



National Transportation Safety Board

Highway Accident Brief

Collision of Two School Buses with Subsequent Rollover

Accident Number:	HWY15FH002
Accident Type:	Collision of two school buses with subsequent rollover
Location:	Asheville Highway (State Route 9), near John Sevier Highway (State Route 168) in Knoxville, Knox County, Tennessee
Date and Time:	December 2, 2014; about 2:52 p.m.
Vehicle #1:	2000 Navistar International transit-style school bus (bus #44)
Operator:	Knoxville Independent School District
Vehicle #2:	2001 Thomas Built transit-style school bus (bus #57)
Operator:	Knoxville Independent School District
Fatalities:	3
Injuries:	22

Crash Description

On Tuesday, December 2, 2014, about 2:52 p.m. eastern standard time, a 2001 Thomas Built transit-style school bus, identified as bus #57, was transporting 18 students and an adult teacher's aide from Sunny View Primary School in Knoxville, Knox County, Tennessee. The bus was traveling westbound in the left lane of Asheville Highway and had just crossed the intersection with John Sevier Highway (East). In the meantime, a 2000 Navistar International transit-style school bus, identified as bus #44, was traveling eastbound in the left lane of Asheville Highway transporting 22 students from Chilhowee Intermediate School. As bus #44 approached the signalized intersection with John Sevier Highway, traffic in front of the bus was stopped at the intersection. The driver of bus #44 swerved left to avoid the stopped traffic and crossed a 30-foot-wide painted median into the westbound lanes of Asheville Highway. The front of bus #44 collided with the left (driver) side of bus #57. (See figure 1 for crash location.)

Following the initial impact, bus #57 rotated counter-clockwise (about 90 degrees); the vehicle partially departed the roadway, slid onto the shoulder, and collided with a barricade made of five steel poles embedded in a concrete curb, before overturning onto its right side. Bus #57 came to rest on the right shoulder of Asheville Highway, partially blocking its westbound travel lanes. Bus #44 came to rest facing north across the westbound lanes.

As a result of the crash, the adult teacher's aide, who was reportedly seated on the left side near the rear axle of bus #57, died. Additionally, two student passengers seated near the impact zone on the left side of bus #57 received fatal injuries.

At the time of the crash, there was intermittent precipitation in the area, and road conditions ranged from dry to wet, depending on the specific location.

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The National Transportation Safety Board (NTSB) initiated a field investigation of this crash with an emphasis on the human performance issues related to distracted vehicle operation. Highway and vehicle factors were also examined. This investigation was conducted with the assistance of the Knoxville Police Department (KPD).

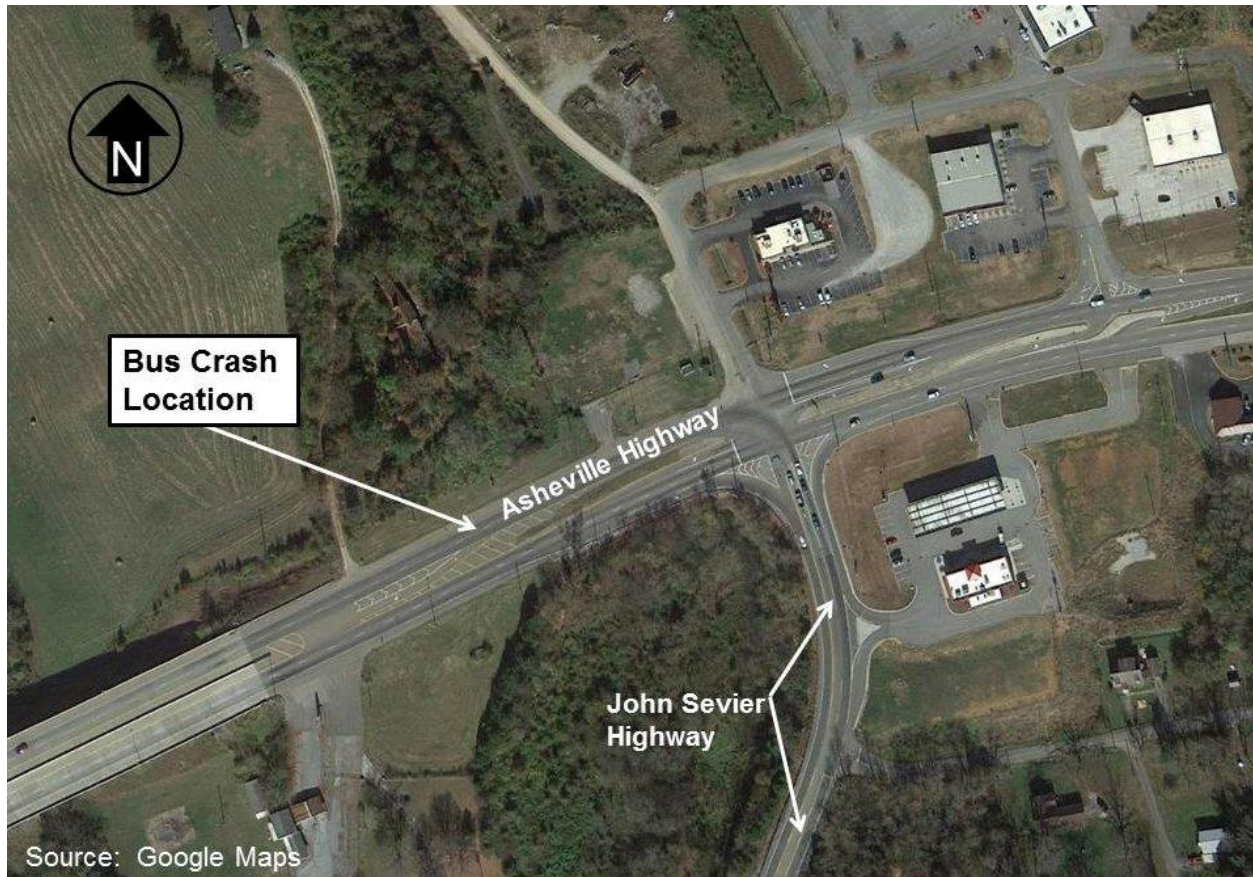


Figure 1. Crash location on westbound Asheville Highway, west of intersection with John Sevier Highway.

Highway Information

The crash occurred on Asheville Highway (State Route 9) approximately 465 feet west of the intersection with John Sevier Highway. The roadway in the area of the crash is a four-lane divided highway with a posted speed limit of 45 mph. The roadway consists of two 12-foot-wide lanes in each direction.

The right-hand shoulders vary in width from 10 to 14 feet, and the median features dividing the east- and westbound lanes include a 2-foot-wide concrete barrier; a 12-foot-wide earthen median; and, at the section of highway where the two school buses collided, a 30-foot-wide painted median.

Following the initial impact, bus #57 rotated, slid onto the shoulder, and collided with a barricade consisting of a concrete curb supporting five yellow vertically mounted tubular steel

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poles. The barricade was used to delineate a private driveway from another driveway that provided access to the Holston River boat ramps. (See figures 2 and 3.)

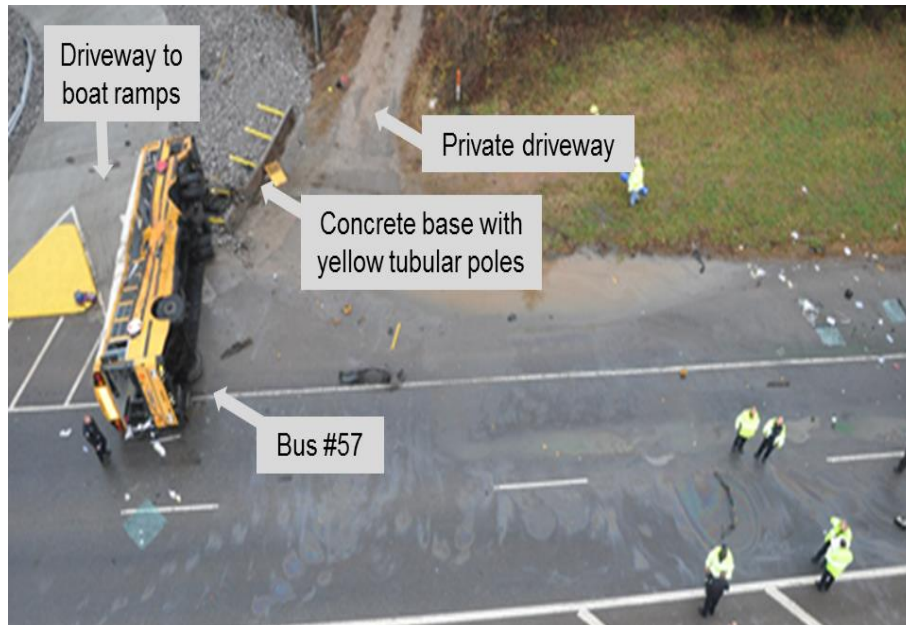


Figure 2. Bus #57 at final rest postaccident; also shown are a private driveway entry, the barricade the bus struck, and the entry to a driveway to the boat ramps on the Holston River. (Courtesy of the Knoxville Police Department)



Figure 3. Bus #57 at final rest on its right side and the overturned barricade. (Courtesy of the Knoxville Police Department)

The most recent resurfacing on Asheville Highway in the vicinity of the crash occurred on March 11, 2005. At the request of the NTSB, the Tennessee Department of Transportation Materials Division conducted pavement friction testing on Asheville Highway in the crash area.

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The friction testing was performed in accordance with the American Society for Testing and Materials standard E274M-11.¹ The pavement friction testing data were collected at a standard speed of 40 mph, and the test was conducted using a ribbed test tire. The test results are shown in table 1.

Table 1. Summary of pavement friction testing on Asheville Highway in crash area.

Log Mile	Pavement Friction Values	
	Westbound Outside Lane	Eastbound Outside Lane
7.5	45.6	47.8
8.0	48.6	46.9
8.1	48.5	42.6
8.5	48.9	48.6
9.0	51.5	51.8
9.5	50.9	50.7

The pavement friction values varied from a low of 42.6 to a high of 51.8. The rating and evaluation of pavement friction values vary with each state's department of transportation; however, it is generally understood that friction may not be a factor contributing to wet weather accidents when friction values are higher than 35 for vehicles with ribbed (or treaded) tires. Both school buses were equipped with ribbed tires in good condition.

Traffic control signs for eastbound traffic in the area of the crash consisted of a "no left turn" sign approximately 675 feet in advance of the intersection with the John Sevier Highway and a "signal ahead" sign approximately 450 feet in advance of the intersection. (See figure 4.)

¹ The test method uses a measurement representing the steady-state friction force on a locked test wheel as it is dragged over a wetted pavement surface under constant load and at a constant speed while its major plane is parallel to its direction of motion and perpendicular to the pavement.

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Figure 4. Locations of the advance “no left turn” and “signal ahead” signs on eastbound Asheville Highway, approaching the intersection with John Sevier Highway from the west (precrash route of eastbound bus #44).

Vehicle Information

Bus #44. Bus #44 was a 2000 Navistar International model 300 transit-style school bus designed to carry 72 passengers. The bus was configured with a loading door on the forward end of the right (passenger) side, followed by 12 windows; the left (driver) side of the bus had a driver window followed by 12 passenger windows. There were two emergency window exits on each side, a vertically hinged emergency exit door on the left side, a horizontally hinged exit door at the back, and two emergency roof exit hatches.

Postcrash examination of the vehicle revealed that damage was most severe at the left front corner. The left frame rail was displaced outward and split open 36 inches from the front. The left steering tie rod was bent about 90 degrees outward, and the steering box was displaced to the region of the left front wheel well. The right frame rail was displaced to the left at an angle of about 162 degrees and buckled at its attachment to the front suspension.

The bumper and front body panels below the windshield were deformed or missing. The windshield frame was deformed, and the glazing was missing. The front surface of the frame of the passenger loading door was crushed rearward approximately 10 inches. The stairs at the

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loading door were crushed in about 3 inches at the bottom. No significant damage was noted on the right (passenger) side or the back of the bus. (See figure 5.)



Figure 5. At left, bus #44 in final rest position, showing the right side of the bus (overturned bus #57 can be seen in the photo background). At right, the focus is on damage to the left front of bus #44. [Note: In both photos, the bright yellow tape used on the bus exterior to highlight emergency exits is visible.] (Courtesy of the Knoxville Police Department)

At the driver's compartment, the floor board and pedals intruded significantly into the vehicle, and one of the pedals was fractured. The steering column was nearly in contact with the front of the driver seat cushion, and the rim of the steering wheel was about 4 inches from the middle of the seatback.

Bus #57. Bus #57 was a 2001 Thomas Built model IT7 transit-style school bus designed to carry 72 passengers. The bus had a loading door on the forward end of the right (passenger) side, followed by 12 windows. The left (driver) side had a driver's window followed by 12 passenger windows. There was a small triangular window at each side of the windshield. There were two emergency window exits on each side, a vertically hinged emergency exit door on the left side, a horizontally hinged exit door at the back, and two emergency exit roof hatches.

The postcrash inspection revealed that the left side exit door was heavily damaged, nonfunctional, and displaced inward into the passenger compartment. The seat in front of the side exit door was found in the folded-up position. The rear exit door was found latched and was functional except for the gas struts designed to keep it open. The struts were present but did not function. The area around the rear exit door was littered with debris, dirt, and glass; there were no obvious indications of exit use. Both exit doors were marked on the outside and inside of the bus. The two roof hatches were found open and functional. The hatches measured 24 by 24 inches.

The passenger loading door on the right side was not damaged and was functional. There were dents along the roofline beginning just aft of the loading door and extending to just above the fifth passenger window. There were vertical scrape marks on the body trim along the entire right side of the bus, and the right side marker lights were crushed. The right rear wheels were rotated inward at the front at an angle of about 163 degrees to the body of the bus. The body

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panel below the mid-height trim was dented inward from the point aft of the rear wheel well extending to the back.

Significant damage, consisting of scrapes and dents, began at the left front wheel well and extended along the entire left side. The left sidewall was deformed inward; the deformation was most severe near the midpoint of the bus. The approximate intrusion distances into the passenger compartment measured 23 inches at the top of the windows, 15 inches along the lower portion of the window line, and 5 inches at the floor level. The panel at the bottom of the bus body had been pushed inward about 22 inches. There was a large tear in the left sidewall, beginning vertically at the level of the top of the wheel well and horizontally 78 inches aft of the front wheel well. The tear extended horizontally to 109 inches aft of the front wheel well. (See figure 6.)



Figure 6. At left, bus #57 at final rest on its side. At right, view of bus #57 after it had been returned to an upright position, showing impact damage along the left (driver) side. (Courtesy of the Knoxville Police Department)

The floor on the driver's side was damaged due to intrusion, and a crack and buckling of the floor was evident at seat row #5. All the primary seat structures remained intact, but several structural mounting points were deformed or fractured in the intrusion area.

Occupant Information

Bus #44 was occupied by a 47-year-old male driver and 22 intermediate school student passengers, ranging in age from 8 to 11 years old. Bus #57 was occupied by a 67-year-old male driver, a 46-year-old teacher's aide, and 18 primary school student passengers, ranging in age from 5 to 8 years old. Table 2 provides injury information for all occupants of both vehicles. There were no ejections; however, the injuries to the occupants of bus #57 were more numerous and severe than those to the occupants of bus #44 because bus #57 struck the barricade and overturned onto its side.

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Table 2. Injury levels for occupants of both buses.

Injury severity ^a	Bus #44 driver	Bus #44 passengers	Bus #57 driver	Bus #57 passengers	Total
Fatal	0	0	0	3	3
Serious	1	0	0	2	3
Minor	0	8	0	11	19
Not Injured	0	14	1	3	18
Total	1	22	1	19	43

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

The driver of bus #44 was not wearing the available three-point seat belt and, as bus #44 swerved toward the left, he was displaced to the right and out of position behind the steering wheel. As a result, the driver suffered serious injuries to his lower extremities and was admitted to the hospital.

Human Performance

The KPD conducted toxicology tests for the driver of bus #44, and the results were negative for alcohol or illicit drugs. The test results showed trace amounts of prescription medications in the driver's blood sample, but these were not at levels that could have contributed to the collision.

According to the local authorities, the driver of bus #44 stated that he had swerved left to avoid stopped traffic ahead of him and then collided with bus #57. A passenger on the bus told police that the driver was looking down, as though he were texting (or possibly nodding off), as the bus approached the stopped traffic ahead.² The KPD case summary for this crash stated that, based on interviews with the children who rode bus #44, the driver "spends a lot of time looking at his phone texting or playing games."³ Tennessee law prohibits school bus drivers from using a mobile phone while the bus is in motion and transporting children, except for use necessary in an emergency. All drivers in the state are prohibited from texting while driving.

Local authorities obtained a search warrant to retrieve the data from the global positioning system and real time data recorders (GPS/RTDR) for both school buses, as well as

² See Survival Factors Attachment 2, KPD report, page 8, in the public docket for this investigation.

³ See Survival Factors Attachment 2, KPD report, page 11, in the public docket for this investigation.

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the data on the cell phone and personal tablet device belonging to the driver of bus #44.⁴ Although NTSB investigators did not have direct access to the electronic data (GPS/RTDR download and cell phone data), the KPD later provided the information obtained from these sources.

The GPS/RTDR data showed that the bus #44 driver was actively operating the bus from 2:30:25 p.m. until the collision at 2:52:27 p.m.; a period of 22 minutes 2 seconds. Data from the cell phone records showed that the driver was engaged in texting with two individuals prior to operating the bus and that he continued to engage in cell phone use while operating the bus, including documentation of a text message being read in the moments prior to the crash.⁵ This evidence, coupled with the witness report that the driver was looking down as though texting just before the crash, strongly indicates that the driver's distraction, due to his reading a text message, caused him to fail to react quickly enough to avoid the collision.⁶

Probable Cause

The National Transportation Safety Board determines that the probable cause of the December 2, 2014, collision between two school buses near Knoxville, Tennessee, was the late reaction and subsequent loss of control by the driver of bus #44 when he swerved to avoid traffic stopped ahead of him due to distraction caused by his reading a text message on his cell phone while driving. Contributing to the severity of the injuries were the crash dynamics and interaction between school bus #44 and school bus #57, resulting in school bus #57 rotating counter-clockwise approximately 90 degrees and subsequently striking a barricade before overturning onto its side, causing the passengers to be displaced from their seating positions.

⁴ The Knoxville school district monitored "All Events" (real time) on its school buses with GPS/RTDR devices. The items recorded by the devices included the GPS readings for the vehicle's speed, heading, and cumulative distance, as well as the following events: amber lights off, amber lights on, diagnostic message, entrance door close, entrance door open, GPS update, harsh acceleration, harsh braking, harsh turning, hi-res GPS event, idle alert, and ignition off.

⁵ The KPD correlated the clocks from the E-911 system and the driver's cell phone, which indicated that the driver had read a text message in the moments prior to the crash. (See Survival Factors Attachment 2, KPD report, page 8, in the public docket for this investigation.)

⁶ On April 28, 2016, Tennessee Governor Haslam signed a bill stemming from this crash into law. The new law increases the penalties for texting and using mobile electronic devices while driving a school bus. Under the new Tennessee law, effective July 1, 2016, texting while driving a school bus or while stopped to load or unload children will be a Class A misdemeanor with a mandatory minimum jail sentence of 30 days and \$1,000 fine upon conviction. If convicted, a school bus driver would also be permanently barred from driving a school bus again in the state of Tennessee.

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Safety Issue

Driver Distraction: The driver of the striking school bus in this crash was distracted from his driving duties by his practice of reading and sending text messages while driving. The NTSB believes that focusing on any other task while driving impairs performance and can have deadly consequences, as it did in this case. The fact that even while transporting children a driver would engage in such risky behavior shows how prevalent it has become on our roads. Because of the danger posed by distracted drivers, the NTSB has made “DISCONNECT FROM DEADLY DISTRACTIONS” one of our Most Wanted Transportation Safety Improvements.

For more details about this accident, visit <http://dms.nts.gov/pubdms/> and search for NTSB accident ID HWY15FH002.

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The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties . . . and are not conducted for the purpose of determining the rights or liabilities of any person.” 49 *Code of Federal Regulations*, Section 831.4. Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. 49 *United States Code*, Section 1154(b).
