



**HUMAN PERFORMANCE GROUP CHAIRMAN'S
FACTUAL REPORT**

Chattanooga, TN

HWY17MH009

(14 pages)

**NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF HIGHWAY SAFETY
WASHINGTON, D.C.**

HUMAN FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

A. CRASH INFORMATION

Location: 300 block of Talley Road, Chattanooga, Hamilton County, Tennessee
Vehicle #1: 2008 Thomas Built School Bus
Operator #1: Durham School Services LP of Warrenton, IL
Date: November 21, 2016
Time: Approximately 3:20 p.m. Eastern Standard Time (EST)
Transported: 38 school bus passengers
Fatalities: 6 school bus passengers
Injuries: 32 school bus passengers; minor to serious injuries, driver; minor injury
NTSB #: **HWY17MH009**

B. ACCIDENT SUMMARY

For a summary of the accident, please refer to the *Accident Summary* report in the docket for this investigation

C. HUMAN PERFORMANCE GROUP

Kenneth Bragg, Human Factors Investigator, Group Chairman
NTSB Office of Highway Safety
490 L'Enfant Plaza East, S.W., Washington, DC 20594

Officer Adam Cavitt
Special Operations
Chattanooga Police Department
3410 Amnicola Highway
Chattanooga, TN 37406

D. DETAILS OF THE HUMAN FACTORS INVESTIGATION

The focus of this report is a crash involving a 2008 Thomas Built Industries 84 passenger school bus which traveled off of the roadway, struck a utility pole, overturned, and struck a tree. The Human Performance factual investigation focused on the behavioral, medical, operational, and environmental factors associated with the driver of school bus; henceforth referred to as the bus driver. Factors that potentially contributed to the crash are documented in the sections below.

1. Bus Driver Behavioral Factors

1.1. Background

1.1.1. Licensing

At the time of the crash, the bus driver held a valid Tennessee Class B Commercial Driver License (CDL) with a public-school bus passenger endorsement.¹ The CDL license was issued on April 22, 2016 with an expiration date of April 22, 2024. The driver was medically certified to operate a commercial motor vehicle.²

The bus driver's license history has one traffic violation, failure to show proof of insurance and one motor vehicle crash.³ The crash occurred on September 20, 2016, while the driver was operating a school vehicle and resulted in no injuries. The driver was found at fault in the crash and issued a citation.⁴

1.1.2. Experience

The 2008 Thomas driver began working for the carrier in April 2016. He drove April and May 2016, until the end of the school year and resumed driving on August 11, 2016, when the new school year resumed. At the time of the crash, the driver had about 5 months of commercial driving experience.

¹ A Tennessee Commercial Class B Driver License permits the holder to operate, in commerce, a vehicle with a gross vehicle weight rating (GVWR) of 26,001 pounds or more.

² 49 Code of Federal Regulations §391.41 requires that a person who operates a commercial motor vehicle in commerce be medically certified as physically qualified to operate such vehicles.

³ Human Performance Factors Attachment 1 – Bus Driver Tennessee Driver License Record

⁴ At the time of this report, the traffic citation had not been adjudicated and was not indicated on his driving history.

1.1.3. Training

According to the driver's training records, he received commercial driver training from the carrier, Durham School Services.⁵ The training began in January 2016 and concluded in April 2016. Topics of instruction included:

- Pre-trip inspection
- Backing Skills
- Driving Skills
- Braking
- Injury prevention
- Student loading/unloading
- Student management
- Preparing to Drive
- Defensive driving
- Intersections
- Railroad crossings, and
- Safe work practices

According to the records, the driver successfully completed all training requirements and received approval to drive independently in May 2016.

1.1.4. Crash History

A review of personnel records from Durham School Services indicate that in addition to the crash which is the focus of this investigation, the bus driver has had two previous crashes; both while operating school vehicles. The first crash occurred on August 18, 2016 when the driver struck a curb on the edge of the roadway. The crash did not involve another vehicle and was not immediately reported to Durham School Services; the crash was not reported to local police. The second crash occurred on September 20, 2016 when the bus driver sideswiped a passing vehicle in a curve. Chattanooga Police Department investigated the crash and found the bus driver to be at fault.⁶ Following each crash, the driver was given a post-crash evaluation and retraining. There is no indication that the bus driver had been involved in a crash outside of his employment with the carrier.

1.1.5. Driver Performance

To gain an understanding of the bus driver's job performance, investigators examined records of complaints against the driver and the bus driver's personnel file.⁷ Staff identified several instances in which the bus driver was observed to display unfavorable driving behavior. The instances in which unfavorable driving behavior was observed are listed below in **Table 1**.

⁵ Human Performance Factors Attachment – 2 Durham School Services Driver Training Records

⁶ Human Performance Factors Attachment – 3 September 20, 2016 Crash Report.

⁷ Human Performance Factors Attachment – 4 Bus Driver Complaint/Disciplinary Records

Table 1. Bus driver performance issues

Date of Action	Driving Behavior	Source
August 11, 2016	Driver observed speeding	Durham School Services Supervisor
August 12, 2016	Driver observed speeding	Durham School Services Supervisor
August 18, 2016	Driver has non-reported crash in school bus	Durham School Services
September 20, 2016	Driver has a reported crash in school bus	Durham School Services
September 28, 2016	Parent complains about driver slamming on brakes; complaint forwarded to transportation supervisor	Woodmore Elementary School Principal
October 27, 2016	Driver speeding in parking lot	Durham School Services Supervisor
October 28, 2016	Driver observed driver speeding	Durham School Services Supervisor
November 8, 2016	Driver observed speeding	Durham School Services Supervisor
November 16, 2016	6 Students complained of erratic driving	Woodmore Elementary School Principal
November 18, 2016	Principal observes driver speeding in school parking lot.	Woodmore Elementary School Principal

1.1.5.1. Driver Performance Monitoring

Complaints about the driver were received by the school principle, the department of education transportation supervisor, a site supervisor for the carrier, and the carrier terminal manager. As detailed in the *Motor Carrier Factors Group Chairman Report* for this investigation, the carrier did not have a systemic method for receiving, tracking, or investigating complaints against drivers. Consequently, the carrier was unaware of many of the complaints; many of the complaints were not documented in the driver's personnel file.

Following the crash, NTSB investigators met with officials from Durham School Services and its parent company, National Express LLC. In the meeting, company officials provided a detailed description of actions the company has taken to improve driver performance monitoring. The month following the crash, Durham School Services implemented a driver monitoring program in Hamilton County, Tennessee which has been used at other locations. The program was implemented as an interim plan to address the company's immediate concerns with driver performance monitoring. The program provides a portal with which school and carrier management can generate a record of a complaint. The program collects information in a central database, ensures the complaint is addressed, and documents the results of the investigation. It also ensures that any disciplinary or training actions are included in the employee's personnel file.

Company officials also described a long-term plan to implement a more inclusive employee monitoring system. This program is to be implemented throughout the parent company, in each division, for all its commercial drivers. Because of the number of drivers, the program is to be implemented in phases.

In addition to the features of the interim system, the long-term program, when fully implemented, will provide a portal for citizens, employees, and management to initiate a complaint of a driver. It collects information about complaints in greater detail and has increased complaint resolution accountability. Response deadlines are generated according to a system determined complaint priority; the greater the safety risk, the higher the priority. When a response to a complaint is delinquent, a notification to senior management is generated. Public access to the portal will be available through the Department of Education's website. At the time of this report, the performance monitoring program is scheduled to be implemented in the Hamilton County Department of Education System by the end of 2017. It is scheduled to be implemented companywide by the end of 2018.

In addition to a complaint monitoring system, Durham School Services has begun installing driver monitoring cameras on school vehicles in Chattanooga, TN. The system provides an outward view of the bus as the vehicle travels as well as an inward facing view of the driver. The system temporarily records on a continual looped system and creates a recording event when the system is triggered. Recording events are triggered by an unusual driving event such as hard braking, sharp turns, crashes, or excessive speed. A monitoring service evaluates each event and determines if the event is of a safety concern. The carrier is then notified of an unsafe event and when required, the employee receives additional training or discipline as appropriate. At the time of this report, the carrier has over 2000 cameras in use; full implementation is expected companywide by 2018.

1.1.5.2. Student Management

Student management is the process in which bus drivers deal with school children during transportation to and from school. It is designed to provide a prescribed approach to address disciplinary or safety issues which may arise during student transportation. The bus driver received student management training during initial commercial driver training. The curriculum provides guidance on interaction with students, keeping students seated while traveling, and techniques and directives for dealing with problem students. The bus driver was tested on his knowledge of student management policies in the written driver training exam. An observer evaluated his ability to apply the principles of student management techniques during his final behind the wheel evaluation. The bus driver successfully passed all training objectives.

The Human Performance Investigation examined how the driver interacted with the student passengers. Staff obtained emails, letters, and personnel documents related to the bus driver's interactions with students. The information contained in these sources are described below in **Table 2**.

Table2: Driver student interaction

Date	Event/ Response
Monday, September 19:	Driver submits 2 student discipline referrals to school administrator. <i>Response: No information in driver file</i>
Wednesday, September 28	A parents submits a written complaint to school administrators complaining that the bus driver cursed at her child. <i>Response: The school administrator attempted to contact the parent but, was unable to. There was no information regarding this complaint in the driver file.</i>
Wednesday, November 2:	Driver observed by school staff member arguing with a student. Driver insists the problem student be removed or he would leave. <i>Response: School administrator responded to the bus and spoke with the bus driver. HCDE transportation supervisor sent an email to Durham terminal manager and school staff that HCDE is addressing the issue with the driver and advises school staff and Durham terminal manager to keep him aware of driver's progress.</i>
Wednesday, November 9:	Driver submits a list of a group students for discipline referral. Complaint reported students riding the bus facing rearward, standing, and engaging in "horseplay" while the bus was in motion. <i>Response: On November 14, HCDE transportation supervisor sent a copy of the video to Woodmore Elementary School principal. There was no information regarding this event.</i>
Thursday, November 10:	Driver submits a list of 10 students for discipline referral. Complaint reported students standing while the bus was in motion. He expressed concern students would possibly be injured if he had to brake unexpectedly. <i>Response: On November 11, HCDE transportation supervisor sent an email to Woodmore Elementary School principal and Durham terminal manager stating he would speak to the driver about the amount of discipline referrals the driver had submitted. HCDE transportation supervisor acknowledged the driver had legitimate concerns but stated "he can't be turning in 10 referrals in a day."</i>
Monday, November 21: crash occurs	

1.1.6. Accident Trip/Route Experience

The bus driver had been assigned to the crash route since school began in August 2016. However, when the crash occurred, the driver had deviated from the normal route and was driving the route in reverse order. GPS records from the accident bus indicate that the bus driver similarly drove the route in reverse order on Friday, November 18. The carrier had no knowledge or explanation of why the bus driver deviated from his route. The crash occurred approximately one mile from the school, which was the origin of the trip. For more information on the crash route, see the *Highway Factors Group Chairman Report* in the docket for this investigation.

1.2. Cell Phone Use

To determine if the bus driver was using his cellphone when the crash occurred, staff examined an inward facing video showing the crash trip and a forensic download of data from the bus driver's cell phone.

The beginning of the crash video shows students boarding the bus as the driver is seated facing the entry door. The driver can be seen holding and sometimes manipulating his phone while students boarded the bus. In one instance, the driver briefly held the phone up to his right ear as if he was talking on the phone. However, data reflecting phone usage does not indicate that he made a voice call during this time. The bus driver then walked to the rear of the bus looking in the isles as he walked; the cell phone can be seen in his right hand. Once he began driving, the bus driver was out of the camera view and his actions cannot be seen.

Following the crash, police investigators obtained the bus driver's cell phone and performed a forensic download of the data contained in the phone. The data provides a detailed log of phone activity including voice calls, text messages, email messages, Bluetooth device use, and other functions. The data shows that at 3:17 p.m. the bus driver answered an incoming phone call. The duration of the call was about 3 minutes, 50 seconds and terminated approximately a minute after the crash occurred. Following the crash, the driver made two out-going calls at 3:25 p.m. Data from the cell phone indicates that the driver did not use a wireless device to talk during the call and the driver was not seen using a wired listening device at other times prior to the crash. Because the driver cannot be seen within the viewing area of the video while he is driving, how or if he held the phone while he talked is inconclusive.

1.3. Medical Factors

Information on the bus driver's health was obtained from historical medical records and his most recent Commercial Driver Fitness Determination Medical Examination Report. Information obtained from these sources are described below.

1.3.1. General Health

A canvass of pharmacies in the vicinity of the bus driver's home identified historical prescription records for the driver. Using this information, medical records were obtained from Parkridge Medical Center. The records indicate that the driver does not have a primary care provider or medical insurance and that he typically seeks medical treatment from the emergency department of the medical center. The driver's most recent medical treatment was on May 23,

2016 for a condition not related to this crash. There were no medical conditions identified which may have contributed to the driver's performance in the crash.

1.3.2. Medical Examination Report for Commercial Motor Vehicle Driver Fitness Determination (CDL Medical Exam)

Commercial drivers in the United States are required by *Federal Motor Carrier Safety Regulations* (FMCSRs) to be medically certified as being physically qualified to drive a commercial vehicle.⁸ These examinations may result in one of four outcomes with respect to medical qualification:

- The driver is found to meet the standards in 49 *Code of Federal Regulations* (CFR) §391.41 and is given a 2-year certificate;⁹
- The driver is found to meet the standards, but requires periodic evaluation for one or more conditions and is qualified for 3 months, 6 months, or 1 year;
- The driver is temporarily disqualified due to a condition or medication; or;
- The driver is found not to meet the standards.

1.3.3. Most Recent CDL Medical Exam

The accident driver's most recent medical Examination for Commercial Driver Fitness Determination was on February 10, 2016. The driver was issued a one-year certification.¹⁰ The exam was conducted by an advance practice nurse at an occupational health medical facility in Chattanooga, Tennessee.

In the self-reporting health history section on the report, the driver indicated "No" to having an illness or injury in the last 5 years. The Medical Examiner's Comments on Health History section of the report, indicates that the driver reports negative health history and denies the use of current or recent medications.

The driver's height was recorded as 73 inches and his weight was recorded as 148 pounds. This corresponds to a Body Mass Index (BMI) of 19.5.¹¹ The driver's blood pressure was recorded to be 104/69 and his pulse rate was 66 and regular. A urinalysis showed no protein, blood, or sugar. The report noted no abnormalities in any of the driver's body systems.

⁸ 49 Code of Federal Regulations §391.41.

⁹ For more information on who must be examined and the examination process, please see 49 CFR §391.43 and 49 CFR §391.45.

¹⁰ Tennessee law requires school bus operators to be medically certified annually.

¹¹ For BMI information, see: http://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm.

1.3.4. Vision

On the bus driver's most recent CDL Medical Exam, the accident driver's corrected Snellen visual acuity was recorded to be 20/20 in the left eye, 20/25 in the right eye, and 20/25 in both eyes.¹² His horizontal field of vision was recorded as 90 degrees for both eyes. The driver was found to meet visual acuity requirements only while wearing corrective lenses. The driver was able to recognize and distinguish among traffic control signals and devices showing standard red, green, and amber colors. The driver was not found to have had monocular vision.

1.3.5. Hearing

In the bus driver's most recent CDL Medical Examination, he was reported to have been able to hear a forced whispered voice at five feet in each ear.

1.3.6. Post-accident Toxicology

Following the crash Chattanooga Police Investigators obtained a blood sample from the bus driver. A forensic toxicology analysis of the sample was performed by the Tennessee Bureau of Investigation (TBI).¹³ The driver's blood tested negative for:

- Opiates
- Buprenorphine and buprenorphine metabolites
- Cannabinoids presumptively
- Cocaine and cocaine metabolites
- Barbiturates
- Benzodiazepines
- No basic drugs detected
- Ethyl alcohol

1.3.7. Medication

Pharmacy records indicate the most recent prescription medication obtained by the bus driver was on October 11, 2016; the driver received 20 tablets of hydrocodone.¹⁴ The prescription was issued by a dentist. There was no other information obtained which indicated that the bus driver was taking prescribed or over-the-counter medications.

1.3.8. Psychological Factors

A query for information through a local hospital emergency mental health system indicates that the driver had not previously received emergency mental health treatment. A subpoena for mental health records was issued to a local mental health treatment center. Records show that the

¹² Snellen fractions are a measure of visual acuity (sharpness of sight). In the Snellen fraction, the first number represents the test distance (20 feet) and the second represents the distance at which the average eye could see the letters on a certain line of the chart. A fraction of 20/20 is considered normal vision.

¹³ Human Performance Factors Attachment 5 – Bus Driver Post-Crash Toxicology Report

¹⁴ Hydrocodone is a narcotic analgesic used to relieve moderate to severe pain.

driver had not been previously treated at the center. There has been no indication that the crash occurred as the result of an intentional act.

1.3.9. Sleep Habits

In addition to working as a school bus driver for Durham School Services, the bus driver also worked as an overnight laborer at the Amazon Fulfillment Center in Chattanooga, TN. Historical employment records from Amazon show that the bus driver typically works twelve-hour shifts; from about 6 p.m. until 6 a.m. In the days leading up to the crash, the bus driver was off from work from about 6:30 a.m. Saturday, November 19 until about 6 a.m. Monday, November 21, the day of the crash. Data from the driver’s cell phone device indicates that the driver did not use his phone during nighttime hours. Because the bus driver and his family members were not interviewed, there was no information obtained in the investigation with respect to his quality or frequency of sleep.

1.4. Activities Prior to the Crash

Following the crash, the bus driver was arrested and taken into police custody. The driver, following the advice of his attorney, declined to participate in an interview. The bus driver’s family also refused to participate in an interview with NTSB Investigators. Information reflecting the bus driver’s activities in the days leading up to the crash were obtained from the bus driver’s cell phone records, employment records from the carrier¹⁵ and employment records from the Amazon Fulfillment Center in Chattanooga, TN, the bus driver’s primary job. The driver’s activities are summarized below in **Table 2**. All times are given in Eastern Standard Time.

Table 3. Driver Activity

Wednesday, November 16, 2016		
<u>Time</u>	<u>Event</u>	<u>Source</u>
5:58 a.m. – 8:29 a.m.	Driver drives morning route	DurhamSchoolService Records
1:48 p.m. – 4:35 p.m.	Driver drives afternoon route	DurhamSchoolService Records
Thursday, November 17, 2017		
<u>Time</u>	<u>Event</u>	<u>Source</u>
5:56 p.m.	Driver begins shift at Amazon Fulfillment Center	Employment Records
Friday, November 18, 2016		
<u>Time</u>	<u>Event</u>	<u>Source</u>
6:39 a.m.	Driver ends shift at Amazon Fulfillment Center	Employment Records
5:52 a.m.	Driver begins shift at Amazon Fulfillment Center	Employment Records
Saturday, November 19, 2016		
6:33 a.m.	Driver ends shift at Amazon fulfillment center	Amazon Employment Records
6:40 a.m.	Driver sends a text message	Cell Phone Device
11:03 a.m.	Driver sends a text message	Cell Phone Device
11:06 a.m.	Driver sends a text message	Cell Phone Device
4:50 p.m.	Driver makes out-going phone call	Cell Phone Device
5:23 p.m.	Driver sends instant message (last phone activity of the day)	Cell Phone Device

¹⁵ Human Performance Factors Attachment 6 – Durham School Services Employment Records

Sunday, November 20, 2016		
<u>Time</u>	<u>Event</u>	<u>Source</u>
6:54 a.m.	Driver sends text message (first phone activity of the day)	Cell Phone Device
10:06 p.m.	Driver receives cell phone call (last phone activity of the day)	Cell Phone Device
Monday, November 21, 2016		
<u>Time</u>	<u>Event</u>	<u>Source</u>
5:37 a.m.	Driver answers incoming phone call (first phone activity of the day)	Cell Phone Device
5:58 a.m. – 7:57 a.m.	Driver drives morning route	Durham School Service Records
1:48 p.m.	Driver begins afternoon route	Durham School Service Records
3:17 p.m.	Driver answers incoming phone call	Cell Phone Device
3:20 p.m.	Crash Occurs in Chattanooga, TN	

2. Environmental Factors

Global Positioning System (GPS) coordinates were utilized to determine relevant environmental conditions for the accident location.

Latitude: N 35.02387

Longitude: W -85.2347

2.1. Weather Information

Historical data for weather station Chattanooga, TN Metropolitan Airport (KCHA) located approximately 5 miles from the crash site, was retrieved and examined. Observations for November 21, 2016, near the time of the accident, are shown in **Table 3**.¹⁶

Table 4. Weather Data from Chattanooga Airport (KCHA)

Time (EST)	3:53 p.m.	4:53 p.m.
Temperature	55.9° F	55.4° F
Dew Point	10.0° F	10.4° F
Humidity	16%	17%
Pressure	30.21 in	30.21 in
Visibility	10 mi	10 mi
Wind Dir.	NNE	ENE
Wind Speed	3.5 mph	5.8 mph
Wind Gust Speed	N/A	N/A
Precipitation	N/A	N/A
Conditions	Partly cloudy	Partly cloudy

¹⁶ Data obtained from <http://www.wunderground.com>.

2.2. Astronomical Data for November 21, 2016

Using the GPS coordinates listed above, astronomical data for the accident location and date was downloaded from the United States Naval Observatory¹⁷ (USNO). Downloaded astronomical data is summarized in **Table 4** below.

Table 5. Sun and Moon Date for Chattanooga, TN for November 21, 2016

Event	Time
ACCIDENT	3:20 p.m.
Begin civil twilight ¹⁸	6:55 a.m.
Sunrise	7:22 a.m.
Sun Transit	12:27 p.m.
Sunset	5:32 p.m.
End civil twilight	5:59 p.m.

E. DOCKET MATERIAL

The following attachments are included in the docket for this investigation:

LIST OF ATTACHMENTS

Human Performance Factors Attachment 1 – Bus Driver Tennessee Driver License Record

Human Performance Factors Attachment 2 – Durham School Services Training Records

Human Performance Factors Attachment 3 – September 20, 2016 Crash Report

Human Performance Factors Attachment 4 – Bus Driver Complaint/Disciplinary Records

Human Performance Factors Attachment 5 – Bus Driver Post-Crash Toxicology Report

Human Performance Factors Attachment 6 – Durham School Services Employment Records

END OF INFORMATION

Kenneth J Bragg

Human Performance Investigator

¹⁷ Data obtained from

<http://aa.usno.navy.mil/rstt/onedaytable?ID=AA&year=2016&month=11&day=21&state=TN&place=chattanooga>

¹⁸ Morning civil twilight begins when the geometric center of the sun is 6° below the horizon and ends at sunrise.