrier was alerted to potential vehicle defects requiring maintenance or repair.

The accident vehicle maintenance manual specifies that hub oil levels need to be checked daily. Some motorcoach models have a "sight glass" that allows observation of the oil level in the hub cavity; though the glass often becomes obscured and prevents an accurate view of oil levels, it can be cleaned or replaced. A wheel seal leak on a tag axle, however, can be observed only by inspecting the inside of the wheel for oil from a position underneath the motorcoach. The current design of the tag axle wheel hub makes it difficult for a roadside safety inspector to check for a wheel seal leak without an undercarriage vehicle inspection. The Safety Board concludes that because neither Global nor its employees routinely inspected the hub oil level or undercarriage of the wheel well, they did not discover the lack of lubrication of the tag axle wheel bearings; and this disregard for vehicle maintenance, pretrip inspections, and posttrip DVIRs led to a wheel bearing failure that resulted in a catastrophic fire and loss of life.

Although manufacturers recommend checking the wheel bearing lubricating oil levels daily, drivers are not specifically required to do so during a pretrip or posttrip inspection. However, proper routine maintenance would reveal inadequate hub oil levels or verify the absence of a wheel seal leak. Moreover, though neither roadside nor annual periodic inspections require checking the sight glass or the wheels for a leak, 49 CFR 396.3 specifies, "Every motor carrier shall systematically inspect, repair, and maintain, or cause to be systematically inspected, repaired, and maintained, all motor vehicles subject to its control." The regulations go on to state, under 396.5, "Every motor carrier shall ensure that each motor vehicle subject to its control is: (a) properly lubricated; and (b) free of oil and grease leaks." Title 49 CFR 393.205 addresses the parts and accessories for safe operation of wheels and sets forth additional requirements for wheel seal and other hub leaks.

The industry acknowledges that a motorcoach tire fire is the most difficult to extinguish; though detection systems may alert a driver to a potential fire situation, adequate suppression systems are not yet available. Therefore, fire prevention is the key objective. The FMCSA has established specific OOS criteria for commercial vehicles in response to safety hazards, and it is the appropriate agency to require that commercial vehicles maintain proper wheel bearing lubrication to prevent failure and possible catastrophic tire fires.

A comprehensive program of proper maintenance by motor carriers, pretrip inspections, posttrip vehicle inspections by drivers, State and Federal requirements, and inspections to verify motor carrier compliance with safety regulations is necessary to prevent motorcoach fires. However, no regulations are in place that set inspection requirements for wheel bearings and wheel seal leaks. According to the FMCSA, the Volpe Center will assess the adequacy of current motorcoach operational inspection practices, both daily and periodic, as they relate to detecting and remedying situations that may lead to a fire.[142]

The Safety Board concludes that Federal regulations and inspection criteria do not require inspection of wheel bearings and adequate lubrication to prevent wheel bearing failure and a resulting wheel well fire. The Safety Board believes that the FMCSA should revise the FMCSRs at 49 CFR 393.205 to prohibit a commercial vehicle from operating with wheel seal or other hub lubrication leaks.

The maintenance manuals published by motorcoach manufacturers afford another means of fostering owner awareness of the risks associated with improper wheel bearing maintenance. MCI, the manufacturer of the accident motorcoach, placed caution and warning text boxes throughout its maintenance manual to provide additional information on the potential hazards of failing to properly maintain specific vehicle components and on methods for handling heavy vehicle parts. The manual cautioned that wheel seal integrity could be affected by excessive wheel bearing end play and lead to bearing or seal failure; no warning was given on the potential consequences of failing to maintain adequate wheel bearing lubrication, though daily checks of hub oil levels were recommended.

Maintenance guidance on vehicle components is based on manufacturers' recommendations because they are in the best position to understand how their products work, including the consequences of not performing proper maintenance. Although the maintenance manual for the accident motorcoach included various warnings, none focused on the lubrication of wheel bearings. The Safety Board concludes that, in the absence of a specific warning in the maintenance manual, owners of vehicles with oil bath bearings may not be aware of the inherent danger of inadequate wheel bearing lubrication and the potentially serious consequences of a wheel bearing failure. The Safety Board believes that MCI should revise its product maintenance manuals to emphasize the importance of wheel bearing lubrication, specifically warning that daily inspection of hub oil levels and wheel seals is vital to prevent wheel bearing failure and that bypassing this requirement is a dangerous practice that can lead to a wheel well fire or other serious consequences. For those vehicles already sold and in service, the Safety Board believes that MCI should disseminate a customer advisory bulletin on the importance of proper wheel bearing maintenance, specifying the type of equipment or oil bath bearings that require an undercarriage inspection to detect wheel seal leaks and alerting customers to the serious consequences of lack of lubrication and subsequent wheel bearing failure.

[142] *Motorcoach Fire Safety Analysis Work Plan*.

As principal purveyors of vehicle safety information, the United Motorcoach Association and the American Bus Association need to inform their members of the dangers inherent in improper maintenance of wheel bearings and the consequences of catastrophic wheel well fires. The Safety Board believes that the United Motorcoach Association and the American Bus Association should disseminate to their motorcoach and bus operator members an advisory bulletin emphasizing the importance of proper wheel bearing maintenance, particularly the importance of checking the oil level in oil-lubricated bearings (also known as oil bath bearings) and inspecting the undercarriage of the tag axle wheels to detect wheel seal leaks, and the serious consequences of lack of lubrication and subsequent wheel bearing failure.

The Safety Board also believes that the United Motorcoach Association and the American Bus Association should advise their motorcoach manufacturer members to review product maintenance manuals and, if the manuals do not emphasize the importance of wheel bearing lubrication, to revise them to specifically warn that daily inspection of hub oil levels and wheel seals is vital to prevent wheel bearing failure and that bypassing this requirement is a dangerous practice that can lead to a wheel fire or other serious consequences. Further, the Safety Board believes that the United Motorcoach Association and the American Bus Association should advise their motorcoach manufacturer members to disseminate, for those vehicles already sold and in service, a customer advisory bulletin on the importance of proper wheel bearing maintenance, specifying the type of equipment or oil bath bearings that require an undercarriage inspection to detect wheel seal leaks and alerting customers to the serious consequences of lack of lubrication and subsequent wheel bearing failure.

## Bus Brokers

BusBank, the company that entered into a contract with Sunrise to obtain motorcoach transportation from Bellaire to another Sunrise facility on September 22, 2005, is a bus broker. According to the FMCSA, it does not have the authority to regulate brokers of motor carriers that transport passengers; bus brokers are exempt from the Secretary of Transportation's jurisdiction. Although the FMCSA does have the authority to require brokers to maintain a bond or insurance, as needed, to protect passenger carriers, neither the FMCSA nor the DOT has imposed an insurance requirement.[143]

At the Safety Board public hearing, BusBank testified that it performs a due diligence check on the motor carriers it contracts with for service. However, this check consisted only of verification of the required FMCSA insurance coverage and review of FMCSA-issued safety ratings available on the Internet. At the time of the accident, Global was listed as a motor carrier of passengers with a satisfactory FMCSA safety rating. The verification performed by BusBank uncovered no safety issues that would have alerted it to potential safety risks to the traveling public.

[143] The FMCSA has stated that without the authority to require registration of brokers, it has no way of identifying them and monitoring their compliance with the insurance requirement.

Any member of the public can perform his or her own due diligence check on a motor carrier of passengers by contacting the FMCSA or searching the FMCSA website.[144] The website also provides a link to detailed information on passenger carrier safety and on evaluating the safety practices of interstate motorcoach companies, such as those related to driver qualifications, limitations on driving, vehicle standards, subcontracting agreements, insurance requirements, carrier operating authority, and carrier insurance and safety information.

Although the BusBank website describes the company as "event specialists with local knowledge of bus availability, [and] bus quality,"[145] its information is gathered from much of the same FMCSA data available to the traveling public. The selection of a motor carrier of passengers and the quality of information gathered by both bus brokers and the general public is ultimately dependent on the information and safety ratings issued by the FMCSA.

## Federal Motor Carrier Safety Administration

On April 10, 2002, a TxDPS intrastate educational review of Global uncovered numerous driver and vehicle safety violations. In February 2004, an FMCSA compliance review of Global found similar violations of the FMCSRs pertaining to commercial drivers and vehicles, though the final safety rating for the carrier was satisfactory. After the Wilmer accident in September 2005, when the FMCSA conducted a second compliance review of Global, it issued the company a safety rating of unsatisfactory, declared that Global's operations created an "imminent hazard" to public safety, and issued an operations OOS order. The order was based on Global's numerous driver qualification violations and FMCSA documentation of Global's lack of vehicle maintenance, inspection, and repairs, which resulted in vehicles that were mechanically unsafe. The FMCSA OOS order stated that Global's pattern of FMCSR violations was consistent in nature and long in history. Although the February 2004 compliance review had documented many of the same safety violations as the postaccident compliance review 19 months later, the FMCSA issued a different final rating of Global, an unsatisfactory rating.

At the time of the accident, Global was not providing proper safety oversight of its operations. The accident driver had been working for Global without being properly licensed to drive a motorcoach in the United States, and after the accident, Global failed to conduct the postaccident alcohol and illicit drug testing required by the FMCSRs. Further, Global had been operating a passenger-carrying commercial vehicle, under an expired temporary trip permit tag, that was not registered in the United States, was displaying the license plate from another vehicle, and had not been systematically maintained. In light of these findings, as well as the violations found by the FMCSA during the postaccident

[144] See "Safe Transportation of Passengers by Motorcoach—and What It Means to You," <www.fmcsa.dot.gov/safetyprogs/bus.htm>, December 5, 2006.

[145] See <www.busbank.com>, December 1, 2006.

compliance review, the Safety Board concludes that Global exhibited a lack of concern for safety management controls by violating several Federal safety regulations pertaining to its drivers and vehicles, including employing a driver who was not properly licensed to drive a motorcoach in the United States, failing to conduct the required postacccident alcohol and illicit drug testing, and operating a passenger-carrying commercial vehicle, which had an expired temporary trip tag, that was not registered in the United States, was displaying the license plate from another vehicle, and had not been systematically maintained. This accident is one of many in which the Safety Board has focused on FMCSA safety oversight of motor carriers and has found inconsistencies based on a safety rating process that fails to ensure the removal of unsafe motor carriers from the Nation's highways.[146]

In reviewing the FMCSA's safety rating system within the compliance review process, the Safety Board has found the rating methodology inadequate in two areas:

- It considers only those violations defined by the FMCSA as "critical" or "acute" in determining a carrier's overall safety rating, and
- It does not factor in a carrier's driver's rate of OOS orders and does not fully review vehicle inspection data.

The FMCSA compliance review uses a computer tabulation program to identify adherence to the FMCSRs for each rating factor, placing weighted numerical value only on violations of acute or critical regulations. Unrated violations—those that are noncritical or nonacute—are not given weight and therefore are not factored[147] into the tabulation; the FMCSA does not consider a motor carrier's violations of many FMCSRs to be an indication of safety management practices. In other words, if a carrier displayed a pattern of 100 percent noncompliance for every nonrated safety regulation violation, its overall safety rating would not be affected. This rating methodology is inconsistent with the FMCSA's stated purpose of the compliance review, which is to make sure that a motor carrier has adequate safety management controls in place to ensure compliance with all applicable Federal safety requirements.

The Volpe Center reported that for the year 2005, the FMCSA performed 8,097 Federal compliance reviews, during which a total of 61,924 violations of Federal safety regulations were found.[148] However, only 1,758 violations were classified "acute," and

[146] (a) National Transportation Safety Board, *Motorcoach Run-off-the-Road and Overturn, Victor, New York, June 23, 2002*, Highway Accident Report NTSB/HAR-04/03 (Washington, DC: NTSB, 2004). (b) National Transportation Safety Board, *Collision Between Truck-Tractor Semitrailer and School Bus Near Mountainburg, Arkansas, May 31, 2001*, Highway Accident Report NTSB/HAR-02/03 (Washington, DC: NTSB, 2002). (c) National Transportation Safety Board, *Selective Motorcoach Issues*, Special Investigation Report NTSB/SIR-99/01 (Washington, DC: NTSB, 1999).

[147] When asked during the Safety Board public hearing about how the FMCSA determines whether an FMCSR violation by a motor carrier is acute, critical, or unrated, an FMCSA field administrator stated that the agency determines certain regulations to be critical or acute depending on the relative risks of an accident (whether violation of those particular regulations would place a carrier at risk for an accident).

[148] See MCMIS March 31, 2006, snapshot, <ai.fmcsa.dot.gov/ProgramMeasures/CR/NR/NSR/Report.asp?FC=C&RF=T.>, October 20, 2006.

7,102 were classified "critical"—which is to say that 85.7 percent of Federal safety regulations violations discovered in 2005 did not carry any weight against the carriers' safety ratings. Further, 65 percent of the 8,097 Federal compliance reviews conducted resulted in satisfactory ratings for the carriers, though 53,069 "other" (nonacute and noncritical) violations (85.7 percent) of Federal safety regulations were documented. The FMCSA documented violations in 7,831 (96.7 percent) of the compliance reviews.

At the Safety Board public hearing, the FMCSA field administrator stated that the agency is working with the Volpe Center to develop a risk model for all FMCSRs to make a determination as to whether a violation should be "critical" or "acute" for a compliance review safety determination. Although this study is a step in the right direction, the Safety Board has long taken the position, as expressed in its reports cited earlier, that violations of safety regulations are an indication of a motor carrier's lack of safety management controls. The Safety Board concludes that the FMCSA's compliance review program does not assign numerical value to safety regulation violations that are classified as neither "acute" nor "critical" during the safety fitness rating process, thereby allowing potentially unsafe carriers, which violate safety regulations without consequence, to continue operating.

The two most important factors in safe motor carrier operations are the operational status of the vehicles (trucks or buses) and the performance of the individuals who drive them. However, the FMCSA compliance review process does not accurately determine a motor carrier's safety fitness because it does not factor in the rate of a carrier's driver OOS orders from roadside inspections, and it includes only a limited amount of vehicle inspection data. Increasing the weight of performance data for driver and vehicle factors in compliance reviews is important because deficiencies in these factors are directly related to accidents. In previous accident investigations, the Safety Board has found that several unsafe carriers were permitted to continue operating as a result of a final satisfactory safety rating, regardless of driver- or vehicle-related safety violations.

In 1995, for example, the Safety Board investigated an accident in Indianapolis, Indiana,[149] in which a motorcoach overturned when it entered an exit ramp; 2 passengers were killed, and 13 were seriously injured. The FHWA's Office of Motor Carriers (now the FMCSA) conducted a postaccident compliance review of the operator, Hammond Yellow Coach Lines, Inc. (Hammond), which resulted in an unsatisfactory rating (10 out of 10 vehicles reviewed were placed out of service). Hammond had had significant safety problems before the accident and yet was still permitted to operate. From 1987–1995, the Office of Motor Carriers had inspected Hammond nine times, and the carrier continued to receive final safety fitness ratings of satisfactory, even though several compliance reviews documented hours-of-service violations and high numbers of vehicles (63 percent) meeting OOS criteria. Following the Indianapolis accident, the Safety Board recommended that the DOT

[149] NTSB/SIR-99/01.

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Change the safety fitness rating methodology so that adverse vehicle or driver performance-based data alone are sufficient to result in an overall unsatisfactory rating for the carrier.

On December 14, 1999, the FHWA responded that it expected to issue an NPRM that would establish a more performance-based means of determining carrier fitness to conduct commercial motor vehicle operations. The agency stated that it would take into account the Safety Board's recommendation, including any comments received, in developing a new system. On March 17, 2000, based on the expected NPRM, the Safety Board classified Safety Recommendation H-99-6 "Open—Acceptable Response." The recommendation is on the Safety Board's List of Most Wanted Transportation Safety Improvements.[150]

On September 4, 2002, the Safety Board reiterated Safety Recommendation H-99-6 to the DOT as a result of its investigation into an accident in Mountainburg, Arkansas,[151] in May 2001, when a commercial truck, operated by Stuart Trucking (Stuart), collided with a school bus and killed three children. The postaccident FMCSA compliance review of the motor carrier resulted in an overall conditional rating; however, the FMCSA staff did not inspect any vehicles during this review, in spite of the fact that the accident was vehicle related. The FMCSA relied instead on the motor carrier profile report, which listed 29 roadside inspections in the previous 12 months,[152] resulting in 4 OOS vehicles (14 percent). The Safety Board asked the Missouri Division of Motor Vehicles and Railroad Safety to conduct an additional review of the carrier and inspect all of its vehicles. Of 12 vehicles examined, 5 had OOS violations (42 percent). The 2001 conditional rating for Stuart underscores the failure of compliance reviews to identify unsafe carriers. At the time of the accident, Stuart had not been rated in more than 11 years. Despite having unsafe vehicles on the road and numerous driver violations, Stuart received a conditional rating (*not* "unsatisfactory") even after the accident.

In June 2002, the Safety Board investigated an accident in Victor, New York,[153] in which a motorcoach ran off the road and overturned because the driver fell asleep at the wheel. Five passengers were killed, and the driver and 41 passengers were injured. The FMCSA conducted a postaccident compliance review of the operator, Arrow Line, Inc. (Arrow), which resulted in a conditional rating (*not* "unsatisfactory"). Yet the compliance review revealed that Arrow had a 40 percent OOS rate for its vehicles, and the FMCSA noted that Arrow's compliance review revealed noncompliance with the FMCSRs "in almost all applicable parts to Arrow Line, Inc.'s passenger transportation operation."

[150] The Safety Board's "Most Wanted" list is a program to increase the public's awareness of and support for action to adopt safety steps that can help prevent accidents and save lives.

[151] NTSB/HAR-02/03.

[152] At the time of issuance of the Safety Board report, in 2002, the FMCSA would not conduct a terminal inspection if 3 or more of a company's vehicles had received roadside inspections in the previous 12 months. The Safety Board recommended that the FMCSA require that a motor carrier's fleet be inspected during compliance reviews (Safety Recommendation H-02-16).

[153] NTSB/HAR-04/03.

Had Global's driver and vehicle factor violations in the February 2004 compliance review resulted in an unsatisfactory rating, the carrier would have had only 45 days to correct the problems or cease operations. Instead, Global received a satisfactory rating and continued to operate and to violate safety regulations for drivers and vehicles; the FMCSA did not again review Global's safety management practices until the accident occurred in September 2005. In the 2 years prior to the Wilmer accident, Global had accrued a driver OOS rate of 50 percent (8 roadside inspections resulted in 4 drivers being placed out of service), compared to the national rate of 6.6 percent. The accident driver himself had undergone three roadside inspections prior to the accident and had been placed out of service in two of the three. Although the motorcoach fire was the result of poor vehicle maintenance, had Global been rated "unsatisfactory" in February 2004 based on driver OOS rates and vehicle safety violations, as the Safety Board recommended in Safety Recommendation H-99-6, the company quite likely would not have been operating. If the FMCSA compliance review rating methodology were revised to give appropriate weight to driver and vehicle safety areas, the FMCSA would have accurate information regarding a carrier's level of passenger safety; under such conditions, Global (like Arrow, Stuart, and Hammond before it) may have received an unsatisfactory rating.

Following the Safety Board's September 2002 reiteration of Safety Recommendation H-99-6, the FMCSA advised that it intended to issue an NPRM on the safety fitness rating methodology in late 2003. In June 2004, the FMCSA notified the Safety Board that it anticipated making a final determination concerning changes to the safety fitness rating methodology in 2004. The FMCSA indicated that it was considering whether to seek additional comments through a supplemental advance NPRM or to proceed directly to an NPRM. The FMCSA expected to complete the rulemaking process in 2005. In a report issued in April 2006, the Safety Board expressed disappointment that the FMCSA had not acted on Safety Recommendation H-99-6 and stated its concern that the long time between the issuance of the recommendation and final action by the FMCSA jeopardizes the safety of the traveling public through unnecessary exposure to possibly unsafe commercial motor vehicles.[154] On June 15, 2006, the FMCSA briefed the Safety Board on the CSA 2010 Initiative, which the agency indicated will include a complete evaluation of the compliance review process, leading to development of a new performance-based operational model for determining motor carrier safety, with emphasis on preventative measures and early detection of unsafe driver and carrier conditions.

At the August 2006 Safety Board public hearing, the FMCSA stated that it is reviewing the compliance review process and safety rating methodology. The FMCSA explained that when it originally promulgated the safety fitness determination process, the driver OOS rate information was found to be insufficient to accurately determine a driver's safety performance; however, the FMCSA's current goal is to develop a data-driven safety fitness determination process, which includes items such as vehicle and driver OOS rates, as part of its comprehensive examination of compliance review and enforcement oversight. Additionally, in September 2006, the FMCSA reported that it is

[154] National Transportation Safety Board, *Multivehicle Collision on Interstate 90, Hampshire–Marengo Toll Plaza Near Hampshire, Illinois, October 1, 2003*, Highway Accident Report NTSB/HAR-06/03 (Washington, DC: NTSB, 2006).

developing a new safety fitness rating methodology based on an objective measure of driver or carrier safety performance data and will issue ratings on all drivers and carriers for which there are sufficient data. According to the CSA 2010 Initiative website, the deployment date of the new operational model is year 2010. The FMCSA plans to develop and draft legislation required for the program; rulemaking within the FMCSA takes at least 2 years. Pilot testing is projected to begin in 2008; pilot tests and training for deployment and implementation are expected to take at least 2 years and thus may extend well beyond 2010.

Concerned that motor carriers with significant regulatory violations for drivers and vehicles are still receiving satisfactory ratings, the Safety Board once more focuses on Federal standards for determining the safety fitness of carriers. As it has done in several accident investigations in the past 8 years, the Safety Board again concludes that the current FMCSA compliance review process does not effectively identify unsafe motor carriers and prevent them from operating. Full evaluation and implementation of the CSA 2010 Initiative will not be completed until 2010 or later, 10 years after the Safety Board first issued Safety Recommendation H-99-6. Accidents such as the Wilmer motorcoach fire, with high loss of life, underscore the need and the urgency for the FMCSA to move forward more expeditiously on this recommendation to remove unsafe motor carriers from the Nation's highways. Therefore, the Safety Board reiterates Safety Recommendation H-99-6.

Although the FMCSA has stated that the conceptual model for CSA 2010 is significantly different from the current operational model in that safety fitness determinations will be independent of the compliance review, the expected time frame for implementation of the new program is at least several more years. In the interim, deficiencies in the current compliance review system should be remedied to help prevent unsafe carriers from continuing to operate. The FMCSA is responsible for ensuring that motor carriers operate safely, and temporary measures to improve the compliance review process may be necessary until new rules are enacted. The FMCSA has already set precedent for the issuance of interim rules to improve safety programs; in 1997, the agency issued an interim final rule to immediately improve the safety rating methodology without prior notice and comment, stating that to have done otherwise would have been contrary to the public interest. Therefore, to protect the traveling public until completion of the CSA 2010 Initiative, the Safety Board believes that the FMCSA should immediately issue an Interim Rule to include all FMCSRs in the current compliance review process so that all violations of regulations are reflected in the calculation of a carrier's final rating.

The Safety Board examined whether the inability of the motorcoach driver to communicate in English was a factor in this accident. Although the driver did not speak English, one of the nursing staff was able to sufficiently communicate with him in Spanish. Further, though the accident driver did not respond verbally to the motorist who informed him that the wheel well was glowing orange-red, he immediately took action to pull over onto the shoulder of the interstate. When the driver exited the motorcoach to inspect the tire, he was accompanied by several of the nursing staff, who also observed the flames. The

driver and the nursing staff reacted to the emergency and immediately began evacuating passengers. Therefore, the Safety Board concludes that although the accident motorcoach driver had previously been cited in a roadside inspection as being a non-English-speaking driver, his inability to speak the English language was not a factor in this accident. The Safety Board was pleased when, in December 2006, the FMCSA provided information on research the agency has initiated into the issue of the English language proficiency requirement for commercial motor vehicle drivers. The FMCSA contracted with the Volpe Center to assess "the extent to which commercial motor vehicle drivers must be capable of communicating in English to ensure the safe operations of their vehicles on the Nation's highways." The FMCSA and the Volpe Center will interview and survey Federal and State enforcement personnel, motor carrier industry groups, individual motor carriers and drivers, State driver licensing agencies and highway departments, and highway safety advocacy groups. The FMCSA anticipates completion of the final research report by October 2007.

## Survival

### *Motorcoach Emergency Egress*

During the investigation of this motorcoach accident, the Safety Board identified problems with emergency egress from the vehicle. Although the motorcoach was equipped with emergency egress windows, they were not used in the evacuation because

- The nursing staff had not been instructed on the availability of the window exits and how to use them, and they were unaware of their potential as a means of exit during the evacuation.
- Most of the passengers who required assistance during the evacuation had special needs, and negotiating the movements necessary to escape through the emergency windows and the front door was all but impossible during the limited time available.

The rapid propagation of the fire and the heavy, thick black smoke afforded those patient-passengers seated beyond the third row little or no opportunity to be evacuated or rescued once the fire ignited combustible elements within the passenger compartment. The intense heat from the fire, coupled with the oppressive smoke, cut off all practical egress in a matter of minutes. The Safety Board concludes that the quick-spreading fire and thick smoke prevented nursing staff, bystanders, and rescuers from extricating all passengers with special needs from the accident motorcoach.

Two options are available to prevent fatalities in highway accidents: prevent the accidents or protect vehicle occupants when accidents do occur (survivability). By examining occupant survivability in motorcoach accidents, the DOT can identify means of increasing survivability. Surviving an accident depends on many factors. The structural integrity of the vehicle and passenger compartment, seat design, and restraint systems can all increase a person's likelihood of surviving a crash. Fire-retardant materials, exit design, and prompt evacuation can assist persons in escaping a vehicle. For example, in aviation,

Safety Board recommendations have provided the impetus for many improvements in occupant protection, including fire detection and suppression systems in aviation lavatories and cargo compartments, modifications in cargo compartments to delay fire spread, and fire blocking of cabin and seat materials.[155]

### *Evacuation Studies*

For more than 30 years, the Safety Board has addressed the issue of motorcoach emergency evacuations.[156] Although the DOT conducted emergency evacuation trials of intercity buses in 1976, no industry- or Government-sponsored research on emergency evacuation of motorcoaches has taken place since then. Motorcoach designs still incorporate the same window exit heights and combustible construction material that prevailed decades ago. The Safety Board has long held that the capability of rapidly evacuating motorcoaches in emergencies is essential.

Although motorcoach and bus fire data are inconsistent in current accident databases, the FMCSA, commercial insurance companies, and the industry generally acknowledge that the number of fires is increasing. Yet today, decades after release of the 1976 and 1984 DOT reports on evacuation of intercity buses[157] and evacuation of elderly and disabled passengers from paratransit vans and buses,[158] motorcoaches are still essentially constructed of the same combustible materials and present the same evacuation issues.

Motorcoaches transport large numbers of people in a confined space. Panic can quickly ensue when occupants are threatened by fire or smoke in an unfamiliar or enclosed environment. Smoke, panicked reactions, unfamiliarity with motorcoach components, and inadequate exit design can hamper the efficient and safe use of emergency exits. The Wilmer accident demonstrates that, just as in airplane and passenger train fires, the danger to passengers is not limited to the flames themselves but also can result from the side effects of a fire, such as inhaling smoke. In the Wilmer accident, passengers died because of injuries caused by smoke inhalation, in addition to thermal injuries caused by the fire.

Unlike in the aviation industry, motorcoaches, which can accommodate 55 or more passengers, are not required to perform full-scale evacuation drills. Just as passengers seated in an airplane or in a railcar are called upon to operate the emergency exits in an evacuation, passengers in a motorcoach are expected to operate exits in the event of an emergency. However, research shows that under the stress of an evacuation, passengers do

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[155] National Transportation Safety Board, *Survivability of Accidents Involving Part 121 U.S. Air Carrier Operations, 1983 Through 2000*, Safety Report NTSB/SR-01/01 (Washington, DC: NTSB, 2001).

[156] (a) National Transportation Safety Board, *Interstate Bus–Automobile Collision, Interstate Route 15, Baker, California, March 7, 1968*, Highway Accident Report NTSB/SS-H-3 (Washington, DC: NTSB, 1968). (b) National Transportation Safety Board, *Greyhound Bus Collision With Concrete Overpass Support Column on Interstate 80, San Juan Pass, Sacramento, California, November 3, 1973*, Highway Accident Report NTSB/HAR-74/05 (Washington, DC: NTSB, 1974). (c) National Transportation Safety Board, Docket No. SRH-96-FH-015.

[157] *Evacuation of Intercity Buses*.

[158] *Evacuation and Rescue of Elderly and Disabled Passengers From Paratransit Vans and Buses*.

not necessarily use the most appropriate exit. Passengers in such situations are less able to cope with new equipment and information; their natural inclination is to leave by the exits they recognize, such as the front loading door. Under stress, passengers may have difficulty figuring out the method of window operation if it is not intuitive or does not match their immediate expectations.[159] The use of emergency window exits in a motorcoach is not intuitive; the hinged windows do not remain open, and the drop to ground is 7–8 feet. Safe and effective evacuation with minimal panic requires that passengers be provided with a basic understanding of the function of exits.

Although the staffing level on the accident motorcoach was sufficient to provide routine care of the patient-passengers (for example, dispensing medications and monitoring the well-being of residents), once the emergency situation arose, the health care staff was insufficient to safely and rapidly evacuate the motorcoach. The ADA ensures equal opportunity and accessibility for persons with disabilities to public conveyances, whether for routine transportation needs or educational and social group outings. Moreover, typically many sightseeing excursions sponsored by senior citizens' or children's groups include passengers with limited mobility or physical handicaps. Motorcoach charters often include passenger populations that have a significant number of persons with special needs. The Federal Government needs to address the ability of persons with special needs to rapidly egress from a motorcoach or bus in an emergency situation. The DOT has not studied this issue or published related research since the 1984 report, *Evacuation and Rescue of Elderly and Disabled Passengers From Paratransit Vans and Buses*.

The Safety Board has used the airEXODUS model to simulate evacuation from a wide-body aircraft with only 8 exits and 440 passengers; limiting the number of exits used can have a dramatic effect on evacuation times. The airEXODUS model is a highly specialized software tool originally developed to model the complex interactions of aircraft configuration and passenger behavior in emergency evacuations.[160] Not all exits are typically available during an escape situation in airplanes, railcars, or motorcoaches. The limited available statistics on motorcoach fires indicate that the rear of the motorcoach (engine compartment and rear wheel wells) experiences the majority of fires and that the windows normally provide the fire pathway into the passenger compartment. As was the case with the accident motorcoach, not all exit windows are likely to be available for escape,[161] depending on the circumstances of the emergency, such as fire, submersion in water, collision damage, rollover, or operational failure.

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[159] Sharon Cook and Dean Southall, *PSV Emergency Exits: Passenger Behaviour and Exit Design*, United Kingdom Department of Transport (London, UK: ICE Ergonomics Ltd., 1997) 5.

[160] Richard W. Bukowski, Richard D. Peacock, and Walter W. Jones, *Sensitivity Examination of the airEXODUS™ Aircraft Evacuation Simulation Model* (Gaithersburg, MD: National Institute of Standards and Technology, 1998) 7.

[161] According to the Safety Board's interviews of the nursing staff, they had covered the windows with newspaper and could not see the latches; the newspaper caught on fire as the flames entered the passenger compartment.

In December 2001, the FRA published an interim report on the fire safety of passenger trains.[162] In the analysis of passenger railcar fire performance, the minimal principal acceptance criterion was considered to be the minimum necessary egress time for a fully loaded passenger car, assuming an orderly, unimpaired evacuation. If the minimum necessary egress time is less than the time available for safe egress for all design fires, the design is considered acceptable. As stated in the report, "like the 90-second certification testing for aircraft, this minimum necessary egress time is simply a consistent point of comparison for different passenger railcar configurations and fire scenarios." In addition, the FRA, through the Volpe Center, is conducting a project related to passenger trains and fires, calling upon the Building and Fire Research Laboratory at the National Institute of Standards and Technology (NIST) for expertise in the development of models for the simulation of fires and associated hazards and risks for the broader application of fire hazard analysis to passenger train transportation.[163]

The FAA has also studied the use of computer simulation models to evaluate commercial aircraft evacuations. Fire hazard analysis using simulations can determine the fire performance of the entire aircraft fire protection and evacuation system by modeling both the fire environment and passenger egress.[164]

Using existing technology and building on the DOT research for aviation and railcar passengers, evacuation trials and computer simulation analyses can expand the application of fire safety analysis to the passenger population throughout the transportation system. Research and evacuation studies are needed to document and analyze actual evacuation scenarios, such as darkness, fire- and smoke-impaired vision, and water submersion, involving all types of passenger populations that require difficult and time-sensitive evacuations.

### *Emergency Exit Design*

The Safety Board has investigated accidents involving motorcoaches with emergency windows, such as on the accident motorcoach, that are approximately 7–8 feet from the ground, hinged at the top, and operated by lifting a release bar and pushing outward.[165] In several of these investigations, emergency responders and bystanders had difficulty rescuing passengers because of window height and top-hinge design, just as bystanders reported in the Wilmer accident.

For example, on June 20, 1998, a 1997 MCI motorcoach operated by Greyhound Lines, Inc., was traveling westbound on the Pennsylvania Turnpike near Burnt Cabins, Pennsylvania,[166] when it ran off the right side of the roadway and struck the back of a

[162] U.S. Department of Transportation, Federal Railroad Administration, *Fire Safety of Passenger Trains, Phase II: Application of Fire Hazard Analysis Techniques*, DOT/FRA/ORD-01/16 (Washington, DC: FRA, 2001).

[163] *Sensitivity Examination of the airEXODUS™ Aircraft Evacuation Simulation Model.*

[164] *Sensitivity Examination of the airEXODUS™ Aircraft Evacuation Simulation Model.*

[165] (a) NTSB/SS-H-3. (b) NTSB/HAR-74/05. (c) NTSB Docket No. SRH-96-FH-015.

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

tractor semitrailer. The entire front of the motorcoach was crushed, and the front loading door was destroyed; the motorcoach driver and 6 passengers were killed, and 16 passengers were injured. The emergency responders reported difficulty in rescuing the trapped passengers and had to set up a ladder to reach the emergency windows. The Safety Board determined that when passersby and emergency responders arrive on scene to rescue trapped passengers and provide medical assistance, any impediment to rapid entry into the accident vehicle can be detrimental to timely treatment of injuries and passenger survival. In the Wilmer accident, witnesses interviewed by the Safety Board reported trying to open the motorcoach windows from the exterior. When two passersby could not reach high enough to pry open two windows, they broke the windows but were unable to rescue any passengers.

Past Safety Board investigations have involved passengers of diverse ages and physical abilities who reported difficulty in evacuating because the windows were heavy and they could not hold them open while attempting to climb out and descend unassisted 8 feet to the ground. The majority of passengers in the Wilmer accident were persons with special needs, were unable to evacuate on their own, and could not be rescued before the fire destroyed the motorcoach; in other emergency situations, however, window height and design could impede the timely egress of passengers responding to a rapidly propagating fire.

On July 29, 1997, for example, a 1985 TMC motorcoach operated by Rite-Way Transportation, Inc., drifted off the side of Interstate 95 near Stony Creek, Virginia,[167] and down an embankment into the Nottoway River, where it came to rest on its left side, partially submerged in water. The front of the motorcoach was severely damaged, and the vehicle immediately began to fill up with water. Many passengers had to swim to the surface to escape. Some of the passengers, as young as 11, were too small to push the heavy emergency windows open far enough to evacuate. The Safety Board concluded that the strength and height needed to open an emergency window when a motorcoach is not upright pose a problem for some passengers, especially children, senior citizens, and injury victims. The Safety Board recommended that NHTSA

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> Revise the Federal Motor Vehicle Safety Standard 217, "Bus Window Retention and Release," to require that other than floor-level emergency exits can be easily opened and that they remain open during an emergency evacuation when a motorcoach is upright or at unusual attitudes.

The Safety Board added this recommendation to the List of Most Wanted Transportation Safety Improvements in 2000,[168] and it is currently classified

[167] NTSB/SIR-99/01.

[168] NHTSA originally responded to the Safety Board by letter on April 15, 1999, stating that the agency would research a "hold open" device for all emergency exit windows that are hinged at the top and determine whether the device would satisfy the conditions set forth in the Safety Board's recommendation. If not, NHTSA stated that it intends "to perform research to establish the feasibility of a device that will limit the forces required to open emergency windows and keep emergency exit windows open when the bus its on its side. When the above is complete, NHTSA will then propose changing Standard 217 to require this device on emergency exit windows on buses and school buses."

"Open—Acceptable Response." On October 12, 2006, NHTSA wrote to the Safety Board and stated that, as part of the regular 7-year regulatory review process, it is studying FMVSS 217 and anticipates completion of the review by early 2007.

The rapid propagation of fire and quickly spreading smoke call for prompt, orderly egress of all motorcoach passengers. The circumstances of the Wilmer accident—a rapidly spreading fire, inadequate motorcoach egress systems, and destruction of the vehicle—along with the increasing number of tire fires noted by the industry, highlight the critical need to evaluate the adequacy of current motorcoach emergency egress design. In any such evaluation, passenger negotiation of the 7–8 foot window drop as a means of escape cannot be ignored. Many motorcoach window exits are 8 feet above ground, a distance higher than the wings of some airplanes, such as the 727, 737, and Canadair regional jet. Federal regulations require an approved means to assist airplane passengers in descending from an exit that is higher than 6 feet above ground; however, no such Federal regulations are in place for motorcoach exit heights. The Safety Board concludes that, in the absence of demonstrated emergency evacuation capabilities for motorcoaches, such as the accident vehicle, the effectiveness of design features in facilitating the safe escape of passengers cannot be determined. The Safety Board believes that NHTSA should evaluate current emergency evacuation designs of motorcoaches and buses by conducting simulation studies and evacuation drills that take into account, at a minimum, acceptable egress times for various postaccident environments, including fire and smoke; unavailable exit situations; and the current above-ground height and design of window exits to be used in emergencies by all potential vehicle occupants.

## Oxygen Cylinders

To avoid dangerous rupture or explosion, a pressure relief device in oxygen cylinders, such as a burst disk, is designed to actuate when the internal pressure in the cylinder reaches 3,025–3,360 psig. As designed, when a fully pressurized cylinder is heated to 260º–315º F, its internal pressure exceeds the actuation pressure (3,025–3,360 psig) of the burst disk, and a controlled release of oxygen occurs to prevent cylinder rupture. Representatives of aluminum cylinder manufacturers stated to Safety Board investigators that, though aluminum melts at 1,020º–1,206º F, the exposure of the cylinders to temperatures well below the melting range will weaken the aluminum. A fully pressurized aluminum cylinder without a burst disk will maintain its integrity for only minutes at temperatures above 600º F because of the increased pressure levels acting on the now heated and structurally weakened aluminum cylinder.

Federal HM regulations on pressure relief devices are designed for the transportation of full cylinders. The regulations require that a pressure relief device prevent the failure of a fully pressurized cylinder in a fire; however, they do not consider cylinders that are partially pressurized. Prior to 1981, this omission was not a problem because all specification cylinders permitted for the transportation of compressed gas were manufactured of steel, which is not as sensitive as aluminum to material strength loss when exposed to heat. In 1981, the HM regulations were amended to permit aluminum

cylinders for use in transporting compressed gases. Because of the potential loss of material strength, the Safety Board is concerned that an aluminum cylinder might rupture at an internal pressure well below the actuation pressure of the burst disk.

The Safety Board's analysis indicated that, though the burst disk on a heated, fully pressurized cylinder actuates as designed before failure of the cylinder (that is, before the aluminum weakens and loses integrity), a partially pressurized heated cylinder can fail before the burst disk actuates. Specifically, when a cylinder containing less than 78 percent of its full charge (1,570 psig at room temperature) is heated to a temperature exceeding 400º F, it will structurally fail before its internal pressure actuates the burst disk. Thus, partially pressurized aluminum cylinders exposed to heat are more likely to rupture before the internal pressure is high enough to actuate the burst disk. When the aluminum weakens and the cylinder loses integrity (the cylinder wall fails), though the internal pressure is *not* high enough to actuate the burst disk, it causes the cylinder to fail, releasing the oxygen and causing the fragmented pieces of the cylinder to become hazardous projectiles.

During this accident investigation, three aluminum cylinders retrieved from the motorcoach were found with intact valves, even though two cylinders displayed evidence of melting, and one had fractured and burst. Upon examination of the burst disks for these three cylinders, the Safety Board determined that two cylinders failed before the burst disks actuated. Such failures would have rapidly released large quantities of oxygen into the fire and may have propelled portions of the cylinders some distance from the point of origin. In fact, the intense burst of fire shown in figure 6, a still photograph from video footage of the motorcoach fire, was likely caused by the failure of one of these two cylinders. Emergency responders and passersby described these bursts of fire as "explosions."

The Safety Board considered what effect, if any, the venting and failure of these cylinders had on the attempted rescue of passengers remaining in the motorcoach. According to the Safety Board's study, the first cylinder failure, which likely caused a burst of fire, would not have occurred until the temperature of the cylinder was at least 400º F. First responders and passersby who were attempting to rescue passengers reported ceasing their efforts just before, or just as, these bursts began to occur.

By the time the temperature levels were high enough to cause two aluminum cylinders to fail, the heat from the fire in the rear of the motorcoach prevented rescuers from safely reaching the passengers seated there. Further, heavy, black smoke from the fire inside the motorcoach was reported to have been overwhelming within only a few minutes of the passenger evacuation and prevented rescue attempts beyond the first few rows of seats. The Safety Board concludes that the smoke and heat from the fire prevented rescuers from safely proceeding further into the motorcoach within minutes of their arrival on scene and that the aluminum cylinders failed, releasing oxygen to the fire, after successful rescue attempts were no longer possible.

The rupture of aluminum cylinders caused by internal pressure exceeding the strength of the cylinder wall poses a significant hazard to emergency responders and

others. Aluminum cylinders can be transported as cargo in any mode of transportation, and the presence of aluminum cylinders containing any compressed gas may pose a significant hazard in transportation fires.

PHMSA recommends limiting the number of cylinders to the extent practicable and limiting the total weight of cylinders to 99 pounds per vehicle;[169] however, these limitations may not be practicable in an emergency evacuation, such as in advance of a hurricane. Should aluminum cylinders be an issue for emergency responders in any mode of transportation, the safety of the vehicle occupants and the responders is of the utmost priority. The Safety Board concludes that the possibility of structural failure in partially pressurized aluminum cylinders when exposed to heat and fire, as occurred on the accident motorcoach, poses a danger to the general public and emergency responders. The Safety Board believes that PHMSA should develop standards for the safe transportation of partially pressurized aluminum cylinders by, for example, requiring the addition of temperature-actuated pressure relief devices or the reduction of residual pressure to safe limits, to ensure that such cylinders do not experience overpressure failure when exposed to a fire.

Furthermore, the Safety Board believes that PHMSA should issue guidance to, at a minimum, the Fraternal Order of Police (FOP), International Association of Chiefs of Police (IACP), International Association of Fire Chiefs (IAFC), International Association of Fire Fighters (IAFF), National Association of State EMS Officials (NASEMSO), National Sheriffs' Association (NSA), and National Volunteer Fire Council (NVFC), describing the risk of overpressure failure of partially pressurized aluminum cylinders and the steps that should be taken to protect responders and the general public from a vehicle fire when aluminum cylinders are present. In addition, the Safety Board believes that the FOP, the IACP, the IAFC, the IAFF, NASEMSO, the NSA, and the NVFC should disseminate to their members the guidance developed by PHMSA describing the risk of overpressure failure of partially pressurized aluminum cylinders and the steps that should be taken to protect responders and the general public from a vehicle fire when aluminum cylinders are present.

## Emergency Evacuation of Persons With Special Needs

When Hurricane Rita became a threat to the Texas Gulf Coast in late September 2005, it posed unique challenges to organizations and entities responsible for ensuring the safety of persons with special needs. In many emergencies, sheltering in place is recommended because of the hazards and difficulties involved in evacuating special needs populations consisting of medically frail individuals. However, the strength of Hurricane Rita, along with the risk it posed to persons and property, made evacuation the appropriate option.

[169] U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, *Guidance for the Safe Transportation of Medical Oxygen for Personal Use on Buses and Trains* (Washington, DC: PHMSA, 2005).

When Sunrise officials tried to locate a nearby shelter to which the Brighton Gardens residents could evacuate in advance of Hurricane Rita, they learned that Hurricane Katrina evacuees occupied their preferred location, which was a facility closer than the 4-hour drive to Dallas, Texas. Lacking a nearby alternative to handle all of its residents, and being urged by the Bellaire fire marshal to evacuate, Sunrise determined that the best option was to travel to a more distant location capable of accommodating the residents. Sunrise monitored the evacuation situation on the news and learned that restrooms were unavailable in many locations, gasoline was in short supply, and many evacuees were stranded on the roadside. Paratransit buses designed for persons with special needs were considered unsuitable for this particular evacuation because of the limited number of seats and the lack of on-board restrooms. According to Sunrise, motorcoach transport became the best available option under the circumstances.

Hurricane Rita placed extraordinary pressures on evacuation transportation operations in coastal Texas, in part because of recent demands on limited emergency resources throughout the Gulf Coast region caused by Hurricane Katrina. Given the prospect of another devastating natural disaster, the evacuation of persons with special needs from nursing homes and other care facilities in the hurricane's path was considered necessary, despite the lack of optimal transportation. Because of the high demand for evacuation transport, both State and private organizations had difficulty locating sufficient transportation.

For example, the State of Texas, through the TBPC, attempted to obtain 1,100 buses and motorcoaches for evacuation purposes but was able to locate only 307 vehicles. Unaware that the TBPC had arranged transportation for Texas residents, including persons with special needs, Sunrise officials contracted with BusBank, which it had previously used when searching for transportation in advance of Hurricane Katrina. Had Sunrise officials been aware of State efforts to obtain and coordinate emergency transportation, they might have been able to meet their needs through the TBPC, though a bus or motorcoach provided by the TBPC might not have been demonstrably safer than the accident motorcoach. After all, the accident motorcoach had received a satisfactory rating from the FMCSA, suggesting that it met minimum safety requirements. Therefore, the Safety Board concludes that, given the unusual circumstances and limited options, Sunrise took reasonable action at the time in deciding to contract with BusBank for motorcoach transportation. Sunrise has since stated that it intends to develop a national bus and motorcoach contract for emergency evacuation of its facilities.

Efforts to improve planning for evacuation of persons with special needs are also under way at the State level. Shortly after Hurricane Rita, the Texas Governor established a Task Force on Evacuation, Transportation, and Logistics to review the hurricane evacuation and recommend improvements for evacuation plans and execution; in March 2006, the Governor directed that all task force recommendations be implemented. Texas has now entered into contingency contracts with out-of-State motorcoach carriers and CUSA to provide 1,100 motorcoach-type buses for emergency evacuations.

Government agencies and organizations representing communities of persons with special needs are attempting to provide better information, both to long-term care industry

members and to individuals with special needs (or their caregivers), on responding to emergencies that may require evacuation. In addition, in response to the 2005 hurricane disasters, private businesses, such as those operating nursing homes and long-term care facilities, have begun to improve their emergency transportation arrangements. For instance, the American Health Care Association has encouraged member facilities to make contingency arrangements for emergency evacuation transportation. The association's draft "bus safety transport checklist," to be included in its *Disaster Preparedness Plan*, even suggests that long-term health care facilities should provide backup arrangements for evacuation transportation in case the contingency contractor fails to provide transportation during an emergency, when market pressure may stress transport supplies.

The Office of the President, the DHS, the DOT, the GAO, the HHS, and other Federal agencies have studied the responses to both Hurricanes Katrina and Rita. These studies include recommendations for improving emergency evacuation of persons with special needs. To deal with transport supply shortfalls when the NRP and NDMS prioritize the limited number of ambulances for hospital evacuation, the DOT has developed a nationwide inventory of more than 100,000 buses and motorcoaches that its national contractor will use for emergency evacuations. In addition, the DOT is working with the American Bus Association to index the capabilities of the buses and motorcoaches, including the numbers of available evacuation-ready vehicles and drivers and their locations, as well as the vehicles' configurations and equipment.

During its investigation into this accident and the subsequent public hearing, the Safety Board found that, since the 2005 hurricane season, many organizations have developed and disseminated information about emergency evacuation of persons with special needs. Government and private entities have also reviewed and evaluated disaster preparedness as it applies to persons with special needs. The results of these efforts appear on websites available to long-term care providers and anyone interested in ensuring the safety of persons with special needs in a disaster. Within the Federal Government, such websites include those of FEMA,[170] the DHS,[171] the DOT's Office of Civil Rights,[172] and the HHS.[173] In addition, the website of the American Health Care Association[174] offers for sale its *Disaster Planning Guide: A Resource Manual for Developing a Comprehensive Preparedness Plan*, developed by the Florida Disaster Preparedness Committee and the Florida Health Care Association. The website of the Joint Commission on Accreditation of Healthcare Organizations provides information in conjunction with its publication,

[170] See <www.fema.gov/plan/prepare/specialplans.shtm>, September 26, 2006.

[171] For preparedness information for persons with special needs, see <www.ready.gov/america/getakit/disabled.html>, September 26, 2006. For developments from the HHS Interagency Coordinating Council on Emergency Preparedness and Individuals With Disabilities, see <www.dhs.gov/dhspublic/interapp/editorial/editorial_0591.xml>, September 26, 2006.

[172] See <www.dotcr.ost.dot.gov/asp/emergencyprep.asp>, September 26, 2006.

[173] Among other HHS publications issued following the 2005 hurricanes was *Nursing Home Emergency Preparedness and Response During Recent Hurricanes*. See <oig.hhs.gov/oei/reports/oei-06-06-00020.pdf> September 26, 2006.

[174] See <www.ahca.org>, September 26, 2006.

*Standing Together: An Emergency Planning Guide for America's Communities*,[175] which addresses the needs of "vulnerable" populations. Many other organizations, such as the American Red Cross[176] and Easter Seals,[177] offer information on their websites concerning emergency planning for persons with special needs.

The Safety Board is gratified that, following the disasters caused by Hurricanes Katrina and Rita, many government and private organizations have begun to improve evacuation systems by working to provide better means of emergency transportation, improving coordination among parties involved in the evacuation of persons with special needs, and disseminating emergency preparedness information to community members.

[175] See <www.jointcommission.org/NR/rdonlyres/FE29E7D3-22AA-4DEB-94B2-5E8D507F92D1/0/planning_guide.pdf>, September 26, 2006.

[176] See <www.prepare.org/disabilities/disabilitiesprep.htm>, September 26, 2006.

[177] See <www.easterseals.com/site/PageServer?pagename=ntl_safety_first_evacuation>, September 26, 2006.)

# Conclusions

## Findings

1. Although the hurricane evacuation was the reason for the trip, neither the weather conditions at the time nor the design and condition of the roadway caused or contributed to the accident.

2. A determination could not be made regarding the potential impact of the motorcoach driver's medical condition on his response to the emergency.

3. The motorcoach driver was fatigued at the time of the tire fire, but his fatigue was not a causal factor in the accident.

4. Appropriate resources were dispatched to the accident scene, responders and medical personnel arrived as quickly as possible, considering the heavily congested roadways and the initially erroneous information about the accident location, and the injured received medical care and were transported to local hospitals in a timely manner.

5. The accident motorcoach was mechanically unsafe because the right-side tag axle wheel bearing assembly lacked sufficient lubrication, which resulted in high frictional forces and high temperatures, causing the wheel bearings to fail and igniting the tire.

6. Continuing analysis of motorcoach and bus fire data is vital to understanding not only the trends in vehicle fires, but also the success or shortcomings of measures taken by the Government and private industry to address this problem.

7. Because of the proximity of the combustible access panels to the tire wheel well, where the fire originated, the fuel delivery system contributed to acceleration of the fire.

8. The tire fire, caused by an overheated right-side tag axle wheel bearing assembly, which ignited the tire, spread up the side of the motorcoach and burnt through the fiberglass sidewall above the wheel well and through the motorcoach windows, creating an entry path for the smoke and fire into the passenger compartment.

9. The exterior of the motorcoach had not been fire-hardened in fire-prone areas, such as around the wheel wells, and was not required to be by regulation, thereby limiting the time available for safe egress in the event of a fire.

10. Because tire fires are difficult to extinguish, early detection of potentially hazardous conditions in a wheel well area is critical, as demonstrated by the sequence of events in this accident, to eliminating the fire hazard.

11. Because neither Global Limo Inc. nor its employees routinely inspected the hub oil level or undercarriage of the wheel well, they did not discover the lack of lubrication of the tag axle wheel bearings; and this disregard for vehicle maintenance, pretrip inspections, and posttrip driver vehicle inspection reports led to a wheel bearing failure that resulted in a catastrophic fire and loss of life.

12. Federal regulations and inspection criteria do not require inspection of wheel bearings and adequate lubrication to prevent wheel bearing failure and a resulting wheel well fire.

13. In the absence of a specific warning in the maintenance manual, owners of vehicles with oil bath bearings may not be aware of the inherent danger of inadequate wheel bearing lubrication and the potentially serious consequences of a wheel bearing failure.

14. Global Limo Inc. exhibited a lack of concern for safety management controls by violating several Federal safety regulations pertaining to its drivers and vehicles, including employing a driver who was not properly licensed to drive a motorcoach in the United States, failing to conduct the required postaccident alcohol and illicit drug testing, and operating a passenger-carrying commercial vehicle, which had an expired temporary trip tag, that was not registered in the United States, was displaying the license plate from another vehicle, and had not been systematically maintained.

15. The Federal Motor Carrier Safety Administration's compliance review program does not assign numerical value to safety regulation violations that are classified as neither "acute" nor "critical" during the safety fitness rating process, thereby allowing potentially unsafe carriers, which violate safety regulations without consequence, to continue operating.

16. The current Federal Motor Carrier Safety Administration compliance review process does not effectively identify unsafe motor carriers and prevent them from operating.

17. Although the accident motorcoach driver had previously been cited in a roadside inspection as being a non-English-speaking driver, his inability to speak the English language was not a factor in this accident.

18. The quick-spreading fire and thick smoke prevented nursing staff, bystanders, and rescuers from extricating all passengers with special needs from the accident motorcoach.

19. In the absence of demonstrated emergency evacuation capabilities for motorcoaches, such as the accident vehicle, the effectiveness of design features in facilitating the safe escape of passengers cannot be determined.

20. The smoke and heat from the fire prevented rescuers from safely proceeding further into the motorcoach within minutes of their arrival on scene, and the aluminum cylinders failed, releasing oxygen to the fire, after successful rescue attempts were no longer possible.

21. The possibility of structural failure in partially pressurized aluminum cylinders when exposed to heat and fire, as occurred on the accident motorcoach, poses a danger to the general public and emergency responders.

22. Given the unusual circumstances and limited options, Sunrise Senior Living Services, Inc., took reasonable action at the time in deciding to contract with BusBank for motorcoach transportation.

## Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was insufficient lubrication in the right-side tag axle wheel bearing assembly of the motorcoach, resulting in increased temperatures and subsequent failed wheel bearings, which led to ignition of the tire and the catastrophic fire. Global Limo Inc. had failed to conduct proper vehicle maintenance, to do pretrip inspections, and to complete posttrip driver vehicle inspection reports, thereby allowing the insufficient wheel bearing lubrication to go undetected. Contributing to the accident was the Federal Motor Carrier Safety Administration's ineffective compliance review system, which resulted in inadequate safety oversight of passenger motor carriers. Contributing to the rapid propagation and severity of the fire and subsequent loss of life was the lack of motorcoach fire-retardant construction materials adjacent to the wheel well. Also contributing to the severity of the accident was the limited ability of passengers with special needs to evacuate the motorcoach.

# Recommendations

## New Recommendations

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

### To the Federal Motor Carrier Safety Administration:

Establish a process to continuously gather and evaluate information on the causes, frequency, and severity of bus and motorcoach fires and conduct ongoing analysis of fire data to measure the effectiveness of the fire prevention and mitigation techniques identified and instituted as a result of the Volpe National Transportation Systems Center fire safety analysis study. (H-07-1)

Revise the *Federal Motor Carrier Safety Regulations* at 49 CFR 393.205 to prohibit a commercial vehicle from operating with wheel seal or other hub lubrication leaks. (H-07-2)

To protect the traveling public until completion of the Comprehensive Safety Analysis 2010 Initiative, immediately issue an Interim Rule to include all *Federal Motor Carrier Safety Regulations* in the current compliance review process so that all violations of regulations are reflected in the calculation of a carrier's final rating. (H-07-3)

### To the National Highway Traffic Safety Administration:

Develop a Federal Motor Vehicle Safety Standard to provide enhanced fire protection of the fuel system in areas of motorcoaches and buses where the system may be exposed to the effects of a fire. (H-07-4)

Develop a Federal Motor Vehicle Safety Standard to provide fire-hardening of exterior fire-prone materials, such as those in areas around wheel wells, to limit the potential for flame spread into a motorcoach or bus passenger compartment. (H-07-5)

Develop detection systems to monitor the temperature of wheel well compartments in motorcoaches and buses to provide early warning of malfunctions that could lead to fires. (H-07-6)

Evaluate the need for a Federal Motor Vehicle Safety Standard that would require installation of fire detection and suppression systems on motorcoaches. (H-07-7)

Evaluate current emergency evacuation designs of motorcoaches and buses by conducting simulation studies and evacuation drills that take into account, at a minimum, acceptable egress times for various postaccident environments, including fire and smoke; unavailable exit situations; and the current above-ground height and design of window exits to be used in emergencies by all potential vehicle occupants. (H-07-8)

**To the Pipeline and Hazardous Materials Safety Administration:**

Develop standards for the safe transportation of partially pressurized aluminum cylinders by, for example, requiring the addition of temperature-actuated pressure relief devices or the reduction of residual pressure to safe limits, to ensure that such cylinders do not experience overpressure failure when exposed to a fire. (I-07-1)

Issue guidance to, at a minimum, the Fraternal Order of Police, International Association of Chiefs of Police, International Association of Fire Chiefs, International Association of Fire Fighters, National Association of State EMS Officials, National Sheriffs' Association, and National Volunteer Fire Council, describing the risk of overpressure failure of partially pressurized aluminum cylinders and the steps that should be taken to protect responders and the general public from a vehicle fire when aluminum cylinders are present. (I-07-2)

**To the Fraternal Order of Police, International Association of Chiefs of Police, International Association of Fire Chiefs, International Association of Fire Fighters, National Association of State EMS Officials, National Sheriffs' Association, and National Volunteer Fire Council:**

Disseminate to your members the guidance developed by the Pipeline and Hazardous Materials Safety Administration describing the risk of overpressure failure of partially pressurized aluminum cylinders and the steps that should be taken to protect responders and the general public from a vehicle fire when aluminum cylinders are present. (I-07-3)

**To Motor Coach Industries, Inc.:**

Revise your product maintenance manuals to emphasize the importance of wheel bearing lubrication, specifically warning that daily inspection of hub oil levels and wheel seals is vital to prevent wheel bearing failure and that bypassing this requirement is a dangerous practice that can lead to a wheel well fire or other serious consequences. (H-07-9)

For those vehicles already sold and in service, disseminate a customer advisory bulletin on the importance of proper wheel bearing maintenance, specifying the type of equipment or oil bath bearings that require an undercarriage inspection to detect wheel seal leaks and alerting customers to the serious consequences of lack of lubrication and subsequent wheel bearing failure. (H-07-10)

**To Motor Coach Industries, Inc., Prevost Car Inc., Setra, Van Hool, Blue Bird Corporation, Trident Industries, Inc., and IC Corporation:**

Until the National Highway Traffic Safety Administration has developed a performance standard for enhanced fire protection of fuel systems in newly manufactured motorcoaches and included it in the *Federal Motor Vehicle Safety Standards*, as requested in Safety Recommendation H-07-4, use materials and designs for fuel system components that are known to provide fire protection for the system. (H-07-11)

**To the United Motorcoach Association and the American Bus Association:**

Disseminate to your motorcoach and bus operator members an advisory bulletin emphasizing the importance of proper wheel bearing maintenance, particularly the importance of checking the oil level in oil-lubricated bearings (also known as oil bath bearings) and inspecting the undercarriage of the tag axle wheels to detect wheel seal leaks, and the serious consequences of lack of lubrication and subsequent wheel bearing failure. (H-07-12)

Advise your motorcoach manufacturer members to review product maintenance manuals and, if the manuals do not emphasize the importance of wheel bearing lubrication, to revise them to specifically warn that daily inspection of hub oil levels and wheel seals is vital to prevent wheel bearing failure and that bypassing this requirement is a dangerous practice that can lead to a wheel fire or other serious consequences. (H-07-13)

Advise your motorcoach manufacturer members to disseminate, for those vehicles already sold and in service, a customer advisory bulletin on the importance of proper wheel bearing maintenance, specifying the type of equipment or oil bath bearings that require an undercarriage inspection to detect wheel seal leaks and alerting customers to the serious consequences of lack of lubrication and subsequent wheel bearing failure. (H-07-14)

## Reiterated Recommendations

The National Transportation Safety Board also reiterates the following two safety recommendations:

**To the U.S. Department of Transportation:**

Change the safety fitness rating methodology so that adverse vehicle or driver performance-based data alone are sufficient to result in an overall unsatisfactory rating for a carrier. (H-99-6)

Require motorcoach operators to provide passengers with pretrip safety information. (H-99-8)

## BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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**Adopted: February 21, 2007**

Member Hersman filed the following concurring statement on February 28, 2007, joined by Member Higgins. Member Higgins filed the following concurring and dissenting in part statement on April 20, 2007, and was joined concurring in part by Member Hersman.

Notation 7774A

**Member Deborah A. P. Hersman, Concurring:**

There was almost nothing about this accident that was usual. The circumstances—from the hurricane evacuation to the general health of the passengers to the traffic conditions—were extraordinary. Yet, the accident uncovered an astounding number of issues of motorcoach safety that we cannot afford to look past just because the accident happened under unusual circumstances. I will focus on just a few of the issues that were raised during our Board meeting on February 21, 2007 but are not thoroughly discussed in the final accident report.

Bus Driver's English Language Deficiency

The bus driver was unable to communicate in English. Although the bus driver's English language deficiency was not causal to the accident, it is nevertheless useful to look at how this deficiency had a tangential effect on the accident in several instances:

- A training video available at Global for training drivers was in English and would not have been useful to the bus driver.
- The MCI maintenance manual for the motorcoach was in English, making it of no use to the driver as far as items to look at during a pre-trip inspection, required maintenance, and proper vehicle operation.
- The driver was unable to read and interpret variable message boards on the highway giving information about routing and the evacuation.
- The residential care director of Sunrise, who was riding in the bus and who knew a little Spanish, had difficulty communicating to the driver their need to stop the bus in order to replace depleted oxygen tanks for two of the passengers.
- The residential care director again had trouble communicating with the driver when trying to ascertain the milepost number of the place they stopped when the bus had a flat tire, so that she could notify the Navarro County Emergency Services dispatcher of their location.
- When the mechanic arrived on scene to repair the flat tire, the driver was unable to converse with him about the repair.
- The bus driver at first had difficulty understanding the severity of the problem when another driver signaled to him that the bus's rear tire was on fire.
- The bus driver was unable to effectively communicate to the passengers the need for them to evacuate the bus quickly. According to a Safety Board investigator's analysis report, it was only after the nursing staff communicated among themselves about the danger threatening the passengers that the bus evacuation began, mostly through the efforts of the nursing staff and bystanders.[1]

[1] Human Performance Group Chairman's Memorandum of Analysis, NTSB Accident no. HWY-05-MH-035.

Federal Motor Carrier Safety Regulations (FMCSRs) require that an individual driving a commercial motor vehicle in the United States must be proficient in English.[2] On February 12, 2005, the bus driver was stopped for a roadside inspection in which the inspector noted on the inspection report that the bus driver did not speak English. In accordance with 49 CFR 396.9(d), Global Limo had 15 days to correct this noncompliance, yet according to company records, the bus driver drove, not only on the day of the accident, but also on many trips between the February inspection and the day of the accident.

Language has been a factor in several tragic accidents in the past several years. In 2005, the Safety Board investigated a motorcoach fire near Meriden, Connecticut. The driver of the motorcoach saw the need for passengers to quickly evacuate the bus, but he spoke only Chinese and was unable to communicate an evacuation order. Eventually, the passengers were able to interpret his body motions and communicated to one another the need to evacuate. Last year, this same motorcoach operator was involved in an accident in Boston in which 48 people were injured. As in the earlier accident, a Chinese-speaking driver could not communicate in English. This time, FMCSA cited the company for violating the English language requirement, in addition to a speeding violation, and fined the company $31,000 for both violations.[3]

Effective communication is the foundation for a successful response to an emergency. In 2005, the Safety Board investigated a gasoline tanker rollover accident in Davie, Florida, in which the driver's inability to speak English impeded first responders' efforts to ascertain what type of hazardous material he was transporting in the tanker. In 2003, the non-English speaking driver of a tractor semi-trailer involved in an accident near Slippery Rock, Pennsylvania, was unable to communicate to first responders the nature of his load when first responders noticed that the trailer, engulfed in flames, was placarded for hazardous materials. He reported through an interpreter that he had been unable to read variable message signs on the roadway, but that he just followed traffic. He also reported that he had been stopped twice for roadside inspections, in which case, he called his boss on his cell phone so that his boss could act as interpreter between him and the inspector. He was not cited for a violation of the English language requirement.

A motorcoach accident near Manahawkin, New Jersey, in 2003 involved a driver who spoke Chinese and was unable to answer basic questions about the accident without a State Police interpreter. In an accident near Old Bridge, New Jersey, in 1998, the driver of a motorcoach was not able to provide needed basic information to investigating officers without a Russian interpreter.

[2] 49 CFR 391.11(b)(2) states: "Except as provided in Subpart G of this part, a person is qualified to drive a motor vehicle if he/she can read and speak the English language sufficiently to converse with the general public, to understand highway traffic signs and signals in the English language, to respond to official inquiries, and to make entries on reports and records."

[3] News release, U. S. Department of Transportation, Office of Public Affairs, October 30, 2006.

We cannot categorically state that if the language barrier in any of these accidents had been removed, the accidents would not have happened. However, it must be acknowledged that in these accidents, as in the accident in Wilmer, the situations would have been more effectively and safely handled had there not been a language issue.

It is worthwhile to note that in 2003, the Commercial Vehicle Safety Alliance (CVSA) petitioned the Department of Transportation (DOT) to amend the FMCSRs to better address the language proficiency of commercial drivers.[4] The petition cites the inability of some commercial drivers to communicate in English as compromising the inspection process as well as highway safety. CVSA suggested that the Federal Motor Carrier Safety Administration (FMCSA) work with CVSA to develop a standard test procedure for law enforcement officers to use to determine if a commercial driver meets the minimum standard for communication. CVSA also suggested that FMCSA revise the regulation at 49 CFR 391.11(b)(2) to reflect requirements for communication under the North American Free Trade Agreement under which it is the responsibility of a driver and a motor carrier to be able to communicate in the country in which they are operating so that safety is not compromised.

Bus Driver's Immigrant Status and Mexican Commercial Driver's License

The bus driver, a citizen of Mexico, was an illegal alien in the U.S. at the time of the accident. When asked by Safety Board investigators if he had a green card or a work visa, he responded that he did not. He stated that he held a commercial driver's license in Mexico since 1988 and was an experienced bus driver in Mexico, having driven for his father's (and later his brother's) company for many years, but he came to the U.S. because of the "differences in pay." At the time of the accident, he was driving under the authority of a Mexican CDL issued in 1998. As a driver with a Mexican CDL, he was permitted to drive from Mexico to the United States, or through the United States to Canada, and return. He was not legally permitted to drive from an origination point in the U.S. to a destination in U.S. as he was doing for Global Limo.

On the back of his CDL, boxes indicated "No" as the response to the following medical conditions: diabetes, vision correction required, and hypertension. Although the bus driver admitted being diagnosed with diabetes in 1998 and being treated by a Mexican physician for Type II diabetes, his CDL did not reflect that he has the illness. Investigators did not find any records associated with his CDL that reflected his condition had been disclosed or was under control. When a U.S. doctor declined to give him a medical certification until he could prove that his diabetes was controlled, he continued to drive under his Mexican CDL.

[4] Commercial Vehicle Safety Alliance to U.S. Department of Transportation, Federal Motor Carrier Safety Administrator, "Petition to Amend 49 CFR Part 391 to Facilitate Adequate Language Proficiency for Commercial Drivers," September 10, 2003.

The bus driver was cited twice for speeding, once in April 2005 near Brownsville, Texas and once in August, 2005 near Laredo, Texas (he said he was trying to make up lost time after the bus broke down on the trip).[5] Neither citation appeared on his license at the time of the accident or any time during the investigation. If he had pleaded guilty and paid for either or both citations, they should have appeared as convictions on his Mexican CDL. If he had failed to pay the fines or appear in court, his license should have been suspended. Data improvement efforts over the last decade have resulted in significant investments in the Commercial Driver's Licensing system. The goal of these federal investments is to guarantee that license and conviction information is transferred between the 50 states, the District of Columbia, Mexico, and Canada. For this purpose, a database has been established in the U.S. that connects to the Federal licensing system in Mexico and so that it functions as the "52nd State." Investigators could not find documentation to determine whether the citations were resolved through the courts or the licensing system. In this case, the system that connects traffic citations to the drivers who commit them, from one country to the other, failed.

While the bus driver's immigration status was not causal to the accident, I believe that it did have a role in keeping a sloppy motorcoach operator in business. The bus driver knew that Global buses had chronic maintenance problems. The owner of the company had avoided recommended repairs, in one instance, departing a repair shop in Aransas Pass, Texas, with a parking brake that did not work. The owner had a reputation for failing to pay for repairs, and in fact, NTSB investigators found two Global buses being held as collateral at Valley Volvo in Pharr, Texas, because Global had neglected to pay for repairs. The accident bus driver reported that he had driven the accident bus to Dallas earlier in the week and that the air conditioner was not working and the front tires were so bald they were causing the front end of the bus to vibrate. He told investigators that he "demanded" that repairs be made before the next trip. The tires were replaced, however the new tires were undersized, which may have caused the front axle to be overloaded by as much as 33.6%.[6]

The violations of FMCSRs accumulated by Global Limo are well documented. In the two years prior to the accident, Global's drivers were subjected to eight roadside inspections that resulted in four drivers being placed out of service for hours-of-service violations. The driver of the accident bus underwent three roadside inspections prior to the accident and was placed out of service after two of the three inspections. Safety Board investigators learned that Global did not require drivers to keep a record of their hours of service, except when driving on behalf of FEMA. The driver said that he continued to work for Global because the company owed him several thousand dollars in back pay. He said he was promised his money once the company had more cash earned from contracts it had with FEMA to transport evacuees from New Orleans following Hurricane Katrina.

[5] Driver interview, Motor Carrier Groups Chairman's Factual Report, Texas Department of Public Safety Citation, NTSB Accident No. HWY-05-M-H035.

[6] Vehicle Group Chairman's Factual Report, NTSB Accident No. HWY-05-M-H035.

Both parties in this employer/employee relationship had deficiencies to hide and compensate for. The bus driver was an undocumented alien working illegally in this country with an apparently problematic foreign CDL with an invalid medical certification. He worked for Global because the company was willing to overlook his immigration status and other licensing problems. Global was a cash-strapped bus company operating in violation of numerous motor carrier safety violations. Global hired the bus driver because he was willing to overlook the company's many safety issues so that he could work in this country. These two parties forged a symbiotic relationship that enabled this motorcoach company to operate on the thinnest of safety margins, until the day of this accident when the margin disappeared.

The Federal Motor Carrier Safety Administration

FMCSA was created by the Motor Carrier Safety Improvement Act of 1999 (MCSIA). Prior to its establishment as an independent modal administration, the functions of FMCSA were housed in the Office of Motor Carriers (OMC) within the Federal Highway Administration (FHWA). Originally, authority for the trucking and motorcoach industries was administered by the Interstate Commerce Commission, but following deregulation and the passage of the Motor Carrier Act of 1980, economic and safety authority were divorced. The Motor Carrier Safety Act of 1984 directed the Secretary of Transportation to establish a procedure to determine the safety fitness of owners and operators of commercial vehicles operating in interstate commerce. It stated that the intent of Congress was to reduce commercial vehicle crashes and fatalities through strong enforcement of motor vehicle safety laws and regulations. Thus, the OMC became responsible for safety oversight of the truck and bus industry.

In the late 1990s, the OMC came under harsh criticism from safety groups, the Congress, and the DOT Inspector General for its failure to reduce large truck crashes and fatalities and for being too close to the trucking industry. The general conclusion was that the priorities of the truck and bus safety office were too buried within a huge agency, FHWA, whose primary mission was to build roads. According to the Inspector General, "The fatality rate for large truck crashes has remained flat since 1995, while the number of fatalities involved in those crashes continues to increase… The OMC has shifted emphasis from enforcement to a more collaborative, educational, partnership-with-industry approach to safety. This is a good approach for motor carriers that have safety as a top priority, but it has gone too far..."[7] FHWA acknowledged in a response letter to the Inspector General that the "pendulum has swung too far towards education/outreach and now must move towards stronger enforcement, particularly for repeat offenders."[8]

In May of 1999, DOT Secretary Rodney Slater and Federal Highway Administrator Kenneth Wykle announced a safety action plan with a goal of reducing motor carrier traffic fatalities by 50% over 10 years through a comprehensive effort with

[7] Department of Transportation Inspector General Report No. TR-1999-091, April 26, 1999, Motor Carrier Safety Program, Federal Highway Administration.

[8] Ibid.

safety groups, industry and state and local governments.[9] By September of 1999, they reported progress, citing a 59% increase in compliance reviews, followed by an increase in Federal investigators at the border from 13 to 40, and a reduction in the enforcement case backlog by two-thirds.[10]

Despite these actions by DOT, Congress quickly passed the MCSIA on a bipartisan basis,[11] which President Clinton signed into law on December 9, 1999. The Act created FMCSA and directed it to "reduce the number and severity of large-truck involved crashes through more commercial motor vehicle and driver inspections and carrier compliance reviews, stronger enforcement, expedited completion of rules, sound research, and effective commercial driver's license testing, recordkeeping, and sanctions."[12] The Act also authorized a large scale truck crash causation study, harsher penalties for violators, reviews of new motor carriers within 18 months of starting operations, improved data collection and reporting requirements, and substantial increases in funding for federal and state oversight efforts.

FMCSA's Budget

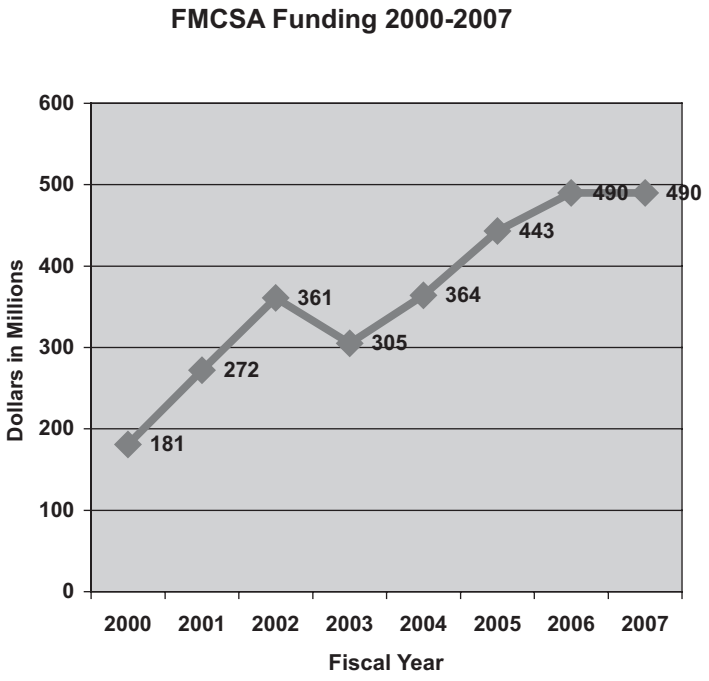
Along with the creation of an independent agency came significant increases in funding for motor carrier safety. As part of FHWA, OMC had existed as an office within a larger agency, but the stand-alone modal administration required additional funds for the overhead costs generated by such independence. In addition, FMCSA has received significant increases each year to hire additional inspectors, complete regulatory activity and improve motor carrier safety. Since the agency opened its doors on January 1, 2000, its annual appropriation has increased by over 250%.

[9] http://www.dot.gov/affairs/1999/52599sp.htm, Remarks by Secretary Slater, Commercial Vehicle Safety Action Plan, May 25, 1999.

[10] FHWA 61-99 Press Release, September 28, 1999, "U.S. Transportation Secretary Slater Reports Progress in Motor Carrier Safety."

[11] In August 1999 Senator McCain introduced S. 1501, The Motor Carrier Safety Improvement Act of 1999 and Representatives Shuster, Oberstar, Petri and Rahall introduced H.R. 2679, The Motor Carrier Safety Act of 1999.

[12] P.L. 106-159.




Source:

2000 (http://testimony.ost.dot.gov/test/passttest/00test/Cirillo1.htm)

2001 – 2002 (http://www.dot.gov/bib2003/fmcsa.html)

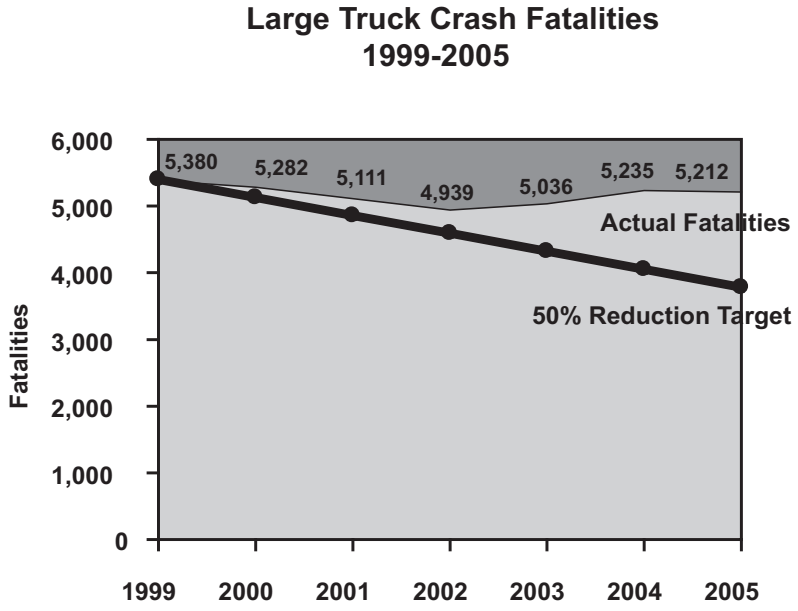
2003 – 2004 (http://www.dot.gov/bib2005/admins.html)

2005 – 2006 (http://www.dot.gov/bib2007/admins.html)

2007 (http://www.dot.gov/bib2008/bibpart06fmcsa.htm)

Performance Measures

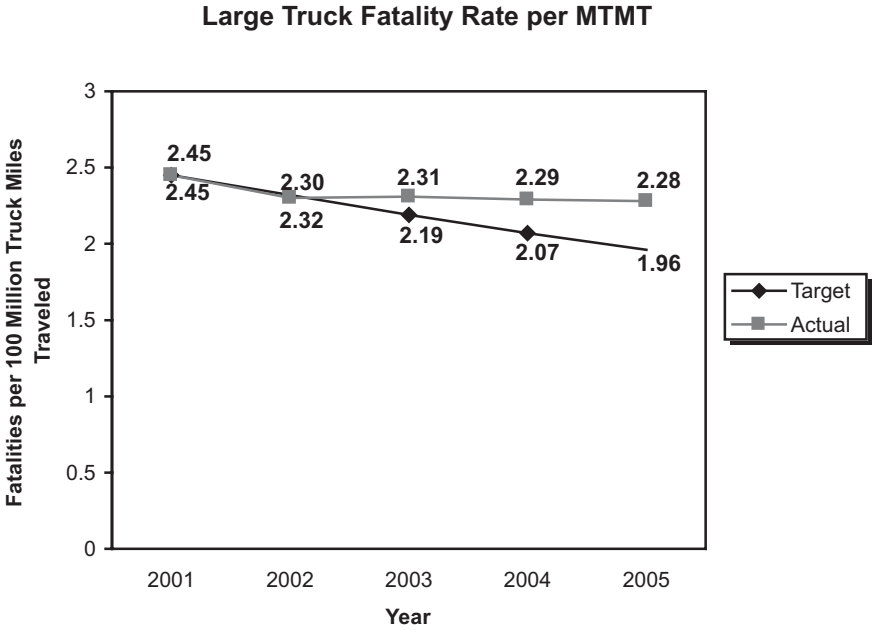
FMCSA has established several performance measures and subjective data sets that provide useful information. One such data set reflects the number of fatalities in large truck crashes. One of the first goals set by FMCSA upon its creation was to reduce the number of fatalities involving large trucks by 50% in ten years. In the past eight years, however, the number of such fatalities has remained fairly constant.




Source:
1999-2004 -http:ai.volpe.dot.gov/test/CarrierResearchResults/HTML/2004Crashfacts/tb11.htm
2005 - http:ai.volpe.dot.gov/CrashProfile/n_overview.asp

As it became increasingly clear that the goal to achieve a 50% reduction in large truck fatalities was not going to be reached in the time allotted, the agency changed its goal. In DOT's proposed Safe, Accountable, Flexible, and Efficient Transportation Equity Act in 2003, FMCSA's "re-stated goal" was to participate in the DOT-wide goal of reducing the fatality rate in all motor vehicle crashes by 41% between 1998 and 2008. FMCSA's part of that goal was to reduce commercial vehicle crash fatalities to 1.65 fatalities per 100 million truck miles traveled (MTMT). In April 2005, Administrator Annette Sandberg testified before Congress about the new FMCSA goal to reduce commercial vehicle crash fatalities, stating, "I am pleased to report that the FY 2003 CMV fatality rate is the lowest recorded since the Department initiated tracking in 1975."[13] While the agency came closest to meeting its goal in 2003, the gap between the annual goal rate and the actual rate increased that year and each year after that. For example, in the FY 2007 budget submission, FMCSA stated that the goal for 2003 was a rate of 2.19, but the actual rate was 2.31. Similarly, in 2004, the goal rate was 2.07, but the actual rate was 2.29, and in 2005, the goal was 1.96, and the estimated rate was projected to be 2.33. FMCSA has not achieved its "restated goal."

[13] Adminstrator Annette Sandberg, Testimony before the Senate Commerce, Science and Transportation Committee, April 5, 2005.




Source:
1999-2004 (http://ai.volpe.dot.gov/test/CarrierResearchResults/HTML/2004Crashfacts/tbl1.htm)
2005-2006 (http://www.whitehouse.gov/omb/expectmore/detail/10000410.2003.html)

In its FY 2008 budget estimates, FMCSA has once again changed the measure to evaluate its own effectiveness, with a new goal to be achieved by 2011.[14] However, that goal is no longer expressed as the large truck fatality rate per 100 MTMT, but rather as the combined bus/large truck fatality rate per 100 million vehicle miles traveled (MVMT). It is important to note, that the agency has done two things to change the measure: first, it merged the fatality rate with the bus/motorcoach rate, and, second, it replaced the number of fatalities per 100 MTMT (which, of course, calculates only truck miles) in favor of a new exposure denominator comprising annually accrued mileage for *all motor vehicles*.

The bus/motorcoach fatality rates per 100 MVMT are far lower than those for trucks, so with the first change of merging bus/motorcoach fatality rates with truck rates, the combined rates were substantially lowered, with new figures expressed as the large truck-bus/motorcoach fatality rate per 100 million *commercial motor vehicle* miles traveled (CMVMT). In the second change, the exposure of total CMVMT was then submerged in the larger, total mileage traveled annually by all motor vehicles. Thus, FMCSA is able to portray a fatality rate that is more than an order of magnitude lower than the previous measure of large truck fatalities per 100 MTMT. Accordingly, instead of large truck fatality rates of 2.31 (2003), 2.37 (2004), and 2.34 (2005) per 100 MTMT, the rate stated in the FY 2008 budget estimates for 2005 (the earliest year cited in the body of

[14] "Budget Estimates Fiscal Year 2008," Federal Motor Carrier Safety Administration, p. 4A-14.

the FY 2008 budget estimates) is 0.184 per 100 MTVMT (million total vehicle miles traveled). Similarly, the target goal for 2006 is 0.179, for 2007 it is 0.175, and for 2008 it is 0.171. While some may question whether this exposure denominator is appropriate, what is clear is that in less than 10 years since it has been created, the total number of commercial vehicle fatalities has remained flat while the agency has thrice revised its goals, making it very difficult for anyone to make meaningful year-to-year comparisons and obfuscating the fact that the agency has failed to meet its target reductions in total fatalities and fatality rates.

Roadside Inspections and Traffic Enforcement

Roadside inspections and commercial motor vehicle traffic enforcement are generally conducted by dedicated commercial vehicle safety inspectors employed by the states. The program consists of roadside inspections performed by approximately 10,000 qualified safety inspectors following the guidelines of the North American Standard, which was developed by the CVSA in cooperation with FMCSA. There are various levels of inspections for each component, which may include a vehicle component, a driver component, or both. An inspection is identified as a traffic enforcement event when at least one traffic violation is present in the inspection. The traffic enforcement program is based on 21 state or local traffic enforcement violations noted in conjunction with a roadside inspection.[15] Approximately 25% of inspections between 2003 and 2005 were traffic enforcement related.[16]

Most roadside inspections by the states are conducted under the Motor Carrier Safety Assistance Program (MCSAP). MCSAP is a Federal grant program administered by FMCSA to provide funding to the states for commercial vehicle safety efforts. MCSAP was initially funded at $8 million in 1984. It increased substantially after the creation of FMSCA and grew to $188 million by FY 2006.[17] The money is allocated by formula, and states are required to provide a match for the Federal funding, generally apportioned on an 80/20 basis. States determine their MCSAP priorities within allowable expenditures, and they may qualify for additional incentive grants or border funds. Some states elect to spend additional state funds beyond the MCSAP program to further oversee motor carrier safety. For example, while the total federal funding for MCSAP during FY 2005 was $169 million,[18] the state of California spent $137 million on commercial motor vehicle programs in FY 2005.[19]

A roadside inspection occurs when an inspector conducts an examination on a commercial motor vehicle and driver to determine if they are in compliance with the FMCSRs and/or the hazardous materials regulations. Serious violations result in the

[15] http://ai.volpe.dot.gov/Help/Help.asp?#ri1 Volpe – A & I Program Measures, Roadside Inspections.

[16] http://ai.volpe.dot.gov/ProgramMeasures/TE/TE.asp Volpe - A & I Program Measures, Traffic Enforcement.

[17] DOT IG Report No. MH-2006-046 Significant Improvements in Motor Carrier Safety Program since 1999, but Loopholes for Repeat Violators Need Closing, Federal Motor Carrier Safety Administration, April 21, 2006.

[18] http://www.fmcsa.dot.gov/safety-security/safety-initiatives/mcsap/mcsap-fy05.htm, FY 2005 MCSAP Grant Allocations by State and Category.

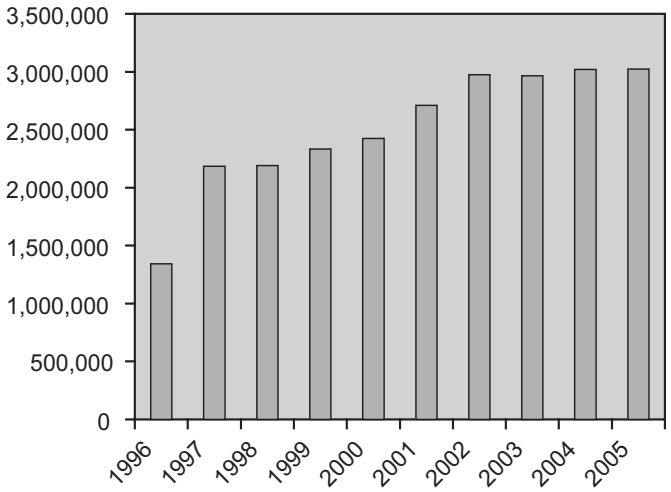
[19] California's FY is July 1 through June 30. These figures do not include Motor Carrier Safety Assistance Program (MCSAP) grant funding.

issuance of driver or vehicle out-of-service (OOS) orders. These violations must be corrected before the affected driver or vehicle can return to service.

Approximately 73% of vehicles inspected are found to have at least one violation in roadside inspections. Further, 23% of vehicles have defects so serious that they are placed OOS and must be parked and repaired.[20] The most common violation is out-of-adjustment brakes and defects in brake components, found in 57% of vehicles placed OOS.[21] Vehicles also may be placed OOS due to defects related to lights, tires, wheels, and cargo securement.

Approximately 7% of drivers are placed OOS. The primary causes for placing drivers OOS are hours of service violations (57%), falsification of logs (12.4%), and drivers operating on suspended or disqualified licenses or without proper endorsements (8.5%).[22]

**Roadside Inspections (1996-2005)**




Source: MCMIS

Although the number of inspections has increased from 1.35 million in 1996[23] to over 3 million inspections in 2005,[24] the OOS rates have remained constant. Studies have shown that targeted inspections of higher-risk carriers and completely random inspections

[20] http://www.itsa.org/itsa/files/presentations/CVFMWirelessInspectionsLoftus.pps "Wireless Inspection Highlights" Jeff Lotus, FMCSA, March 2, 2006.

[21] Roadcheck 2006, CVSA.

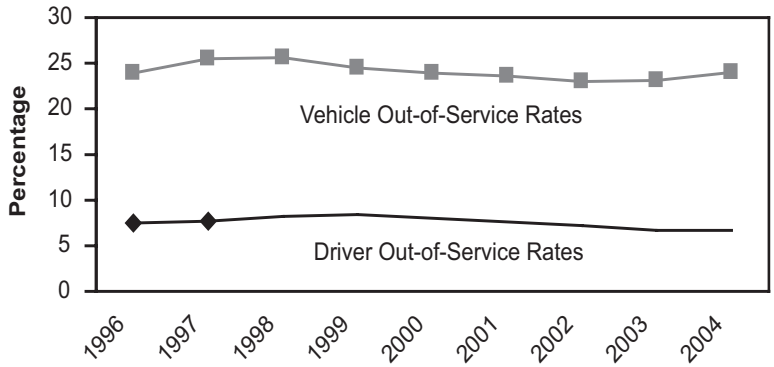
[22] Ibid.

[23] http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/06factsfigures/table5_6.htm reight Facts and Figures, DOT.

[24] MCMIS.

result in similar OOS rates for drivers and vehicles.[25] No matter the type or the number of inspections conducted in a given year, approximately one-quarter of commercial vehicles inspected have such serious violations that they must be parked and repaired before they can move. Such a high rate of safety violations is seen in no other mode of commercial transportation (air, rail, marine), nor would it be tolerated. The fact that this rate has remained high and constant over the last 10 years is significant. It means that the current penalty scheme is not sufficiently effective in ensuring that motor carriers comply with safety regulations. The sanctions imposed are considered the cost of doing business and thus suggest a tolerance level for violations of safety requirements.

**Vehicle and Driver Out-of-Service Rates**




**Source: MCMIS**

Compliance Reviews

Compliance reviews are the keystone of FMCSA's safety program. According to the agency, the two main components of its safety monitoring system are compliance reviews and roadside inspections. As defined by FMCSA, a compliance review is an on-site examination of a motor carrier's operations by a Federal safety investigator to determine a motor carrier's safety fitness.[26] A carrier cannot obtain a safety rating unless it undergoes a compliance review. Neither roadside inspections nor state safety audits similar to a compliance review result in a safety rating. There are over 900,000 active carriers,[27] and the majority of carriers are unrated.

[25] http://www.ai.fmcsa.dot.gov/CarrierResearchResults/PDFs/AdditionalReports/2003FleetSafety Surveys.pdf 2003 National Truck Fleet and Bus Fleet Satety Surveys: Final Report.

[26] Powerpoint, "What is a compliance review?" www.fmcsa.dot.gov/documents/training/comp_rev_mx_eng.ppt - 2006-08-01.

[27] MCMIS, Number of active carriers in 2005.

FMCSA prioritizes carriers for review based on their Safestat[28] score or to follow up previous enforcement action. Additionally, compliance reviews may be initiated following a fatal accident or involvement in a major hazardous materials accident, as well as by complaints about carriers or at the carrier's request. Generally, carriers subjected to compliance reviews are some of the worst carriers operating on the roadways.

As identified in this accident report, only a fraction of the existing carriers received a compliance review in 2005; of the 910,866 carriers, just under 8,000, or less than 1%, were subjected to an on-site safety inspection. Of those, 5,022 carriers (63%) received a satisfactory rating, 2,138 carriers (27%) received a conditional rating, and 594 carriers (7%) received an unsatisfactory rating.

In 2004, 19 months prior to the accident, Global received a satisfactory rating, despite numerous safety deficiencies cited, a fact that underscores the failure of compliance reviews to identify unsafe carriers. Although it had no maintenance program, deficiencies in its drug and alcohol program, and numerous driver violations, Global still received a satisfactory rating. (*See* attachment #1). Immediately following the bus fire, however, an FMCSA compliance review concluded that the carrier was not only unsatisfactory, but also an imminent hazard, and the agency ordered the company to cease operations. Although FMCSA predicts that its Comprehensive Safety Analysis of 2010 will address revisions to the carrier fitness rating system, the tragic consequences of this accident add urgency to the Safety Board's Safety Recommendation H-99-6 to change the safety fitness rating methodology so that adverse vehicle and driver performance-based data alone are sufficient to garner an overall unsatisfactory rating. This recommendation was issued in 1999 following publication of NTSB's *Special Investigation Report on Selective Motorcoach Issues*[29] in which several motorcoach accidents were analyzed. It has been reiterated in this and other investigations,[30] and it resides on our Most Wanted List of Transportation Safety Improvements.[31]

Only .0006 carriers of all carriers received a rating of unsatisfactory although the data indicate that 75% of roadside inspections result in at least one violation, with approximately 25% of vehicles and 7% of drivers having such serious violations that they must be placed OOS. The data further show that few carriers have their operating authority revoked. In addition, the Safety Board found during a recent investigation that a passenger carrier that had its interstate operating authority revoked continued to operate in interstate commerce undetected for several years. Although the carrier was subjected to at least one roadside inspection during that time, the lack of operating authority was not detected until after the company was scrutinized following its involvement in a fatal accident. [32]

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[28] 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 motor carrier.

[29] NTSB/SIR-99/01.

[30] NTSB/HAR-02/03 Collision Between Truck-Tractor Semitrailer and School Bus Near Mountainburg, Arkansas, on May 31, 2001.

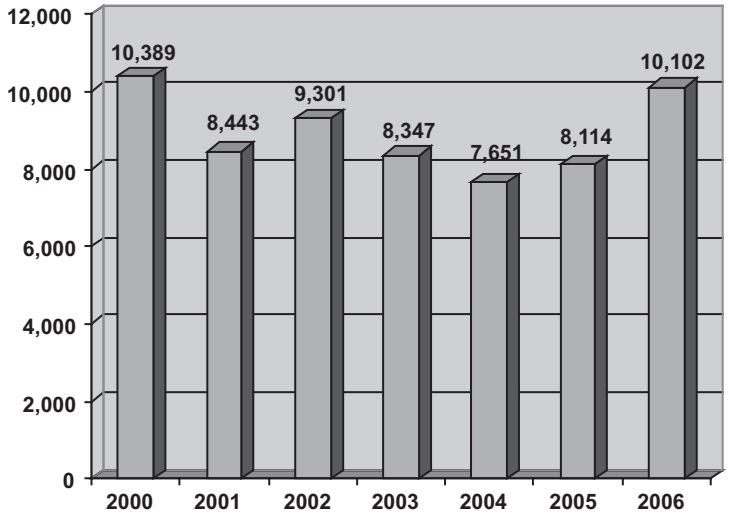
[31] http://www.ntsb.gov/Recs/mostwanted/highwayissues.htm.

[32] NTSB Report Number HAR-06-03, Highway Accident Report: Multivehicle Collision on Interstate 90, Hampshire-Marengo Toll Plaza, Near Hampshire, Illinois, October 1, 2003.

Improvements to a carrier's safety program and any enforcement action are predicated on the information documented in the compliance review. For years, regulators have been discussing ways to increase the number of compliance reviews, but while FMCSA's budget has increased substantially since it was formed, there has been no commensurate increase in the number of the reviews completed. This issue was addressed by the House Appropriations Committee last year: "The Committee continues to be concerned that only a very small percentage of registered motor carriers undergo a safety compliance review each year."[33]

While the agency has long promoted compliance reviews as the critical part of their mission, they often overstate the number of compliance reviews conducted each year. Testimony given by Administrator Sandberg in 2004 indicated that 11,000 compliance reviews were conducted that year.[34] However data on FMCSA's website show that less than 8,000 compliance reviews were conducted in 2004. A recent article in *Bus & Motorcoach News* stated that 12,000 compliance inspections are conducted annually[35] when in reality, the agency has consistently fallen short of that goal.

**Compliance Reviews 2000-2006**




Source:
2000 – 2001 (http://ai.fmcsa.dot.gov/ProgramMeasures/CR/NR/NSR/Report.asp?FC=C&RF=T&DP=P)
2002 – 2006 (http://ai.fmcsa.dot.gov/ProgramMeasures/CR//NR/NSR/Report.asp?FC=C&RF=T)

[33] House Report 109-495 – Departments of Transportation, Treasury, and Housing and Urban Development, the Judiciary, District of Columbia, and Independent Agencies Appropriations Bill, 2007.

[34] Administrator Annette Sandberg, Testimony before the Senate Commerce, Science and Transportation Committee, April 5, 2005.

[35] "FMCSA Administrator vows to upgrade Fed's coach safety oversight", Bus & Motorcoach News, February 1, 2007.

Large trucks represent about 4% of registered vehicles; however, they account for 8% of the travel volume on our Nation's highways. Approximately 12% of all the people killed in motor vehicle crashes die in crashes involving a large truck.[36] There are approximately 9 million commercial truck and buses operating in the U.S. and over 900,000 registered motor carriers. The truck vehicle miles traveled increase at a rate of approximately 2% each year.

FMCSA's primary mission is to prevent commercial motor vehicle-related fatalities and injuries. It would be unfair to overlook the fact that FMCSA has made progress in certain areas: more enforcement cases have been opened and it has expanded its use of out-of-service orders consistent with authorities established in the MCSIA. In 2004, 425 carriers received OOS orders for maintaining an unsatisfactory rating for more than 60 days, and 1,378 carriers received OOS orders for failing to pay a civil penalty after 90 days. While commercial vehicles are over-represented in fatal accidents,[37] fatalities have held steady in recent years although exposure is increasing due to higher vehicle miles traveled. However, while the FMCSA budget has almost increased by over 250% since the agency was established, many of FMCSA's critical performance measures have remained essentially flat, including the number of annual fatalities in commercial motor vehicle crashes, the fatality rate, the driver and vehicle OOS rate in roadside inspections and the number of compliance reviews.

Conclusion

It is important to point out that for every unsafe motor carrier on the road, there are hundreds that take appropriate measures everyday to ensure the safety of their equipment and their drivers. Because the Safety Board's role is to investigate accidents, we more often see those transportation providers (in *all* modes of transportation) whose approach to safety is something less than adequate. The circumstances of this tragic accident do not lead us to the conclusion that the motorcoach industry is unsafe or that motorcoaches are dangerous, because in reality, they have an excellent safety record, especially when compared to commercial trucks and passenger cars. However, it does serve to make us all aware that all motorcoach operations are not equal with respect to safety. Unfortunately, passengers place their trust in a motorcoach operator without any easy way to discern if the operator deserves that trust. They are entirely dependent on those charged with safety oversight to prevent them from entrusting themselves, or their loved ones, to the wrong carrier.

Unfortunately, this accident investigation revealed that a company that violates almost all of the safety rules can still slip through the cracks. FMCSA conducted a compliance review of Global's operations in February, 2004 and issued the company a satisfactory rating, even though major deficiencies existed. In the following year, after the September, 2005 bus fire, the agency conducted a compliance review that documented

[36] http://www.dot.gov/bib2008/bibpart06fmcsa.htm, U.S. Department of Transportation, Budget in Brief – FY 2008, FMCSA.

[37] Large trucks represent about four percent of registered vehicles; however, they account for eight percent of the travel volume on our Nation's highways. Approximately 12 percent of all the people killed in motor vehicle crashes die in crashes involving a large truck.

many of the same safety violations but yielded a vastly different outcome. FMCSA declared that Global's operations created an "imminent hazard" to public safety and issued an out-of-service order stating that Global's pattern of FMCSR violations was consistent in nature and long in history. This accident is one of many in which the Safety Board has found inconsistencies based on a safety rating process that fails to remove the most unsafe carriers from the Nation's highways.

FMCSA has the Herculean task of overseeing an industry where there are few barriers to entry and insufficient resources to conduct 100% oversight of every carrier, driver or truck. However, prior to this accident, there were multiple opportunities for intervention. FMCSA had the benefit of eight roadside inspections in the two years prior to this accident, four of which resulted in the drivers being placed out-of-service for serious violations of the Federal safety regulations. This 50% OOS rate identified Global as a high-risk carrier and prioritized them for inspection. The review conducted by the State of Texas in 2002 and the Federal compliance review conducted in 2004 documented numerous safety violations. Following the post-accident compliance review in 2005, FMCSA found that Global's violations of the FMCSRs were "so widespread as to demonstrate a continuing and flagrant disregard for compliance" and that Global had a management philosophy "indifferent" to motor carrier safety. This disregard and indifference did not occur overnight -- it had existed for years. FMCSA has advised the Safety Board for over a decade that the rating system is going to be revised to better identify unsafe carriers. Recently, these promises were made part of FMCSA's Comprehensive Safety Analysis 2010. But right now, this accident proves that the agency charged with safety oversight of our motor carriers is not getting even the worst of the worst carriers off the roads. The system is broken, and the traveling public can't afford to wait until 2010 to fix it.

Deborah A. P. Hersman
February 28, 2007

## Exhibit from Panel Six – Wilmer Public Hearing
## VIOLATIONS NOTED ON REVIEWS

| Educational Review 4/10/2002 | Pre-Fire Compliance Review 2/12/2004 | Post-Fire Compliance Review 10/07/2005 |
|---|---|---|
| Part 382, Drug & Alcohol Program<br>• No drug/alcohol testing program ACUTE | Part 382, Drug & Alcohol Program<br>• Failing to provide drivers with drug/alcohol policies<br>• Failure to have persons trained for reasonable suspicion | Part 382, Drug & Alcohol Program<br>• Using driver w/o pre-employment drug test CRITICAL<br>• Failing to provide drivers with drug/alcohol policies<br>• Failure to have drug/alcohol random testing method<br>• Failure to conduct post accident drug/alcohol test<br>• Failure to have persons trained for reasonable suspicion |
| Part 391, Driver Qualification Files<br>• No driver background investigation<br>• No driver employment application<br>• No driver record inquiry CRITICAL | Part 391, Driver Qualification Files<br>• Failing to maintain a copy of response from each State agency<br>• Failing to maintain a note relating to the driver's annual record check<br>• Failing to maintain a driver's medical examiner certificate | Part 391, Driver Qualification Files<br>• Non-English speaking driver<br>• Using driver w/o valid license<br>• Using driver w/o complete employment application<br>• Failure to maintain a Driver Qualification File<br>• No driver record inquiry CRITICAL<br>• Failing to maintain a note relating to the drivers annual record check<br>• Failure to maintain list of motor vehicle violations |
| Part 395, Hours of Service<br>• Failure to require driver to make a record of duty status[1] (log) CRITICAL | Part 395, Hours of Service<br>• False logs | Part 395, Hours of Service<br>• Permit violation 10 hour rule<br>• Permit violation of 15 hour rule<br>• Failure to require driver to make a record of duty status (log) |

[1] 49 CFR Part 395.8 identifies the driver's Record of Duty Status (RODS). The motor carrier industry and public commonly use the word "log" in lieu of the term Record of Duty Status or RODS. The term log is used in this report because of its common usage and familiarity to the public and the motor carrier industry.

| | | |
|---|---|---|
| • Failure to require form and manner on driver log | | • False log CRITICAL |
| Part 396, Vehicle<br>• Failure to maintain vehicle inspection and maintenance records<br>• Failure to maintain evidence of brake inspector's qualifications | Part 396, Vehicle<br>Failure to have a schedule for vehicle inspection and maintenance | Part 396, Vehicle<br>• Failure to maintain vehicle inspect vehicles<br>• Fail to inspect emergency exits<br>• Failure to require driver inspection reports CRITICAL<br>• Operate CMV w/o Periodic Inspection CRITICAL |

| Factor | Rating | Acute | Critical |
|---|---|---|---|
| Factor 1: | S | 0 | 0 |
| Factor 2: | U | 1 | 1 |
| Factor 3: | U | 0 | 2 |
| Factor 4: | S | 0 | 0 |
| Factor 5: | N | 0 | 0 |
| Factor 6: | S | - | - |
| **SAFETY RATNG** | | | |
| Unsatisfactory | | | |

| Factor | Rating | Acute | Critical |
|---|---|---|---|
| Factor 1: | S | 0 | |
| Factor 2: | S | 0 | 0 |
| Factor 3: | S | 0 | 0 |
| Factor 4: | S | 0 | 0 |
| Factor 5: | N | 0 | 0 |
| Factor 6: | S | 0 | 0 |
| **SAFETY RATING** | | | |
| Satisfactory | | | |

| Factor | Rating | Acute | Critical |
|---|---|---|---|
| Factor 1: | S | 0 | 0 |
| Factor 2: | U | 1 | 2 |
| Factor 3: | U | 0 | 2 |
| Factor 4: | U | 0 | 2 |
| Factor 5: | N | 0 | 0 |
| Factor 6: | S | - | - |
| **SAFETY RATING** | | | |
| Unsatisfactory | | | |

Factor 1: General = Parts 387 & 390
Factor 2: Driver = Parts 382, 383 & 391
Factor 3: Operational = Parts 392 & 395
Factor 4: Vehicle = Parts 393 & 396
Factor 5: Haz Mat = Parts 397, 171, 177 & 180
Factor 6: Accident Factor = Recordable Rate

| CALCULATION FORMULA | | |
|---|---|---|
| Unsatisfactory | Conditional | Overall Rating |
| 0 | 2 or fewer | Satisfactory |
| 0 | 3 or more | Conditional |
| 1 | 2 or fewer | Conditional |
| 1 | 3 or more | Unsatisfactory |
| 2 | 0 or more | Unsatisfactory |

**Member Kathryn O'Leary Higgins, Concurring and dissenting in part:**

I concur with nearly all of this important report on our investigation into the tragic fire aboard a motor coach evacuating 44 assisted living residents and staff out of the forecast path of Hurricane Rita in September 2005. Twenty-three passengers were killed in that fire.

**Probable Cause:**

Naming the Federal Motor Carrier Safety Administration in the probable cause statement was justified because of the agency's delay in making changes that are critical to improving highway safety. Eight years ago the Safety Board first recommended significant and substantive change to improve the safety of motor carrier operations: specifically, recommendation H-99-6, was issued in February 1999, was reiterated in 2002 and was added to the Most Wanted List in 2000 and is reiterated again in this report. That recommendation would require a change in the safety fitness methodology so that adverse vehicle or driver performance-based data alone would be sufficient to result in an overall unsatisfactory rating for a carrier. The status of that recommendation currently is "open-unacceptable response." I believe that this accident could have been prevented if FMCSA had acted to implement this recommendation when it was first proposed. Under the compliance standard recommended by the Safety Board, Global Limo would have been rated unsatisfactory in pre-accident inspections based on the issues identified with both drivers and vehicle maintenance.

The State of Texas conducted an educational review of the operator in 2002 and found several serious issues. That initial review was triggered by customer complaints. Information from that review was provided to FMCSA. The findings from that review were so serious that the carrier would have been put out of service if it had been a compliance review rather than an education review. At that time Texas did not have the authority to place vehicles out of service. Texas gained that authority in 2004, prior to the fatal accident. Compliance monitoring and a follow-up review was recommended in 2002 but not conducted by the state. At the public hearing the state acknowledged its earlier recommendations but offered no explanation as to why the recommended reviews were not conducted.

FMCSA did not conduct a compliance review for almost two years after the initial Texas review. This was the first compliance review of Global Limo since the company began operations in 1980. The company was given a satisfactory rating because the vehicles were not inspected and not all the drivers were interviewed, nor was that required under the FMCSA compliance review system. That same system is still in place today.

In my opinion, the lack of rigorous oversight, inspection and enforcement at both the Federal and state levels contributed to this accident. Only after the Wilmer accident did FMCSA place the carrier out of service, citing violations that were virtually identical to the violations found in the earlier review. This time the vehicles were inspected. I believe that both the State of Texas and FMCSA should be cited as contributing to this accident. Both failed in their responsibility to exercise oversight and enforce the regulations.

To improve safety on our highways, the current system needs an immediate overhaul. FMCSA has promised to make changes as part of their 2010 initiative. Each year there are over 5,000 fatal accidents involving federally registered motor carriers. Can we really afford to wait another three years and perhaps longer to tighten the rules that will take unsafe vehicles and drivers off the road? I am pleased that the Board voted to issue an Urgent Recommendation that asks FMCSA to issue an interim rule "to include all Federal Motor Carrier Safety Regulations in the current compliance review process so that all violations of regulations are reflected in the calculation of a carrier's final rating".

With only 1,000 employees nationwide, FMCSA must leverage its resources more effectively by partnering with the States to ensure that the rules are being enforced. More than 910,000 motor carriers were registered in the United States in 2005. FMCSA conducted compliance reviews on almost 8,100 of those carriers. In other words, less than 1% of carriers undergo a compliance review each year. Even the IRS has a higher audit rate.

As a result of those reviews, 61,924 violations were discovered yet the vast majority of those violations – 85.7% (53,064) – were not used to develop a safety rating of a carrier. It is not clear whether it is the design or the implementation of the safety program that results in this unsettling statistic. But, it is clear that change is needed.

One approach is to require the states to take more responsibility for ensuring compliance. Approximately half the states are conducting compliance reviews for intrastate carriers. A similar number of states have the authority to put intrastate carriers out of service. Most of the carriers reviewed by states operate under both intra and interstate authority. We need a uniform system across the country. All states should have the authority to both conduct compliance reviews, using, at a minimum, FMCSA criteria, and put carriers out of service. If an intrastate carrier is taken out of service as a result of a state review, that carrier should no longer be able to operate across state lines. I believe the role of the states can and should be expanded in the name of making our roads and highways safer. The federal role should be to set uniform standards, develop model enforcement and compliance programs, provide technical assistance to states and operators, maintain the database and ensure state compliance with federal requirements. The current federal enforcement scheme does not raise the safety bar. States refer interstate cases to FMCSA with its regulatory scheme that has been compared to Swiss cheese. We recently celebrated the 50th anniversary of the interstate highway system. This system has connected this country from coast to coast and has made an enormous difference in the way business is conducted. Many, if not most, of the goods purchased on the inter-net are delivered via the interstate. Those roads were built with a combination of state and federal funds but to uniform standards. Why shouldn't the rules that enforce safety on those roads be uniform, as well?

**Bus Brokers**

I firmly believe that BusBank, the broker that linked Global Limo and Sunrise, should be cited as a contributing to this accident. BusBank promotes the safety and qualifications of its operators on its website. BusBank advertises a 5-Star Guarantee, and the first star is safety. Unfortunately, as this accident revealed, that guarantee is hollow because there is no supporting qualification program behind that promised guarantee. If BusBank

had gone behind its website promises to investigate, Global Limo Inc. would have failed several of the criteria that BusBank said it used to qualify the company for referral: there were no pre-drug and alcohol testing of the driver; no driver training program: the accident driver was not properly licensed in the State of Texas and did not have a U.S. medical certificate, as required and could not communicate with the passengers because he did not speak English; the accident bus was not properly registered; and the bus was being operated in violation of the contract signed by the Canadian owners and was not maintained.

Bus Bank, contrary to their claims, did not put Global Limo through a "due diligence" process, did not know the operator, and had no ongoing qualifications process for this operator. Global Limo did not even return the qualifications questionnaire sent to them by the BusBank. Without further inquiry, BusBank added Global Limo to its list of operators. The form does not ask for any of the other safety information mentioned above, nor does it ask for information from any previous inspections or reviews that might have been done on the vehicles, drivers or operators.

A consumer, such as Sunrise Assisted Living, might well be swayed by the claims of independent safety oversight by a third party claiming to be a leader in the bus industry. And the stopgap, the Federal oversight on which BusBank claimed to rely and on which the American public rely also failed. When asked about their safety assurances, BusBank said they relied on the FMCSA website and the satisfactory rating given to Global Limo. They admitted that they did not look behind the rating to better understand issues that may have been identified in the compliance review. They did not seek any information from the State of Texas on Global's operations.

BusBank's claims misled customers because BusBank did not look behind the federal rating did not seek information from the state, did not ask for relevant safety information from Global Limo nor was there any independent review of Global Limo. BusBank is in the business of connecting the public with bus transportation, claiming to be experts in their field. They ask the public to rely on their 5- Star Guarantee where "safety is first." Yet, in our public hearing on this accident, BusBank testified that they are not "safety experts" but they guarantee safety in their promotions.

FMCSA has some limited statutory authority to protect consumers by regulating household goods brokers. FMCSA does not have similar authority over brokers who connect paying passengers and bus companies. The Department of Transportation is specifically prohibited from regulating bus brokers. The traveling public is relying on the claims of BusBank and other companies when they or their representatives contract to charter a bus. The inter-net has made it much easier for individuals and companies to become transportation brokers. How is the public supposed to verify claims made by these brokers without some independent way to assess them? We don't even know how many bus brokers there are because they aren't required to register, as those who broker the transport of household goods are. Why have we placed a higher value on the transport of goods than the transport of people? I believe the Department of Transportation should seek repeal of the regulatory prohibition and develop standards that to require the registration of bus brokers and compliance with standards to protect and promote public safety.

NTSB staff has agreed to look into the issue of Federal jurisdiction to protect traveling consumers against deceptive and false advertising and to return to the Board with a recommended approach to highlight this issue for Federal policymakers. The Chairman has sent a letter to the Federal Trade Commission asking them to investigate BusBank's practices. While that is a good start, I believe we should go further. We should take action to help policy makers understand this issue in order to determine the best approach to deter misrepresentation by brokers.

**Reporting of Bus Fires:**

The public hearing on this accident documented that adequate data on bus fires in this country is lacking because there is no requirement that bus fires be reported. Therefore, bus fire incidents are not captured in a consistent way in any national database. As a result of our investigation and the public hearing, we learned that the incidence of bus fires is much higher than had been previously understood. One witness testified that as many as five bus fires per week may occur in this country. The causes of bus fires are also varied and can start in the engine, in the electrical system, in the wheel wells and in the cooling system.

While I am encouraged by FMCSA's contract with the Volpe Center to gather data and set up a system to analyze the data that currently exists, I continue to be concerned that the Volpe study is examining data from previous fires, captured from a variety of sources. While that study may be useful in establishing a baseline, it does not appear to be designed to capture information on future bus fires. For that reason we have made a recommendation to FMCSA to continue to gather and evaluate information on the causes, frequency, and severity of bus and motor coach fires.

I want to emphasize the importance of this issue. I urge immediate attention to this recommendation because we must begin to document these events and understand the source of the fires as well as their frequency, and the impact on passengers and the vehicles. Unless we accurately document this significant safety challenge we will not understand the dimensions of the bus fire problem, nor will we know what steps are most effective in mitigating the problem and will have no way of documenting progress in reducing the number and severity of such incidents.

**Fire Detection and Suppression:**

During our hearing we heard that bus fires are started by more than one source. We also learned that the source of the fire does not seem to affect the intensity of the fire because of the new materials and more powerful engines found on modern motor coaches. For this reason we asked the FMCSA to move expeditiously to evaluate the best way to detect fires that begin in wheel wells as well as fires ignited by other sources and then develop standards to be used by industry for purchasing and installing such detection equipment. As part of the revisions adopted at the Board Meeting and circulated afterwards for Board Member approval, a new recommendation to the National Highway Traffic Safety Administration (NHTSA) was added. The recommendation asks NHTSA to *"evaluate the need for a Federal Motor Vehicle Safety Standard that would require installation of fire detection and suppression systems on motor coaches"*. While I concur with the recommendation, I believe clarification of that recommendation is in order.

During our investigation of the Wilmer accident and a 2-day public hearing that followed, we learned that bus fires are an alarming and under-reported safety issue in this country. We also learned that there are multiple sources for these fires (engines, batteries, electrical systems, heaters, and tires/wheel and braking components). Our report and findings, as currently written, do not adequately address actions that should be taken with regard to fires that begin in a location other than the tire or wheel well. Our report also does not mention the important work done by staff to investigate and document other bus fires.

I am concerned that the report and recommendation to NHTSA, as currently drafted, do not provide adequate guidance to NHTSA concerning the rationale for this additional recommendation. I would like to place that recommendation in context in light of my extensive personal involvement in the hearing that supported the investigation.

If I were drafting this recommendation, I would ask NHTSA to "Evaluate the need for a Federal Motor Vehicle Safety Standard that would require installation of fire detection and suppression systems on motor coaches, *taking into account the multiple causes and sources of bus fires and the technology available to detect and suppress these fires."* I believe this additional language offers better guidance to NHTSA as to this Member's intent in proposing this additional recommendation.

I also believe that the report would be strengthened if it included a finding reflecting the need for this recommendation. Research results, information provided separately to the Board and public testimony from the hearing confirm that bus fires occur more frequently than previously understood and are ignited in a number of different ways. Unfortunately, there is currently no federal standard requiring detection or suppression equipment on busses or motor coaches. An energetic response to this situation by NHTSA could significantly improve this situation.

**Evacuation of citizens with special needs:**

In this accident, 23 people died, and 21 escaped the burning bus with a variety of injuries. We have learned many things as result of this accident, including how ill-prepared we were to evacuate and ensure the safety of travelers with special needs. With the experience of Hurricane Katrina fresh in our minds, there was extraordinary pressure on transportation resources in advance of Hurricane Rita. Local, state and federal agencies worked, but not always in concert, to evacuate those in the path of another dangerous natural event. In an effort to get as many large trucks and buses on the road to provide disaster assistance before and after Hurricane Rita, the governor of Texas declared a state of emergency and waived certain regulatory requirements. While it has been claimed that safety requirements were not waived, this declaration process does in fact result in the temporary waiver of some federal safety requirements for drivers and companies providing direct relief efforts in a declared emergency. The only federal requirements that may not be waived are those related to commercial driver licenses, drug and alcohol testing, and insurance responsibility. I was also told that the waivers do not exempt operators from maintaining their busses. Press accounts have suggested that the operator of Global Limo could not be charged with all of the violations he committed because of the Evacuation Order and the subsequent waivers. As a result, his sentence

was much lighter than it might have been. I am concerned that in the interest of taking people out of harms way we may inadvertently be "waiving safety" and creating the potential for more harm. I hope that is not the case but this accident has raised that issue.

I understand that these were terrible circumstances and extraordinary things were done to evacuate people out of the path of Hurricane Rita. And I am pleased that governments at all levels have reviewed their performance during that time. Many reports were produced that raised and changed awareness of the challenges and solutions for large-scale emergency evacuations. A particularly troubling aspect of these reports is how ill prepared we are as a nation to evacuate those who are most vulnerable, particularly the elderly, disabled and those in hospitals and nursing homes. Only a few states currently have acceptable evacuation plans. In a post 9/11 world that is both unfortunate and unacceptable.

As a result of these reviews the White House designated the Department of Transportation as the lead Federal agency to coordinate and oversee transportation planning for emergency evacuations and assist state and local jurisdictions when help is needed. I hope those charged with that responsibility will review this report, the records contained in the public docket and the transcript of the public hearing.

This accident must be considered in the context of the events that were occurring at the time. While the evacuation of persons with special needs does not come under the purview of the NTSB, this accident cannot be understood without looking at these issues. As the Probable Cause makes clear, the loss of life was exacerbated because of the frailty of the passengers. Motor coaches were used for this evacuation and will be used again should a similar emergency arise. For that reason alone our recommendations must be given every consideration and implemented as quickly as possible. Our findings on oversight and compliance, on survival factors, bus design and maintenance, fire detection and suppression, to list a few will hopefully move policy makers to act. None of us want to see this accident repeated and the only way to insure that doesn't happen is to act on the changes proposed in this report.

Kathryn O'Leary Higgins
April 20, 2007

# Appendix A

## Investigation and Public Hearing

### *Investigation*

The National Transportation Safety Board was notified of the Wilmer, Texas, accident on September 23, 2005. An investigative team was dispatched with members from the Washington, D.C.; Denver, Colorado; Gardena, California; Arlington, Texas; and Parsippany, New Jersey, offices. Ellen Engleman Conners was the Member on scene. Groups were established to investigate human performance; motor carrier operations; hazardous materials; fire; and highway, vehicle, and survival factors.

Participating in the investigation were representatives of the Federal Motor Carrier Safety Administration (FMCSA), the Pipeline and Hazardous Materials Safety Administration (PHMSA), the State of Texas Department of Transportation, the State of Texas Department of Public Safety (TxDPS), the Dallas County Sheriff's Department, Motor Coach Industries, Inc. (MCI), ArvinMeritor, Inc., and Bridgestone Americas Holding, Inc.

No depositions were taken.

### *Public Hearing*

The Safety Board held a public hearing on this accident on August 8–9, 2006, in Washington, D.C. Board Member Kathryn O'Leary Higgins presided over the hearing, and Member Deborah A. P. Hersman participated. The issues presented at the hearing were the scope of bus fires in the United States, Government oversight of motorcoach operators and bus brokers, commercial vehicle inspections, evacuation of motorcoaches, and planning for the transportation of passengers with special needs during emergency evacuations.

Safety Board investigators were members of the technical panel. Parties to the public hearing included the FMCSA, the National Highway Traffic Safety Administration, the TxDPS, the Commercial Vehicle Safety Alliance, MCI, ArvinMeritor, Inc., Bridgestone Americas Holding, Inc., Sunrise Senior Living Services, Inc., the American Bus Association, and the United Motorcoach Association.

# Appendix B

## Global Limo Inc. Federal Motor Carrier Safety Administration Compliance Reviews

### *February 2004 Compliance Review Violations*

#### 382.601(a) Violation

- Failing to provide educational materials explaining the requirements of Part 382 and employer's policies.

#### 382.603 Violation

- Failing to ensure persons designated to determine that drivers undergo reasonable suspicion testing receive 60 minutes training for alcohol and/or 60 minutes training for controlled substances.

#### 391.25(c)(1) Violation

- Failing to maintain a copy of the response from each State agency in the driver qualification file.

#### 391.51(b)(5) Violation

- Failing to maintain a note relating to the annual review of the driver's driving record as required by 3941.25(c)(2).

#### 391.63(a) Violation

- Failing to maintain medical examiner's certificate in driver's qualification file.

#### 395.8(e) Violation

- False reports of records of duty status.

#### 396.3(b)(2) Violation

- Failing to have a means of indicating the nature and due date of the various inspection and maintenance operations to be performed.

### *February 2004 Compliance Review Recommendations*

This report contains citations of regulations that are deemed serious in nature and could result in penalties against your company and/or drivers.

- Review with your drivers periodically the procedures for doing pretrip and posttrip inspections. Ensure that safety defects reported on driver vehicle inspection reports (DVIRs) are repaired before the vehicle is re-dispatched. Require drivers to prepare DVIRs on a daily basis. Keep them on file for 90 days.
- Ensure that all vehicles are systemically repaired and maintained. Establish a complete file for each vehicle and record all inspection, maintenance, and repair operations performed. Consider keeping records pertaining to each individual unit in its own folder.
- Periodically review the maintenance and inspection records for all leased vehicles as required by Part 396 of the FMCSRs. Keep a record to document these reviews and notify the owner of any violations detected.
- Ensure that all drivers are fully and properly qualified before operating in interstate commerce. Maintain a complete file, as required, for each driver, documenting the qualification process.
- Ensure that all drivers' records of duty status (logs) are accurate. Check them against "supporting documents" to verify accuracy. Prohibit falsification of logs by any driver. Review rules on supporting documents. Take appropriate action against drivers who falsify logs.
- Establish a system to control passenger-carrying drivers' hours of service. Do not dispatch drivers who do not have adequate hours available to complete assigned trips legally. Do not allow drivers to exceed the 10-, 15-, and 60/70-hour limits.

### *October 2005 (Post-Fire) Compliance Review Violations*

#### 382.301(a) Violation

- Using a driver before the motor carrier has received a negative preemployment controlled substance test result.

#### 382.303(a) Violation

- Failing to conduct postaccident alcohol testing for each surviving driver.

#### 382.303(b) Violation

- Failing to conduct postaccident controlled substances testing for each surviving driver.

**382.305(i)(1) Violation**

- Failing to use a scientifically valid method to select drivers for random testing.

**382.305(i)(2) Violation**

- Failing to ensure that each driver selected for random alcohol and controlled substance testing has an equal chance of being selected each time selections are made.

**382.401(c)(6) Violation**

- Failing to maintain semiannual laboratory statistical summaries of urinalysis required by 40.29(g)(6).

**382.601(a) Violation**

- Failing to provide education materials explaining requirements of Part 382 and employer's policies.

**382.603 Violation**

- Failing to ensure persons designated to determine that drivers undergo reasonable suspicion testing receive 60 minutes training for alcohol and/or 60 minutes training for controlled substances.

**391.11(b)(2) (Primary) 391.11(a) (Secondary) Violation**

- Using a driver unable to read and/or speak the English language.

**391.11(b)(5) (Primary) 391.11(a) (Secondary) Violation**

- Using a driver without a currently valid motor vehicle operator's license or permit.

**391.21(a) Violation**

- Using a driver who has not completed and furnished an employment application.

**391.51(a) Violation**

- Failing to maintain driver's qualification file on each driver employed.

**391.51(b)(2) Violation**

- Failing to maintain inquiries into driver's driving record in driver's qualification file.

**391.51(b)(5) Violation**

- Failing to maintain a note relating to annual review of the driver's driving record, as required by 3914.25(c)(2).

**391.51(b)(6) Violation**

- Failing to maintain a list or certificate relating to violations of motor vehicle laws and ordinances required by 391.27.

**395.3(a)(1) Violation**

- Requiring or permitting a driver to drive more than 10 hours.

**395.3(a)(2) Violation**

- Requiring or permitting driver to drive after having been on duty 15 hours.

**395.8(a) Violation**

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

**395.8(e) Violation**

- False reports of records of duty status.

**396.3(a)(1) Violation**

- Failing to inspect and maintain vehicle to ensure safe and proper operating condition.

**396.3(a)(2) Violation**

- Failing to inspect pushout windows, emergency doors, and emergency marking lights in buses at least every 90 days.

**391.11(a) Violation**

- Failing to require driver to prepare DVIRs.

**396.17 Violation**

- Using a commercial motor vehicle not periodically inspected.

### *October 2005 (Postfire) Compliance Review Recommendations*

This report contains citations of regulations that are deemed serious in nature and could result in penalties against your company and/or drivers.

- Review with your drivers periodically the procedures for doing pretrip and posttrip inspections. Ensure that safety defects reported by drivers on their DVIRs are repaired before the vehicle is redispatched. Require drivers to prepare DVIRs on a daily basis. Keep them on file for 90 days.
- Ensure that the persons or entities that perform preventative maintenance inspections on your equipment are abiding by agreed time or mileage intervals. Ensure that records are kept of such periodic preventative maintenance inspections. Take corrective action if schedules are not being adhered to.
- Require all drivers to prepare a written inspection report for each day a vehicle is operated. Ensure that each report is signed by the driver, certified, and reviewed if defects are reported, and then kept in the vehicle for a day.
- Keep all driver DVIRs signed, certified, and reviewed, as required, on file for at least 90 days.
- Ensure that all vehicles are systemically repaired and maintained. Establish a complete file for each vehicle, recording all repair, maintenance and inspection operations performed.
- Establish a system to control drivers' hours of service. Do not dispatch drivers who do not have adequate hours available to complete assigned trips legally. Do not allow drivers to exceed the 10-, 15-, and 60/70-hour limits.
- Ensure that all drivers' records of duty status (logs) are accurate. Check them against "supporting documents" to verify accuracy. Prohibit falsification of logs by any driver. Review rules on supporting documents. Take appropriate action against drivers who falsify logs.
- Require all drivers to prepare complete and accurate records of duty status for each day and to submit them within 13 days. Maintain all duty status records on file, with all supporting documents, for at least 6 months.
- U.S. Department of Transportation (DOT) drug testing rules require that employers test for marijuana, cocaine, opiates, amphetamines, and phencyclidine, 49 CFR Parts 40 and 382.
- Ensure that all drivers subject to preemployment, random, reasonable cause, postaccident, return to duty, and/or followup controlled substance testing are tested as required by 49 CFR Parts 40 and 382.
- Ensure that all drivers are fully and properly qualified before operating in interstate commerce. Maintain a complete file, as required, for each driver, documenting the qualification process.
- Ensure that drivers provide a 10-year employment history on their employment applications.

# Appendix C

## Federal Motor Carrier Safety Administration Safety Program

### *Compliance Review*

The safety fitness rating begins with a compliance review conducted by the Federal Motor Carrier Safety Administration (FMCSA), as specified in 49 *Code of Federal Regulations* (CFR) Part 385, appendix A. The FMCSA applies six factors (general, driver, operational, vehicle, hazardous materials [HM], and accident rate [see table C-1]) to rate a carrier's compliance with the *Federal Motor Carrier Safety Regulations* (FMCSRs). A carrier may be selected for a compliance review if it is identified as a high-risk carrier because of (1) a Safety Status Measurement System (SafeStat) score,[1] (2) a complaint against the company, (3) an enforcement followup, (4) involvement in a fatal accident, or (5) involvement in a major HM accident. In addition, a carrier may be selected as a result of a U.S. Department of Transportation (DOT) Office of Inspector General request, a congressional inquiry, or a carrier's request.

For factor 4, vehicle, the carrier's out-of-service (OOS) rate is determined by the number of vehicles placed out of service in relation to the number of vehicles inspected roadside. The number of roadside vehicle inspections depends on the number of vehicles in a carrier's fleet. Only the most recent (the past 12 months in chronological order) roadside inspections are applied for the OOS calculation.[2] If a carrier's OOS rate exceeds 34 percent and the carrier has a pattern of critical or acute violations or both, the rating is unsatisfactory. If the carrier's OOS rate exceeds 34 percent, but the carrier does not have a pattern of violations, the rating is conditional. If the carrier's OOS rate is less than 34 percent, but the carrier has a pattern of critical or acute vehicle violations or both, the rating is conditional. Otherwise, the carrier receives a satisfactory rating for an OOS rate under 34 percent.

**Table C-1.** Factors for FMCSA safety compliance.

| Factor | Applicable FMCSRs and other criteria |
|---|---|
| 1 – General | Parts 387 and 390 |
| 2 – Driver | Parts 382, 383, and 391 |
| 3 – Operational | Parts 392 and 395 |
| 4 – Vehicle | Parts 393 and 396 and OOS rate |
| 5 – Hazardous materials | Parts 107, 171, 173, 177, 180, and 397 |
| 6 – Accident rate | Recordable accident rate |

[1] 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.

[2] For example, a motor carrier with 20 vehicles would require a minimum of 5 vehicle inspections, and the 5 most recent inspections for the past 12 months or since the last compliance review would be used to calculate the carrier's OOS rate. These inspections may have been conducted during a roadside inspection or at the carrier's terminal.

Factor 6, accident rate, is rated either "satisfactory" or "unsatisfactory"; a conditional rating is not given. The recordable accident rate is calculated by multiplying the number of interstate, reportable accidents for the 12 months prior to the compliance review by 1 million and dividing that number by the fleet's total interstate miles. If a carrier's accident rate exceeds 1.5 million miles for a company that operates over a 100-mile radius or 1.7 million miles for a company that operates in less than a 100-mile radius, an unsatisfactory rating is given. A calculated number under these rates results in the company receiving a satisfactory rating for this factor.

The rating table establishes the motor carrier's overall final safety rating, also designated "satisfactory," "conditional," or "unsatisfactory," as defined below:

- Satisfactory rating: The carrier is determined to have sufficient safety management controls in place to meet the safety fitness standards of the FMCSRs.
- Conditional rating: The carrier does not have sufficient safety management controls in place and could be in violation of the safety fitness standards.
- Unsatisfactory rating: The carrier does not have adequate safety management controls in place and has violated the safety fitness standards.

When the FMCSA issues a final[3] unsatisfactory safety rating to a carrier, the owner or operator is deemed unfit to operate.[4] Owners or operators of commercial 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 following the date of such safety fitness determination and may not reestablish interstate operations until they become fit for such transportation.

[3] A safety rating will be issued to a motor carrier within 30 days of 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 it 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.

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

# Appendix D

## Excerpts From *Federal Motor Carrier Safety Regulations*

### *49 Code of Federal Regulations (CFR) Parts 390–396*

#### 393.205 Wheels

(a) Wheels and rims shall not be cracked or broken.

(b) Stud or bolt holes on the wheels shall not be elongated (out of round).

(c) Nuts or bolts shall not be missing or loose.

#### 396.5 Lubrication

Every motor carrier shall ensure that each motor vehicle subject to its control is

(a) properly lubricated; and

(b) free of oil and grease leaks.

#### 396.7 Unsafe Operations Forbidden

(a) General: A motor vehicle shall not be operated in such a condition as to likely cause an accident or a breakdown of the vehicle.

(b) Exemption: Any motor vehicle discovered to be in an unsafe condition while being operated on the highway may be continued in operation only to the nearest place where repairs can safely be effected. Such operation shall be conducted only if it is less hazardous to the public than to permit the vehicle to remain on the highway.

See <www.fmcsa.dot.gov>, December 15, 2006.

### *Appendix B, 49 CFR Part 385, Explanation of Safety Rating Process*

*Part II. Converting Compliance Review Information Into a Safety Rating*

(a) The FMCSA gathers information through an in-depth examination of the motor carrier's compliance with identified "acute" or "critical" regulations of the *Federal Motor Carrier Safety Regulations* (FMCSRs) and *Hazardous Materials Regulations* (HMRs).

(b) Acute regulations are those identified as such where noncompliance is so severe as to require immediate corrective actions by a motor carrier regardless of the overall safety posture of the motor carrier. An example of an acute regulation is §383.37(b), allowing, requiring, permitting, or authorizing an employee with more than one commercial driver's license (CDL) to operate a commercial motor vehicle. Noncompliance with §383.37(b) is usually discovered when the motor carrier's driver qualification file reflects that the motor carrier had knowledge of a driver with more than one CDL, and still permitted the driver to operate a commercial motor vehicle. If the motor carrier did not have such knowledge or could not reasonably be expected to have such knowledge, then a violation would not be cited.

(c) Critical regulations are those identified as such where noncompliance relates to management and/or operational controls. These are indicative of breakdowns in a carrier's management controls. An example of a critical regulation is §395.3(a)(1), requiring or permitting a property-carrying commercial motor vehicle driver to drive more than 11 hours.

(d) The list of the acute and critical regulations which are used in determining safety ratings is included at the end of this document.

(e) Noncompliance with acute regulations and patterns of noncompliance with critical regulations are quantitatively linked to inadequate safety management controls and usually higher-than-average accident rates. The FMCSA has used noncompliance with acute regulations and patterns of noncompliance with critical regulations since 1989 to determine motor carriers' adherence to the safety fitness standard in §385.5.

(f) The regulatory factors, evaluated on the basis of the adequacy of the carrier's safety management controls, are (1) Parts 387 and 390; (2) Parts 382, 383, and 391; (3) Parts 392 and 395; (4) Parts 393 and 396, when there are less than 3 vehicle inspections in the last 12 months to evaluate; and (5) Parts 397, 171, 177, and 180.

(g) For each instance of noncompliance with an acute regulation or each pattern of noncompliance with a critical regulation during the compliance review, one point will be assessed. A pattern is more than one violation. When a number of documents are reviewed, the number of violations required to meet a pattern is equal to at least 10 percent of those examined.

(h) However, each pattern of noncompliance with a critical *regulation* relative to Part 395, Hours of Service of Drivers, will be assessed two points.

*Part VII. List of Acute and Critical Regulations*

- §382.115(a): Failing to implement an alcohol and/or controlled substances testing program (domestic motor carrier) (acute).
- §382.201: Using a driver known to have an alcohol concentration of 0.04 or greater (acute).
- §382.211: Using a driver who has refused to submit to an alcohol or controlled substances test required under Part 382 (acute).
- §382.213(b): Using a driver known to have used a controlled substance (acute).
- §382.215: Using a driver known to have tested positive for a controlled substance (acute).
- §382.301(a): Using a driver before the motor carrier has received a negative preemployment controlled substance test result (critical).
- §382.303(a): Failing to conduct post accident testing on driver for alcohol and/or controlled substances (critical).
- §382.305: Failing to implement a random controlled substances and/or an alcohol testing program (acute).
- §382.305(b)(1): Failing to conduct random alcohol testing at an annual rate of not less than the applicable annual rate of the average number of driver positions (critical).
- §382.305(b)(2): Failing to conduct random controlled substances testing at an annual rate of not less than the applicable annual rate of the average number of driver positions (critical).
- §382.309(a): Using a driver who has not undergone a return-to-duty alcohol test with a result indicating an alcohol concentration of less than 0.02 (acute).
- §382.309(b): Using a driver who has not undergone a return-to-duty controlled substances test with a result indicating a verified negative result for controlled substances (acute).
- §382.503: Allowing a driver to perform safety sensitive functions, after engaging in conduct prohibited by subpart B, without being evaluated by a substance abuse professional, as required by §382.605 (critical).
- §382.505(a): Using a driver within 24 hours after being found to have an alcohol concentration of 0.02 or greater but less than 0.04 (acute).
- §382.605(c)(1): Using a driver who has not undergone a return-to-duty alcohol test with a result indicating an alcohol concentration of less than 0.02 or with a verified negative test result, after engaging in conduct prohibited by Part 382 Subpart B (acute).

- §382.605(c)(2)(ii): Failing to subject a driver who has been identified as needing assistance to at least six unannounced followup alcohol and/or controlled substance tests in the first 12 months following the driver's return to duty (critical).
- §383.23(a): Operating a commercial motor vehicle without a valid CDL (critical).
- §383.37(a): Knowingly allowing, requiring, permitting, or authorizing an employee with a CDL which is suspended, revoked, or canceled by a State or who is disqualified to operate a commercial motor vehicle (acute).
- §383.37(b): Knowingly allowing, requiring, permitting, or authorizing an employee with more than one CDL to operate a commercial motor vehicle (acute).
- §383.51(a): Knowingly allowing, requiring, permitting, or authorizing a driver to drive who is disqualified to drive a commercial motor vehicle (acute).
- §387.7(a): Operating a motor vehicle without having in effect the required minimum levels of financial responsibility coverage (acute).
- §387.7(d): Failing to maintain at principal place of business required proof of financial responsibility (critical).
- §387.31(a): Operating a passenger-carrying vehicle without having in effect the required minimum levels of financial responsibility (acute).
- §387.31(d): Failing to maintain at principal place of business required proof of financial responsibility for passenger-carrying vehicles (critical).
- §390.15(b)(2): Failing to maintain copies of all accident reports required by State or other governmental entities or insurers (critical).
- §390.35: Making, or causing to make, fraudulent or intentionally false statements or records and/or reproducing fraudulent records (acute).
- §391.11(b)(4): Using a physically unqualified driver (acute).
- §391.15(a): Using a disqualified driver (acute).
- §391.45(a): Using a driver not medically examined and certified (critical).
- §391.45(b)(1): Using a driver not medically examined and certified during the preceding 24 months (critical).
- §391.51(a): Failing to maintain driver qualification file on each driver employed (critical).
- §391.51(b)(2): Failing to maintain inquiries into driver's driving record in driver's qualification file (critical).
- §391.51(b)(7): Failing to maintain medical examiner's certificate in driver's qualification file (critical).

- §392.2: Operating a motor vehicle not in accordance with the laws, ordinances, and regulations of the jurisdiction in which it is being operated (critical).
- §392.4(b): Requiring or permitting a driver to drive while under the influence of, or in possession of, a narcotic drug, amphetamine, or any other substance capable of rendering the driver incapable of safely operating a motor vehicle (acute).
- §392.5(b)(1): Requiring or permitting a driver to drive a motor vehicle while under the influence of, or in possession of, an intoxicating beverage (acute).
- §392.5(b)(2): Requiring or permitting a driver who shows evidence of having consumed an intoxicating beverage within 4 hours to operate a motor vehicle (acute).
- §392.6: Scheduling a run which would necessitate the vehicle being operated at speeds in excess of those prescribed (critical).
- §392.9(a)(1): Requiring or permitting a driver to drive without the vehicle's cargo being properly distributed and adequately secured (critical).
- §395.1(h)(1)(i): Requiring or permitting a property-carrying commercial motor vehicle driver to drive more than 15 hours (driving in Alaska) (critical).
- §395.1(h)(1)(ii): Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty 20 hours (driving in Alaska) (critical).
- §395.1(h)(1)(iii): Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 7 consecutive days (driving in Alaska) (critical).
- §395.1(h)(1)(iv): Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 80 hours in 8 consecutive days (driving in Alaska) (critical).
- §395.1(h)(2)(i): Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive more than 15 hours (driving in Alaska) (critical).
- §395.1(h)(2)(ii): Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty 20 hours (driving in Alaska) (critical).
- §395.1(h)(2)(iii): Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 7 consecutive days (driving in Alaska) (critical).
- §395.1(h)(2)(iv): Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty more than 80 hours in 8 consecutive days (driving in Alaska) (critical).
- §395.1(o): Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty 16 consecutive hours (critical).

- §395.3(a)(1): Requiring or permitting a property-carrying commercial motor vehicle driver to drive more than 11 hours (critical).
- §395.3(a)(2): Requiring or permitting a property-carrying commercial motor vehicle driver to drive after the end of the 14th hour after coming on duty (critical).
- §395.3(b)(1): Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 60 hours in 7 consecutive days (critical).
- §395.3(b)(2): Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 8 consecutive days (critical).
- §395.3(c)(1): Requiring or permitting a property-carrying commercial motor vehicle driver to restart a period of 7 consecutive days without taking an off-duty period of 34 or more consecutive hours (critical).
- §395.3(c)(2): Requiring or permitting a property-carrying commercial motor vehicle driver to restart a period of 8 consecutive days without taking an off-duty period of 34 or more consecutive hours (critical).
- §395.5(a)(1): Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive more than 10 hours (critical).
- §395.5(a)(2): Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty 15 hours (critical).
- §395.5(b)(1): Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty more than 60 hours in 7 consecutive days (critical).
- §395.5(b)(2): Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 8 consecutive days (critical).
- §395.8(a): Failing to require driver to make a record of duty status (critical).
- §395.8(e): False reports of records of duty status (critical).
- §395.8(i): Failing to require driver to forward within 13 days of completion, the original of the record of duty status (critical).
- §395.8(k)(1): Failing to preserve driver's record of duty status for 6 months (critical).
- §395.8(k)(1): Failing to preserve driver's records of duty status supporting documents for 6 months (critical).
- §396.3(b): Failing to keep minimum records of inspection and vehicle maintenance (critical).
- §396.9(c)(2): Requiring or permitting the operation of a motor vehicle declared "out-of-service" before repairs were made (acute).

- §396.11(a): Failing to require driver to prepare driver vehicle inspection report (VIR) (critical).
- §396.11(c): Failing to correct out-of-service defects listed in a driver VIR before the vehicle is operated again (acute).
- §396.17(a): Using a commercial motor vehicle not periodically inspected (critical).
- §396.17(g): Failing to promptly repair parts and accessories not meeting minimum periodic inspection standards (acute).
- §397.5(a): Failing to ensure a motor vehicle containing Division 1.1, 1.2, or 1.3 (explosive) material is attended at all times by its driver or a qualified representative (acute).
- §397.7(a)(1): Parking a motor vehicle containing Division 1.1, 1.2, or 1.3 materials within 5 feet of traveled portion of highway or street (critical).
- §397.7(b): Parking a motor vehicle containing hazardous material(s) other than Division 1.1, 1.2, or 1.3 materials within 5 feet of traveled portion of highway or street (critical).
- §397.13(a): Permitting a person to smoke or carry a lighted cigarette, cigar, or pipe within 25 feet of a motor vehicle containing Class 1 materials, Class 5 materials, or flammable materials classified as Division 2.1, Class 3, Divisions 4.1 and 4.2 (critical).
- §397.19(a): Failing to furnish driver of motor vehicle transporting Division 1.1, 1.2, or 1.3 (explosive) materials with a copy of the rules of Part 397 and/or emergency response instructions (critical).
- §397.67(d): Requiring or permitting the operation of a motor vehicle containing explosives in Class 1, Divisions 1.1, 1.2, or 1.3, that is not accompanied by a written route plan (critical).
- §397.101(d): Requiring or permitting the operation of a motor vehicle containing highway route-controlled quantity, as defined in §173.403, of radioactive materials that is not accompanied by a written route plan.
- §171.15: Carrier failing to give immediate telephone notice of an incident involving hazardous materials (HM) (critical).
- §171.16: Carrier failing to make a written report of an incident involving HM (critical).
- §172.313(a): Accepting for transportation or transporting a package containing a poisonous-by-inhalation material that is not marked with the words “Inhalation Hazard” (acute).
- §172.704(a)(4): Failing to provide security awareness training (critical).
- §172.704(a)(5): Failing to provide in-depth security awareness training (critical).

- §172.800(b): Transporting HM without a security plan (acute).
- §172.800(b): Transporting HM without a security plan that conforms to Subpart I requirements (acute).
- §172.800(b): Failure to adhere to a required security plan (acute).
- §172.802(b): Failure to make copies of security plan available to hazmat employees (critical).
- §173.24(b)(1): Accepting for transportation or transporting a package that has an identifiable release of HM to the environment (acute).
- §173.421(a): Accepting for transportation or transporting a Class 7 (radioactive) material described, marked, and packaged as a limited quantity when the radiation level on the surface of the package exceeds 0.005 mSv/hour (0.5 mrem/hour) (acute).
- §173.431(a): Accepting for transportation or transporting in Type A packaging a greater quantity of Class 7 (radioactive) material than authorized (acute).
- §173.431(b): Accepting for transportation or transporting in a Type B packaging a greater quantity of Class 7 (radioactive) material than authorized (acute).
- §173.441(a): Accepting for transportation or transporting a package containing Class 7 (radioactive) material with external radiation exceeding allowable limits (acute).
- §173.442(b): Accepting for transportation or transporting a package containing Class 7 (radioactive) material when the temperature of the accessible external surface of the loaded package exceeds 50° Celsius (C) (122° Fahrenheit [F]) in other than an exclusive use shipment, or 85° C (185° F) in an exclusive use shipment (acute).
- §173.443(a): Accepting for transportation or transporting a package containing Class 7 (radioactive) material with removable contamination on the external surfaces of the package in excess of permissible limits (acute).
- §177.800(c): Failing to instruct a category of employees in HM regulations (critical).
- §177.801: Accepting for transportation or transporting a forbidden material (acute).
- §177.817(a): Transporting a shipment of HM not accompanied by a properly prepared shipping paper (critical).
- §177.817(e): Failing to maintain proper accessibility of shipping papers (critical).
- §177.823(a): Moving a transport vehicle containing HM that is not properly marked or placarded (critical).

- §177.835(a): Loading or unloading a Class 1 (explosive) material with the engine running (acute).
- §177.835(c): Accepting for transportation or transporting Division 1.1, 1.2, or 1.3 (explosive) materials in a motor vehicle or combination of vehicles that is not permitted (acute).
- §177.835(j): Transferring Division 1.1, 1.2, or 1.3 (explosive) materials between containers or motor vehicles when not permitted (acute).
- §177.841(e): Transporting a package bearing a poison label in the same transport vehicle with material marked or known to be foodstuff, feed, or any edible material intended for consumption by humans or animals unless an exception in §177.841(e)(i) or (ii) is met (acute).
- §180.407(a): Transporting a shipment of HM in cargo tank that has not been inspected or retested in accordance with §180.407 (critical).
- §180.407(c): Failing to periodically test and inspect a cargo tank (critical).
- §180.415: Failing to mark a cargo tank which passed an inspection or test required by §180.407 (critical).
- §180.417(a)(1): Failing to retain cargo tank manufacturer's data report certificate and related papers, as required (critical).
- §180.417(a)(2): Failing to retain copies of cargo tank manufacturer's certificate and related papers (or alternative report) as required (critical).

For more detailed information, see <www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/385appnb.htm>, December 15, 2006.

# Appendix E

## Excerpts From Federal Railroad Administration Testimony

The Federal Railroad Administration (FRA) passenger railcar regulations are principally found in 49 *Code of Federal Regulations* (CFR) Part 238, Passenger Equipment Safety Standards. Section 238.103 and appendix B contain specific fire safety requirements, which were issued in 1999 and amended in 2002. The purpose of the requirements generally is to prevent fire ignition, to minimize fire spread and smoke emissions, and to maximize the time available for passenger and crew egress. The majority of combustible materials used in passenger railcars and locomotive cabs, organized by categories and functions, are required to be tested and meet certain flammability and smoke emission criteria. In addition, a structural floor fire endurance test is required.

### *January 17, 1996*

The FRA published an advance Notice of Proposed Rulemaking (NPRM) concerning the establishment of comprehensive safety standards for railroad passenger equipment.

### *February 1996*

Following two serious passenger train accidents, the FRA issued Emergency Order No. 20, "Emergency Order Requiring Enhanced Operating Rules and Plans for Ensuring the Safety of Passengers Occupying the Leading Car of a Train." Among other provisions, the order requires prompt action (within 60 days) by each commuter and intercity passenger railroad to immediately enhance emergency egress of trains by ensuring that: (1) each emergency exit location on every passenger car is clearly marked on the inside of the car and that operational instructions are posted; (2) each rescue access window is marked on the exterior of the car; (3) a representative sample of emergency window exits has been tested and is operable; and (4) each railroad discuss in an Interim Systems Safety Plan its programs and plans for liaison with and training of emergency responders with respect to emergency access to passengers, as well as the methods used to inform passengers of the location and method of operation of emergency exits, such as flyers, announcements, or messages on tickets.

### *June 17, 1997*

As a result of the investigation of the Amtrak/MARC train collision and fire that occurred in Silver Spring, Maryland, on February 6, 1996, the Safety Board issued the following fire safety recommendation to the FRA:

R-97-20

Require that a comprehensive inspection of all commuter passenger cars be performed to independently verify that the interior materials in these cars meet the expected performance requirements for flammability and smoke emissions characteristics.

### *September 23, 1997*

The FRA published an NPRM proposing that the 1989 FRA Guidelines be made mandatory standards for materials used in new and refurbished passenger cars and locomotive cabs. In particular, the NPRM addressed Safety Recommendation R-97-20. In addition, the FRA included fire safety analysis requirements for evaluation of the design and materials of new passenger cars to ensure sufficient time for passenger evacuation from the train.

### *1998*

The FRA issued the Passenger Train Emergency Preparedness final rule, which incorporated and superseded several requirements of Emergency Order No. 20 into 49 CFR Parts 223 and 239. Specifically, 49 CFR 239.101 requires that each railroad's emergency preparedness plan also provide for passenger awareness of emergency procedures to enable passengers to properly respond during an emergency; and each railroad must post emergency instructions inside all passenger cars and use one or more additional methods to provide safety awareness information.

### *May 12, 1999*

The FRA published the Passenger Equipment Safety Standards final rule, containing detailed fire safety analysis requirements for new equipment to reduce the risk of personal injury and equipment damage caused by a fire to an acceptable level. The rule also included a formal safety methodology and a documented analysis checklist, which considers car design, materials, and ventilation. In addition, railroads were required to determine the extent to which overheat detection and fire suppression systems must be installed to ensure sufficient time for the safe evacuation of passengers and crew.

The final rule also addressed Safety Recommendation R-97-20 by requiring that passenger railroads perform a fire safety analysis of their existing equipment to determine whether materials currently installed in railcars posed an unacceptable hazard in terms of material quantity, location, and proximity to ignition sources. Railroads were required to consider the extent to which existing materials met the test criteria in appendix B of the rule and their potential hazard relating to the unacceptable risk of personal injuries. Categories of existing equipment and current rail service were to be included in the fire safety evaluation.

### *Other Excerpts*

The FRA also requires that the structural floor pass the American Society for Testing and Materials (ASTM) E 119[1] fire endurance test. The nominal test period should be twice the maximum expected time under normal circumstances for a vehicle to stop completely and safely from its maximum operating speed, plus the time necessary to evacuate all vehicle occupants to a safe area. The fire resistance period required should be consistent with the safe evacuation of a full load of passengers from the vehicle under a worst case scenario. The nominal test period is a minimum of 15 minutes.

Under FRA sponsorship, the Volpe National Transportation Systems Center is currently conducting emergency evacuation and fire safety research to assist in determining whether the amount of time available to evacuate a passenger railcar is sufficient, given the amount of time occupants actually need to evacuate safely using the available emergency egress features in a railcar. The Volpe Center is using fire safety-related research findings to assist in determining the amount of available time for evacuation before conditions on board become untenable due to smoke and fire and is also using emergency evacuation simulations to predict the amount of time to evacuate cars under various circumstances and in different operating environments. Findings from this research may be used to supplement existing emergency egress standards.

[1] American Society for Testing and Materials, *Standard Test Methods for Fire Tests of Building Construction and Materials*, ASTM E-119-05a (West Conshohocken, PA: ASTM, 2006).

# Appendix F

## Emergency Evacuation of Special Needs Populations: Major Federal Studies Since Hurricanes Katrina and Rita

### *Catastrophic Hurricane Evacuation Plan Evaluation: A Report to Congress*

Report[1] recommendations 1, 4, and 6 address transport and special needs evacuations:

- Recommendation 1: Develop regional plans for mass evacuations in connection with catastrophic incidents on the scale of Hurricane Katrina. These plans should be developed jointly by State and local officials within the region in cooperation with officials from appropriate Federal agencies; providers of all safe and practical modes of transportation and providers of shelters, food, fuel, and other necessities; managers of hospitals, *nursing homes*, emergency medical services (air, ground, etc.), jails, and *other institutions with their own evacuation plans*; *and representatives of various special needs populations*. [Italics added.]
- Recommendation 4: Transportation agencies and operators should be more directly involved in key aspects of evacuation planning and implementation.
- Recommendation 6: State and local agencies should work with the special needs communities to develop systems whereby those requiring specialized transportation or sheltering services during evacuations can make those needs known to emergency managers and operators of transportation and sheltering services before evacuations.

### *Disaster Preparedness: Limitations in Federal Evacuation Assistance for Health Facilities*

This report[2] makes two recommendations for executive action, as follows:

- Clearly delineate how the Federal Government will assist State and local governments with the movement of patients and residents out of hospitals and nursing homes to a mobilization center, where National Disaster Medical System (NDMS) transportation begins.

[1] U.S. Department of Transportation and U.S. Department of Homeland Security, *Catastrophic Hurricane Evacuation Plan Evaluation: A Report to Congress* (Washington, DC: DOT, 2006).

[2] U.S. Government Accountability Office, *Disaster Preparedness: Limitations in Federal Evacuation Assistance for Health Facilities Should be Addressed* (Washington, DC: GAO, 2006) 19. See <www.gao.gov/cgi-bin/getrpt?GAO-06-826>, September 26, 2006.

- In consultation with the other NDMS Federal partners—the Secretaries of Defense, Health and Human Services, and Veterans Affairs—clearly delineate how to address the needs of nursing home residents during evacuations, including the arrangements necessary to relocate these residents.

### *Federal Response to Hurricane Katrina: Lessons Learned*

As a lesson learned, this report[3] stated:

> The Department of Transportation, in coordination with other appropriate departments of the Executive Branch, must also be prepared to conduct mass evacuation operations when disasters overwhelm or incapacitate State and local governments.

The report made 125 recommendations for improving future Federal responses to disasters. Three of these recommendations concern evacuation (numbers 41, 42, and 43):[4]

> 41. Designate the DOT as the primary Federal agency responsible for developing the Federal Government's capability to conduct mass evacuations when disasters overwhelm State and local governments. The DOT should, in coordination with the U.S. Department of Health and Human Services, the U.S. Department of Defense, the U.S. Department of Veterans Affairs, the U.S. Department of Homeland Security (DHS), and the American Red Cross, plan, train, and conduct exercises for the timely evacuation of patients and transportation of medical supplies and personnel.
>
> 42. The DHS should require State and local governments, as a condition for receiving Homeland Security grants, to develop, implement, and exercise emergency evacuation plans and to cooperate fully with all Federal evacuation activities.
>
> 43. The DHS should, in coordination with the DOT, evaluate all State evacuation plans as well as the evacuation plans of the 75 largest urban areas.

[3] The White House, *The Federal Response to Hurricane Katrina: Lessons Learned* (Washington, DC: 2006) 57. See <www.whitehouse.gov/reports/katrina-lessons-learned/>, September 26, 2006.

[4] *The Federal Response to Hurricane Katrina: Lessons Learned*, 99–100.