National Transportation Safety Board

Washington, D.C. 20594

Highway Accident Brief

Accident No.:	HWY-06-MH-026
Accident Type:	Run off roadway and rollover
Location:	Westport, New York
Date and Time:	August 28, 2006; 6:40 p.m.
Vehicle:	2000 MCI 102DL3 55-passenger motorcoach
Owner/Operator:	Greyhound Lines, Inc.
Occupants:	Driver and 52 passengers
Fatalities:	5, including driver
Injuries:	48 (20 serious and 28 minor)

Accident Description

About 6:40 p.m. daylight savings time, on Monday, August 28, 2006, a 2000 Motor Coach Industries, Inc. (MCI), 45-foot, 55-passenger motorcoach operated by Greyhound Lines, Inc. (Greyhound), transporting 52 passengers and the driver, was traveling northbound on Interstate 87 (I-87) near Westport, New York. The motorcoach had departed the Port Authority terminal in New York City about 1:00 p.m. and was en route to its final destination of Montreal, Quebec. The weather was partly cloudy and the roadway was dry.

The motorcoach began descending a 5-percent grade, in the left lane at about 75 mph,[1] and passed a tractor-semitrailer that was in the right lane. As the motorcoach descended the grade, its speed increased to 78 mph. The left-steer-axle[2] tire of the motorcoach experienced a failure and sudden deflation. While the tractor-semitrailer was adjacent to the motorcoach in the right lane, the motorcoach departed the left lane, continued across the left shoulder, and struck the three-strand cable barrier. The motorcoach continued through the three-strand cable barrier and into the depressed earthen center median. The motorcoach began to rotate clockwise when the left rear wheels struck a large boulder, causing it to roll over 1.5 times before coming to rest on its roof.

The driver and 4 passengers were killed; 48 passengers sustained injuries ranging from minor to serious.

[1] Speed based on electronic control module (ECM) data. An ECM is a semiconductor unit used for controlling ignition timing, fuel delivery, speed, and other engine management system parameters that is capable of logging data associated with critical diagnostic events. This feature, however, is not intended to capture crash data but rather to assist technicians in troubleshooting system fault conditions.

[2] Refers to the left front tire. This motorcoach had three axles—a steer axle in the front, a drive axle connected to the power train, and a tag axle in the rear that provided support and stability.

Roadway Information

I-87 is a limited access highway running north and south in eastern New York. At the accident scene, I-87 is a five-lane, asphalt-paved, divided highway with two northbound traffic lanes and three southbound lanes.[3] The northbound and southbound lanes are separated by an earthen center median that varies in width from 56 to 65 feet. The posted speed limit is 65 mph.

The left paved shoulder is 5 feet 4 inches wide. A three-strand cable barrier is erected at the edge of the left paved shoulder. Prior to the accident location, the roadway consists of a 2,900-foot-long, 3,800-foot-radius curve to the right. At the accident location, the roadway is tangential, with a 5-percent descending grade.

Physical Evidence

A series of scalloped-shaped tire marks, measuring a total of 120 feet, started in the left lane near the yellow painted edge line and continued to the pavement edge. The final approximately 45 feet of tire marks departed the roadway to the left at an average angle of 7 degrees. Each scalloped section was approximately 11.5 feet long and 18 inches wide. The scalloped-shaped marks terminated at the three-strand cable barrier. These marks are consistent with the left-steer-axle tire being deflated and continuing to roll on the pavement.

An additional set of tire marks was located about 20 feet north of, and roughly parallel with, the scalloped-shaped tire marks. Where the scalloped-shaped marks ended, approximately 260 feet of tire furrow was observed in the earthen center median before several large rocks that showed evidence of having been struck. Approximately 110 feet of additional evidence, such as gouges and other marks in the center median, could be seen from the rocks to where the motorcoach came to rest, likely caused by the motorcoach's rolling over. The motorcoach came to rest on its roof, facing a westerly direction, in the center median.

Numerous pieces of tire tread were located at the scene by the New York State Police and collected for later analysis. Before being collected, many of the tire pieces had been moved from their original positions on the roadway as first responders tended to the injured vehicle occupants. As a result, the majority of these pieces could not be documented at their original postaccident positions. However, most of the tire pieces were located before (south of) the beginning of the tire marks. Additional tire pieces were located along the roadway edge and in the center median near the beginning of the tire marks.

Driver Factors

The 52-year-old motorcoach driver held a valid New York class "B" commercial driver's license (CDL) with a passenger endorsement issued in September 2004 that was valid through July 2010. The driver had almost 7 years of experience driving motorcoaches for Greyhound, beginning in November 1999. The driver had a CDL medical certificate, issued on April 27, 2006, which was valid for 2 years. The driver had no reported accidents or motor vehicle-related

[3] The third of the three southbound lanes accommodates slower-moving vehicles on the ascending grade.

convictions during the preceding 5 years. He had driven the same route between New York City and Montreal since about June or July 2006.

Postmortem examination of the driver identified no evidence of an acute medical condition that would have affected the driver's performance. Toxicological testing for the presence of alcohol and drugs was also negative. The driver had logged 53.75 continuous hours off duty before reporting for work on the day of the accident.

Motor Carrier

The motorcoach was owned and operated by Greyhound. According to the Federal Motor Carrier Safety Administration (FMCSA), Greyhound is an authorized, interstate for-hire passenger motor carrier operating throughout the continental United States, with limited operations in Canada and Mexico. Greyhound operates special destination, charter, and package service throughout its areas of scheduled operations. At the time of the accident, the company had 1,550 motorcoaches (including the accident motorcoach) and 3,317 drivers.

During the 2-year period preceding this accident, Greyhound had a vehicle out-of-service rate of 10.3 percent, compared to the average of 22.92 percent for other passenger motor carriers. During the same time frame, Greyhound had a driver out-of-service rate of 1.1 percent, compared to the industrywide average of 6.78 percent.[4]

The FMSCA conducted compliance reviews of Greyhound on September 14, 2001, and November 3, 2003, following fatal accidents in Nevada and Texas, respectively. In both instances, the company received a satisfactory[5]compliance rating. Greyhound's last recorded compliance review[6]occurred in November 2006, for which the company received a satisfactory rating.

Vehicle

Damage

During the accident sequence, the motorcoach went off the roadway, struck a three-strand cable barrier, and finally impacted a large boulder with its left rear wheels before rolling over

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[4] Safety Fitness Electronic Records (SAFER) is an FMCSA database available to the public <www.safersys.org>. SAFER provides information about a motor carrier's type of operation, size, safety record (including the most recent safety rating), roadside inspection history, and accident history.

[5] Following a compliance review, the FMCSA issues safety ratings that identify carriers as follows: *satisfactory*, indicating that the carrier's records revealed no evidence of substantial noncompliance with safety requirements; *conditional*, indicating that the carrier's records revealed that it was out of compliance with one or more safety requirements; and *unsatisfactory*, indicating that the carrier's records revealed evidence of substantial noncompliance with safety requirements. An "unrated carrier" is one that has not been assigned a safety rating by the FMCSA. A limited compliance review or inquiry of a specific category may also result in the absence of a safety rating.

[6] For further information on the accident vehicle's compliance review, see the following <http://safer.fmcsa.dot.gov/query.asp?searchtype=ANY&query_type=queryCarrierSnapshot&query_param=USDOT&query_string=44110>, accessed on March 17, 2009.

1.5 times and coming to final rest on its roof. As a result of these impacts, the motorcoach sustained damage to the undercarriage, front driver area, and roof.

The motorcoach roof's vertical supports along the left (driver) side were partially pulled away from the frame at the lower window sill level (sash rail) along the entire left side, pushing the majority of the roof and the right side of the passenger compartment wall outward to the right. Seven of the eight vertical pillars along the left side separated from the lower window sill level. The eighth was cracked but not separated.

Survivable space inside the motorcoach was compromised due to the roof's being crushed downward and shifted to the right. Intrusion of the roof into the motorcoach was concentrated more on the left side and toward the front and rear. The motorcoach driver's seating area sustained intrusion by the roof; the privacy panel behind the driver was severely damaged, while the privacy panel at the entry door remained intact with only minor damage. The lavatory in the rear of the motorcoach collapsed into the adjacent row of three seats. The roof was touching the top of the seatbacks along the aisle on the left side of the motorcoach. The overhead consoles with television monitors along both sides were severely damaged by roof crush. Inspection of the vehicle's interior revealed numerous occupant contacts to seatbacks (deformation) and both sides of the overhead consoles below the luggage racks (scuffs).

Engine

The motorcoach was equipped with a Detroit Diesel Series 60 electronically controlled diesel engine with an ECM that had been configured to limit the motorcoach's speed to 70 mph.[7] The ECM recorded a "last stop record" on August 28, 2006, at 6:35 p.m.,[8] indicating that the motorcoach gradually achieved a maximum speed of 78 mph while traveling on a downgrade just before the driver applied the brakes. The motorcoach then decelerated from 78 to 75 mph, and then from 75 to 0 mph, in approximately 5 seconds.

Brakes

The motorcoach was equipped with pneumatic drum brakes with a four-channel Bendix antilock braking system (ABS). Postaccident examination of the ABS electronic control unit revealed a diagnostic fault condition related to the left-drive-axle brake assembly that predated the accident. Postaccident inspections revealed a broken wire at the left rear modulator. The broken wire would cause the left rear brakes, including those on the tag axle, not to be controlled by the ABS system, although the wheels still had full braking capability. The ABS system was functioning properly on all other wheels.

All wheel positions were equipped with Haldex automatic slack adjusters. The pushrod measurement for the right-drive-axle brake was 1/2 inch beyond the adjustment limit. However, the slack adjuster's control arm, which is necessary for automatic adjustment, was found broken

[7] The variable speed governor is designed to cut off fuel to the engine at 70 mph. However, the motorcoach's speed could exceed 70 mph on downhill portions of the roadway due to gravity.

[8] A *last stop record* is triggered any time a motorcoach goes from a moving to a stopped state for 15 seconds or longer. The last stop record registers vehicle speed, engine rpm, engine load, percent throttle, and brake and clutch use (if equipped) for the 105 seconds preceding and 15 seconds following the time the event is triggered.

off. It could not be determined whether the control arm was broken prior to or during the crash. Pushrod measurements for all the other axle locations were within requirements. All brake linings, as measured at their centers, were at least 1/2-inch thick, exceeding the 1/4-inch thickness required by the *Federal Motor Vehicle Safety Regulations*.

Based on calculations of vehicle braking efficiency, the accident motorcoach would have experienced an uneven brake balance due to the inoperative ABS sensor on the left drive axle and the out-of-adjustment brake. Because the ABS sensor on the left rear wheel was not operable, a brake application could cause the left-drive-axle brakes to lock, while all other brakes were modulated to avoid locking. An analysis of the accident motorcoach's brake system at the time of the accident indicates that the left side of the motorcoach could generate a greater braking force than the right side. The result was a natural rotation to the left (counterclockwise) upon application of the vehicle's brakes.

Steering

The vehicle was equipped with a TRW Automotive (TRW) integral power steering gearbox, rated at a maximum of 2,175 pounds pressure. The engine-mounted power steering pump furnished a maximum of 1,550 pounds pressure to the steering gearbox. Postaccident examination revealed that the tie rod, drag link, and pitman arm linkages were tight and without noticeable free play. Following the accident, the steering pump was tested at a TRW facility; it was found to be without defects and operated within the manufacturer's specifications.

Tires

The motorcoach was equipped with Goodyear Tire and Rubber Company (Goodyear) 315/80R22.5, model G-409 tires. This tire has a "J" load index (8,270 pounds @120 psi) and an "L" speed rating (75 mph). When new, these tires have a tread depth of approximately 20/32 inch. All of these parameters conform to those listed in the 2006 Yearbook, published by the Tire and Rim Association, Inc. (TRA).[9]

Both steer axle tires were manufactured in September 2005 at the Goodyear plant in Topeka, Kansas. According to records furnished by Goodyear, the left-steer-axle tire was initially installed on the steer axle of a 40-foot MCI motorcoach in October 2005. In November 2005, the tire was rotated to the right steer axle of the same unit. In December 2005, it was rotated to the left tag axle (3L) of the accident motorcoach. The following day, it was rotated to the steer axle (1L), where it remained until the day of the accident.[10]

When the outer tread grooves of the two steer axle tires were measured individually, as much as a 6/32-inch difference existed between the first and second tread grooves of the

[9] The TRA is an independent association composed of members who manufacture tires, rims, and related wheel products. The TRA Yearbook contains standards and related information approved by the TRA, including tire designations, tire load ratings and dimensions, approved rim contour(s) and valve(s) for each tire size, rim contour dimensions, valve dimensions, and other data necessary for tire/rim/valve interchangeability. Goodyear is an active member of the TRA. (Source: 2006 Yearbook—Tire and Rim Association, Inc.)

[10] Goodyear tire records show that the left-steer-axle tire had 91,000 miles of wear. According to sources at Goodyear and Greyhound, this tire's life expectancy is 140,000 miles.

left-steer-axle tire,[11] and a 5/32-inch difference for the right-steer-axle tire. Uneven wear could be seen on the inside tread grooves of both steer axle tires. Such uneven tread groove wear indicates that the tires had been operated while misaligned and/or underinflated or that the tires wore irregularly for other unknown reasons.

Analysis of roadway evidence determined that the left-steer-axle tire had failed and deflated before the vehicle left the roadway. All available tire remnants were collected for examination, but due to tire damage and the inability to recover all fragments, the complete tire could not be reconstructed. Postaccident examination of the tire remnants identified a small puncture in the tire. Although no air could be heard or felt on the outside of the tire when an air cup was placed on the inside of the tire liner at the location of the puncture and the tire was pressurized to about 75 psi, small bubbles could be seen when a liquid solution was applied to the outside liner. This finding is consistent with a slow leak, which could lead to a steady reduction in air pressure, potentially causing excessive heat buildup and, eventually, damaging stress and strain upon the tire's structural components, leading to tread/belt separation of the tire. Investigators could not determine how long the puncture might have existed or the likely rate of air loss due to the damaged condition of the steer axle tire postaccident.

On September 15, 2006, both steer axle tires were examined by representatives from the National Transportation Safety Board (NTSB), the National Highway Traffic Safety Administration (NHTSA), and Goodyear at the Goodyear facility in Akron, Ohio. The left-steer-axle tire was x-rayed as part of the examination. The construction of the tire appeared normal; no defects were observed. X rays did, however, identify a foreign object that had the appearance of a nail within the tire at the site of a puncture. Neither the x rays nor visual inspection of the tire during the examination disclosed any evidence of a manufacturing defect that would have led to a tire failure.

During the tire examination, diagonal bead undulation was also noted. Diagonal undulations on the bead face of a radial tire indicate an overdeflection.[12] The amount of overdeflection, length of time the tire is overdeflected, speed, and ambient temperature are all factors that contribute to the presence and magnitude of the diagonal undulations. Overdeflection can be a consequence of underinflation.

Tire Maintenance

The tires were maintained under a long-term lease agreement between Greyhound and Goodyear, which states that the responsibility for maintaining the tires on all motorcoaches in the Greyhound fleet is shared between the two companies. Greyhound maintains written standard

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[11] The outside tread groove of the left front tire was worn into the undertread.

[12] Tire "deflection" is the tread and sidewall flexing that occurs when the tread comes into contact with the road. "Overdeflection" is a tire deflection that is "greater than that intended for the rated load and inflation pressure. Overdeflection occurs when the load is excessively high, or the inflation pressure is too low, or when a combination of load and inflation pressure creates an excessively high deflection," resulting in a flattening of the tire. (Information obtained from the e-book *The Pneumatic Tire*, A.N. Gent and J.D. Walter, eds., DOT HS 810 561 [Akron, Ohio: University of Akron and National Highway Traffic Safety Administration, 2005]. For further information, see <http://www.safetyresearch.net/Library/NHTSA_Pneu_Tire.pdf>, accessed April 15, 2010.)

operating procedures for wheel and tire maintenance, which are to be adhered to by both Greyhound and Goodyear personnel.

According to Greyhound tire maintenance guidelines, all new tires should be balanced and placed on the drive axle in order to establish an even wear pattern. The drive axle tires, which have about 20/32-inch tread depth when new, are transferred to the steer axle when worn to between 10/32 and 16/32 inch. The steer axle tires, when worn to about 6/32 inch, are then rotated to the tag axle, where they remain until they need to be replaced.

On July 11, 2006, about 6 weeks before the accident, another driver of the accident vehicle noted in the daily vehicle inspection report (DVIR) that the front tire had uneven tread wear on both the inside and outside tread (as installed on the motorcoach). The notation did not specify which tire (right or left) was wearing unevenly. The NTSB's postaccident inspection found significant uneven wear for both steer axle tires on the vehicle, which had been driven 5,389 miles from the date of the DVIR notation to the time of the accident. Despite a requirement in the Greyhound standard operating procedures calling for rotation from the steer axle to the tag axle when uneven wear is noted, there was no indication that this occurred following the driver's DVIR notation indicating uneven wear.

Greyhound tire maintenance personnel record air pressure and tread depth measurements on a "Coach Tire Record" that is kept on the motorcoach and usually replaced monthly with a new form. The tire service technician must record the inflation pressure each time the tires are checked. If air is added, the technician is also expected to record the final inflation pressure. The most recent entry, on August 18, 2006 (about 10 days before the accident), showed the air pressure at 115 psi and 114 psi for the left- and right-steer-axle tires, respectively. This suggests that the tires were underinflated by 5 and 6 psi at that time. There is no notation that air was added.

Four days later, on August 22, 2006, Greyhound personnel performed a federal annual vehicle safety inspection of the accident motorcoach, which included checking the tires. The *Federal Motor Vehicle Safety Regulations* (49 *Code of Federal Regulations* [CFR] 396.17) require an annual "periodic inspection" and enumerate 14 specific items pertaining to the steer axle tires to be checked. The regulations do not explicitly state that air pressure should be checked.[13] The absence of a notation for August 22, 2006, on the Coach Tire Record suggests that tire inflation pressures were not measured—or at least not recorded—at the time of the annual inspection. If tire pressures had been measured and recorded, a discrepancy between the August 18 and August 22 levels might have alerted tire service personnel of the existence of a slow leak.

Pretrip Inspection

Title 49 CFR 392.7 requires that commercial drivers examine the tires of their motor vehicles at the beginning of each trip. The regulation does not require that the driver use a tire

[13] Appendix G, Section 10 ("Tires"), item 11, states, "Weight carried exceeds tire load limit. This includes overloaded tire resulting from low air pressure."

pressure gauge. If a tire is found to be improperly inflated, the driver must remedy the problem before driving the vehicle.

The NTSB recently recommended to the FMCSA and the American Association of Motor Vehicle Administrators, as a result of its investigation of a motorcoach rollover accident near Sherman, Texas, that tires be checked with a tire pressure gauge during pretrip inspections:[14]

FMCSA

> Require that tire pressure be checked with a tire pressure gauge during pretrip inspections, vehicle inspections, and roadside inspections of motor vehicles. (H-09-19)

American Association of Motor Vehicle Administrators

> Revise the model *Commercial Driver's License Manual* to stipulate that tire pressure be checked with a tire pressure gauge during pretrip inspections, vehicle inspections, and roadside inspections of motor vehicles. (H-09-27)

The NTSB looks forward to hearing from these organizations concerning anticipated actions on tire pressure monitoring.

The accident driver, who was killed in this accident, was not required to document the pretrip inspection until after the conclusion of the trip, but a completed inspection form was found by NTSB investigators inside the accident motorcoach. The driver indicated on the form that the motorcoach was in satisfactory condition.

NTSB investigators also interviewed the driver who had driven the accident motorcoach that morning. That driver indicated that he did not notice anything unusual and stated that the motorcoach did not shimmy.[15]

[14] *Motorcoach Run-Off-the-Bridge and Rollover, Sherman, Texas, August 8, 2008*, Highway Accident Report NTSB/HAR-09/02 (Washington, DC: National Transportation Safety Board, 2009).

[15] The DVIR completed by this driver was not marked "satisfactory" or "unsatisfactory." In the "remarks" section, the driver indicated that the bus had old body damage and that a new DVIR book was needed.

Injuries

There were 53 occupants aboard the accident motorcoach (see figure 1). The driver and four passengers sustained fatal injuries (see table 1). The passengers who died were seated in seats 5 (left-side[16] window), 6 (left-side window), and 14 (right-side aisle)[17]; the location of the fourth passenger could not be determined. For seating locations marked "unknown" in figure 1, investigators were unable to determine specific seating locations.[18] The driver was wearing a lap belt restraint; the passenger seats did not have restraints.

Table 1. Injuries.

Injury Type	Motorcoach Driver	Motorcoach Passengers	Total
Fatal	1	4	5
Serious	0	20	20
Minor	0	28	28
None	0	0	0
Total	1	52	53

Title 49 CFR 830.2 defines a fatal injury as any injury that results in death within 30 days of the accident. It defines a serious injury as an injury that requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; results in a fracture of any bone (except simple fractures of the 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 burns affecting more than 5 percent of the body surface.

[16] The left side of the motorcoach is the driver side.

[17] This row of seats was the rearmost row and contained three seats: a window seat, a center seat, and an aisle seat.

[18] Investigators were able to gather personal information and medical records for the majority of passengers.

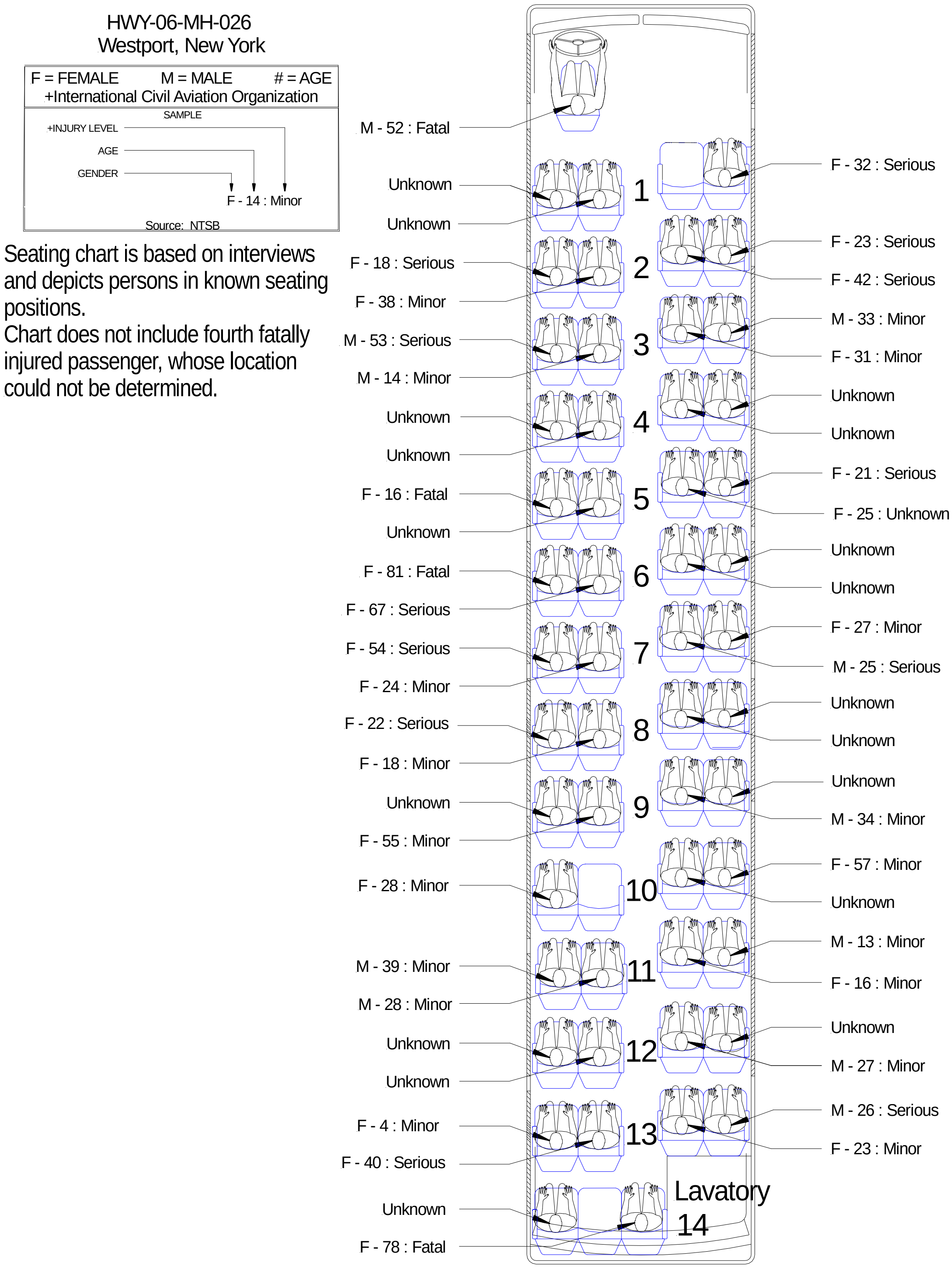

Figure 1. Seating chart.

The cause of death for the driver and two of the passengers was determined to be traumatic asphyxiation as a result of compression. The driver was found compressed between his seatback and the steering wheel, while one of the passengers (the passenger whose seating location could not be determined) was partially ejected through the front roof hatch and compressed against the ground as the motorcoach rolled over. The passenger who had occupied seat 5 (left-side window) was found compressed beneath the overturned motorcoach. The passenger who had occupied seat 6 (left-side window) was ejected and came to rest on the shoulder of the roadway. The passenger who had been seated in seat 14 (right-side aisle) was recovered inside the adjacent lavatory following the crash. However, witnesses stated that she was in her seat at the time of the crash.

At least 23 passengers were ejected from the motorcoach. All but one of those ejected were ejected through the side windows. (One passenger was partially ejected through the roof hatch.)

Those passengers who were still inside the motorcoach when the vehicle came to rest evacuated through the side windows, windshield, and wheelchair access door. Passengers who were seriously injured in the accident sustained a variety of injuries, including depressed skull fractures; fractures of the cervical spine, thoracic spine, and extremities; and internal injuries.

Motorcoach Occupant Protection

Motorcoach accidents result in an average of 11 occupant fatalities per year.[19] Passenger ejections account for more than half (56 percent) of all motorcoach fatalities; in motorcoach rollover crashes, 70 percent of passenger fatalities are caused by ejections.[20] Similar analyses of occupant injury data can be found in studies conducted by other countries.[21]

No federal regulations require that motorcoaches in the United States be equipped with an occupant restraint system for passengers. In 1999, the NTSB conducted a bus crashworthiness special investigation and issued a series of safety recommendations to improve occupant protection in the event of an accident.[22] In that report, the NTSB concluded that one of the primary causes of preventable injury in motorcoach accidents involving a rollover, ejection, or both, is occupant motion out of the seat during a collision when no intrusion into the seating area occurs. Safety Recommendations H-99-47, -48, -50, and -51 asked that NHTSA take the following actions:

> In 2 years, develop performance standards for motorcoach occupant protection systems that account for frontal impact collisions, side impact collisions, rear impact collisions, and rollovers. (H-99-47)

[19] See <http://www.fmcsa.dot.gov/facts-research/art-analysis_Large-Truck-and-Bus-Crash-Facts-2008.aspx>, accessed on March 16, 2010.

[20] NHTSA docket no. 2007-28793-0001, page 20.

[21] M. Matolcsy, "The Severity of Bus Rollover Accidents," *Proceedings: 20th International Technical Conference on the Enhanced Safety of Vehicles, Lyon, France, June 18 through 21, 2007*, Paper No. 07–0989 (2007). See <http://www-nrd.nhtsa.dot.gov/pdf/nrd-01/esv/esv20/07-0152-O.pdf>, accessed on April 3, 2010.

[22] *Bus Crashworthiness Issues*, Highway Special Investigation Report NTSB/SIR-99/04 (Washington, DC: National Transportation Safety Board, 1999).

> Once pertinent standards have been developed for motorcoach occupant protection systems, require newly manufactured motorcoaches to have an occupant crash protection system that meets the newly developed performance standards and retains passengers, including those in child safety restraint systems, within the seating compartment throughout the accident sequence for all accident scenarios. (H-99-48)
>
> In 2 years, develop performance standards for motorcoach roof strength that provide maximum survival space for all seating positions and that take into account current typical motorcoach window dimensions. (H-99-50)
>
> Once performance standards have been developed for motorcoach roof strength, require newly manufactured motorcoaches to meet those standards. (H-99-51)

All of these recommendations are classified "Open—Unacceptable Response." Safety Recommendations H-99-47 and -50 are on the NTSB's Most Wanted List of Transportation Safety Improvements.

All four recommendations have been reiterated to NHTSA as a result of several motorcoach accident investigations over the last decade, and again in 2009, in conjunction with the NTSB's investigation of a motorcoach rollover accident near Sherman, Texas.[23] The Westport accident motorcoach rolled over 1.5 times. Previous NTSB motorcoach investigations concluded that passengers would be safer with an occupant protection system and sufficient roof strength. Recent NHTSA crash testing showed that injury risk was much lower for lap/shoulder-belted dummies than for unrestrained dummies.[24]

The Secretary of Transportation ordered the review of motorcoach safety after the NTSB's 2009 Board Meeting on the Mexican Hat, Utah, motorcoach rollover accident that resulted in 50 ejections and 9 passenger fatalities.[25] In November 2009, the U.S. Department of Transportation released a Motorcoach Safety Action Plan,[26] which lists steps to be taken by NHTSA for improving motorcoach safety, with target dates, including the items noted in table 2. NHTSA has not made an official statement regarding the status of these action items.

Table 2. Selected NHTSA Motorcoach Safety Action Plan items.

Action Item	Milestone Date
Research roof crush testing procedures and determine roof crush performance requirements	Third quarter 2009
Decide whether to take regulatory action on roof crush performance	Fourth quarter 2009
Require installation of seat belts on motorcoaches and publish notice of proposed rulemaking	First quarter 2010

[23] NTSB/HAR-09/02.

[24] Motorcoach Roof Crush/Rollover Testing Discussion Paper, NHTSA docket no. NHTSA-2007-28793-0019, March 2009.

[25] *Motorcoach Rollover Near Mexican Hat, Utah, January 6, 2008*, Highway Accident Report NTSB/HAR-09/01 (Washington, DC: National Transportation Safety Board, 2009).

[26] *Motorcoach Safety Action Plan*, U.S. Department of Transportation, November 16, 2009 <http://www.nhtsa.gov/staticfiles/DOT/NHTSA/reports/HS811177.pdf>, accessed on April 15, 2010.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the left-steer-axle tire, due to an extended period of low-pressure operation, which resulted in overheating and tread separation, leading to loss of vehicle control. Contributing to the accident was the imbalanced brakes, which enhanced the vehicle's counterclockwise rotation and loss of control when applied by the driver. Also contributing to the severity of passenger injuries was the lack of occupant protection standards for motorcoaches.

Adopted: April 21, 2010