



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Highway Safety
490 L'Enfant Plaza SW, Washington, DC 20594

October 18, 2022

FACTUAL REPORT OF INVESTIGATION

HWY22FH001

A. ACCIDENT

Location: Big Spring, Texas
Date: November 19, 2021
Time: 4:01 p.m. CST
Vehicle 1: 2016 Ford F-350 Pick Up Truck (truck). Private Owner
Vehicle 2: 2005 MCI Motorcoach (motorcoach). Andrews Independent School District
Vehicle 3: 2018 Freightliner Bus (bus). Andrews Independent School District

B. INVESTIGATIVE GROUP

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Group Member	Trooper Dustin Henderson Texas Department of Public Safety (TXDPS) San Angelo, Texas

C. SUMMARY

On Friday, November 19, 2021, about 4:01 p.m. central standard time, a multi-vehicle crash occurred in the eastbound lanes of Interstate 20 near Big Spring, Howard County, Texas. A 2016 truck traveling the wrong way (westbound) in the eastbound lanes near mile marker 179 struck an eastbound motorcoach nearly head-on. The truck came to rest in the right lane of eastbound I-20 and was destroyed in a post-crash fire. As a result of the collision, the sole occupant of the truck, the 59-year-old driver, was killed. The motorcoach was the lead vehicle in a caravan of 3 commercial passenger vehicles owned and operated by the Andrews Independent School District (Andrews ISD) and had been traveling to a high school football game in a neighboring town. After the collision, the motorcoach traveled into the median and contacted the cable barrier before coming to rest. The 69-year-old driver of the motorcoach and an adult occupant were killed, 1 adult and 36 students sustained various injuries, and 1 student was uninjured.

After the initial impact with the motorcoach, the truck was pushed backwards and sideswiped the second vehicle in the caravan, a 2018 Freightliner bus, which sustained minor damage. The driver of the bus made a controlled stop into the right shoulder of the interstate.

Thirteen of the 31 passengers in the bus were injured and the 60-year-old driver was uninjured. The third Andrews Independent School district commercial passenger vehicle in the caravan was not involved in the crash.

In the crash location, I-20 consisted of two travel lanes in each direction, which were separated by a median and a cable barrier. Posted speed limit was 75 mph. The crash occurred during daylight hours, the conditions (road and weather) were dry.



Figure 1. View of impact area near mile marker 179 with motorcoach at final position in the median and the pickup in the right-hand eastbound traffic lane (Courtesy of the TXDPS).

D. SURVIVAL FACTORS

1.0 Injuries

The truck driver was unrestrained, but he was not ejected from his vehicle during the crash sequence.¹ He suffered multiple blunt-force trauma injuries. Due to fire damage to the vehicle, it could not be determined if the airbags in the truck deployed. There were no seatbelts on the motorcoach other than in the driver's seating position.² The driver of the motorcoach was restrained and not ejected from the bus. He sustained traumatic head injuries and was flown to the University Medical Center in Lubbock, Texas, where he later died. An adult male occupant who was seated in the right-front seat of the motorcoach was ejected and died. Of the 37 other occupants in the motorcoach, three were ejected and suffered serious injury. The remaining occupants in the motorcoach sustained injuries ranging from serious to minor and one passenger was not injured. As mentioned previously, thirteen of the 31 passengers in the Freightliner bus were injured and the 60-year-old driver was uninjured. The initial TXDPS crash report indicated that none of the passengers utilized the available seatbelts in the bus. None of the occupants in the bus were ejected in the crash sequence. The third motorcoach in the caravan was not involved in the crash. See Table 1 for a summary of the injuries in the three vehicles involved.

¹ Attachment – TXDPS initial crash report.

² National Highway Traffic Safety Administration. "Federal Motor Vehicle Safety Standards; Occupant Crash Protection; Final Rule." *Federal Register* 78, no. 227 (November 25, 2013):70415-70474.

Table 1. Injury severity of occupants in the truck, motorcoach, and bus.

Vehicles	Occupants	Injury Severity ³				Total
		Fatal	Serious	Minor	None	
Truck	Driver	1	0	0	0	1
Motorcoach	Driver	1	0	0	0	1
	Passengers	1	10	27	1	39
Bus	Driver	0	0	0	1	1
	Passengers	0	0	13	18	31
Total		3	10	40	20	73

2.0 Emergency Response

At 4:01 p.m., the 9-1-1 system received three calls about a vehicle traveling east in the westbound lanes.⁴ At 4:02 p.m., the system received a call that a crash occurred. The Big Spring Police Department was notified of the crash at 4:03 p.m.⁵ A unit was assigned at 4:04 p.m. and arrived on scene at 4:14 p.m. The Howard County Sheriff Office was also notified at 4:03 p.m. and arrived on scene at 4:15 p.m. Big Spring Fire/EMS was contacted at 4:07 p.m. and arrived on scene at 4:15 p.m. The TXDPS was informed at 4:21 p.m. and arrived at 4:26 p.m. Three air ambulances and 6 ground ambulances responded to the scene, with the first arriving at 4:15 p.m. In total, four agencies assisted with the response.

E. HUMAN PERFORMANCE

1.0 Truck Driver

1.1 Background and License History

The truck driver was a 59-year-old male with a Class C noncommercial driver’s license. The license was issued in January 2019 and expired January 2025. It had no restrictions. His driver records did not show any violations or suspensions in the past three years.

The truck driver owned a machine shop that he operated at his home address since May 1997.⁶ According to the business card found in his wallet, the machine shop “specialized in pumping unit repair, welding, field work, straighten beam, grease and inspection.” The machine shop had a United States Department of Transportation (USDOT) number of 3418603. In addition, according to his spouse, the truck driver had been the pastor of Valley View Baptist Church for 1.5 years and was familiar with the area around Midland, among which was Big

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

⁴ Attachment - Transcript of 9-1-1 calls.

⁵ Attachment - Big Spring Police Department call log.

⁶ <https://www.corporationwiki.com/Texas/Midland/nathan-haile-machine-shop-inc/34544158.aspx>; https://texas.repair-misc.org/228172-nathan_hailes_machine_shop.htm; Accessed February 15, 2022.

Spring.⁷ On the day of the crash, the driver had not been working for the machine shop and had planned to spend the day evangelizing.

1.2 Pre-Crash Activities

Investigators from the TXDPS and the NTSB interviewed the truck driver's spouse four days after the crash. The interview was brief, and his spouse stated that she had retained an attorney. According to his spouse, the truck driver went to bed around 10 p.m. and woke up around 5:30 a.m. On the day of the crash, the truck driver left the house between 10 a.m. and 10:30 a.m. and planned to spend the day evangelizing.

The TXDPS obtained video surveillance footage of the truck driver as he traveled the north frontage road adjacent to westbound I-20 in Big Spring (figure 2).⁸ Surveillance video from Don's Tire Service showed the truck driver traveling east on the frontage road and making a left into Don's. The truck driver stopped there, exited his vehicle, and separately approached and spoke with the drivers of three other vehicles. Afterwards, he returned to his vehicle and drove away. Surveillance video from Eagles Den Suites, east of Don's Tire Service and on the same frontage road, showed the truck driver stopping and separately speaking with two other individuals. Surveillance video from Hull's Meat Company at the intersection of the same I-20 frontage road and Birdwell Lane showed the truck driver parking, speaking with someone in the parking lot of the meat market, then heading to the Big Spring Livestock Auction adjacent to the meat market before heading back to his vehicle. Finally, the truck driver appeared to speak very briefly with another driver while they are both in their vehicles.

The surveillance videos from Don's Tire Service, Eagles Den Suites, and Hulls Meat Company showed that the truck driver generally walked quickly, approached strangers confidently, and gesticulated while speaking. TXDPS interviewed several individuals who spoke with the truck driver prior to the crash, and they all indicated that the truck driver spoke quickly and was very animated during the conversation. He was also in a hurry to leave so that he could continue speak to others.

Surveillance video from the DK showed the truck driver after he left Hulls Meat Company.⁹ The truck driver made a left from Birdwell Lane onto East 3rd Street and headed east. However, from Birdwell, only right turns are allowed because East 3rd Street is a one-way westbound road. Surveillance video from the Quality Inn on East 3rd Street showed the truck driver going the wrong way and entering the off-ramp of I-20 east. Finally, surveillance video from the Crossroads Collision Center showed the truck driver proceeding west on eastbound I-20 and being passed by an eastbound vehicle.

⁷ Human Performance Attachment – Interview with next-of-kin of truck driver.

⁸ Human Performance Attachment – List of surveillance video clips.

⁹ DK is the name of the general store next to the ALON gas station.

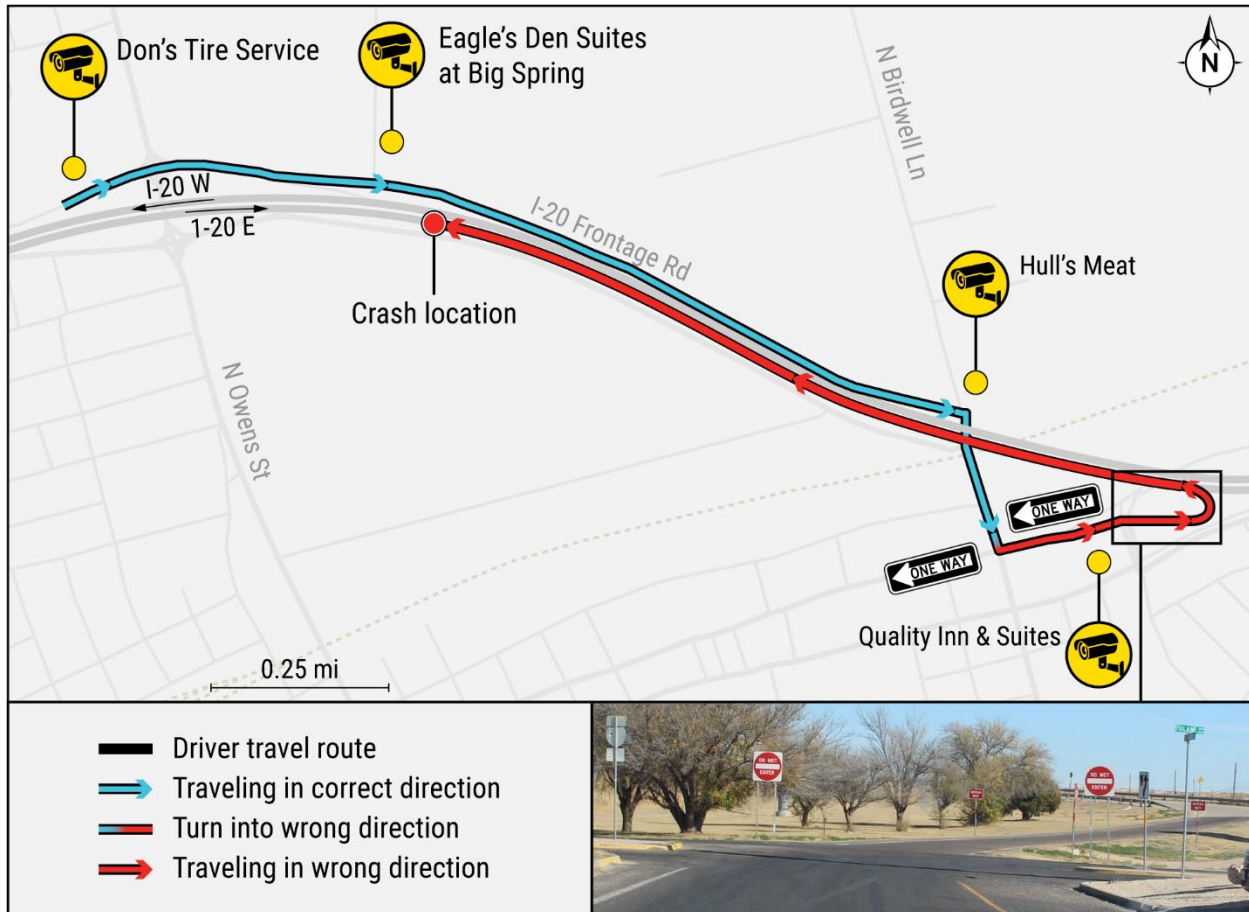


Figure 2. Path of truck driver prior to the crash, based on surveillance video obtain by TXDPS.

1.3 Health History

According to records obtained from the truck driver’s primary care physician, his most recent visit was on September 14, 2021. At that time, the physician noted the driver had donated a kidney in May 2021. He had a history of hypertension, high cholesterol, and hypothyroidism (low thyroid). He had had negative reactions to treatments for his high cholesterol (including rash and muscle pain) and had refused to continue the treatments. As a result, at the last visit, the driver was taking amlodipine for his high blood pressure, aspirin to try and prevent heart disease, and thyroid hormone replacement.¹⁰ He was recorded as being 71 inches tall and weighing 216 pounds (Body Mass Index of 30.1 kg/m²).

Blood and urine kidney function testing performed before the kidney donation was normal. However, testing on this visit noted an increase in the driver’s creatinine from 0.86 in February 2021 to 1.46 mg/dl.¹¹ The remainder of his laboratory testing showed some elevated cholesterol, but other kidney function tests (blood urea nitrogen and potassium) were normal.

¹⁰ Amlodipine is a blood pressure medication that is not generally considered impairing.

¹¹ Creatinine is a toxin produced by protein breakdown in the body that is normally excreted by the kidneys. Elevated levels point to poorly functioning kidneys. As kidney function declines, the body’s ability to excrete potassium and urea nitrogen also declines.

The primary care physician recommended that he follow up within a month with the medical team who had performed his kidney donation.

Records from the truck driver's renal transplant team were reviewed. They demonstrated an unremarkable hospital course during his donation and a single follow up visit in June 2021 when his creatinine was 1.4 mg/dl. There were no records of any follow up visits between September 2021 and the November 2021 crash.

1.4 Autopsy and Toxicology

An autopsy was performed on the truck driver three days after the crash. According to the autopsy report issued by South Plains Forensic Pathology, PA, the cause of death for the 59-year-old male driver was multiple blunt force injuries. The left kidney was noted to have been surgically removed. In addition, he had severe coronary artery disease with 95% of the left anterior descending coronary artery, 80% stenosis of the first diagonal, and 40% stenosis of the right coronary artery. The heart was enlarged with left ventricular hypertrophy (420 gm; 1.5 cm thickness for the left ventricular thickness and 1.7 cm for the septum). The average for a man of his weight (216 pounds; see below) is 387 gm with a range from 293 to 511 gm and the average thickness for both the ventricular and septal walls is 1.3 cm.¹² No other significant disease was identified.

Toxicology testing performed by the Federal Aviation Administration's Forensic Sciences Laboratory identified amlodipine in blood and urine. In addition, 0.011 gm/dl of ethanol was identified in cavity blood but zero was identified in urine. Toxicology testing performed at the request of the pathologist by NMS Labs identified 0.031 gm/dl of ethanol in abdominal blood. In addition, clinical testing of vitreous identified significantly elevated amounts of creatinine at 5.56 mg/dl (normal is up to 1.3 mg/dl); potassium at >20 mmol/l (normal postmortem levels are <15 mmol/l); and urea nitrogen at >100 mg/dl (normal is less than 20 mg/dl). Other tests including sodium, chloride, and glucose were normal in vitreous. A conversation with the NMS toxicologist showed they had no more vitreous specimen for further confirmatory testing.

1.5 Phone Records

Investigators obtained the truck driver's cellular phone records to estimate sleep/wake times and determine if he had been using his phone for texting or calling at the time of the crash (Table 2).¹³ On November 16, the truck driver initiated two early morning phone calls. Based on the numbers called, these were likely related to his machine shop business, which catered to the oil extraction industry in West Texas. Other than that, his phone activity was scant and offered little clues to his sleep/wake schedule. Based on these records, it appeared that the truck driver had not been on a call or had not been texting (using the phone's native texting application) at the time of the crash.

¹² Kitzman, DW; Scholz, DG; Hagen, PT; Ilstrup, DM; Edwards, WD. Age Related Changes in Normal Human Hearts During the First 10 decades of Life. Part II, Maturity: A Quantitative Study of 765 Specimens from 20 to 99 Years Old. Mayo Clin Proc. 1988; 63:137-146.

¹³ Human Performance Attachment – Truck driver phone records.

The phone records did indicate data usage until the time of the crash; however, because the truck driver’s phone was not recovered in the crash, the NTSB could not perform a forensic evaluation of the device to determine if the activity was initiated by the truck driver or by the phone itself.

Table 2. truck driver cellular phone activity.

Date	Start Time	End Time	Activity
11/16/2021	2:07 AM	3:51 AM	Call out
11/16/2021	4:08 AM	6:23 AM	Call out
11/16/2021	9:14 AM	9:15 AM	Call in
11/17/2021	10:19 AM	10:21 AM	Call in
11/17/2021	10:27 AM	10:42 AM	Call in
11/17/2021	11:47 AM	11:47 AM	Call in
11/17/2021	11:53 AM	11:54 AM	Call in
11/17/2021	12:27 PM	12:27 PM	Outgoing text
11/17/2021	3:26 PM	3:26 PM	Call in
11/17/2021	3:43 PM	3:44 PM	Call in
11/17/2021	3:53 PM	3:54 PM	Call in
11/17/2021	5:25 PM	5:26 PM	Call in
11/18/2021	6:17 PM	6:18 PM	Call out
11/19/2021	11:03 AM	11:03 AM	Call out

2.0 Motorcoach Driver

2.1 Background and License History

The motorcoach driver was a 69-year-old male. He held a Class B driver’s license with a passenger endorsement. The license was issued in November 2021 and expired November 2029. The motorcoach driver was required to use corrective lenses when operating a vehicle. His medical certificate was issued in July 2020 and expired in July 2022.¹⁴ The medical certificate was signed by a medical examiner certified by the Federal Motor Carrier Safety Administration (FMCSA).

The motorcoach driver started his employment with Andrews ISD in 2009. Records from the Drug and Alcohol Clearinghouse indicated that he had no past inspections and was clear to operate commercial vehicles. Documents from Andrews ISD indicated that the motorcoach driver had submitted to three federally regulated controlled substance tests. The controlled substance tests were classified as random tests and were conducted on December 11, 2015, May 20, 2016, and again on March 27, 2017. All tests returned negative results.

Table 3 lists the traffic event history of the motorcoach driver, none of which were in a commercial motor vehicle.

¹⁴ Although the MCI driver had a 2-year USDOT Medical Certificate, he was examined every year as required by Texas statute.

Table 3. Traffic event history of motorcoach driver.

Date	Violation/Incident	Vehicle
10/22/2009	Speeding	Non-CMV
4/6/2018	Non-injury crash Failed to drive in single lane	Non-CMV
7/18/2019	Speeding	Non-CMV

2.2 Hours of Service

Based on payroll data provided Andrews ISD, the motorcoach driver had worked a little over 35 hours for the pay period from November 5, 2021, to the crash date of November 19, 2021. The driver only worked part time and only operated student activity trips.

2.3 Pre-Crash Activities

Investigators spoke with the motorcoach driver's spouse 4 days after the crash.¹⁵ Investigators learned that on November 18th (Thursday) the motorcoach driver awoke around 5 a.m., took a walk around the church building, returned by 6 a.m., read the paper, ate breakfast, then volunteered at the church. He came back home for lunch, then worked on the yard. He then departed for the Lions Club, then spent 1 – 1.5 hours visiting his dad, returned home, had supper, watched a movie on his computer, then went to bed between 10:30 and 11 p.m. On Friday, the day of the crash, the motorcoach driver again awoke around 5 a.m. then took his walk around the church. He had felt a little rushed that day due to an issue related to insurance. He left to get the motorcoach around 1p.m.

His spouse stated that the motorcoach driver slept well and did not snore. There were no family issues that would cause him stress. She further stated that the motorcoach driver was very familiar operating buses, having done so since 1974. He was very familiar driving the motorcoach.

The motorcoach driver's phone records were obtained to determine if he was using his phone at the time of the crash. His phone records indicated that he had not been on a call or texting using the phone's native applications.

2.4 Toxicology

An autopsy was performed on the motorcoach driver on November 22, three days after the crash. A urine drug screen performed during the autopsy was negative for alcohol and common drugs of abuse.

¹⁵ Human Performance Attachment – Interview with next-of-kin of motorcoach driver.

3.0 Bus Driver

3.1 Background and License History

The bus driver was a 60-year-old male. The driver started his employment with Andrews ISD as a shop teacher and sports coach. He had worked for 34 years as a full-time teacher and as a tennis coach. He began driving school buses because coaches at Andrews ISD middle school were required to drive their students to and from activity trips. When he retired from full time teaching, he continued as a substitute bus driver. The bus driver held a Class B driver's license with a passenger and a school passenger endorsement. The license was issued in September 2020 and expired November 2028. The bus driver was required to use corrective lenses when operating a vehicle. His medical certificate was issued in August 2020 and expired in August 2022.¹⁶ The medical certificate was signed by a medical examiner certified by the FMCSA. Records from the Drug and Alcohol Clearinghouse indicate had no past inspections and was clear to operate commercial vehicles. According to information from the Commercial Driver's License Information System (CDLIS), the bus driver had no convictions, accidents, or withdrawals on his license.

Records from the Drug and Alcohol Clearinghouse indicate had no past inspections and was clear to operate commercial vehicles. According to documents obtained from Andrews ISD, the bus driver had submitted to two federally regulated controlled substance tests. The controlled substance tests were classified as random tests and were conducted on September 30, 2020, and again on December 7, 2021. All tests returned negative results.

3.2 Driver's Hours of Service

According to payroll data provided by Andrews ISD, the bus driver had been on duty for 23 hours during the pay period from November 5, 2021, to the crash date of November 19, 2021. The driver only worked part time as a driver and operated yellow route buses as well as student activities trips. As a retired employee, he was limited to a maximum of 80 hours per month of extra employment.

3.3 Pre-Crash Activities

Investigators spoke with the bus driver 4 days after the crash.¹⁷ According to the bus driver, on November 18th, he woke up late then taught a tennis class from 2:30 p.m. until 4 p.m. He stated he did not do much after that and went to bed around 11 p.m. The bus driver stated that he awoke around 5 a.m. but went back to bed. On November 19, the day of the crash, the bus driver awoke between 8 and 9 a.m. and relaxed at home. He went to the school around 12 p.m. and taught a junior varsity tennis class from 12:20 p.m. until 1 p.m. He then taught a varsity tennis class from 1 p.m. until 1:30 p.m. He then received a call from "Donny" because one of their bus drivers canceled and needed him to substitute. The bus driver arrived at the bus bay around 2 p.m. and left Andrews ISD for the football game in Sweetwater around 2:45 p.m.

¹⁶ Although the bus driver had a 2-year USDOT Medical Certificate, he was examined every year as required by Texas statute.

¹⁷ Human Performance Attachment – Interview with bus driver.

The bus driver stated that he got on I-20 at Exit 177.¹⁸ He made no stops prior to the crash. He usually used a citizen's band radio to stay in touch with the other drivers but only did so once on this trip. He usually sets the cruise control for 73 mph but does not remember doing so prior to the crash because he was trying to catch up to the motorcoach. He stated that the bus was not as fast as the motorcoach.

As the bus followed the motorcoach, he noticed the motorcoach make an evasive maneuver to the left, then to the right. These maneuvers caused the motorcoach to fishtail. At this point, the bus driver took his foot off the accelerator. He stated that the motorcoach was in the middle of the road when the crash occurred. The bus driver steered to the right to avoid the crash and went through the smoke of the initial crash. He stated that he couldn't see anything at this point. He pulled to the side of the road, parked the bus, and exited the bus. He noticed the damage along the driver's side of the bus. He then started walking back to the final rest position of the motorcoach.

According to the bus driver, he had no medical issues that could affect his operation of a vehicle. Post-crash urine or blood samples were not collected from this driver.

F. MOTOR CARRIER AND VEHICLE FACTORS

1.0 Current Operations

Andrews ISD is the public school district serving the city of Andrews ISD and Andrews ISD County, Texas. Andrews ISD consists of five schools: one high school, one middle school and 3 elementary schools. It has 4,359 students and 279 full time teachers. Andrews ISD does not have a USDOT number because it is not required to register with the USDOT as most of its transportation operations are exempt from federal oversight. Andrews ISD owns a facility that includes a maintenance shop and covered parking for the vehicles. The facility employs an operations supervisor, a transportation director, 3 full time mechanics, and 18 bus drivers. Andrews ISD has 25 yellow school buses and 9 larger buses that are used for school activity trips.

Oversight over Andrews ISD was conducted by the FMCSA and the State of Texas. Texas independent school districts are exempt from the Federal Motor Carrier Safety Regulations (FMCSRs) except for those regulations pertaining to drug testing and commercial driver's licensure.¹⁹ Primary regulatory oversight was conducted by the State of Texas, which has adopted most of the FMCSRs into its regulation.

The motorcoach was a model J-4500 and was owned and operated by Andrews ISD. The vehicle had its last federal annual inspection on October 26, 2021, with a mileage of 103,907 at the time of the inspection. The vehicle passed the inspection in accordance with Title 49 Code of Federal Regulations (CFR) 396.17 through 396.21. The motorcoach was purchased used in August 2016 from a bus dealer in Tulsa, Oklahoma. Maintenance files were provided by the

¹⁸ The three buses in the convoy likely took Andrews Highway (state route 176) to I-20. Exit 177 was the next major exchange.

¹⁹ Title 49 Code of Federal Regulations (CFR) 382 and 49 CFR 383.

Andrews ISD that indicated the vehicle had regular maintenance. The vehicle had been serviced on October 25, 2021.

The Freightliner bus was purchased new in July of 2018. This vehicle was purchased from the same bus dealer in Tulsa, Oklahoma. The last federal annual inspection was performed on September 30, 2021, and the vehicle passed that inspection. The mileage at the time of the inspection was 34,933. Andrews ISD provided maintenance records that indicated the vehicle had been maintained and had regular service and repairs. Maintenance records produced by Andrews ISD documented a systematic program of preventive maintenance that exceeded the requirements of 49 CFR 396.17.

The motorcoach and bus involved in this crash were classified as school activity buses. As such, they were not subject to the speed limit restriction found in Texas Code Title 7 Section 545.352.

G. DATA RECORDERS

A Detroit Diesel Electronic Control unit (DDEC) was recovered from the motorcoach. This DDEC was an engine-mounted electronic control unit (ECU) that includes control logic to provide overall engine management. The DDEC performed self-diagnostic checks and monitored other system components. System diagnostic checks were made at ignition-on and continued throughout all engine-operating modes.

Upon arrival at the NTSB Vehicle Recorder Laboratory, an external examination revealed the device had sustained minor damage. Upon powering the DDEC, the internal battery was not functional, therefore, all timestamps recorded to non-volatile memory did not correspond to their actual date and time of recording. Timestamps ranged from the year 2010 through 2030 and data recorded were unable to be correlated to a standard time.

Two hard brake events were recorded on the DDEC. The first occurred at a motorcoach odometer reading of 90,591.4 miles and the second occurred at 92,165.8 miles. The final odometer reading for the motorcoach at the time of the crash was 105,554.3 miles. Because of the discrepancies in odometer reading, NTSB investigators could not link either hard braking event to the November 19, 2021, crash in Big Spring.

H. HIGHWAY FACTORS INVESTIGATION

1.0 General Information

The crash occurred on I-20, 159-feet west of eastbound mile marker 179. The GPS coordinates for this location are 32.26640 latitude and -101.46660 longitude. Near the crash area, I-20 had 12-foot-wide lanes with 10-foot-wide right-hand shoulders and 4-foot-wide median shoulders. The right-hand shoulder was delineated from the travel lanes by a solid white pavement stripe and the median shoulder was delineated from the travel lanes by a solid yellow pavement stripe. Both shoulders had rumble strips milled into the shoulder surface to alert errant drivers departing the travel lanes. The dual east and westbound lanes were delineated by a dashed 10-foot-long white pavement stripe spaced at 30-foot gaps. The earthen median was 40 feet wide. A Gibraltar Test-Level 4 high tension cable barrier (TL-4 HTCB) was installed 12-

feet from the westbound shoulder stripe, and it had three high-tension cables installed at 39-inch, 30-inch, and 20-inch mounting heights. The cable posts were located at 19-foot intervals. Scene measurements showed that the bus impacted the HTCB at a 14-degree encroachment angle. The location was equipped with highway safety lighting. The high-pressure sodium vapor lights were mounted on 40-foot-high poles at 200-foot spacings.

1.1 Traffic Metrics

The Average Annual Daily Traffic (AADT) in 2020 on I-20 near the crash site was 20,030 vehicles per day. Heavy truck and bus traffic comprised approximately 41-percent of that volume. The design speed is 70 mph. The speed limit on I-20 was posted at 75 mph. A speed study was performed by the Texas Department of Transportation (TXDOT) on I-20 between mile marker 178-179 on December 6, 2021. The study showed the average speed was 74.8 mph.²⁰

1.2 Roadway Geometry

The crash occurred in a 4,230-foot-long right-hand horizontal curve that had a radius of 1-degree, or 5,229.58-feet, and sloped downward on a 2.8 percent downgrade. The impact area was approximately 2,990-feet from the beginning of the curve. The crash location was also located east of an 1,100-foot vertical curve. The vertical curve began approximately 817-feet before the impact area. Line of sight testing was conducted on scene using an exemplar motorcoach and an exemplar pickup truck (an F-550 was available for sight testing to replicate the F-350 involved in the crash).

1.3 Crash History

Records obtained from the TXDOT showed that in the preceding five years, seven other wrong-way crashes occurred on or along I-20 in Howard County. Three of those crashes were on 4th Street, one crash was on 3rd Street, and three crashes were on the main lanes of I-20 at mile markers 192, 193, and 176.²¹ Since 2012, there have been 13 fatal wrong-way crashes in the TXDOT Abilene District, with 6 of these crashes occurring in the past two years. Five of the 13 fatal crashes involved alcohol impaired drivers.

TXDOT also examined crashes on 3rd and 4th streets in Big Spring since 2012 and found that 10 were attributable to wrong-way drivers. However, only two of the 10 crashes on these one-way city streets resulted in injuries. For more information see section 1.6 in this report.

1.4 Wrong-Way Signage Near the Crash Location

The security video from Hull Meat Company on Birdwell Lane showed the pickup truck driver departed the business and traveled to 3rd St. where he turned left on the one-way street. TXDOT indicated 3rd Street had been a one-way street for at least the preceding 34 years. See

²⁰ See Highway Attachment TXDOT Speed Study and Highway Attachment Procedures for Establishing Speed Zones.

²¹ See Highway Attachment Wrong-Way Crash History Reports for more information.

figure 3 for a view of the one-way signage on 3rd St. and figure 4 for the additional WRONG WAY sign on 3rd St.

The one-way sign had a mounting height of 13.5feet and was 36inches by 12inches in dimension. The wrong way sign had a mounting height of 7feet and was 36-inches by 24-inches. There was an additional One-Way sign posted on the right-hand side of 3rd St., approximately 155-feet east of the Birdwell intersection that preceded the WRONG WAY sign. After the pickup driver turned left onto 3rd St. it was approximately 0.25 mile to where 3rd St transitioned to the exit ramp for the I-20 exit 179. Figures 5 and 6 show the signage on the exit ramp to deter wrong-way entry.



Figure 3. View of ONE-WAY sign on 3rd Street where the truck driver turned left traveling east on the westbound one-way road.



Figure 4. View of WRONG-WAY sign on 3rd St. viewed from Birdwell Lane.



Figure 5. View of DO NOT ENTER signs followed by WRONG WAY signs on the exit ramp where the truck driver traveled to enter I-20.



Figure 6. View of WRONG WAY signs posted 150 feet after the DO NOT ENTER signs.

The following dimensions were measured for the lateral placement, mounting height, and dimensions of the signage. The DO NOT ENTER signs were located 53-feet east of the Tulane St. intersection. They were posted on both the left and right sides of the exit ramp. The 48-inch square signs were located 14-feet from the road edge and had a 9-foot mounting height from the pavement to the center of the sign.

The WRONG WAY signs were located 150-feet past the DO NOT ENTER signs. The 36-inch-wide by 24-inch-tall signs were located 14-feet from the pavement line and mounted 8-feet above the pavement to the center of the sign.²² Also, the sign pole had a 12-inch-tall red reflective tape located 57-inches above the pavement. Also, traveling the wrong way the yellow shoulder stripe was on the right and the white shoulder stripe was on the left or just the opposite as it would appear driving the correct direction.

Figure 7 depicts Figure 2B-18 from the Texas Manual on Uniform Traffic Control Devices (TMUTCD), which shows an example application of signage at an exit ramp to deter wrong-way entry.

²² See the 2011 Edition Revision 2 of the Texas MUTCD on page 83, Table 2B-1 MUTCD for sign dimensions for a single lane ramp.

Figure 2B-18. Example of Application of Regulatory Signing and Pavement Markings at an Exit Ramp Termination to Deter Wrong-Way Entry

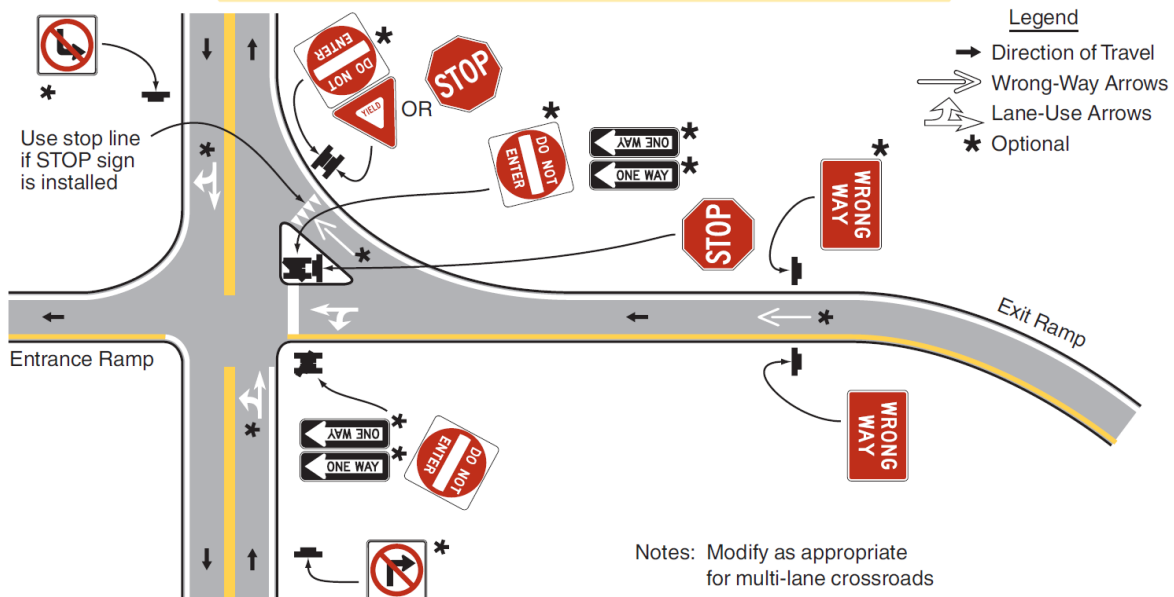


Figure 7. View of TXMUTCD figure 2B-18 which provides example applications on signing exit ramp termination to deter wrong-way entry.

Only one DO NOT ENTER sign and one WRONG WAY sign are required to be installed on the right-hand side of the road. The additional DO NOT ENTER sign and WRONG WAY sign that were installed on the left-hand side of the road were optional features that TXDOT chose to install.²³

1.5 Vehicle Damage and Cable Barrier Damage

The frame on the right side of the motorcoach was displaced inward 7-feet over a 42-inch-wide area. The wheelbase on the right-hand side was reduced 42-inches. The right side of the motorcoach had contact and intrusion damage along a 26-foot-long area to the rear of the baggage compartment. See figure 8 for a view of the motorcoach damage. Three of the cable barrier posts were bent over at the base to the ground from the impact. None of the three steel wire ropes were fractured.

²³See Highway Attachment Excerpts from Texas MUTCD.



Figure 8. View of frontal damage to the motorcoach.

The truck was destroyed by impact and the postcrash fire. The Freightliner bus had sideswipe damage beginning at the front of the bus body and running the length of the bus. See figure 9 and 10 for view of sideswipe damage. See figure 11 for a view of the damage to the truck.



Figure 9. View of damage to left forward edge of the bus body.



Figure 10. View of sideswiped damage along the left side of the bus body.



Figure 11. View of damage to the truck.

1.6 Sight Distance Testing

On December 22, 2021, I-20 was closed by TXDOT and TXDPS to conduct sight distance testing with an exemplar motorcoach and an exemplar truck (figure 12). The truck was placed in the eastbound right-hand lane of I-20 facing westbound, approximately 400-feet east of where the impact occurred. The motorcoach was driven east on I-20 until the driver could discern the truck. According to the driver of the exemplar motorcoach, the exemplar truck was clearly visible when he was 1,055-feet from the truck. At these positions, the motorcoach was

655-feet from the point of impact and the truck was 400-feet from the point of impact. The sight distance measured met the minimum requirements established in Table 3-2 of the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets*, which indicates that a stopping sight distance of 866-feet should be provided for 75 mph speeds on a three-percent downgrade in new construction projects.²⁴



Figure 12. Exemplar bus driver's view of an exemplar truck located 1,055-feet ahead.

1.7 TXDOT Assessment of Wrong Way Crashes and Post-Crash Improvements

The increase in wrong-way driving crashes in Abilene District has resulted in a TXDOT initiative to evaluate and improve traffic operations and signing at all ramp connections and at-grade crossovers on four-lane divided highways. All ramps and crossovers are being inspected by the 3 area engineers to ensure that the proper signing is in place conforming to the Texas MUTCD standards. In addition to the required signage, all ramps will have the Wrong-Way Arrow installed that includes the raised, retroreflective pavement markers that display reflected red light to wrong-way drivers. The projects to inspect, add signing, and new pavement markings is projected to be complete by the end of calendar year 2023. Additionally, a separate initiative is underway on 3rd and 4th Streets in Big Spring. An engineering study is being performed to study these routes and inventory all street, alleyway, and driveway connections, existing signage, and pavement markings. The results of the study will provide TXDOT with recommendations to improve and enhance the conspicuity of the traffic operation elements so that wrong-way driving can be reduced or eliminated in this area before wrong way drivers reach the connections with ramps leading to the main-line lanes of I-20. As of July 2022, the following improvements have been completed:

²⁴ AASHTO design criterion provides for a 2.5 second reaction time, a deceleration rate on .34 g's on wet pavement, a seated eye height of 3.5-feet and an object target height of 2.0-feet.

- At all signalized intersections, DO NOT ENTER and WRONG WAY signs have been installed along 3rd and 4th Streets.
- WRONG WAY signs have been installed every other block, with WRONG WAY pavement marking arrows placed on the roadway pavement at intermediate intervals between the signs.
- ONE WAY signs have been placed on all traffic signals and stop signs.

Work is still in progress for the placement of ONE WAY signs at all street and alleyway intersections. TXDOT is also planning on placing ONE WAY signs at some private drives where vehicles can enter the property from more than one direction. For example, if a business has a driveway that enters/exits 3rd or 4th streets, but also has access from a side street or alley, a ONE WAY sign will be placed in front of the driveway on 3rd/4th streets. Other improvements may include more frequent installation of “Do Not Enter” signs, “Wrong Way” signs, Movement Prohibition Signs, and the use of lane arrows and pavement markings at strategic locations. The results of the study and implementation of the recommended improvements is anticipated to be complete by the end of 2023.

I. GENERAL FACTORS

1.0 Weather

The closest official National Weather Service weather station to the crash site was located approximately 48 miles southwest, at Midland International Airport (weather station KMAF). Observations closest to the time of the crash are shown in Table 5.

Table 4. Weather data from weather station KMAF.

Time (EST)	3:53 p.m.
Temperature	67° F
Dew Point	32° F
Humidity	27%
Pressure	27.15 in
Wind Dir.	S
Wind Speed	13 mph
Wind Gust Speed	0
Precipitation	0
Events	None
Conditions	Fair

2.0 Astronomical Factors

According to the Earth System Research Laboratory/Global Monitoring Division of the National Oceanic and Atmospheric Administration, apparent sunrise in the immediate area of this crash occurred at 7:19 a.m., and apparent sunset occurred at 5:43 p.m. This crash occurred at 4:01 p.m., during the daylight hours. The sun was to the southwest, at an azimuth of 231 degrees and

an elevation of 17 degrees (see figure 13). The sun would have been to the left of the truck driver at the time of the crash.

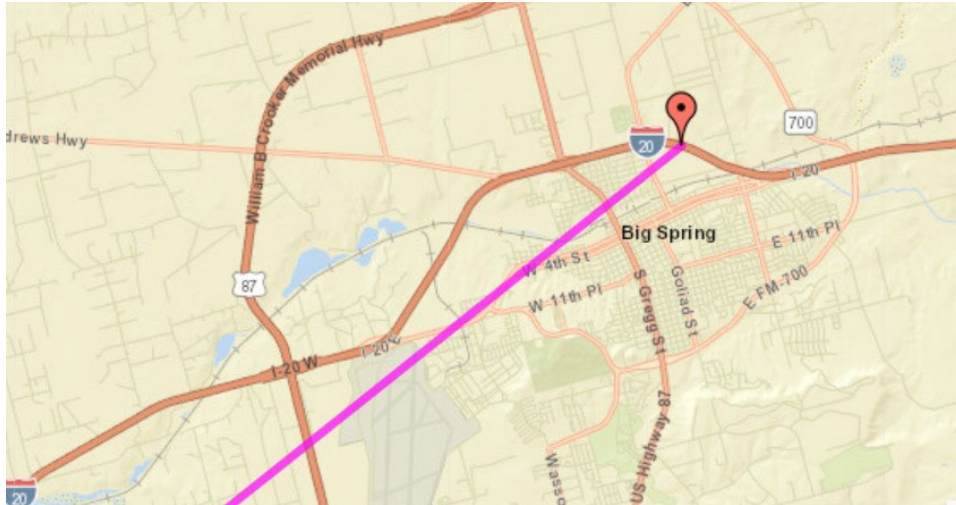


Figure 13. Direction of the sun at the time of the crash.

J. DOCKET MATERIAL

Attachment – Initial crash report

Attachment - Transcript of 9-1-1 calls

Attachment - Big Spring Police Department Call Log

(See the separate Group Chairman factual reports for additional attachments)

END OF REPORT

Rafael Marshall
Senior Human Performance Investigator