

Highway Accident Report

Multivehicle Collision
Interstate 44 Eastbound, Gray Summit, Missouri
August 5, 2010



**National
Transportation
Safety Board**

490 L'Enfant Plaza, SW
Washington, DC 20594

1 Factual Information

1 1.1 Accident Narrative

2 On Thursday morning, August 5, 2010, in Gray Summit, Franklin County, Missouri,
3 traffic slowed approaching an active work zone on eastbound Interstate 44 (I-44), in the vicinity
4 of mile marker 250.6, as motor vehicles merged from the left lane, which was closed ahead, to
5 the right lane. A 2007 Volvo truck-tractor with no trailer, operated by a 43-year-old driver, was
6 traveling eastbound in the right lane and had slowed or stopped^d behind traffic in the work zone.
7 (See figure 1.) About 10:11 a.m. central daylight time,¹ a 2007 GMC Sierra extended cab pickup
8 truck, operated by a 19-year-old driver, merged from the left to the right lane and struck the rear
9 of the Volvo tractor.

10 A convoy of two school buses from St. James High School, St. James, Missouri, was
11 traveling eastbound in the right lane of I-44, to the Six Flags St. Louis amusement park in
12 Eureka, Missouri. A 2003 Blue Bird 71-passenger bus (lead school bus), operated by a 75-year-
13 old driver and occupied by 23 passengers, was approaching the slowed traffic and the accident
14 ahead. A 2001 Blue Bird 72-passenger bus (following school bus), operated by a 38-year-old
15 driver and occupied by 31 passengers, was following the lead school bus. Seconds after the lead
16 bus passed a motorcoach that had pulled over and stopped on the shoulder because of the initial
17 collision, it struck the rear of the GMC pickup. This collision pushed the pickup forward, and it
18 overturned onto the back of the Volvo tractor. The front of the lead bus was ramped upward, and
19 it came to rest on top of the GMC pickup and the Volvo tractor. Moments later, the left front of

¹ All times in this report are central daylight time unless stated otherwise.

1 the following bus struck the right rear of the lead bus. The following bus remained engaged with
2 the lead bus. (See figures 2–5.)

3 As a result of this accident sequence, the driver of the GMC pickup and one passenger
4 seated in the rear of the lead school bus were killed. A total of 35 school bus passengers from
5 both buses, the 2 school bus drivers, and the driver of the Volvo tractor received injuries ranging
6 from minor to serious. Eighteen persons were uninjured.

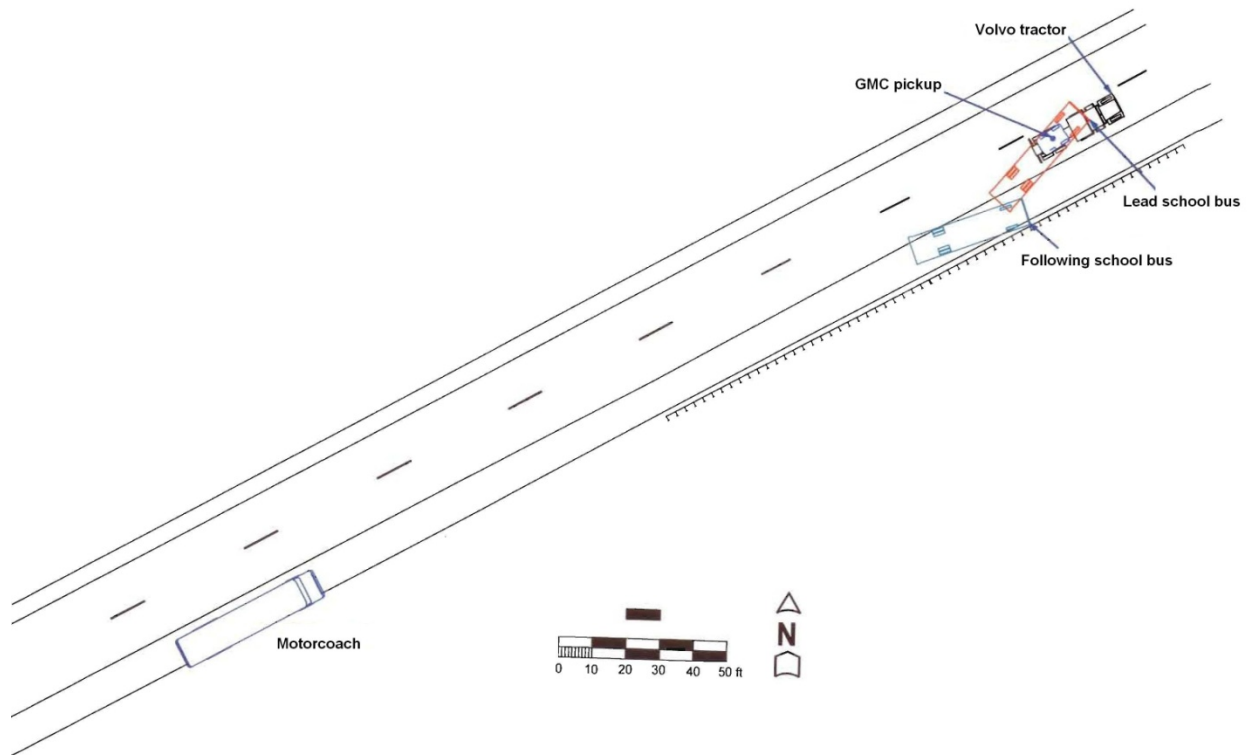
7 The accident occurred on a straight section of roadway with a 3 percent upgrade. The
8 temperature at the time of the accident was 81° Fahrenheit (F), the weather was clear, and the
9 roadway was dry.

10 Appendix A presents background information on the National Transportation Safety
11 Board's (NTSB) launch to the accident site.



1 **Figure 1.** Gray Summit, Missouri, accident location.^e

2 *Alt text: Map showing location of accident on Interstate 44, in Gray Summit, Missouri, about*
3 *100 miles southwest of the city of St. Louis.*



1 **Figure 2.** Diagram of accident vehicles at rest. Final rest position of GMC pickup was beneath
2 lead school bus. Motorcoach shown to the west was not involved in accident but is referenced
3 throughout the report.

4 *Alt text: Diagram of accident vehicles at rest, showing the Volvo tractor, the GMC pickup, the*
5 *lead and following school buses, and the motorcoach that pulled over to the shoulder behind the*
6 *collisions.*



1 **Figure 3.** Gray Summit accident scene, showing Volvo tractor and lead school bus. GMC
2 pickup is located between the two vehicles and acted as a ramp for the school bus. The
3 following school bus is located at right rear of photo. (Courtesy of Boles Fire Protection District)

4 *Alt text: Photograph showing the Gray Summit accident scene, including the Volvo tractor, the*
5 *GMC pickup on the back of the tractor, and the lead school bus perched at an angle on top of the*
6 *pickup. The back of the following school bus is visible in the right rear of the photo.*



- 1 **Figure 4.** Override and intrusion of following school bus into lead school bus. (Courtesy of Boles
- 2 Fire Protection District)
- 3 *Alt text: Photograph looking onto the accident scene from the rear, showing the extent of*
- 4 *override and intrusion of the following school bus into the back of the lead school bus.*



1 **Figure 5.** Position of accident vehicles at rest, with GMC pickup located between lead school
2 bus and top of rear wheels of Volvo tractor. (Courtesy of Boles Fire Protection District)

3 *Alt text: Photograph of accident scene from the front, showing the position of the vehicles at rest,*
4 *with the front of the lead school bus atop the Volvo tractor, the pickup truck between the two*
5 *vehicles, and the following school bus at the rear.*

1.2 Witness Statements

1 A witness, who had been driving in the left lane, approaching the rear of the GMC
2 pickup, stated that he noticed the pickup driver lower his head to the right, as if he was leaning to
3 reach for something. He said that he then noticed the Volvo tractor come to a stop and saw the
4 GMC pickup hit the back of the tractor. According to the witness, he then looked in his right
5 outside rearview mirror and saw the lead school bus hit the pickup truck and override the back of
6 the Volvo tractor. When asked, the witness said that he did not see any brake lights from the
7 GMC pickup prior to its collision with the Volvo tractor.

8 Another witness, who had been driving a motorcoach, told NTSB investigators that he
9 was traveling about 45 mph before the accident, and cars were passing him. He reported that the
10 traffic density was moderate to heavy. He saw a truck-tractor in front of him stop, and he began
11 to slow. He then saw what he described as an “SUV” pass him from the left and enter the right
12 lane. At an estimated distance of 600 feet in front of him, he saw the vehicle collide with the rear
13 of the tractor. He stated that another vehicle also passed him on the left and continued past the
14 collision. The motorcoach driver stopped his bus on the right shoulder about 180 feet behind the
15 accident. The driver told NTSB investigators that he saw the collisions involving the two school
16 buses approximately 5–6 seconds after the initial collision between the Volvo tractor and the
17 GMC pickup. This statement contradicts what he told the Missouri State Highway Patrol
18 (MSHP): that after parking his vehicle, he exited and attempted to slow down other drivers and
19 that he did not see the accident with the buses because he was facing the opposite direction.

1 1.3 Injuries

2 Table 1 summarizes the injuries resulting from the accident. Figures 6 and 7 show the
 3 seating charts for the lead and following school buses, respectively. The passengers in the lead
 4 bus were female students, 13–17 years old. The passengers in the following bus included
 5 1 chaperone and 30 male students, 6–18 years old. None of the occupants in either bus were
 6 ejected during the accident sequence.

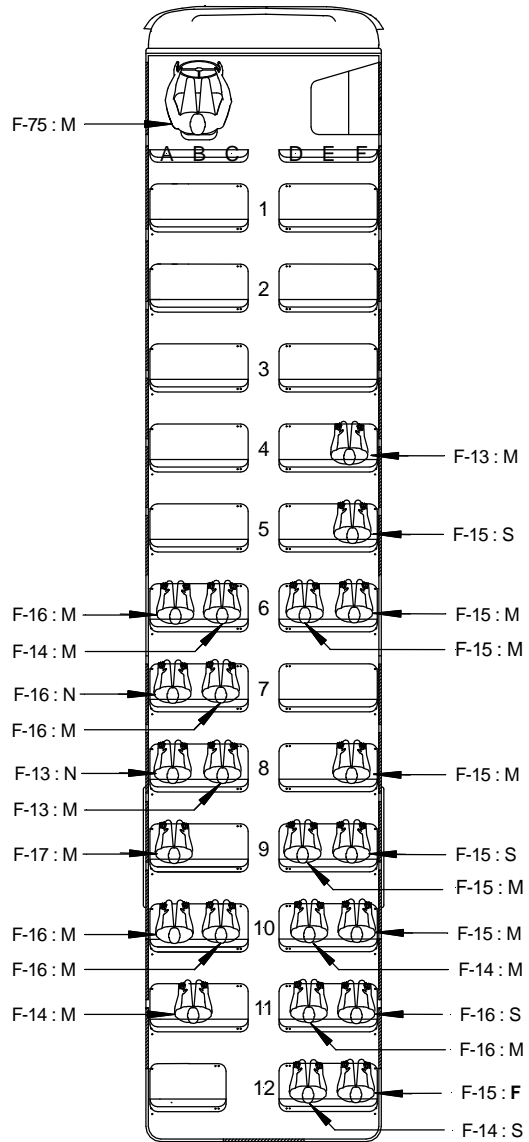
7 **Table 1.** Injuries.

Injuries ^a	Drivers	Passengers	Total
Fatal	1	1	2
Serious	1	4	5
Minor	2	31	33
None	0	18	18
Total	4	54	58

^a Title 49 *Code of Federal Regulations* (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 of the date of injury; 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 burn affecting more than 5 percent of the body surface.

GRAY SUMMIT, MISSOURI
HWY-10-MH-018

ICAO INJURY LEGEND		
N	=	None
M	=	Minor
S	=	Serious
F	=	Fatal
F = FEMALE	M = MALE	# = AGE
*International Civil Aviation Organization		
INJURY LEVEL	SAMPLE	
AGE		
GENDER		
		F - 14 : Minor
Source: NTSB		

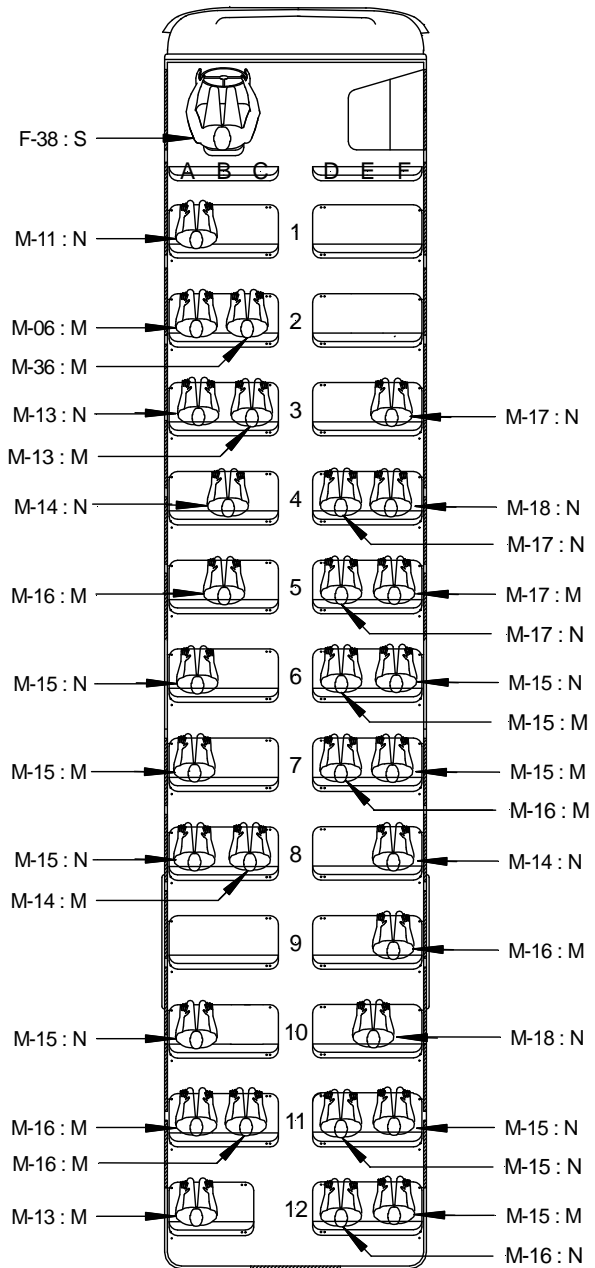


1 **Figure 6.** Seating chart for lead school bus.

2 *Alt text: Seating chart for the lead school bus, indicating 1 fatality in the right rear of the bus, 4*
 3 *passengers with serious injuries, 16 passengers and the driver with minor injuries, and 2*
 4 *passengers with no injuries.*

GRAY SUMMIT, MISSOURI
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GENDER													
		F - 14 : Minor											
Source: NTSB													



- 1 **Figure 7.** Seating chart for following school bus.
- 2 *Alt text: Seating chart for the following school bus, indicating the driver with serious injury, 15*
- 3 *passengers with minor injuries, and 16 passengers with no injuries.*
- 4

1 **1.4 Medical and Pathological Information**

2 According to autopsy reports, the driver of the GMC pickup sustained multiple fractures
3 to the skull and lower right leg, and large lacerations and abrasions to the face, torso, and
4 extremities. The 15-year-old female school bus passenger, who had been seated in the last row of
5 seats on the right side of the lead school bus, sustained multiple fractures to the skull, chest, and
6 extremities.

7 According to the emergency medical services (EMS) incident commander, ambulances
8 transported 19 school bus occupants to five area hospitals—where they were evaluated, treated,
9 and released, or transferred to higher trauma hospitals. Thirty-five occupants of the two buses
10 were transported to Cardinal Glennon Children’s Hospital. Two uninjured occupants left the
11 accident scene.

1.5 Emergency Response

12 The Franklin County dispatcher was notified of the accident through the 911 system at
13 10:13 a.m. on August 5, 2011. The first call from dispatch went out to the Boles Fire Protection
14 District at 10:14 a.m., and the incident commander arrived on scene at 10:18 a.m. Emergency
15 responders from the Boles Fire District, the Meramec Ambulance District, and the MSHP arrived
16 shortly afterward. A level 1 mass casualty incident was declared at 10:21 a.m.^f At 10:29 a.m., the
17 incident commander asked dispatch to contact the Missouri Department of Transportation
18 (MoDOT) to close down I-44 at exit 247. At 10:43 a.m., traffic was redirected to exit 247, and
19 the eastbound and westbound lanes of I-44 were closed.

1 A total of two law enforcement agencies, three fire districts, and six ambulance services
2 responded to the accident.² In all, 12 rescue and engine units and 13 ambulances were present at
3 the scene. Fire engines placed foam over a gasoline spill from the GMC pickup, which was
4 located under the lead school bus and atop the fifth wheel of the Volvo tractor. This task was
5 completed at 11:01 a.m.

6 A surviving trapped occupant in the lead school bus was extricated at 10:37 a.m.
7 Extrication of the two deceased occupants began at 1:00 p.m. and was completed by 2:11 p.m.
8 MoDOT reopened traffic on this section of I-44 at 4:16 p.m.

9 In postaccident interviews, first responders commented that the rescue and recovery
10 operations went smoothly and all responding agencies worked well together. The incident was
11 handled as a unified command, with the MSHP investigating the accident; EMS units
12 transporting the injured; and fire districts handling the rescue, extrication, and recovery efforts.
13 Franklin County had an emergency operations plan in place, as required by the U.S. Department
14 of Homeland Security.³ At the time of the accident, however, it did not have standard operating
15 procedures for mass casualty incidents. The county completed a draft mass casualty incident plan
16 and a draft mass patient care plan in May 2011.

17

² The MSHP, Franklin County Sheriff's Department, Boles Fire Protection District, Union Fire Protection District, Pacific Fire Protection District, Meramec Ambulance District, Eureka Fire Protection District EMS, Metro West Fire Protection District EMS, Big River Ambulance District, Washington Area Ambulance District, and St. Clair EMS responded to the accident.

³ The Franklin County emergency operations plan is currently in the all hazards format, with annexes for more specific topics. The plan contains the basic personnel roles and responsibilities—such as for triage and patient tracking—in accordance with the current Federal Emergency Management Agency National Incident Management System standards. The hazard-specific annexes contain more detail about specific topics. The health and medical services annex, for example, outlines the procedures for notification, request for more units, information flow, and activation. The Franklin County Mortuary Service standard operating procedures are included in an appendix.

1.6 Survival Factors

1.6.1 2007 Volvo Truck-Tractor

1 The collision and override of the GMC pickup caused moderate damage to the rear of the
2 Volvo tractor and the top of the rear frame rails around the fifth wheel coupling. Both rear
3 tandem mud flaps were broken off, and the left frame member was bent inward approximately
4 1 inch. In addition, the metal cross member between the frame rails, which supported the license
5 plate and rear brake lights, was crushed inward approximately 9 inches. NTSB investigators
6 measured the postaccident wheelbase on the right and left sides of the Volvo tractor at
7 244 inches and 242.5 inches, respectively.

8 The impact and override of the lead school bus damaged the top left corner of the Volvo
9 tractor's fiberglass roof above the sleeper berth. The interior of the cab sustained significant
10 damage to the top portion of the sleeper berth but no damage to the driver or front right
11 passenger seating area.

12 The Volvo tractor was equipped with a driver air bag, and both the driver and passenger
13 seats were equipped with three-point lap and shoulder restraints attached to the B-pillar of the
14 cab. Because the Volvo tractor was involved in a rear-end collision, the air bag did not deploy,
15 and no evidence of friction rub or stretching was found on the driver's seat belt.

1.6.2 2007 GMC Sierra Pickup Truck

1 The GMC pickup was taken to an impound lot in Saint Clair, Missouri, where it was
2 examined by NTSB investigators. The damage to the exterior and interior was catastrophic. The
3 front end of the pickup was severely damaged due to its impact with the rear of the Volvo
4 tractor. The subsequent impact by the lead school bus resulted in the pickup overriding the back
5 of the Volvo tractor and its undercarriage being folded into a “U” shape. During the accident
6 sequence, the pickup’s high-density polyethylene gasoline tank was torn and released fuel at the
7 site. (See figures 8 and 9.)

8 The interior of the GMC pickup was fully destroyed and contained no survivable space.
9 The rear seats were collapsed into the front seats, and the front seatbacks were folded down flat
10 to the seat cushions. The steering wheel did not appear to be deformed; the steering column’s
11 shear capsule⁴ was totally collapsed (that is, pushed inward) and separated by approximately
12 6 inches. The vehicle was equipped with^g a driver air bag, which deployed. The passenger-side
13 air bag did not deploy because no one was seated in that position. An inspection of the driver’s
14 seat belt showed no evidence of usage at the time of the accident. According to first responders,
15 the driver was found unrestrained by the available lap and shoulder belts.

⁴ A shear capsule is a component of an energy-absorbing steering column that deforms with the application of a collision’s direct forward force.



- 1 **Figure 8.** GMC pickup in an inverted “U” shape, with its rear at left and its front at right.
- 2 Undercarriage of pickup forms exterior of “U” shape.
- 3 *Alt text: Photograph showing the extent of damage to the GMC pickup. The vehicle’s*
- 4 *undercarriage is in an inverted “U” shape, with its rear to the left and its front to the right.*



- 1 **Figure 9.** Gas tank tear in GMC pickup.
- 2 *Alt text: Photograph showing a tear in the gas tank of the GMC pickup.*

1.6.3 2003 Blue Bird Bus (Lead School Bus)

1 The lead school bus sustained moderate front-end damage from hitting the back of the
2 GMC pickup and undercarriage damage from overriding the pickup and the sleeper berth of the
3 Volvo tractor. The rear of the bus was seriously damaged as a result of being overridden by the
4 following school bus. (See figure 10.)



5 **Figure 10.** Front and rear views of lead school bus. Emergency door supports and several roof
6 pillars were cut to extricate an entrapped passenger.

7 *Alt text: Two photographs showing the front and rear of the lead school bus. The first photo*
8 *shows moderate crush damage to the front of the bus. The second photo shows extensive damage*
9 *throughout the bumper, rear panels, and rear roof, as well as damage to the emergency door*
10 *supports and several roof pillars that were cut to extricate a passenger.*

1 According to manufacturer specifications, the lead school bus had an original overall
2 length of 427 inches, an overall width of 94 inches, and a wheel base of 210 inches. The initial
3 frontal damage due to impact with the GMC pickup began at the left front corner and extended
4 80 inches to the right. Maximum crush was measured at 9.5 inches from the left front bumper,
5 extending to the undercarriage of the bus. The driver-side windshield was knocked out. The
6 passenger-side windshield was severely cracked but still in place. The right-side wheelbase was
7 measured at 210 inches and the left at 211.5 inches.

8 The impact from the following school bus severely damaged the rear of the lead school
9 bus. Direct damage to the rear bumper was primarily on the right side and spanned a width of
10 35 inches. The bumper was crushed inward 6 inches at its maximum point. The maximum
11 residual crush into the passenger compartment was 62 inches. The override impact crushed the
12 rear emergency door and rear wall inward, and caused the roof to buckle and crush inward and
13 upward. In addition, the right outside side wall was crushed inward and to the right. The
14 emergency door supports and several roof pillars were cut to extricate a passenger.

15 Interior damage to the lead school bus was primarily in the area of the right rear
16 passenger compartment and the emergency exit door. The back right wall panel adjacent to the
17 emergency door and roof sustained significant damage from the intruding front end of the
18 following school bus. All rear windows, three side windows near the right rear, and one side
19 window near the left rear were broken out. The rear emergency door, back right wall panel, and
20 roof intruded into the occupant compartment. In the last two seating rows on the right side, the
21 roof was crushed approximately 45 inches, to 6 inches below the seatbacks. The roof and side
22 walls were also buckled inward at several locations near the rear of the bus.

1 The lead school bus was equipped with a bucket seat with cushion springs for the driver.
2 Inspection of the driver's lap and shoulder restraint system revealed a small heat abrasion near
3 the latch and buckle connection, indicating that the restraints were in use at the time of the
4 accident. The steering wheel had no noticeable deformation. Behind the driver's seat were 11
5 rows of three-person bench seats and a twelfth row with a two-person seat. The right side had 12
6 rows of three-person seats. Each of the three-person bench seats was 39 inches wide, with the
7 seatbacks 28.5 inches high. The two-person bench seat was 27 inches wide and 28.5 inches high.
8 None of the passenger seating positions were equipped with seat belts.

9 The floor and wall anchors remained secured on both sides, postaccident, except at the
10 seats in rows 10, 11, and 12 on the right side. The forward floor post for the right seat in row 12
11 was cut to allow extrication of the entrapped passenger, and the rearward floor post and wall
12 anchors were torn out. The forward floor post of the seat in row 11 was bent forward at an angle
13 of 20°, and the rear post was bent forward at an angle of 10°. The seatback in row 11 was
14 touching the backside of the seatback in row 10, and both wall anchors were pulled out. Both of
15 the floor posts in row 10 were bent forward, with the front at a 20° angle and the rear at a 45°
16 angle. The rear wall anchor was pulled out but the front remained attached.

17 The lead school bus was equipped with one loading door opposite the driver's seat, four
18 emergency windows (located on the left and right sides of the bus, in rows 4 and 10), two
19 emergency roof hatches (located above rows 3 and 9), and a rear emergency door. Based on
20 interviews with emergency responders and passengers on both buses, all but one occupant exited
21 the bus through the left rear emergency exit window. The one entrapped passenger was

1 extricated by emergency responders and placed on a backboard before being removed through
2 the right rear emergency exit window.

3 All four emergency exit windows were laminated and properly marked with identifying
4 decals and instructions. The size of egress was 20 by 30 inches for all emergency exit windows.⁵
5 According to a Blue Bird representative, the emergency exit windows were double 9-inch push-
6 out, split-sash window assemblies with laminated glass. The push-out window assembly consists
7 of two split-sash window panes within a hinged frame. A positive latch mechanism located on
8 the bottom of the frame assembly, which releases, allows the window to swing outward while
9 remaining hinged at the top to provide emergency egress. A warning buzzer alerts the driver of
10 the opened window. A 4- by 3-inch emergency release latch plate, which is elevated about 1 inch
11 from the window base, is exposed when the window is disengaged from the positive latch
12 mechanism.

13 According to emergency responders and passengers in the lead school bus, evacuation
14 was hindered by the design of the emergency window. The latch plate that protruded from the
15 bottom of the window snagged the clothing of several passengers. (See figure 11.) Additionally,
16 one person had to hold the hinged emergency window open so that another bus occupant could
17 exit unimpeded. According to the Blue Bird representative, the company had changed the design
18 of its newly manufactured^h emergency exit windows in 2005 so that the hinges are now
19 vertically positioned, instead of horizontally, as in the accident buses.⁶ In addition, Blue Bird

⁵ Section 5.4.2.1(c) of Federal Motor Vehicle Safety Standard (FMVSS) 217, Bus Emergency Exits, specifies that the openings of school bus emergency exit windows must be large enough to admit unobstructed passage of a 50- by 33-centimeter ellipsoid (19.70 by 13.0 inches).

⁶ According to representatives from Thomas Built and IC/Navistar, these school bus manufacturers still offer both the horizontal- and vertical-mounted emergency exit windows.

- 1 representatives stated that they have decreased the elevation of the emergency release latch plate
- 2 so that it does not extend more than 0.5 inch beyond the window opening.



- 3 **Figure 11.** Raised emergency release latch plate (circled) at bottom of emergency exit window,
- 4 lead school bus.

5 *Alt text: Photograph showing the raised latch plate at the bottom of an emergency exit window in*
6 *the lead school bus. The plate protrudes 1 inch into the area of egress and has a hooked top that*
7 *bends inward toward the interior of the bus.*

- 8 The lead school bus was equipped with a first aid kit, a triangle/flare kit, and a fire
- 9 extinguisher. According to the inspection sticker, the extinguisher was last inspected in February
- 10 2008, and the sticker expired in February 2009.

1.6.4 2001 Blue Bird Bus (Following School Bus)

1 The following school bus sustained moderate front-end damage from hitting the back of
2 the lead school bus. (See figure 12.) According to manufacturer specifications, the following bus
3 had an original overall length of 420 inches, an overall width of 94 inches, and a wheelbase of
4 190 inches. The frontal impact damage began at the left corner and extended to the right
5 64.5 inches. The damage also extended vertically to the roof. Maximum crush to the left front
6 bumper was 13.5 inches. Damage to the left side of the bus extended approximately 49.5 inches,
7 detaching the side rearview mirror and shattering the driver's window. Both windshield panes
8 were also shattered. Postaccident measurement of the wheelbase showed the left side to be
9 189.5 inches and the right side 190.25 inches.

10 The following school bus was equipped with a bucket seat with cushion springs for the
11 driver. Behind the driver's seat, on both sides of the bus, were 12 rows of three-person bench
12 seats. Each of the bench seats was 39 inches wide, with 24.5-inch-high seatbacks. All of the floor
13 and wall anchors on both sides of the bus remained secured.

14 Inspection of the vehicle's interior revealed that most of the damage was in the driver's
15 seating area. Three of the five gauges located on the dash and instrument panels, directly forward
16 of the steering wheel, were broken out. Inward deformation to the steering wheel was evident
17 from loading by the driver. An inspection of the driver's lap and shoulder restraint showed a
18 small heat abrasion near the buckle/latch connection, consistent with the seat belt being in use at
19 the time of the accident.



1 **Figure 12.** Front view of following school bus.

2 *Alt text: Photograph showing the front of the following school bus, with moderate crush damage*
3 *to the driver's side.*

4 The following school bus was equipped with one loading door opposite the driver's seat,
5 four emergency windows (located on the left and right sides of the bus, in rows 4 and 10), two
6 emergency roof hatches (located above rows 3 and 9), and a rear emergency exit door. All four
7 emergency exit windows were properly marked with identifying decals and instructions. All but
8 one occupant of the bus evacuated through the rear emergency exit door; the adult chaperone
9 exited through the front loading door.

10 Safety equipment in the following school bus consisted of a first aid kit, a triangle/flare
11 kit, and a fire extinguisher. According to the inspection sticker, the extinguisher was last
12 inspected in July 2009, and the sticker expired in July 2010.

1 NTSB also reiterates Safety Recommendations H-01-6 and -7 to NHTSA.⁰⁰⁰ **[Reiterated**
2 **Recommendations]**

2.7 School Bus Evacuation

2.7.1 Emergency Exit Windows

3 All but one occupant of the lead school bus evacuated through the left rear emergency
4 exit window. One injured passenger who had been entrapped between seats was extricated and
5 removed by emergency responders through the right rear emergency exit window. According to
6 the incident commander, all occupants, except for the one fatality, were removed from the bus by
7 10:37 a.m., 24 minutes after the first call to 911. Several passengers, and a witness who assisted
8 in the evacuation, stated in postaccident interviews that egress was hindered due to (1) a raised
9 emergency release latch plate at the bottom of the emergency exit window, which snagged
10 clothing; and (2) the failure of the emergency window to independently remain in the open
11 position as occupants climbed out. The NTSB concludes that the 24 occupants of the lead school
12 bus were evacuated in a timely manner, despite the encumbrances caused by the emergency exit
13 windows. **[Conclusion]**

14 According to the School Bus Manufacturers Technical Committee (SBMTC),¹²¹ it has
15 never received negative feedback from end users (buyers) regarding evacuation through
16 emergency exit windows. The SBMTC representative interviewed by NTSB investigators stated
17 that when a school bus is involved in an accident and does not roll over, the front, rear, and side
18 doors are the primary points of egress; when a bus rolls on its side, evacuation occurs primarily

¹²¹ The SBMTC is a committee within the National Association of State Directors of Pupil Transportation Services (NASDPTS) comprised of school bus and chassis manufacturers, such as Freightliner, Blue Bird, Ford Motor Company, and Thomas Built Buses.

1 through the emergency exit windows or roof hatches. In this accident, the 71-passenger lead
2 school bus remained upright, but the rear-end collision blocked the rear emergency exit door, and
3 the elevated resting position of the bus prevented egress through the loading door and roof
4 hatches. Because the accident bus was not equipped with side emergency exit doors, the
5 emergency exit windows became the only egress option.

6 The Federal standard for bus emergency exits and window retention and release,
7 FMVSS 217 (at 49 CFR 571.217), was established to minimize the likelihood of occupants being
8 thrown from a bus and to provide a means of readily accessible emergency egress. FMVSS 217
9 specifies the minimum number of emergency exit windows, minimum window size, designation
10 as emergency exit windows, and maximum force allowed to push the window out, among other
11 characteristics. To assist manufacturers in meeting the requirements, NHTSA published
12 laboratory test procedures for school bus emergency exits and window retention and release.¹²²

13 The NTSB reviewed the test procedures for side emergency exit windows and found
14 separate procedures for determining the maximum force requirements to push the window out
15 and the minimum size requirements for egress. However, the procedures do not address
16 scenarios in which an occupant would need to push the window out and maintain it in the open
17 position while attempting egress. On the lead school bus, one person was needed to hold the
18 emergency window open while another attempted egress. Although the opening size of the
19 emergency exit window met Federal standards, this opening could not be maintained by a single
20 occupant while simultaneously exiting from the window. Both FMVSS 217 and the associated
21 NHTSA laboratory test procedures require that each emergency exit be manually extendable by a

¹²² *Laboratory Test Procedures for FMVSS 217: School Bus Emergency Exits and Window Retention and Release*, TP-217-06 (Washington, DC: National Highway Traffic Safety Administration, December 1996).

1 single occupant to admit unobstructed passage, but neither directive then specifies that the same
2 occupant be able to egress while manually extending the window.

3 The National Congress on School Transportation (NCST) publishes specifications and
4 procedures to supplement FMVSS 217.¹²³ For rear emergency exit on school buses with a rear
5 engine, large windows are used in lieu of rear emergency exit doors, and the NCST specifies that
6 a lifting assistance device be in place to aid in lifting and holding the window open. However, no
7 such specification is provided for side emergency exit windows during evacuation.

8 According to Blue Bird Corporation, in 2005, after the last state removed its requirement
9 for horizontally hinged windows, the company redesigned all side emergency exit windows. The
10 emergency exit windows now offered are vertically hinged, with release latch tabs that present
11 less intrusion into the area of egress. Although a vertically hinged side emergency exit window
12 may be an improvement, accident scenarios are still possible in which the window may have to
13 be held in place so as not to hinder evacuation. The NTSB concludes that the situation of a single
14 occupant having to manually hold open the emergency exit window could delay school bus
15 evacuation. **[Conclusion]** Therefore, the NTSB recommends that NHTSA modify FMVSS 217
16 to require that all emergency exits on school buses be easily opened and remain open during an
17 emergency evacuation. **[Recommendation]**

18 The NTSB has previously addressed potential hindrances due to emergency exits that fail
19 to stay in the open position during evacuation. As the result of an accident field investigation of a

¹²³ *National School Transportation Specifications and Procedures* (Warrensburg, Missouri: Fifteenth National Congress on School Transportation, 2010). This document serves as the national guideline for school bus design specifications, inspection procedures, and out-of-service criteria.

1 pickup and a tour bus collision in Laredo, Texas, in 1984,¹²⁴ the NTSB issued the following
2 recommendation to NHTSA:

3 Revise Federal Motor Vehicle Safety Standard 217 to require a locking
4 mechanism that would hold open side window emergency exits on intercity-type
5 buses during use. (H-86-61)

6 Because NHTSA indicated that no rulemaking was planned for this recommendation, it was
7 classified “Closed—Unacceptable Action” in 1987.

8 In 1999, the NTSB completed a special investigation on selective motorcoach issues
9 based on two motorcoach accidents—one of which occurred in Stony Creek, Virginia, in
10 1997.¹²⁵ It involved a motorcoach that drifted off the road and into the Nottoway River,
11 resulting in 2 killed and 39 injured. Several passengers reported difficulty evacuating the bus
12 because the emergency window would not remain open. As a result, the NTSB issued the
13 following recommendation to NHTSA:

14 Revise the Federal Motor Vehicle Safety Standard 217, “Bus Window Retention
15 and Release,” to require that other than floor-level emergency exits can be easily
16 opened and remain open during an emergency evacuation when a motorcoach is
17 upright or at unusual attitudes. (H-99-9)

18 In November 2009, the DOT published its Motorcoach Safety Action Plan and identified
19 as a priority safety initiative enhancing the ability of passengers to evacuate a motorcoach in a
20 crash. The NTSB was pleased that progress was being made to improve motorcoach safety but

¹²⁴ 1982 Eagle Charter Coach Head-on Collision With 1983 Ford Pickup Truck, Near Laredo, Texas, October 20, 1984, Highway Field Report NTSB FTW-85-H-FR02 (Washington, DC: National Transportation Safety Board, 1986).

¹²⁵ *Selective Motorcoach Issues*, Highway Special Investigation Report NTSB/SIR-99/01 (Washington, DC: National Transportation Safety Board, 1999).

1 expressed concern that decisions on regulatory action were not forthcoming. Accordingly, the
2 NTSB classified Safety Recommendation H-99-9 “Open—Unacceptable Response” in 2010.

3 FMVSS 217 and the accompanying test procedures also fail to address other emergency
4 exit design characteristics that could affect egress safety, such as the latch plate protrusion found
5 on the lead school bus. The Gray Summit accident did not require an expedited evacuation
6 because the spilled fuel from the GMC pickup was managed by first responders and did not catch
7 fire, and because several people assisted in the evacuation. Although, in this case, the latch plate
8 only snagged clothing, the NTSB is concerned that any protrusion into a space of egress may act
9 as an injury source and delay egress, especially during more urgent evacuation scenarios.

10 The NTSB concludes that components of emergency exit windows, such as protruding
11 latch plates, could cause delays or injuries during school bus evacuation. **[Conclusion]**
12 Therefore, the NTSB recommends that NHTSA modify FMVSS 217 or the corresponding
13 laboratory test procedure to eliminate the potential for objects such as latch plates to protrude
14 into the emergency exit window opening space even when that protrusion still allows the exit
15 window to meet the opening size requirements. **[Recommendation]** To cover the interim period
16 until FMVSS 217 is modified, the NTSB also recommends that NHTSA provide the states with
17 guidance on how to minimize potential evacuation delays that could be caused by protruding
18 latch mechanisms on emergency exit windows and by exit windows that require additional
19 manual assistance to remain open during egress. **[Recommendation]**

2.7.2 Evacuation Instruction

1 Under 5 CSR 30-261.010(1)(J), Missouri requires that all students in kindergarten
2 through sixth grade participate in emergency evacuation drills on school buses at least once each
3 semester. In addition, the St. James School District requires emergency evacuation drills for
4 students in seventh and eighth grades. During postaccident interviews, the majority of students
5 said that they had drills at least once while in grade school and that they were aware of where the
6 exits were located, though some students were not familiar with how to operate the window
7 exits. None of the interviewed occupants of either accident bus mentioned ever receiving a
8 pretrip briefing on emergency evacuation prior to traveling to school sports activities or other
9 school-sponsored events. To date, Missouri does not require emergency evacuation briefings
10 prior to school activity trips on either a school bus or a school-chartered bus.

11 Despite the mandatory evacuation training required by the state and the St. James School
12 District, students who do not normally ride a bus may not pay attention to the information
13 because they feel that it does not apply to them. Instituting evacuation training prior to school
14 activity trips would ensure that both regular bus riders and occasional bus riders alike obtain
15 training at an applicable time. In an emergency evacuation situation, the success of any one
16 person in unlatching an exit window affects how quickly and safely others can exit the bus. The
17 NTSB concludes that the lack of school bus evacuation briefings prior to activity trips may
18 hinder evacuation and pose a risk for all students. **[Conclusion]** Accordingly, the NTSB
19 recommends that the state of Missouri revise its bus evacuation regulations to require that pupils
20 traveling to an activity or on a field trip in a school bus or a school-chartered bus be instructed in
21 safe riding practices and on the location and operation of emergency exits prior to starting the
22 trip. **[Recommendation]**

1 Resources are available to assist Missouri in revising its regulations on school bus
2 evacuation training. In October 2001, the NTSB began an investigation of an Omaha, Nebraska,
3 accident involving a school bus that plunged off a bridge and fell 49 feet into a creek.¹²⁶ NTSB
4 investigators learned that very few of the 27 high school students on the bus had ever received
5 emergency evacuation training. Most of the students did not ride a school bus to or from school
6 and, therefore, did not receive the mandated evacuation training. The NTSB issued the following
7 recommendation to NASDPTS:

8 Prepare a report that can be used by the State Directors to influence their States to
9 require pretrip briefings before school-related activity trips on school buses or
10 school-chartered buses and subsequently assist the States in developing criteria
11 for such briefings, to include training all students regarding the location and use
12 of emergency exits. (H-04-6)

13 In response to the NTSB recommendation, NASDPTS completed and distributed an
14 information paper on the importance of pretrip briefings before school-related activity trips.¹²⁷
15 The report encouraged state directors of pupil transportation to require that all students
16 transported on such trips receive instruction about the location of all emergency exits, as well as
17 a demonstration of their operation. In addition, the report discussed the importance of
18 maintaining clear aisles and access to emergency exits and of being aware of hazardous highway
19 conditions and other aspects of bus safety. Because this response surpassed NTSB expectations,
20 Safety Recommendation H-04-6 was classified “Closed—Exceeds Recommended Action” in
21 2004.

¹²⁶ *School Bus Run-Off Bridge Accident, Omaha, Nebraska, October 13, 2001*, Highway Accident Report NTSB/HAR-04/01 (Washington, DC: National Transportation Safety Board, 2004).

¹²⁷ *Information Paper: Emergency Evacuation Training, School Activity Trips*, <<http://www.nasdpts.org/Documents/EmergEvacOmaha2004.pdf>>, accessed August 4, 2011

1 In May 2010, the NCST updated the *National School Transportation Specifications and*
2 *Procedures* to discuss the need for emergency evacuation drills under “Evacuation Procedures
3 for Activity and Field Trips.” This document provides detailed guidance on pretrip emergency
4 evacuation training procedures.

5 In its 1999 special investigation report,¹²⁸ the NTSB addressed the need for pretrip
6 briefings for other types of buses and made the following recommendations to the FMCSA:

7 Provide guidance on the minimum information to be included in safety briefing
8 materials for motorcoach operations. (H-99-7)

9 Require motorcoach operators to provide passengers with pre-trip safety
10 information. (H-99-8)

11 Safety Recommendation H-99-7 was classified “Closed—Acceptable Action” in 2007 after the
12 FMCSA published a basic plan for motorcoach passenger safety awareness, recommending that
13 motorcoach companies inform passengers of such safety topics as emergency exits, emergency
14 contact information, driver direction, fire extinguishers, restroom emergency information, and
15 information pertaining to slips and falls. In response to Safety Recommendation H-99-8, the
16 FMCSA stated that it believed that voluntary adoption of the plan was the best approach so as to
17 allow each carrier to develop an appropriate passenger safety awareness program for its
18 operations. The FMCSA stated that it had developed and distributed 30,000 brochures, 6,000
19 posters, and 20,000 audio CDs to bus/motorcoach associations, bus/motorcoach companies, and
20 FMCSA division offices. Safety Recommendation H-99-8 is classified “Open—Acceptable
21 Alternate Response.”^{PPP}

¹²⁸ NTSB/SIR-99/01.

1 The NTSB recognizes that the school bus-related issues identified in this report are not
2 unique to Missouri and that it would be beneficial to disseminate, discuss, and resolve the issues
3 identified in this accident.^{qqq} These issues include driver distraction, proper driver scanning
4 behavior, and the importance of maintaining a sufficient following distance at all times;
5 emergency evacuation issues that might occur with certain emergency exit window designs;
6 vehicle inspection issues due to insufficient oversight and procedures; and the potential safety
7 benefits of technologies such as VER and FCW systems. Therefore, the NTSB recommends that
8 NASDPTS, the National Association for Pupil Transportation, and the National School
9 Transportation Association inform their members of the circumstances and events that
10 contributed to the Gray Summit accident; discuss solutions for the driver, pretrip evacuation
11 briefings,^{rrr} and vehicle, inspection, and technological issues presented in the report; and urge the
12 implementation of these solutions among their members.^{sss} **[Recommendation]**