Motorcoach Collision With the Alexandria Avenue Bridge Overpass George Washington Memorial Parkway Alexandria, Virginia November 14, 2004

ACCIDENT REPORT

NTSB/HAR-06/04
PB2007-916201

National Transportation Safety Board

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Highway Accident Report

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George Washington Memorial Parkway
Alexandria, Virginia
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National Transportation Safety Board
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Abstract: On November 14, 2004, about 9:30 a.m., eastern standard time, a 44-year-old bus driver departed the Baltimore/Washington International Thurgood Marshall Airport, operating a 2000 Prevost, 58-passenger motorcoach owned by Eyre Bus Service, Inc., (Eyre) for an approximately 60-mile trip to Mount Vernon, Virginia. This vehicle was the second one of a two-bus team. About 10:40 a.m., the bus was traveling southbound in the right lane of the George Washington Memorial Parkway in Alexandria, Virginia, at an electronic control module–recorded speed of approximately 46 mph. Upon approaching the Alexandria Avenue bridge, the bus driver passed warning signs indicating that the bridge had a 10-foot, 2-inch clearance in the right lane. The driver remained in the right lane and drove the 12-foot-high bus under the bridge, colliding with the underside and side of the overpass. At the time of the accident, the 13-foot, 4-inch-high left lane was available to the bus, and the lead Eyre bus was in the left lane ahead of the accident bus. Witnesses and the bus driver himself reported that the bus driver was talking on a hands-free cellular telephone at the time of the accident. Of the 27 student passengers, 10 received minor injuries and 1 sustained serious injuries. The bus driver and chaperone were uninjured. The bus's roof was destroyed.

Major safety issues identified in this accident include low bridge clearance, cellular telephone use while driving, and collection of adequate cellular telephone accident data. As a result of this accident, the Safety Board makes recommendations to the Federal Motor Carrier Safety Administration, the 50 States and the District of Columbia, the American Bus Association, the United Motorcoach Association, the Community Transportation Association of America, the American Public Transportation Association, the National Association for Pupil Transportation, the National School Transportation Association, the National Association of State Directors of Pupil Transportation Services, the International Brotherhood of Teamsters, and the Amalgamated Transit Union. The Safety Board also reiterates Safety Recommendation H-03-09 to the 20 States that do not yet have driver distraction codes on their traffic accident investigation forms.

Contents

Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
AAMVA	American Association of Motor Vehicle Administrators
ABA	American Bus Association
ADT	average daily traffic
ADTSEA	American Driver and Traffic Safety Education Association
APTA	American Public Transportation Association
ATU	Amalgamated Transit Union
BWI	Baltimore/Washington International Thurgood Marshall Airport
CDL	commercial driver's license
CDL manual	*Model Commercial Driver License Manual*
CFR	*Code of Federal Regulations*
CTAA	Community Transportation Association of America
DDEC ECM	Detroit Diesel Electronic Control Module
DoD	U.S. Department of Defense
ECM	electronic control module
Eyre	Eyre Bus Service, Inc.
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
GVWR	gross vehicle weight rating
MUTCD	*Manual on Uniform Traffic Control Devices*
NAPT	National Association for Pupil Transportation
NASDPTS	National Association of State Directors of Pupil Transportation Services
NHTSA	National Highway Traffic Safety Administration
NPS	National Park Service
NSTA	National School Transportation Association
The Parkway	George Washington Memorial Parkway
PCP	phencyclidine
Teamsters	International Brotherhood of Teamsters
UMA	United Motorcoach Association
USPP	United States Park Police

Executive Summary

On November 14, 2004, about 9:30 a.m., eastern standard time, a 44-year-old bus driver departed the Baltimore/Washington International Thurgood Marshall Airport, operating a 2000 Prevost, 58-passenger motorcoach for an approximately 60-mile trip to Mount Vernon, Virginia. Vehicle occupants were the bus driver, an adult chaperone, and 27 high school students. This vehicle was the second one of a two-bus team traveling to Mount Vernon. The motor carrier, Eyre Bus Service, Inc., (Eyre) operates this route frequently, and the accident bus driver had driven this route on one previous occasion 9 days earlier (November 5, 2004).

About 10:40 a.m., the bus was traveling southbound in the right lane of the George Washington Memorial Parkway in Alexandria, Virginia, at an electronic control module–recorded speed of approximately 46 mph. As the bus approached the Alexandria Avenue bridge, the bus driver passed warning signs indicating that the bridge had a 10-foot, 2-inch clearance in the right lane. Nonetheless, the driver remained in the right lane and drove the 12-foot-high bus under the bridge, colliding with the underside and side of the overpass. At the time of the accident, the 13-foot, 4-inch-high left lane was available to the bus, and the lead Eyre bus was in the left lane ahead of the accident bus. The accident bus came to a final stop in the right lane about 470 feet beyond the bridge. Witnesses and the bus driver himself reported that the bus driver was talking on a hands-free cellular telephone at the time of the accident.

Of the 27 student passengers, 10 received minor injuries and 1 sustained serious injuries. The bus driver and chaperone were uninjured. The bus's roof was destroyed.

The National Transportation Safety Board determines that the probable cause of this accident was the bus driver's failure to notice and respond to posted low-clearance warning signs and to the bridge itself due to cognitive distraction resulting from conversing on a hands-free cellular telephone while driving. Contributing to the accident was the low vertical clearance of the bridge, which does not meet current National Park Service road standards or American Association of State Highway and Transportation Officials guidelines.

Major safety issues identified in this accident include low bridge clearance, cellular telephone use while driving, and collection of adequate cellular telephone accident data. As a result of this accident, the Safety Board makes recommendations to the Federal Motor Carrier Safety Administration, the 50 States and the District of Columbia, the American Bus Association, the United Motorcoach Association, the Community Transportation Association of America, the American Public Transportation Association, the National Association for Pupil Transportation, the National School Transportation Association, the National Association of State Directors of Pupil Transportation Services, the International Brotherhood of Teamsters, and the Amalgamated Transit Union. The Safety Board also reiterates Safety Recommendation H-03-09 to the 20 States that do not yet have driver distraction codes on their traffic accident investigation forms.

Factual Information

Accident Narrative

On November 14, 2004, about 9:30 a.m., eastern standard time, a 44-year-old bus driver departed the Baltimore/Washington International Thurgood Marshall Airport (BWI), operating a 2000 Prevost, 58-passenger motorcoach for an approximately 60-mile trip to Mount Vernon, Virginia. Vehicle occupants were the bus driver, an adult chaperone, and 27 high school students. This vehicle was the second one of a two-bus team traveling to Mount Vernon. The motor carrier, Eyre Bus Service, Inc., (Eyre) operates this route frequently, and the accident bus driver had driven this route on one previous occasion 9 days earlier (November 5, 2004).

About 10:40 a.m., the bus was traveling southbound in the right lane of the George Washington Memorial Parkway (the Parkway) in Alexandria, Virginia, at an electronic control module (ECM)–recorded speed of approximately 46 mph. As the bus approached the Alexandria Avenue bridge, the bus driver passed warning signs indicating that the bridge had a 10-foot, 2-inch clearance in the right lane. Nonetheless, the driver remained in the right lane and drove the 12-foot-high bus under the bridge, colliding with the underside and side of the overpass. At the time of the accident, the 13-foot, 4-inch-high left lane was available to the bus, and the lead Eyre bus was in the left lane ahead of the accident bus. The accident bus came to a final stop in the right lane about 470 feet beyond the bridge. Witnesses and the bus driver himself reported that the bus driver was talking on a hands-free cellular telephone at the time of the accident.

Of the 27 student passengers, 10 received minor injuries and 1 sustained serious injuries. The bus driver and chaperone were uninjured. The bus's roof was destroyed.

Preaccident Events

Two Eyre buses were assigned for the trip from BWI to Mount Vernon, Virginia. The lead bus driver said he arrived at the bus terminal at 7:45 a.m. on the morning of the accident and completed a pretrip inspection of his bus. The accident bus driver said he arrived at the terminal at 8:45 a.m. and proceeded to complete the pretrip paperwork and vehicle inspection. According to the lead bus driver, after being informed by the dispatcher that the high school group had arrived at BWI, he left for the airport without the accident bus because it was not prepared to leave. He said that he loaded his bus and departed the airport as the accident bus arrived and began loading. The accident bus caught up with the lead bus on the Baltimore-Washington Parkway while en route. The lead bus driver said that when he entered the George Washington Memorial Parkway, he moved to the left lane of the roadway in anticipation of the low clearance of the Alexandria Avenue bridge. The accident bus driver remained in the right lane and subsequently collided with the overpass. The accident bus driver reported that he was talking to his sister on a hands-free cellular telephone prior to and at the time of the accident.

Injuries

Twenty-nine people, including the driver, 1 adult chaperone, and 27 high school passengers, ages 16 to 17 years, were on the accident bus. Ten student passengers, seated primarily on the right side of the bus, received minor injuries consisting of contusions and small lacerations from broken glass (see table 1). An additional student passenger, seated in row 10 on the right side of the bus, sustained a fractured jaw and a laceration on his neck that required several stitches. The bus driver and chaperone were uninjured.

Table 1. Injuries.*

Injury type	Bus driver	Bus passengers	Others	Total
Fatal	0	0	0	0
Serious	0	1	0	1
Minor	0	10	0	10
None	1	17	0	18

*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 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, 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.

Emergency Response

The United States Park Police (USPP) was the primary law enforcement agency responding to the accident; the Fairfax County and Alexandria fire departments were the primary emergency response agencies. Records indicate that, at 10:45 a.m., the Fairfax County Fire and Rescue Department received a telephone call from a citizen about the bus accident. The first Fairfax County Fire and Rescue Department units arrived at 10:50 a.m., followed within minutes by Alexandria Fire Department units. At 10:52 a.m., the USPP communications center contacted the Fairfax County emergency operations center, provided an update, and requested additional assistance for traffic control. All injured passengers were extricated and transported to area medical facilities by 11:19 a.m.

Toxicology

The USPP collected toxicological specimens from the bus driver about 1 hour after the accident. The motor carrier also collected postaccident toxicological specimens from the bus driver approximately 5 hours after the accident. All test results were negative for drugs and alcohol.[1]

[1] Title 49 CFR Part 382 requires motor carriers to conduct postaccident alcohol and drug testing. Title 49 CFR 40.85 requires testing for marijuana metabolites, cocaine metabolites, amphetamines, opiate metabolites, and phencyclidine (PCP). The specimen collected by the USPP was screened for amphetamines, barbiturates, benzidiazepines, cannabinoids, cocaine, opiates, PCP, and ethanol.

Vehicle and Wreckage Information

The accident bus was a 2000 Prevost model H3-45, 58-passenger motorcoach. According to Prevost specifications, the bus was 45.6 feet long (including bumpers), 8.42 feet wide, and 12 feet high. It had a gross vehicle weight rating (GVWR) of 52,060 pounds. Posted on the dashboard was a placard informing the driver that the bus's height was 12 feet, 4 inches.[2]

Postaccident examination showed that the bus's roof was crushed downward at the front of the bus; damage was more pronounced on the right side (opposite the driver's seat). (See figure 1.) Much of the roof was crushed downward to the point that it touched the top of the passenger seat headrests; a portion of the right side of the roof was in contact with the bottom window anchorages. (See table 2 for postaccident bus measurements.)

Figure 1. Postaccident view of the accident motorcoach.

The bus's right-side mirrors were broken off, and there were gouge marks at the right-front corner of the bus, just forward of the boarding door. All of the windows on the right side of the bus were broken out, and all of the window frames were damaged. On the left side of the bus, two windows were unbroken but detached from their lower anchorage points. The tires and the steering and braking systems appeared to be undamaged.

[2] The measurement noted on Eyre's standard placard was greater than the accident bus's actual height.

Table 2. Postaccident dimensions of 2000 Prevost motorcoach.

Position	Measurement
Overall length, including bumpers	45.6 feet
Height, right front (boarding door side)	10 feet, 3 inches
Height, center front	11 feet, 7 inches
Height, left front (driver's side)	11 feet, 3 inches
Height, right rear	10 feet, 2 inches
Height, left rear	11 feet, 4 inches
Height at maximum downward roof intrusion (right side)	7 feet, 8 inches
Distance from front of bus to area of maximum downward roof intrusion (right side)	31 feet
Approximate length of roof damage from right side inward	3 feet, 7 inches
Width, rear	8 feet, 5 inches
Width, front	8 feet, 9 inches

The bus's engine was equipped with a fourth generation Detroit Diesel Electronic Control Module (DDEC ECM), which is used to control engine timing and fuel injection based on engine and sensor inputs. The unit also performs diagnostics associated with engine and sensor inputs and may then illuminate warnings on the dashboard. In addition to recording information such as vehicle speed, the DDEC ECM is capable of collecting data regarding "last stop" and "hard brake" events.[3] (See table 3 for the last three events recorded before the accident.)

Table 3. Data from DDEC ECM.

Report	Odometer reading	Time on DDEC ECM clock	Adjusted time[a]
Last stop record	381699.4 miles	11/14/2004 09:02:49	10:39:00
Hard brake #1	381699.3 miles	11/14/2004 09:02:29	10:39:00
Hard brake #2[b]	379902.2 miles	11/09/2004 04:54:51	—

[a] Due to the known differential between local time (based on the accident investigator's cellular telephone time) and the DDEC ECM clock, the reported DDEC ECM time has been adjusted by 1 hour, 37 minutes.
[b]This incident occurred 5 days and nearly 1,800 miles before the accident.

The recorded data indicated a speed change from 45.5 mph (20 seconds before last stop) to 32.5 mph (19 seconds before last stop) in 1 second. Additionally, the data indicated that the brake pedal was applied 4 to 5 seconds after the rapid deceleration, the driver applied the throttle for at least a minute and a half before the crash, and cruise control was not being used.

[3] A *hard brake* is triggered when the calculated vehicle wheel speed decelerates at a greater speed than the user-defined threshold, which can be configured from 0 to 15 mph per second. The accident bus was set at 7 mph per second.

Highway

General

The accident occurred in the southbound lanes of the George Washington Memorial Parkway at the Alexandria Avenue bridge, outside the city of Alexandria in Fairfax County, Virginia. The Parkway, which is maintained by the National Park Service (NPS), U.S. Department of the Interior, was the first federally funded highway. Initially constructed between 1927 and 1932, the Parkway was established with the specific legislative purpose of providing a scenic transportation route to Mount Vernon. The NPS and the Federal Highway Administration (FHWA) classify the Parkway as a Class VII Urban Parkway.[4]

The Parkway in the vicinity of the accident is a four-lane, undivided concrete-surfaced roadway that runs north and south. The Parkway's pavement was most recently restored in June 1985. The width of the paved portion of the four-lane parkway is approximately 43 feet, measured from curb face to curb face. The southbound right lane is approximately 10 feet, 5 inches wide, and the southbound left lane is approximately 9 feet, 7 inches wide. The northbound left lane is approximately 9 feet, 5 inches wide, and the northbound right lane is approximately 10 feet, 5 inches wide. A 1-foot, 7-inch-wide gutter pan runs from the edge of the travel lane to the face of curb, both northbound and southbound. Beyond the face of the curb is a 1-foot, 4-inch-wide ledge. Beyond the ledge is a stone retaining wall that measures 2 feet, 7 inches high by 1 foot, 8 inches wide.

Vehicles heavier than 7,500 pounds gross vehicle weight, longer than 28 feet, 6 inches, or wider than 102 inches may not use any park road without a permit.[5] No fees are charged for the permits, which are valid for various time periods.[6] The permit used at the time of the accident did not contain information or warnings regarding hazards on the Parkway, such as low vertical clearances or narrow road passages. The NPS intends to clarify the information on the permit. The NPS stated that, at the time of the accident, permit issuance and enforcement had not been a priority but that, since the accident, the NPS has increased enforcement and contacted carriers to inform them of the permit requirement. Eyre did not possess a permit to access the Parkway at the time of the accident.

Evidence Documentation

There were no tire marks in the southbound right lane of the Parkway approaching the Alexandria Avenue bridge. Scrape marks were observed southbound along the stone

[4] *Class VII Urban Parkways* are facilities that serve high volumes of park- and non-park-related traffic and are restricted, limited-access facilities in an urban area. This category of roads primarily includes the major parkways, which serve as gateways to the Nation's capital. For further information, see National Park Service, Office of Policy, *Park Road Standard*s (Washington, DC: NPS, 1984).

[5] Title 36 CFR compendium.

[6] For example, carriers that travel the Parkway regularly may be granted a yearly permit; carriers that travel the Parkway occasionally may be granted a per-trip permit.

arch bridge's underside for its total depth in the direction of vehicles traveling beneath the overpass. Additional scrape marks, observed on the inside wall of the bridge's west side, were matched with the right-front bumper and right windshield of the accident bus.

Speed Limit

The speed limit for the Parkway in the vicinity of the accident is 45 mph. At the time of the collision, the bus was traveling at an estimated speed of 46 mph.[7]

Alexandria Avenue Bridge

The Alexandria Avenue bridge (see figure 2), which is maintained by the Virginia Department of Transportation, accommodates vehicle travel from adjacent neighborhoods. The bridge's construction began in 1930 and was completed in 1932. It is a rigid-frame, reinforced concrete structure that is faced with native stone. The two-lane bridge is about 43 feet long and spans the Parkway's four lanes. The total depth of the bridge's underside, in the direction of vehicles traveling beneath the overpass, is 39 feet.

Figure 2. Alexandria Avenue bridge over the Parkway (southbound).

The FHWA inspected the bridge on March 24, 2003, and stated in its report:[8]

> This bridge is in fair to good condition overall. While there have been no significant changes in the structural condition since the last inspection, several problems remain. The main problems include parapet masonry mortar joint

[7] This estimate is based on the DDEC ECM–recorded speed.

[8] U.S. Department of Transportation, Federal Highway Administration, *Bridge Inspection Report, Alexandria Avenue Overpass, Structure No. 3300-024P*, Date of Inspection: 3/24/03, page 2 of 7.

> deterioration throughout and severe deterioration of the vertical expansion joint filler. The parapet mortar joints should be repointed as required and the vertical expansion joints cleaned and resealed.
>
> With corrective action and regular maintenance, a useful life of approximately 20-25 years can be expected for this structure under current loading conditions.

On November 16, 2004, the Safety Board and the USPP measured the vertical clearance of the Alexandria Avenue bridge (see table 4). The vertical measurements were taken from the roadway to the bottom edge of the stone arch bridge every 2 feet along the width of the Parkway. Due to the arched configuration of the stone bridge, the outside lanes have less vertical clearance. The measured height of the arch ranges from approximately 14 feet, 9 1/2 inches at the center of the bridge to approximately 10 feet, 3 inches at the face of the curb.

Table 4. Alexandria Avenue bridge measurements.

Lateral distance on Parkway from west to east curb faces	Vertical clearance from roadway to bottom edge of stone arch bridge
0 feet	10 feet, 3 inches
2 feet	11 feet, 0 inches
4 feet	11 feet, 10 inches
6 feet	12 feet, 6 inches
8 feet	13 feet, 1 inch
10 feet	13 feet, 6 inches
12 feet	13 feet, 11 inches
14 feet	14 feet, 3 inches
16 feet	14 feet, 6 inches
18 feet	14 feet, 8 inches
20 feet	14 feet, 9 inches
22 feet (approximate center of bridge)	14 feet, 9 1/2 inches
24 feet (approximate center of bridge)	14 feet, 9 inches
26 feet	14 feet, 7 inches
28 feet	14 feet, 5 inches
30 feet	14 feet, 3 inches
32 feet	13 feet, 10 inches
34 feet	13 feet, 6 inches
36 feet	13 feet, 0 inches
38 feet	12 feet, 5 inches
40 feet	11 feet, 8 inches
42 feet	10 feet, 11 inches
43.3 feet	10 feet, 4 inches

The 1984 edition of the NPS *Park Road Standards* recommends that, for new roadway bridges, the vertical clearance for underpasses be at least 14 feet above the entire roadway width. This recommendation is consistent with American Association of State Highway and Transportation Officials (AASHTO) guidance, which recommends that, on local urban streets, the vertical clearance at underpasses be at least 14 feet over the entire roadway width, with an allowance for future resurfacing.[9] The recommended 14-foot clearance would apply if the bridge were to be reconstructed or replaced.

Existing Vertical Clearance Signs

Among the signs posted in the southbound lanes preceding the accident site were those indicating the vertical clearance of the Alexandria Avenue bridge. Roadside warning signs placed next to the southbound lane 1,580 feet before the bridge, and mounted warning signs placed on the bridge's face over the left and curb lanes, showed the clearance to be 13 feet, 4 inches in the left lane and 10 feet, 2 inches in the right (curb) lane (see figures 3 and 4). The signs complied with the *Manual on Uniform Traffic Control Devices* (MUTCD).[10]

Figure 3. Roadside warning signs—Alexandria Avenue bridge clearance.

[9] American Association of State Highway and Transportation Officials, *A Policy on Geometric Design of Highways and Streets*, 5th edition (Washington, DC: AASHTO, 2004) 399.

[10] U.S. Department of Transportation, Federal Highway Administration, *Manual on Uniform Traffic Control Devices* (Washington, DC: FHWA, 2003) chapter 2C.

Figure 4. Mounted warning signs—Alexandria Avenue bridge clearance.

Average Daily Traffic

According to the FHWA and the NPS, the average daily traffic (ADT) in the vicinity of the accident in recent years is as follows in table 5:

Table 5. ADT data for station 6003 (Hunting Creek), located approximately 2 miles north of the accident site.

Year	ADT
2000	9,500
2001	10,225
2002	17,949
2003	24,386
2004	31,481
Source: FHWA and NPS.	

According to the FHWA, 99.3 percent of the vehicles traveling on the Parkway are passenger vehicles (see table 6); tour buses comprise about 0.1 percent of total vehicles. The George Washington's Mount Vernon Estate and Gardens reported that during the peak seasons of April, May, and June, approximately 200 tour buses a day use the Parkway to reach Mount Vernon. Tour buses that travel to Mount Vernon typically measure 12 feet high; 8 feet, 5 inches wide (10 feet wide with the mirrors extended); and 45 feet, 8 inches long. The Washington Metropolitan Area Transit Authority operates four morning and four

afternoon buses along the Parkway;[11] these buses typically measure 10 feet, 1 inch high; 8 feet, 6 inches wide; and 40 feet long. The Fairfax County Public School system also runs buses along the Parkway; they typically measure 10 feet high, 8 feet wide, and 35 feet long.

Table 6. Vehicles using the Parkway.

Vehicle type	Percentage of total
Passenger car	99.3
Recreational vehicle	0.0
Transit/shuttle bus	0.1
Tour bus	0.1
Light-duty truck	0.3
Motorcycle	0.2

Recent Accident History

Table 7 shows the Alexandria Avenue bridge's recent accident history. From 2000 to 2004, 13 accidents occurred, 10 of which involved trucks that struck the underside of the bridge.[12] The current accident investigation brings the total number of bridge strikes during this period to 11. The two other accidents that occurred from 2000 through 2004 were vehicle collisions.

Table 7. Alexandria Avenue bridge recent accident history.

Year	Number of accidents
2000	1
2001	2
2002	2
2003	4
2004	4
Total	13

Weather

Weather data obtained from the Ronald Reagan Washington National Airport, approximately 7 miles north of the accident site, indicated that, at 9:51 a.m., the temperature was 43° Fahrenheit, with a 10 mph wind from the north, unrestricted visibility of 10 statute miles, and clear skies. No precipitation was reported within 24 hours of the accident. According to the U.S. Naval Observatory, at 10:45 a.m., eastern standard time, the sun was at an altitude of 30.7° and an azimuth of 161.3° (east of north).[13]

[11] The morning buses run from Mount Vernon to Farragut Square; the afternoon buses run from 18th Street and Pennsylvania Avenue to Mount Vernon.

[12] Trucks are not permitted on the Parkway.

[13] *Azimuth* is the horizontal component of a compass direction, measured around the horizon, usually from the north.

Motor Carrier Information

General

Eyre Bus Service, Inc., is an interstate, for-hire passenger carrier with 48-State operating authority, headquartered in Glenelg, Maryland.[14] Eyre employs 30 full-time drivers and 39 part-time drivers and operates a fleet of 35 motorcoaches. In 2003, the company reported 3 million annual vehicle miles traveled. The carrier makes the trip to Mount Vernon about 30 to 40 times yearly.

In the 24-month period before the accident, Eyre received 230 vehicle roadside inspections and 80 driver roadside inspections, resulting in a vehicle out-of-service rate of 3.5 percent and a driver out-of service rate of 1.2 percent.[15] The Federal Motor Carrier Safety Administration's (FMCSA's) SafeStat record indicated the carrier had been involved in four accidents—one each in June and October 2002 and two more in February 2003. The last compliance review for Eyre, conducted by the FMCSA on June 19, 2003, resulted in a "Satisfactory" rating. The U.S. Department of Defense (DoD) rated Eyre as a "1" on equipment and a "2" for the overall inspection.[16]

According to Eyre officials, bus driver applicants receive 3 weeks of initial training and 1 week of classroom training before being allowed to operate a vehicle. Each driver also receives a minimum of 35 hours of team driving prior to solo operation. Eyre officials stated that the company informs drivers about the height of their buses and cautions them about the possibility of low-clearance areas.

Motor Carrier's Cellular Telephone Policy

All Eyre bus drivers are issued company-owned cellular telephones before a trip.[17] At the time of the accident, the motor carrier permitted its drivers to use a cellular telephone while driving if the driver used a hands-free device. On November 15, 2004, the day after the accident, the motor carrier instituted a policy prohibiting the use of cellular telephones while operating company equipment.[18] The new policy requires that drivers, except in an emergency, safely stop their vehicle to make a cellular telephone call.

Some other motor carriers, including Greyhound, Peter Pan, and Coach USA (which is developing a policy), have also instituted policies prohibiting the use of cellular

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[14] U.S. Department of Transportation authority number 110610; motor carrier number 116212.

[15] The 2003 national vehicle out-of-service rate was 22.9 percent; the driver out-of-service rate was 6.8 percent. The 2004 national vehicle out-of-service rate was 23.6 percent; the driver out-of-service rate was 6.7 percent. Information accessed on October 26, 2006, from <http:/ai.fmcsa.dot.gov/programmeasures/RI/RI.asp>.

[16] The DoD rates motor carriers on a scale of 1 to 5, with 1 being "outstanding" and 5 being "unsatisfactory."

[17] At the time of the accident, Eyre was issuing hand-held cellular telephones. Eyre is transitioning to a two-way communications system.

[18] Eyre's new cellular telephone policy appears in boldface in its driver/operating manual.

telephones while driving.[19] The primary motorcoach industry associations (the American Bus Association [ABA] and the United Motorcoach Association [UMA]), public bus transportation organizations (the Community Transportation Association of America [CTAA] and the American Public Transportation Association [APTA]), school bus industry associations (the National Association for Pupil Transportation [NAPT], the National School Transportation Association [NSTA], and the National Association of State Directors of Pupil Transportation Services [NASDPTS]), and bus driver unions (the International Brotherhood of Teamsters [Teamsters] and the Amalgamated Transit Union [ATU]) do not have official policies concerning cellular telephone use.

Permit Compliance

Eyre officials said that the carrier did not possess a permit at the time of the accident because it was not required[20] for the bus to access the Parkway. Eyre obtained a permit on May 25, 2006, which is valid for 1 year.

Driver Information

The 44-year-old driver had a valid Maryland Class AM, commercial driver's license (CDL) with endorsements for passenger, tank, hazardous material, and school bus operations. The license was issued May 23, 2003, with an expiration date of September 19, 2008. He possessed a current medical certificate issued January 14, 2004, with an expiration date of January 13, 2006. According to the medical examination report, the bus driver reported no adverse medical history or use of medications, and the physician's examination disclosed no disqualifying conditions.

The driver began working for Eyre as a full-time bus driver in February 2004 and entered part-time status in June 2004. During his first month of employment, he was a student in the company training program. The driver stated on his Eyre employment application that he had 3 years of CDL driving experience, reporting previous employment driving a tractor-semitrailer unit and a school bus. A certified copy of the bus driver's Maryland driving record in the driver's qualification file showed that the driver was convicted in 2001 for "failure to wear a seatbelt" and in 2002 for "driving or permitting a vehicle to be driven with expired registration." The bus driver's Maryland driving record also indicated that he had no record of moving traffic violations or accident history.

The bus driver reported three previous employers on his employment application to Eyre. Interviews with these companies revealed that the driver had experienced

[19] (a) "Cell Phone Use By Drivers Is Becoming More Routine: New Worry: GPS Devices," *Bus and Motorcoach News,* June 1 (2006): 1. (b) "Driver Use of Cell Phones: Steering Clear of Liability," *Bus and Motorcoach News,* June 1 (2006): 12. (c) June and July 2006 telephone conversations with Greyhound, Peter Pan, and Coach USA representatives.

[20] According to the Title 36 CFR compendium, permits are required for vehicles heavier than 7,500 pounds gross vehicle weight, longer than 28 feet, 5 inches, or wider than 102 inches.

problems dealing with customers and with other employees. The interviews also revealed that he had been involved in a December 2003 run-off-the-road, non-reported accident after he fell asleep while driving.

Sleep/Awake History

The bus driver started work on Saturday, November 13, 2004 (the day before the accident), at 4:45 a.m. and was on duty until 7:15 a.m. From 7:15 a.m. until 10:30 a.m., the driver was off duty. (See figure 5.) He was on standby from 10:30 a.m. to 1:00 p.m., then off duty for 8.5 hours, from 1:00 p.m. until 9:30 p.m. He resumed driving at 9:30 p.m. and completed work at 11:45 p.m. He was off duty for 9 hours before returning to work on Sunday morning at 8:45 a.m. When interviewed by Safety Board investigators, the driver stated that he received about 9 hours of sleep at home the night before the accident and did not feel fatigued at the time of the accident. The driver was in compliance with the hours-of-service regulations.[21] Earlier in the week (November 10, 11, and 12), he worked other, non-driving jobs.

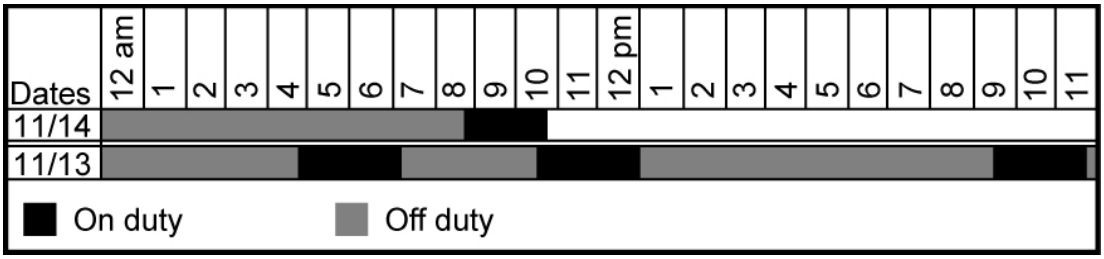

Figure 5. Driver's rest schedule.

Cellular Telephone Use

The bus driver possessed both a company-issued cellular telephone and a personal telephone. The bus driver reported that he had been talking with his sister on a hands-free personal cellular telephone when the accident occurred. Records from the bus driver's personal cellular telephone service provider showed that the bus driver initiated a 12-minute cellular telephone call at 10:23 a.m.[22] the morning of the accident. The chaperone stated: "The driver was talking on a headset for [the] majority of [the] trip. I believe he was talking on the telephone when we hit the bridge. He also had a hand-held telephone that he used at one point. I don't know whether he was using it when we hit the bridge." The bus dispatcher on duty at the time of the accident reported that, shortly before the accident, the accident bus driver contacted her and complained about the conduct of the lead bus driver, stating that he refused to communicate with the accident driver

[21] Title 49 CFR 395.5 states: "No motor carrier shall permit or require any driver used by it to drive a passenger-carrying commercial motor vehicle, nor shall any such driver drive a passenger-carrying commercial motor vehicle more than 10 hours following 8 consecutive hours off duty or for any period after having been on duty 15 hours following 8 consecutive hours off duty."

[22] Time differences between cellular telephone and dispatcher records may be attributed to desynchronized clocks.

concerning bus movement. The dispatcher said she advised the accident bus driver to remain professional and cooperate with the lead bus driver, who was the senior driver assigned to bus movement.

Bus Driver Interview

The bus driver stated that he was upset at the time of the cellular telephone conversation with his sister because he believed that he had been mistreated by the lead bus driver during the trip. The bus driver stated that the lead bus driver had refused to communicate with him about the details of bus movement, had departed from the terminal without him, and had departed from the airport before the accident driver had finished boarding his passengers.

The bus driver said that he did not notice the signs warning of low-clearance restrictions for the Alexandria Avenue overpass while driving toward the accident site on the Parkway and that he did not recall seeing the bridge until the accident occurred. The accident bus driver told Safety Board investigators that he could see the lead bus ahead of him. The bus driver reported that he had driven the same route once previously; company records verified that the trip occurred on November 5, 2004, 9 days before the accident.

Other Information

Buses

The FHWA estimates that, of the 795,274 buses[23] registered with the States in 2004, a total of 647,531 were defined as school buses and other nonrevenue buses (such as church buses), 142,459 were defined as private commercial buses,[24] and 5,284 were defined as federally owned buses.[25] According to a 2006 motorcoach census update,[26] 39,068 motorcoaches operate in the United States and Canada, making an estimated 631 million passenger trips and traveling more than 2.4 billion miles. According to the Fatality Analysis Reporting System (FARS) data for 2005, of the 59,373 vehicles involved in fatal accidents, 278 were buses. The 278 buses involved in fatal accidents include 111 defined as school buses, 38 as cross country/intercity buses, 82 as transit (city) buses, 33 buses as other, and 14 as unknown.

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[23] A *bus* is a vehicle designed to carry at least nine people, including the driver, that is not used for personal transportation.

[24] *Commercial buses* are all buses used in intercity, charter, and local transit operations, including municipal and transit buses.

[25] U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2004*, table MV-10 <www.fhwa.dot.gov/policy/ohim/hs04/index.htm>.

[26] American Bus Association, *Motorcoach Census Update 2006* (Washington, DC: ABA, September 2006). The 2006 ABA census update collected data for 2004 and 2005 and defined "motorcoach" as "a vehicle designed for long distance transportation of passengers, characterized by integral construction with an elevated passenger deck located over a baggage compartment. It is at least 35 feet in length and carries more than 30 passengers."

Cellular Telephones

Research. According to industry data, more than 204.7 million subscribers receive U.S. wireless communications services,[27] more than double the 97 million subscribers reported in 2000.[28] Cellular telephones, like text messaging devices and personal digital assistants, are a type of interactive wireless communications device.

An observational survey conducted by NHTSA showed that hand-held cellular telephone use while driving increased from 5 percent in 2004 to 6 percent in 2005.[29] The incidence of drivers using headsets increased from 0.4 to 0.7 percent of all drivers from 2004 to 2005. A 2002 NHTSA-sponsored telephone survey indicates that about 30 percent of all drivers report using a cellular telephone while driving to make or receive calls.[30]

Epidemiological studies show that the risk of being involved in an injury accident almost quadruples when drivers use a cellular telephone as compared to when a telephone is not used.[31] The 2002 telephone survey indicated that 0.1 percent of all drivers can attribute an accident in the past 5 years to cellular telephone use. According to 2003 FARS data, of the 58,517 drivers involved in fatal accidents, "cellular telephone in use in vehicle" was coded as a driver factor for 104 drivers (0.18 percent) and "cellular telephone present in vehicle" was coded for 1,670 drivers (2.9 percent). Analysis of North Carolina accident records from January 1, 1996, to August 31, 2000, revealed that 54.8 percent of accidents in which the driver was using a cellular telephone resulted in no injuries, 36.2 percent resulted in possible injuries, 6.4 percent resulted in non-incapacitating injuries, 2.1 percent resulted in incapacitating injuries, and 0.5 percent were fatal. In comparison, 58.4 percent of the accidents not involving a cellular telephone resulted in no injuries, 27.3 percent resulted in possible injuries, 10.6 percent resulted in non-incapacitating injuries, 3.1 percent resulted in incapacitating injuries, and 0.6 percent were fatal. Accidents involving cellular telephones were more likely than accidents not involving cellular telephones to involve a rear-end collision (45.1 percent of cellular telephone versus 25.6 percent of non-cellular telephone accidents), to occur during midday or afternoon hours (60 percent of cellular telephone

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[27] Information accessed on March 10, 2006, from <www.ctia.org>.

[28] *CTIA—The Wireless Association. Wireless Industry Indices: 1985-2005. Annualized Wireless Industry Service Results—June 1985 to June 2005* <www.ctia.org/research_statistics/index.cfm/AID/10030>. Data reflect domestic cellular, enhanced specialized mobile radio, and personal communication service providers.

[29] U.S. Department of Transportation, National Highway Traffic Safety Administration, *Driver Cell Phone Use in 2005—Overall Results,* DOT HS 809 967 (Washington, DC: NHTSA, 2005). The data source is the National Occupant Protection Use Survey, 2004-2005, conducted by the National Highway Traffic Safety Administration's (NHTSA's) National Center for Statistics and Analysis. The survey data were collected by trained observers from June 6 to June 25, 2005, between 8:00 a.m. and 6:00 p.m., at probabilistically selected intersections in the United States controlled by a stop sign or a stoplight.

[30] U.S. Department of Transportation, National Highway Traffic Safety Administration, *National Survey of Distracted and Drowsy Driving Attitudes and Behavior: 2002, Volume I: Findings,* DOT HS 809 566 (Washington, DC: NHTSA, 2003).

[31] (a) D.A. Redelmeier and R.J. Tibshirani, "Association Between Cellular-Telephone Calls and Motor Vehicle Collisions," *The New England Journal of Medicine*, Vol. 336, No. 7 (1997). (b) S. McEvoy and others, "Role of Mobile Phones In Motor Vehicle Crashes Resulting In Hospital Attendance: A Case-Crossover Study," *BMJ* (July 2005).

accidents occurred between 10:00 a.m. and 5:59 p.m. versus 54 percent of non-cellular telephone accidents), and to occur in urban areas (90.6 percent of cellular telephone accidents versus 62.3 percent of non-cellular telephone accidents) and on local streets (69.8 percent of cellular telephone accidents versus 37.9 percent for non-cellular telephone accidents).[32]

NHTSA recently released initial findings from its 100-car naturalistic driving study in which 100 vehicles, equipped with video and sensor devices, tracked driver behavior for 1 year.[33] The vehicles were driven nearly 2,000,000 miles, and 43,000 hours of data were obtained. The 241 drivers participating in the study had 82 crashes, 761 near-crashes, and 8,295 critical incidents.[34] The most common distraction for drivers was hand-held devices, primarily cellular telephones. Dialing a hand-held device increased the risk of a crash or near-crash by almost 3 times and talking on or listening to a hand-held device, by 1.3 times.

Research or surveys of cellular telephone use by commercial vehicle drivers are relatively uncommon. One such survey of Danish drivers[35] notes that cellular telephone use is likely to be a frequent and widespread activity among commercial drivers, that driving constitutes the sole or major part of a commercial driver's working day, and that this group uses cellular telephones to communicate with employers and customers. The Danish survey further indicates that 99 percent of the drivers responding used cellular telephones while driving. Of the Danish survey respondents, 0.5 percent said a cellular telephone contributed to an accident and 6 percent said cellular telephone use contributed to a dangerous situation, citing paying less attention to other drivers and missing road signs as factors. Examination of data from six drivers in a naturalistic local or short-haul study[36] showed that cellular telephone use accounted for about 4 percent of 4,329 events classified as distracting. The study further found that the average duration for cellular telephone conversations was 67.1 seconds, and the average duration for dialing was

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[32] J.C. Stutts, H.F. Huang, and W.W. Hunter, "Cell Phone Use While Driving in North Carolina: 2002 Update Report," final project report to the North Carolina Governor's Highway Safety Program (December 2002).

[33] (a) U.S. Department of Transportation, National Highway Traffic Safety Administration, *The 100-Car Naturalistic Driving Study. Phase II—Results of the 100-Car Field Experiment,* DOT HS 810 593 (Washington, DC: NHTSA, 2006). (b) U.S. Department of Transportation, National Highway Traffic Safety Administration, *The Impact of Driver Inattention on Near-Crash/Crash Risk: An Analysis Using the 100-Car Naturalistic Study Data*, DOT HS 810 594 (Washington, DC: NHTSA, 2006).

[34] NHTSA's 100-car naturalistic driving study defines a crash as: "Any contact with an object, either moving or fixed, at any speed in which kinetic energy is measurably transferred or dissipated. Includes other vehicles, roadside barriers, objects on or off of the roadway, pedestrians, cyclists, or animals." The study defines a near-crash as: "Any circumstance that requires a rapid, evasive maneuver by the subject vehicle, or any other vehicle, pedestrian, cyclist, or animal to avoid a crash." A rapid, evasive maneuver is defined as "a steering, braking, accelerating, or any combination of control inputs that approaches the limits of the vehicle capabilities." An incident would include crash-relevant conflicts requiring "a crash avoidance response on the part of the subject vehicle, any other vehicle, pedestrian, cyclist, or animal that is less severe than a rapid evasive maneuver, but greater in severity than a 'normal maneuver' to avoid a crash" and also proximity conflicts, which are "any circumstance resulting in extraordinarily close proximity of the subject vehicle to any other vehicle, pedestrian, cyclist, animal, or fixed object where, due to apparent unawareness on the part of the driver(s), pedestrians, cyclists, or animals, there is no avoidance maneuver or response."

[35] T. Troglauer, T. Hels, and P.F. Christens, "Extent and Variations In Mobile Phone Use Among Drivers of Heavy Vehicles in Denmark," *Accident Analysis and Prevention,* Vol. 38, No. 5 (2006): 105-111.

[36] L.C. Barr, C.Y.D. Yang, and T. Ranney, "An Exploratory Analysis of Truck Driver Distraction Using Naturalistic Driving Data," Transportation Research Board, 82nd annual meeting, January 12-16, 2003, Washington, D.C.

13.4 seconds. The 2005 FARS data indicate that cellular telephones were coded as a driver-related factor for 6 of the 278 drivers (2.2 percent) involved in fatal bus accidents.[37]

A number of studies,[38] including several using a simulator,[39] show that driving performance is impaired when drivers use cellular telephones; these studies found that drivers have slower reaction times, take longer to recover speed following braking, drive more slowly, maintain greater following distances, and have more traffic violations. For example, a study examining the effects of cellular telephone use on younger (18 to 25 years) and older (65 to 74 years) drivers found, relative to drivers in a pace car, that drivers using a cellular telephone while driving had an 18-percent slower braking response time, maintained a 12-percent greater following distance, and took 17-percent longer to recover speed after braking. Driving performance was impaired for both younger and older drivers.[40] Other studies have focused on visual behavior and visual information in the driving environment. A Transport Canada on-road experiment showed that drivers engaged in a distracting conversation made fewer saccades (quick eye movements), spent more time looking centrally and less time looking to the right periphery, and spent less time checking instruments and looking at the rear view mirror.[41]

Some studies have focused on information that the driver missed or was unaware of in the driving environment. In a study evaluating a driver's situational awareness, drivers using cellular telephones were found less likely to correctly answer questions

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[37] Driver-related codes pertaining to cellular telephone use are "cellular telephone present in vehicle" and "cellular telephone in use in vehicle."

[38] (a) D.L. Strayer and F.A. Drews, "Profiles in Driver Distraction: Effects of Cell Phone Conversations on Younger and Older Drivers," *Human Factors*, Vol. 46, No. 4 (2004): 640-649. (b) K.E. Beede and S.J. Kass, "Engrossed in Conversation: The Impact of Cell Phones On Simulated Driving Performance," *Accident Analysis and Prevention,* Vol. 38, No. 2 (2006): 415-421. (c) C.J.D. Patten, A. Kircher, J. Östlund, and L. Nilsson, "Using Mobile Telephones: Cognitive Workload and Attention Resource Allocation," *Accident Analysis and Prevention*, Vol. 36, No. 3 (2004): 341-350. (d) U.S. Department of Transportation, National Highway Traffic Safety Administration, *Examination of the Distraction Effects of Wireless Phone Interfaces Using the National Advanced Driving Simulator—Final Report on a Freeway Study*, DOT HS 809 787 (Washington, DC: NHTSA, 2005). (e) U.S. Department of Transportation, National Highway Traffic Safety Administration, *An Investigation of the Safety Implications of Wireless Communications In Vehicles,* DOT HS 808 635 (Washington, DC: NHTSA, 1997). (f) D.L. Strayer, F.A. Drews, and D.J. Crouch, "A Comparison of the Cell Phone Driver and the Drunk Driver," *Human Factors*, Vol. 48, No. 2 (2006): 381-391. (g) D.L. Strayer and W.A. Johnston, "Driven to Distraction: Dual-Task Studies of Simulated Driving and Conversing on a Cellular Phone," *Psychological Science,* Vol. 12 (2001): 462-466.

[39] A *simulator* is a piece of training equipment that mimics real life situations. The 2004 Strayer study measured driver performance using a high-fidelity simulator, comparing driver performance under three conditions: (1) driving without using a cellular telephone or being intoxicated, (2) driving while using a cellular telephone, and (3) driving while intoxicated.

[40] Strayer and Drews (2004).

[41] J.L. Harbluk, Y.I. Noy, and M. Eizenman, *The Impact of Cognitive Distraction on Driver Visual Behaviour and Vehicle Control*, TP#13889 E (Ottawa, Canada: Transport Canada, 2002).

about the driving environment.[42] Another study showed that drivers using cellular telephones had more traffic violations (such as speeding, ignoring stop signs and traffic signals, and committing lane violations) and attention lapses (defined as a driver failing to scan intersections at stop signs, stopping in the absence of a stop sign, stopping at a red light but proceeding before it turned green and then stopping again, or stopping at a green light).[43] The authors suggested that the drivers were either unaware of, or failed to process information from, the driving environment. Other research has demonstrated that talking on a cellular telephone while driving interferes with creating a memory of objects in the environment, in some cases even when the driver looked directly at the object.[44]

Some research indicates that changes in driving behavior are a result of the cognitive distraction of a cellular telephone conversation[45] diverting attention from driving to the conversation.[46] Drivers have been found to attempt to compensate for talking on a cellular telephone by altering other behaviors, such as increasing their distance from the car in front of them.[47]

Researchers have concluded that complex cellular telephone conversations create the greatest distraction.[48,49] Driver conversations with passengers differ from cellular telephone conversations because passengers are part of the environment, are aware of the

[42] A. Parkes and V. Hooijmeijer, *The Influence of the Use of Mobile Phones on Driver Situation Awareness* (undated). The study's subjects were asked the following questions: "1. Can you tell me what other traffic was surrounding you just before I stopped the simulation? 2. Can you tell me the colour of the car that was in your rear-view mirror? 3. Was the car in your rear-view mirror driving faster than you or not?" Information accessed on July 28, 2006, from <www-nrd.nhtsa.dot.gov/departments/nrd-13/driver-distraction/pdf/2.pdf>.

[43] Beede and Kass (2006).

[44] D.L. Strayer, J.M. Cooper, and F.A. Drews, "What Do Drivers Fail to See When Conversing on a Cell Phone?," *Proceedings of the Human Factors and Ergonomics Society, 48th Annual Meeting, New Orleans, Louisiana, September 20 through 24, 2004*. (b) D.L. Strayer, F.A. Drews, and W.A. Johnston, "Cell Phone-Induced Failures of Visual Attention During Simulated Driving," *Journal of Experimental Psychology–Applied,* Vol. 9, No. 1 (2003): 23-32.

[45] Transport Canada TP#13889 E.

[46] Strayer, Drews, and Johnston (2003).

[47] Strayer and Drews (2004).

[48] (a) C. Wood and J. Hurwitz. "Driver Workload Management During Cell Phone Conversations," *Proceedings of the Third International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design, Rockport, Maine, June 27 through 30, 2005* (Iowa City, IA: University of Iowa Public Policy Center, 2005). (b) J. McKnight and A.S. McKnight, "The Effect of Cellular Telephone Use Upon Driver Attention" (1991). Research sponsored by a grant from the AAA Foundation for Traffic Safety. Information accessed on July 28, 2006, from <www.aaafoundation.org/resources>.

[49] Patten, Kircher, Östlund, and Nilsson (2004).

driving environment, and can monitor the effects of the conversation on driving.[50] Drivers conversing on a cellular telephone have been found to speak more than they would during an in-car conversation.[51] Suspending the cellular telephone conversation positively affected driving performance. [52]

Studies comparing accident rates and performance between hand-held and hands-free cellular telephones suggest either that no difference exists between the two telephone modes or that hand-held telephones interfere more with driving.[53] A study conducted on rural roadways using an instrumented vehicle showed that reaction times increased when conversing, but no difference was found between telephone modes (hand-held and hands-free).[54] Reaction time results for both telephone modes were similar in a simulator study,[55] which showed that lateral lane deviation position increased during dialing but decreased during conversation. In the simulator study, driving speed during a conversation was reduced for drivers when using hand-held telephones but not when using hands-free telephones. A meta-analysis[56] revealed that hands-free cellular telephones produced similar performance decrements to hand-held telephones.[57]

Education. The FMCSA does not have a policy concerning cellular telephone use while driving. NHTSA states the following in its policy concerning cellular telephone use:

> The primary responsibility of the driver is to operate a motor vehicle safely. The task of driving requires full attention and focus. Cellular telephone use can

[50] F.A. Drews, M. Paupathi, and D.L. Strayer, "Passenger and Cell-Phone Conversations in Simulated Driving," *Proceedings of the Human Factors and Ergonomics Society, 48th Annual Meeting, New Orleans, Louisiana, September 20 through 24, 2004*.

[51] D. Crundall, M. Bains, P. Chapman, and G. Underwood, "Regulating Conversation During Driving: a Problem for Mobile Telephones?," *Transportation Research, Traffic Psychology and Behaviour*, Vol. 8F, No. 3 (2005): 197-211.

[52] Wood and Hurwitz (2005).

[53] (a) Redelmeier and Tibshirani (1997). (b) McEvoy and others (2005). (c) J.E.B. Törnros and A.K. Bolling, "Mobile Phone Use–Effects of Handheld and Handsfree Phones on Driving Performance," *Accident Analysis and Prevention*, Vol. 37, No. 5 (2005): 902-909. (d) S.B. Wilcox, "Comparison of Driving In a Simulated Environment While Using a Cell Phone With and Without a Headset" (2004). Information accessed on July 28, 2006, from <www.ctia.org/industry_topics/topic.cfm/TID/17/CTID/16#16>. (e) Strayer, Drews, and Crouch (2006).

[54] Patten, Kircher, Östlund, and Nilsson (2004).

[55] Törnros and Bolling (2005).

[56] A *meta-analysis* is a statistical method of combining results of studies that examine similar measures.

[57] J.K. Caird, C.T. Scialfa, G. Ho, and A. Smiley, "A Meta-analysis of Driving Performance and Crash Risk Associated With the Use of Cellular Telephones While Driving," *Proceedings of the Third International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design, Rockport, Maine, June 27 through 30, 2005* (Iowa City, IA: University of Iowa Public Policy Center, 2005).

> distract drivers from this task, risking harm to themselves and others. Therefore, the safest course of action is to refrain from using a cellular telephone while driving.[58]

The American Association of Motor Vehicle Administrators (AAMVA) notes in its *Model Commercial Driver License Manual* (CDL manual) that distracted driving can result when performing an activity that shifts full attention away from driving.[59] The CDL manual lists several potential distractors, including talking on a cellular telephone or a citizens band radio. It provides specific guidance on in-vehicle communication equipment, suggesting that drivers pull off the road to a safe, legal place when making or receiving a call, stating, "Do not place a call while driving." The CDL manual also suggests that drivers should, if possible, turn off cellular telephones while in transit. The CDL manual further suggests that, if a call must be made, drivers should keep conversations short, avoid social calls, and not use the equipment in challenging traffic conditions, such as when driving in severe weather, congested areas, or work zones. The CDL manual further advises drivers to use caution when talking into hands-free devices because these devices can be unsafe to use while driving.

Legislation. No jurisdiction completely bans the use of all cellular telephones while driving.[60] Connecticut, New Jersey, New York, and the District of Columbia prohibit the use of *hand-held* telephones while driving; California will also do so, effective July 2008. Colorado, Connecticut, Delaware, Illinois, Maine, Maryland, Minnesota, New Jersey, North Carolina, Tennessee, Rhode Island, Texas, West Virginia, and the District of Columbia restrict the use of cellular telephones by drivers with learner's permits. The DoD recently implemented a policy that prohibits the use of cellular telephones without a hands-free device while operating privately owned vehicles on DoD installations and while operating Government vehicles anywhere. Eleven States—Arizona, Arkansas, California, Connecticut, Delaware, Illinois, Massachusetts, New Jersey, Rhode Island, Tennessee, and Texas—and the District of Columbia prohibit school bus drivers from using cellular telephones while operating a school bus.

Researchers found that, in the District of Columbia, the rate of hand-held cellular telephone use declined significantly, from 6.1 percent to 3.5 percent, after legislation banning their use while driving passed.[61] An earlier study found that, in New York State, hand-held cellular telephone use while driving declined initially after the law's

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[58] See *NHTSA Policy and FAQs on Cellular Phone Use While Driving* under *Drowsy and Distracted Driving* <http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.54757ba83ef160af9a7ccf10dba046a0/>. Information accessed on June 25, 2006.

[59] American Association of Motor Vehicle Administrators, "Section 2.9—Distracted Driving," *Model Commercial Driver License Manual* (Arlington, VA: AAMVA, 2005).

[60] Information on State cellular telephone laws can be found on the Governors Highway Safety Association Web site <http://www.ghsa.org/html/stateinfo/index.html>.

[61] A.T. McCartt, L.A. Hellinga, and L.L. Geary, "Effects of Washington, D.C., Law on Drivers' Hand-Held Cell Phone Use," *Traffic Injury Prevention*, Vol. 7, No. 1 (2006): 1-5.

introduction (from 2.3 percent to 1.1 percent) and increased to 2.1 percent 1 year later.[62] The earlier study concluded that long-term compliance with bans on cellular telephone use will require substantial enforcement efforts.

Previous Accident Investigation on Cellular Telephone Use and Data

On February 1, 2002, about 8:00 p.m., on the outer lanes of Interstate 95/495 near Largo, Maryland, a 1998 two-door Ford Explorer Sport, traveling northbound at an estimated speed of 70 to 75 mph, veered off the left side of the roadway, crossed over the median, climbed up a guardrail, flipped over, and landed on top of a southbound 2001 four-door Ford Windstar minivan.[63] Subsequently, a 1998 four-door Jeep Grand Cherokee ran into the minivan. Of the eight people involved in the accident, five adults were fatally injured, one adult sustained minor injuries, and two children were uninjured.

The Safety Board determined the probable cause of the accident was the Explorer driver's failure to maintain directional control of her high-profile, short-wheelbase vehicle in the windy conditions, due to a combination of inexperience, unfamiliarity with the vehicle, speed, and distraction caused by use of a hand-held wireless telephone. Contributing to the severity of the accident was the lack of an effective median barrier at the accident site. Safety recommendations concerning cellular telephones issued as a result of this accident are discussed in the *Analysis* section of this report.

Accident Investigations on the Alexandria Avenue Bridge's Clearance and Visibility

On April 4, 1987, about 7:15 p.m., a 70-passenger double-decked sightseeing bus, carrying a driver and 65 passengers to Mount Vernon, Virginia, collided with the Alexandria Avenue bridge.[64] The 13-foot, 2-inch-high bus was traveling southbound in the right lane of the Parkway, at an estimated speed between 22 and 42 mph, when it struck the Alexandria Avenue arched stone overpass. The impact sheared off the bus's roof rearward, exposing the upper seating level. Thirty-three passengers were transported to four area hospitals. Twenty-five passengers with minor injuries were treated and released; eight sustained minor-to-critical injuries and were hospitalized. One passenger died approximately 10 hours after the accident from injuries sustained in the accident. All but one of the injured were on the upper level of the bus, and most of the severely injured were located toward the rear of the upper level.

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[62] A.T. McCartt and L.L. Geary, "Longer Term Effects of New York State's Law On Drivers' Handheld Cell Phone Use," *Injury Prevention*, Vol. 10, No. 1 (2004): 11-15.

[63] National Transportation Safety Board, *Ford Explorer Sport Collision with Ford Windstar Minivan and Jeep Grand Cherokee on Interstate 95/495 Near Largo, Maryland, February 1, 2002*, Highway Accident Report NTSB/HAR-03/02 (Washington, DC: NTSB, 2003).

[64] National Transportation Safety Board, *Impact With Arched Stone Overpass of 70-Passenger Double-Decked Sightseeing Bus on the George Washington Memorial Parkway, Alexandria, Virginia, April 4, 1987,* Highway Accident/Incident Summary Report NTSB/HAR-87/04 (Washington, DC: NTSB, 1987).

The Safety Board determined that the probable cause of this accident was the failure of the bus driver to anticipate and to recognize his approach to the low-clearance overpass and move the bus into the left lane in time to allow it to clear the overpass. Contributing to the accident was the lack of appropriate advance warning of the low clearance, the inadequate delineation of the overpass by means of artificial illumination or reflective signing, and the driver's recent use of illicit drugs.

As a result of the accident, the Safety Board recommended that the NPS:

H-87-58

Inform all park superintendents of the facts, conditions, and circumstances of this accident. Identify any low-clearance structures over roadways in the National Park System. Determine the extent and severity of any low-clearance problems in relation to the vehicles that use the park roads and provide information to roadway users about the low-clearance problems.

The Safety Board also recommended that the NPS, in cooperation with the FHWA:

H-87-59

Identify and implement appropriate countermeasures for low-clearance structures over all park roadways including, but not limited to, roadway and low-structure signing, lighting, or the prohibition of vehicles on the roadway that cannot clear the lowest clearance structures.

On April 4, 2003, the Safety Board classified both recommendations "Closed—Acceptable Action," after the NPS informed the Safety Board that it had forwarded the Safety Board's report to all NPS regional directors and that it was in agreement with the intent of the Board's recommendations.

In addition, on April 10, 1987, 6 days after the accident, the NPS replaced the low-clearance warning signs with signs meeting MUTCD guidance (see figures 3 and 4). The new sign over the left southbound lane indicated a 13-foot, 4-inch clearance, and the new sign over the right southbound lane, a 10-foot, 2-inch clearance.

Actions Following the November 2004 Accident

Following the most recent bus accident in November 2004, the FHWA formed an interdisciplinary team of bridge, safety, and intelligent transportation system experts. The team made several recommendations to the NPS for the accident site: (1) provide additional signing and revise existing advance warning signs, (2) consider installation of an early warning overhead clearance system, (3) consider modification of lane number and configuration, and (4) consider bridge replacement. In response, the NPS installed four new warning signs on the Parkway before the Alexandria Avenue bridge. The new signs, which are identical, are located approximately 3,455

feet and 1,197 feet before the Alexandria Avenue bridge for southbound motorists and 4,282 feet and 1,018 feet before the bridge for northbound motorists. (See figure 6.)

Figure 6. One of the four new warning signs for the Alexandria Avenue bridge overpass.

The NPS also replaced the existing 24- by 24-inch "No Trucks" signs on all feeder roads to the southbound Parkway with larger 24- by 30-inch signs. The NPS did not consider installation of an early warning overhead clearance system, reconfiguration of the traffic lanes, or bridge replacement as viable options for several reasons, including aesthetic and historical considerations. The NPS also established a new standard for vegetation trimming; beginning about 1,200 feet from the Alexandria Avenue bridge, southbound and northbound, vegetation will be cut back about 37 feet from the curb and up the embankment. Finally, the NPS added to its Web site the following information pertaining to commercial vehicle permit requirements and low-clearance information:

> A National Park Service Commercial Vehicle Permit must be obtained prior to the use of a commercial vehicle on the George Washington Memorial Parkway, the Clara Barton Parkway, Crest Lane, East Boulevard and West Boulevard.
>
> You must be aware that there are low bridge clearances which range from 10'2" to 18'5" in height. There are also weight restrictions for vehicles.[65]

[65] Information accessed December 19, 2006, from <http://www.nps.gov/gwmp/planyourvisit/permits.htm>.

On July 17, 2006, NPS and USPP representatives met to discuss concerns regarding trucks and buses using the Parkway. They identified several locations before the entrance to the Parkway with inadequate signage regarding Parkway restrictions (that is, "No Trucks"). They also determined that the text size on some of the signs along the Parkway is too small. Another related issue identified by the USPP concerns the fact that truck drivers who use Internet travel direction tools (for example, MapQuest, Yahoo, and Google) do not receive information on vehicle restrictions. In its August 25, 2006, letter, the NPS updated the Safety Board on its progress in resolving problems on the Parkway, noting that it had contacted the Virginia Department of Transportation to assist with incorporating "No Trucks" signage at selected locations and also contacted MapQuest and other Web sites to request that they add vehicle restrictions to their directions. The NPS plans to improve other signage along the Parkway and in advance of it.

Analysis

This analysis first discusses the factors and conditions the Safety Board was able to exclude as neither causing nor contributing to the accident. It then provides a brief overview of the accident events and discusses the safety issues relevant to the accident: low bridge clearance, cellular telephone use while driving, and collection of adequate cellular telephone accident data.

Exclusions

At the time of the accident, skies were clear and no rain was reported. Postaccident mechanical inspection of the bus revealed no mechanical defects that would have affected the driver's ability to control the vehicle. The vehicle was traveling at an ECM-recorded speed of approximately 46 mph, which was consistent with the posted speed limit signs of 45 mph. Toxicological tests were negative for alcohol and drugs. At the time of the accident, the driver had been on duty for about 2 hours and he had been off duty for 9 hours. He was in compliance with the hours-of-service regulations (49 CFR 395.5). Firefighters arrived at the scene 5 minutes following notification, and all of the injured were extricated and transported to a hospital within 30 minutes. The Safety Board therefore concludes that the following factors neither caused nor contributed to the accident: the weather, the mechanical condition of the vehicle, the vehicle's speed, the driver's use of alcohol or drugs, and driver fatigue. The Safety Board further concludes that the emergency response was timely and adequate.

The accident bus had a GVWR of 52,060 pounds and a length of 45 feet, 6 inches, clearly within range of permit requirements for access to the George Washington Memorial Parkway. At the time of the accident, Eyre did not possess such a permit. However, even had Eyre obtained a permit, it would not have increased the bus driver's knowledge of hazards specific to the Parkway, such as low clearances, because Parkway permits did not contain that information. The Safety Board concludes that Eyre's lack of a permit to access the Parkway did not contribute to the accident.

Truck and bus drivers must be aware of the height of their vehicles to avoid collisions with bridges and roof overhangs at gas stations, garages, hotels, and other buildings. According to the Prevost specifications, the bus was 12 feet high. A placard inside the vehicle on the dashboard noted that the vehicle's height was 12 feet, 4 inches. Further, Eyre provides training to its drivers, including the accident driver, which presents information on bus height and the dangers of low-clearance areas. The Safety Board therefore concludes that sufficient information was provided to the accident driver on his vehicle's height and on the dangers of low vertical clearance areas for him to have avoided this accident.

Accident Discussion

On November 14, 2004, a 2000 Prevost motorcoach occupied by the bus driver, 27 student passengers, and a chaperone departed BWI heading toward Mount Vernon, Virginia. It was the second bus of a two-bus team. As the bus approached the Alexandria Avenue bridge on the Parkway, the driver failed to notice or respond to warning signs indicating that the bridge's right lane has a 10-foot, 2-inch vertical clearance. The driver subsequently drove the 12-foot-high bus under the bridge, colliding with the bridge's underside and side and coming to rest about 470 feet beyond the bridge. The bus's roof was destroyed, and 11 of the 29 occupants were injured.

The data recovered postaccident from the accident bus's DDEC ECM contained limited precrash information on "last stop" and "hard brake" events. The DDEC ECM data indicate that the driver applied the throttle for at least a minute and a half before the accident and that the accident bus was traveling approximately 46 mph just before the accident. The data also indicate that the driver was not using cruise control at the time of the accident and show that the speed of the bus decelerated from 45.5 mph (20 seconds before last stop) to 32.5 mph (19 seconds before last stop), a deceleration rate of 13 mph per second. This rapid deceleration rate can only be explained by an outside force acting on the bus because, according to the DDEC ECM data, the brakes were not being applied at the time of the accident. In this case, the outside force was the bridge, a fixed object capable of decelerating the bus at the recorded rate.

Furthermore, the DDEC ECM data indicate that about 4 to 5 seconds after the point of initial deceleration, which slowed the bus from 45.5 mph to 32.5 mph, the brakes were applied and remained applied until the bus came to a complete stop. Using the speeds given at each second from 19 seconds before last stop to initial braking, the bus would have traveled a distance of approximately 183 feet, placing the front of the bus approximately 144 feet past the 39-foot-long bridge at the time the brakes were applied. The data also show that, after the brakes were applied, the bus traveled another 326 feet before coming to final rest approximately 470 feet beyond the overpass. The Safety Board therefore concludes that the driver did not attempt to stop the bus until after the vehicle struck the bridge.

Witnesses stated, the driver admitted, and cellular telephone records verify that the driver was talking on a hands-free cellular telephone about the time of the accident. The driver reported he was talking to his sister and that he was upset because he believed the lead bus driver had mistreated him during the trip. The accident bus driver stated that he saw neither the warning signs nor the bridge until after the accident occurred. Researchers have found that drivers conversing on a cellular telephone are cognitively distracted from the driving task;[66] that is, drivers' mental resources are diverted from the driving task, consequently impairing driving performance. Furthermore, complex cellular telephone conversations are more distracting than simple conversations. The Safety Board concludes that the bus driver's cellular telephone conversation at the time of the accident diverted his attention from driving, and, as a result, he failed to notice the low-clearance warning signs for the bridge and the low vertical clearance of the bridge itself.

[66] (a) Transport Canada TP#13889 E. (b) Strayer, Drews, and Johnston (2003).

Alexandria Avenue Bridge's Vertical Clearance

The Alexandria Avenue bridge spans four lanes (two southbound and two northbound) of the Parkway. Due to the bridge's arched configuration, the outside lanes have less vertical clearance than the inside lanes. At the time of the accident, the roadside sign 1,580 feet before the bridge, as well as signs on the bridge, warned motorists that the clearance was 13 feet, 4 inches in the left southbound lane and 10 feet, 2 inches in the right southbound lane. Since the accident bus was traveling near the posted speed of 45 mph, the bus driver would have had sufficient time—approximately 23 seconds—to change lanes from the point at which he encountered the warning sign 1,580 feet before the bridge until his vehicle reached the bridge.

Although up to 200 buses per day were using the Parkway, only the bus involved in this accident had collided with the bridge in the 5 years preceding the accident. Because bus collisions with the Alexandria Avenue bridge are an uncommon event, the Safety Board concludes that the low-clearance warning signs located in advance of the bridge, as well as the low-clearance warning signs on the bridge, provide sufficient warning for drivers approaching the Alexandria Avenue bridge to avoid colliding with it.

Following the accident, the NPS placed four additional warning signs in advance of the structure: 3,455 feet and 1,197 feet before the bridge for southbound motorists and 4,282 feet and 1,018 feet before the bridge for northbound motorists. The addition of the new southbound warning sign 3,455 feet before the bridge increases motorist warning time to 52 seconds, assuming travel at the 45-mph posted speed limit. This action and recent initiatives to improve signage and to add information about vehicle restrictions to travel direction Web sites should increase information available to drivers concerning vehicle height restrictions on the Parkway.

Cellular Telephone Use

As noted earlier in this report, more than 204 million people subscribe to U.S. wireless communications services, which include devices such as cellular telephones. Cellular telephone use by drivers continues to increase, as evidenced by NHTSA's 2005 observational survey in which 6 percent of drivers were observed to be using a hand-held cellular telephone, compared to 5 percent of drivers in 2004. Surveys of self-reported use of cellular telephones while driving show that about 30 percent of all drivers use a cellular telephone while driving.[67] Furthermore, commercial drivers, such as the accident bus driver, who spend their workday on the road and use cellular phones for maintaining contact with their companies, are likely to be heavy cellular telephone users.[68]

Research has demonstrated that using a cellular telephone while driving degrades several aspects of driving performance, resulting in slower reaction times, slower driving

[67] DOT HS 809 566.

[68] Troglauer, Heis, and Christens (2006).

speeds, and increased instances of attention lapses.[69] The driver involved in this accident was using a hands-free cellular telephone at the time of the accident. Research has shown that conversing on a hands-free cellular telephone while driving impairs performance.[70] Epidemiological studies indicate that the risk of being involved in a crash when using a cellular telephone is almost four times higher than when a cellular telephone is not used and that using a hands-free cellular telephone is no safer than using a hand-held cellular telephone.[71] The Safety Board concludes that the use of either a hand-held or hands-free cellular telephone while driving can impair the performance of even a CDL holder, such as the driver of the accident vehicle.

This accident investigation, like the investigation of the Largo, Maryland, accident in 2003,[72] shows the grave danger of driving while distracted by cellular telephone conversation. In its report of the Largo investigation, the Safety Board concluded that all drivers should be educated about the risks of distracted driving, including the cognitive demands associated with the use of wireless interactive communication devices, which include cellular telephones.[73] As a result of the investigation, the Safety Board made the following recommendations to NHTSA (H-03-03 and -04), to the American Driver and Traffic Safety Education Association (ADTSEA) (H-03-10), and to the Advertising Council, Inc. (H-03-11):

> H-03-03
>
> Develop, in conjunction with The Advertising Council, Inc., [H-03-11] a media campaign stressing the dangers associated with distracted driving.
>
> H-03-04
>
> Develop, in conjunction with the American Driver and Traffic Safety Education Association, [H-03-10] a module for driver education curriculums that emphasizes the risks of engaging in distracting behavior.
>
> H-03-10
>
> Develop, in conjunction with the National Highway Traffic Safety Administration [H-03-04], a module for driver education curriculums that emphasizes the risks of engaging in distracting behavior.
>
> H-03-11
>
> Develop, in conjunction with the National Highway Traffic Safety Administration [H-03-03], a media campaign stressing the dangers associated with distracted driving.

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[69] (a) Strayer and Drews (2004). (b) Beede and Kass (2006). (c) Strayer and Johnston (2001).

[70] (a) Patten, Kircher, Östlund, and Nilsson (2004). (b) Törnros and Bolling (2005).

[71] (a) Redelmeier and Tibshirani (1997). (b) S. McEvoy and others (2005).

[72] NTSB/HAR-03/02.

[73] NTSB/HAR-03/02.

NHTSA indicated on September 22, 2003, that it was working with an international public relations firm to develop an advertising campaign stressing the dangers of distracted driving that would focus initially on novice drivers and then phase in other groups identified as the highest risk users of potentially distracting technologies while driving. On March 2, 2004, the Safety Board classified Safety Recommendation H-03-03 "Open—Acceptable Alternate Response" because the public service campaign, even though not developed in conjunction with The Advertising Council, as recommended, made progress in addressing the intent of this recommendation. However, the Safety Board also noted the need for a media campaign that stresses the dangers of distracted driving for *all* populations, not just high-risk users. Since The Advertising Council did not participate in NHTSA's campaign and had not responded to the Board, Safety Recommendation H-03-11 remained classified "Open—Await Response."

NHTSA again addressed the issue in a January 27, 2006, letter to the Safety Board, in which it stated that it was serving in a technical advisory role to the Ford Multi-State Working Group and various advertising and public relations firms, including The Advertising Council, to develop a public service campaign targeting teenage reckless driving. The Safety Board acknowledges that teenage reckless driving is an important issue but remains concerned about the narrow focus of the campaign and its relevance to distracted driving, the intended target of Safety Recommendations H-03-03 and -11. Safety Recommendation H-03-03 to NHTSA remains classified "Open—Acceptable Alternate Response" pending establishment of a media campaign that stresses the dangers of distracted driving for all driving populations. Safety Recommendation H-03-11 to The Advertising Council is reclassified "Open—Acceptable Alternate Response" in this report.

NHTSA also stated in its January 27, 2006, letter to the Safety Board that the ADTSEA driver education curriculum had been updated to include a section discussing distractions that can cause driver inattention, such as cellular telephone use, passengers, and audio systems, and ways the distractions increase risk for negative consequences, such as a crash. NHTSA further indicated that it had served as a reviewer of the model curriculum revisions, which were finalized in spring 2006. The updated training materials, including videos, are available for a fee through the ADTSEA Web site <http://adtsea.iup.edu/adtsea/>. As this revised curriculum satisfies the intent of these recommendations, Safety Recommendations H-03-04 to NHTSA and H-03-10 to ADTSEA are classified "Closed—Acceptable Action."

Some States have prohibitions in place against cellular telephone use by novice drivers. As a result of the Largo, Maryland, accident investigation,[74] the Safety Board recommended to the 48 States that did not have such prohibitions:

> H-03-08
>
> Enact legislation to prohibit holders of learner's permits and intermediate licenses from using interactive wireless communication devices while driving.

[74] NTSB/HAR-03/02.

Currently, 13 States and the District of Columbia limit cellular telephone use by drivers with learner's permits.[75] In an effort to provide safe transportation to school children, 11 States and the District of Columbia also prohibit the use of cellular telephones by drivers when driving a school bus.[76] (For more information on individual State's progress in implementing Safety Recommendation H-03-08, see table 8.)

Table 8. Status of Safety Recommendation H-03-08 by State.

Status	State
Open—Acceptable Alternate Response	AL, AZ, AR, CA, FL, GA, HI, IN, IA, KS, KY, LA, MA, MI, MS, MT, NE, NV, NH, OH, OK, PA, SC, SD, VT, VA, WA, WI, WY
Open—Acceptable Response	CO, NY, TX
Open—Unacceptable Response	AK, ID, MO, NM, ND, OR, UT
Closed—Acceptable Action	CT, DE, IL, MD, MN, NC, RI, TN, WV

The driver distraction initiatives being developed by NHTSA, ADTSEA, and the States target mainly noncommercial and young, novice drivers. The AAMVA's CDL manual recognizes that cellular telephone use by commercial drivers can also be hazardous.[77] The manual recommends pulling off the road in a safe, legal place when making or receiving a call on communications equipment, stating "Do not place a call while driving." The manual also recognizes that hands-free cellular devices are unsafe to use while driving. Connecticut, New Jersey, New York, and the District of Columbia prohibit the use of hand-held cellular telephones while driving by all drivers, including commercial drivers. Industry is also beginning to recognize the need for cellular telephone policies; in addition to Eyre, other motor carriers, including Greyhound, have instituted policies on restricting cellular telephone use or are in the process of doing so. However, the primary motorcoach industry associations (the ABA and the UMA), public bus transportation organizations (the CTAA and APTA), school bus industry associations (the NAPT, the NSTA, and the NASDPTS), and bus driver unions (the Teamsters and the ATU) have not yet developed such policies for their members. Furthermore, the FMCSA has not published a policy regarding cellular telephone use while driving.

Payment for transportation services creates an implicit contract between the passenger and the carrier that the carrier will transport the passenger safely and not allow the vehicle operator to take unnecessary risks. Motorcoaches, such as the accident bus, typically transport 40 to 50 passengers per trip, creating the potential for significant injury or death to a large number of people in the event of an accident. In addition, like school buses, such vehicles frequently transport children (27 high school students in this accident) and other vulnerable groups, including the elderly. Transit buses also transport

[75] These jurisdictions are Colorado, Connecticut, Delaware, Illinois, Maine, Maryland, Minnesota, New Jersey, North Carolina, Rhode Island, Tennessee, Texas, West Virginia, and the District of Columbia.

[76] These jurisdictions are Arizona, Arkansas, California, Connecticut, Delaware, Illinois, Massachusetts, New Jersey, Rhode Island, Tennessee, and Texas, and the District of Columbia.

[77] American Association of Motor Vehicle Administrators, "Section 2—Driving Safely," *Model Commercial Driver License Manual* (December 2005) 2-22.

large numbers of passengers, often in urban areas. Consequently, these drivers have a special obligation to provide the safest driving environment possible for the passengers in their care. Therefore, the Safety Board believes that the States and the District of Columbia should enact legislation to prohibit cellular telephone use by CDL holders with a passenger-carrying or school bus endorsement, while driving under the authority of that endorsement, except in emergencies. Because the FMCSA is the primary oversight agency for buses, the Safety Board believes that the FMCSA should publish regulations prohibiting cellular telephone use by CDL holders with a passenger-carrying or school bus endorsement, while driving under the authority of that endorsement, except in emergencies. The Safety Board recognizes that regulatory change takes time and considers it imperative to alert motor carriers and drivers without delay about the dangers of using cellular telephones while driving; therefore, the Safety Board believes that the ABA, the UMA, the CTAA, APTA, the NAPT, the NSTA, the NASDPTS, the Teamsters, and the ATU should develop formal policies prohibiting cellular telephone use by CDL holders with a passenger-carrying or school bus endorsement, while driving under the authority of that endorsement, except in emergencies.

Cellular Telephone Accident Data Issues

The 2005 FARS data show that, of the 59,373 drivers involved in fatal accidents, "cellular telephone in use in vehicle" was coded for 135 drivers (0.23 percent) and "cellular telephone present in vehicle" was coded for 726 drivers (1.2 percent). As noted earlier, FARS data indicate that cellular telephones were coded as a driver-related factor for 2.29 percent of the bus drivers involved in fatal bus accidents that occurred in 2005.[78]

In its 2003 investigation of the Largo, Maryland, accident, which involved a driver using a cellular telephone while driving,[79] the Safety Board concluded that "available data are insufficient to determine the magnitude of risks associated with wireless telephone use" and identified several possible explanations:

> (1) drivers are unlikely to self-report wireless telephone use during an accident; (2) police officers are not necessarily trained to detect wireless telephone use, nor are they required to report it in the majority of State accident reports; (3) obtaining and analyzing wireless telephone records is time-consuming; (4) culling wireless telephone use from existing accident reports is difficult; and (5) currently, [at the time of the Largo, Maryland, accident investigation] only 16 States have codes for driver distraction including codes for wireless telephone use, on their traffic accident investigation forms.

[78] FARS, 2005.

[79] NTSB/HAR-03/02.

The Safety Board consequently recommended that the 34 States that did not have driver distraction codes on their traffic accident investigation forms: [80]

H-03-09

Add driver distraction codes, including codes for interactive wireless communication device use, to your traffic accident investigation forms.

For information on individual State's progress in implementing this recommendation, see table 9.

Table 9. Status of Safety Recommendation H-03-09 by State.

Status	State
Open—Acceptable Alternate Response	AL, AR, CT, HI
Open—Acceptable Response	GA, IN,* ME, MS, NH, NC, OH, RI, WA,* WV, WI, WY
Open—Unacceptable Response	AZ, ID, ND, CO*
Closed—Acceptable Action	AK, DE, IL, KS, LA, NM, NV, SD, VT, VA
Closed—Reconsidered	KY, MO, SC, UT
*The Safety Board has received and is currently reviewing information on the status of this recommendation for these States.	

This accident, like others discussed in this report, demonstrates the negative consequences of driving while distracted by a cellular telephone conversation. However, it is difficult to determine the extent of this problem with the available accident data. The Safety Board concludes that the lack of data on cellular telephone use in accidents hinders a formal accounting of the driving risks associated with cellular telephone use. The Safety Board therefore reiterates Safety Recommendation H-03-09 to the States of Alabama, Arizona, Arkansas, Colorado, Connecticut, Georgia, Hawaii, Idaho, Indiana, Maine, Mississippi, New Hampshire, North Carolina, North Dakota, Ohio, Rhode Island, Washington, West Virginia, Wisconsin, and Wyoming to add driver distraction codes, including codes for interactive wireless communication device use, to their traffic accident forms.

[80] These States are Alabama, Alaska, Arizona, Arkansas, Colorado, Connecticut, Delaware, Georgia, Hawaii, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Mississippi, Missouri, Nevada, New Hampshire, New Mexico, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, South Dakota, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Conclusions

Findings

1. The following factors neither caused nor contributed to the accident: the weather, the mechanical condition of the vehicle, the vehicle's speed, the driver's use of alcohol or drugs, and driver fatigue.

2. The emergency response was timely and adequate.

3. Eyre Bus Service, Inc.'s, lack of a permit to access the George Washington Memorial Parkway did not contribute to the accident.

4. Sufficient information was provided to the accident driver on his vehicle's height and on the dangers of low vertical clearance areas for him to have avoided this accident.

5. The driver did not attempt to stop the bus until after the vehicle struck the bridge.

6. The bus driver's cellular telephone conversation at the time of the accident diverted his attention from driving, and, as a result, he failed to notice the low-clearance warning signs for the bridge and the low vertical clearance of the bridge itself.

7. The low-clearance warning signs located in advance of the bridge, as well as the low-clearance warning signs on the bridge, provide sufficient warning for drivers approaching the Alexandria Avenue bridge to avoid colliding with it.

8. The use of either a hand-held or hands-free cellular telephone while driving can impair the performance of even a commercial driver's license holder, such as the driver of the accident vehicle.

9. The lack of data on cellular telephone use in accidents hinders a formal accounting of the driving risks associated with cellular telephone use.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the bus driver's failure to notice and respond to posted low-clearance warning signs and to the bridge itself due to cognitive distraction resulting from conversing on a hands-free cellular telephone while driving. Contributing to the accident was the low vertical clearance of the bridge, which does not meet current National Park Service road standards or American Association of State Highway and Transportation Officials guidelines.

Recommendations

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

New Recommendations

To the Federal Motor Carrier Safety Administration:

Publish regulations prohibiting cellular telephone use by commercial driver's license holders with a passenger-carrying or school bus endorsement, while driving under the authority of that endorsement, except in emergencies.
(H-06-27)

To the 50 States and the District of Columbia:

Enact legislation to prohibit cellular telephone use by commercial driver's license holders with a passenger-carrying or school bus endorsement, while driving under the authority of that endorsement, except in emergencies.
(H-06-28)

To the American Bus Association, the United Motorcoach Association, the Community Transportation Association of America, the American Public Transportation Association, the National Association for Pupil Transportation, the National School Transportation Association, the National Association of State Directors of Pupil Transportation Services, the International Brotherhood of Teamsters, and the Amalgamated Transit Union:

Develop formal policies prohibiting cellular telephone use by commercial driver's license holders with a passenger-carrying or school bus endorsement, while driving under the authority of that endorsement, except in emergencies. (H-06-29)

Reiterated Recommendation

To the 20 States that do not have driver distraction codes on their traffic accident investigation forms:

> Add driver distraction codes, including codes for interactive wireless communication device use, to your traffic accident investigation forms. (H-03-09)

Previously Issued Recommendations Classified in This Report

H-03-03

> Develop, in conjunction with The Advertising Council, Inc., [H-03-11] a media campaign stressing the dangers associated with distracted driving.

Safety Recommendation H-03-03, previously issued to the National Highway Traffic Safety Administration, remains classified "Open—Acceptable Alternate Response" in the *Cellular Telephone Use* section of this report's *Analysis*.

H-03-04

> Develop, in conjunction with the American Driver and Traffic Safety Education Association, [H-03-10] a module for driver education curriculums that emphasizes the risks of engaging in distracting behavior.

Safety Recommendation H-03-04, also previously issued to the National Highway Traffic Safety Administration, is reclassified from "Open—Acceptable Response" to "Closed—Acceptable Action" in the *Cellular Telephone Use* section of this report's *Analysis*.

H-03-10

> Develop, in conjunction with the National Highway Traffic Safety Administration [H-03-04], a module for driver education curriculums that emphasizes the risks of engaging in distracting behavior.

Safety Recommendation H-03-10, previously issued to the American Driver and Traffic Safety Education Association, is reclassified from "Open—Acceptable Response" to "Closed—Acceptable Action" in the *Cellular Telephone Use* section of this report's *Analysis*.

H-03-11

Develop, in conjunction with the National Highway Traffic Safety Administration [H-03-03], a media campaign stressing the dangers associated with distracted driving.

Safety Recommendation H-03-11, previously issued to The Advertising Council, Inc., is reclassified from "Open—Await Response" to "Open—Acceptable Alternate Response" in the *Cellular Telephone Use* section of this report's *Analysis*.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

MARK V. ROSENKER
Chairman

DEBORAH A. P. HERSMAN
Member

ROBERT L. SUMWALT
Vice Chairman

KATHRYN O'LEARY HIGGINS
Member

Adopted: November 21, 2006

Member Higgins filed the following concurring statement on November 29, 2006, and was joined in this statement by Member Hersman on December 11, 2006.

Notation 7845A

Member HIGGINS, concurring:

I commend staff for bringing this report to the Board and for raising the important and timely issue of the hazards of using a cellular telephone while driving a vehicle. The report and the staff's formal presentations highlighted the distraction that a phone conversation can create with the great potential to distract a driver from the primary duty to operate a vehicle safely and with full attention to that task.

As I stated at the Board meeting, I fully support further action on the issue of cell phone use while operating motor vehicles. I understand the staff's desire for a complete prohibition on all cell phone use for all drivers while driving, except in bona fide emergencies. While I share the concern that a piecemeal, driver-by-driver approach may not be the best way to address this issue, I hesitate to take the sweeping action recommended by some staff because I believe it is premature. I do not believe we have enough information to understand the level of cognitive impairment that results from cell phone use or from other activities that distract drivers. Nor do I believe a total ban on cell phone use can be achieved at this time.

I continue to be concerned about the safety risks for drivers, passengers and other motorists when cell phones and other electronic devices are used by those behind the wheel of any vehicle. The data we have show that distractions are increasing and hand-held electronic technology is changing constantly and being used more frequently.

I believe the NTSB has an important role to play in evaluating the research that has been done on the use of hand held devices and other driver distractions, seeking out expertise from industry, the states, law enforcement, academia, government and elsewhere, and educating the public on the issues and on what can and should be done to eliminate or minimize these distractions.

At the Board's request, the staff agreed to come back to the Board with a proposal to address these issues. Possible options include a safety study or public forum. There may be others. I look forward to reviewing staff recommendations for addressing these critical issues and working with my colleagues to implement them. We have an opportunity, working together, to take additional and important actions that will contribute to reducing the unacceptable level of highway deaths and injuries that occur every year in this country.

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Appendix A

Investigation and Public Hearing

The National Transportation Safety Board was notified of the Alexandria, Virginia, accident on November 14, 2004. Investigative team members were dispatched from the Washington, D.C., Atlanta, Georgia, and Arlington, Texas, offices. Groups were established to investigate highway factors, motor carrier operations, vehicle factors, survival factors, and human performance factors.

Participating in the investigation were representatives of Eyre Bus Service, Inc., the National Park Service, and the Federal Highway Administration.

No public hearing was held; no depositions were taken.

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