April 26, 2023 HIR-23-05

Multivehicle Crash and Postcrash Fire on Interstate 65

Greenville, Alabama
June 19, 2021

On June 19, 2021, about 2:21 p.m. central daylight time, a series of vehicle collisions occurred in the northbound lanes of Interstate 65 (I-65) near Greenville, Alabama, in Butler County.[1] This investigation focuses on one multivehicle crash sequence involving 10 passenger vehicles and 2 commercial trucks. Several passenger vehicles were slowing or had stopped due to earlier crashes, creating a traffic queue at the northern end of the bridge that crosses Pigeon Creek. A 2020 Ford Explorer collided with a vehicle at the end of the traffic queue. A 2020 Volvo truck-tractor with a Cottrell trailer for transporting automobiles collided with the Ford Explorer, initiating a series of additional collisions in both travel lanes. A 2005 Freightliner truck-tractor/2009 Wabash dry trailer combination vehicle that was following behind the Volvo auto-transporter combination vehicle collided with several vehicles and continued into the median. The two commercial trucks and four passenger vehicles, including a 2017 transit van, came to rest in the center median (see figure 1). A postcrash fire ensued and destroyed the vehicles in the median. Ten vehicle occupants died and 19 others sustained injuries. At the time of the crash, there was light rain, and the roadway was wet. The posted speed limit was 70 mph.

[1] (a) In this report, all times are central daylight time. (b) Visit ntsb.gov to find additional information in the public docket for this NTSB investigation (case no. HWY21MH009). Use the CAROL Query to search safety recommendations and investigations.

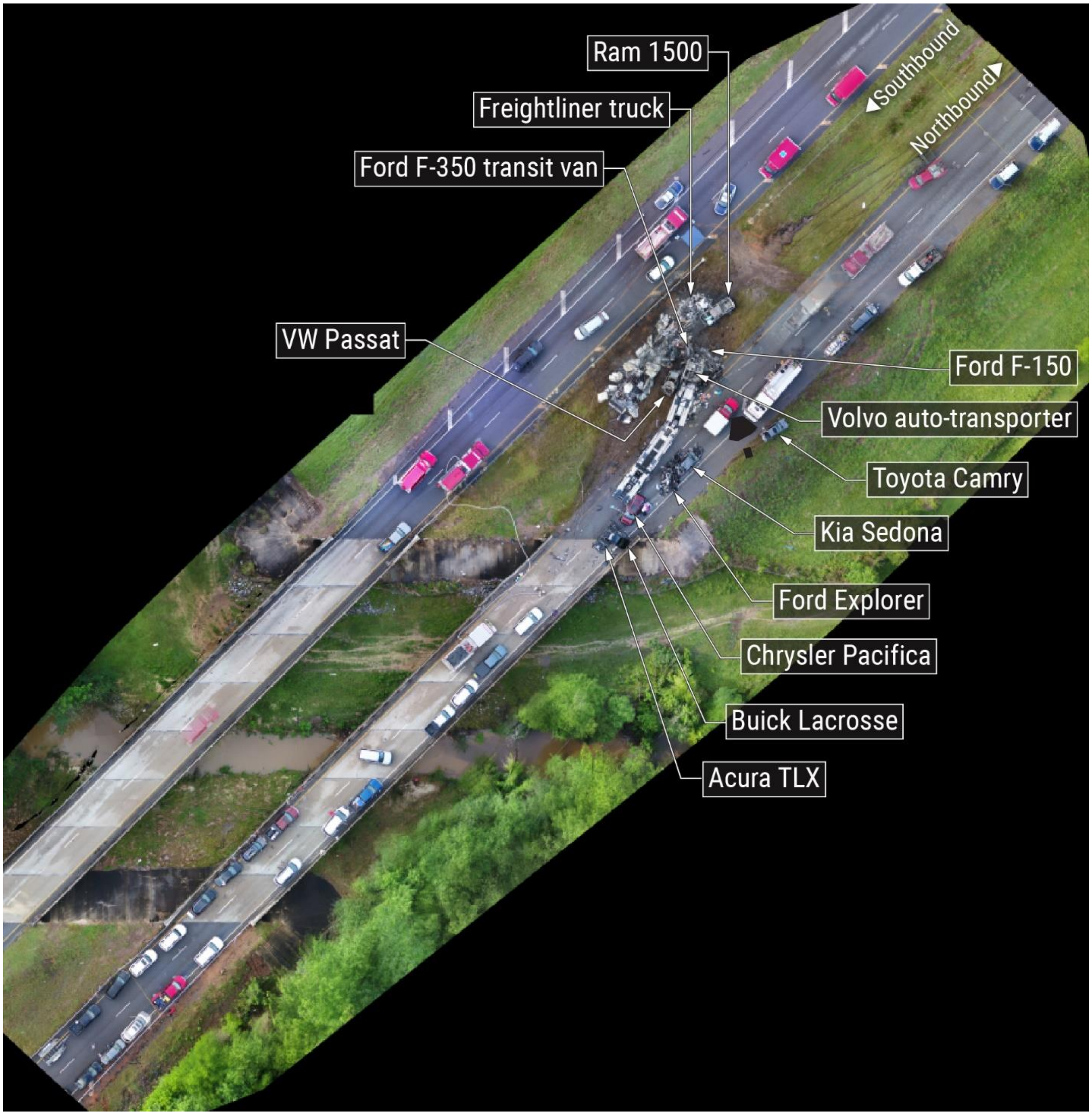

Figure 1. Orthomosaic image of final rest positions of vehicles involved in crash. (Source: Alabama Law Enforcement Agency; labels added by the NTSB)

Location	I-65 north, at the northern end of the bridge crossing Pigeon Creek near mile marker 138, near Greenville, Butler County, Alabama (see figure 2)
Date	June 19, 2021
Time	About 2:21 p.m.
Involved vehicles	12
Involved people	37
Injuries	10 fatal, 2 serious, 16 minor, and 1 injured but injury level unknown (8 uninjured)
Weather	Light rain
Roadway information	Four-lane divided highway (two northbound and two southbound lanes) separated by a 46-foot-wide earthen median. The roadway was wet.

Figure 2. Map showing location of crash on I-65. (Source: Google Maps)

1. Factual Information

1.1 Background

The crash occurred in the northbound lanes of I-65 near mile marker 138 at the northern end of a bridge structure that crosses over Pigeon Creek near Greenville, Butler County, Alabama (see figure 3). In the area of the collision, I-65 is a four-lane divided highway with two lanes in each direction, separated by a 46-foot-wide earthen median. The bridge is 272 feet long and 33.2 feet wide, flanked with shoulders and curbs on both sides (see figure 3 and section 1.5.1 for additional information). The posted speed limit is 70 mph.

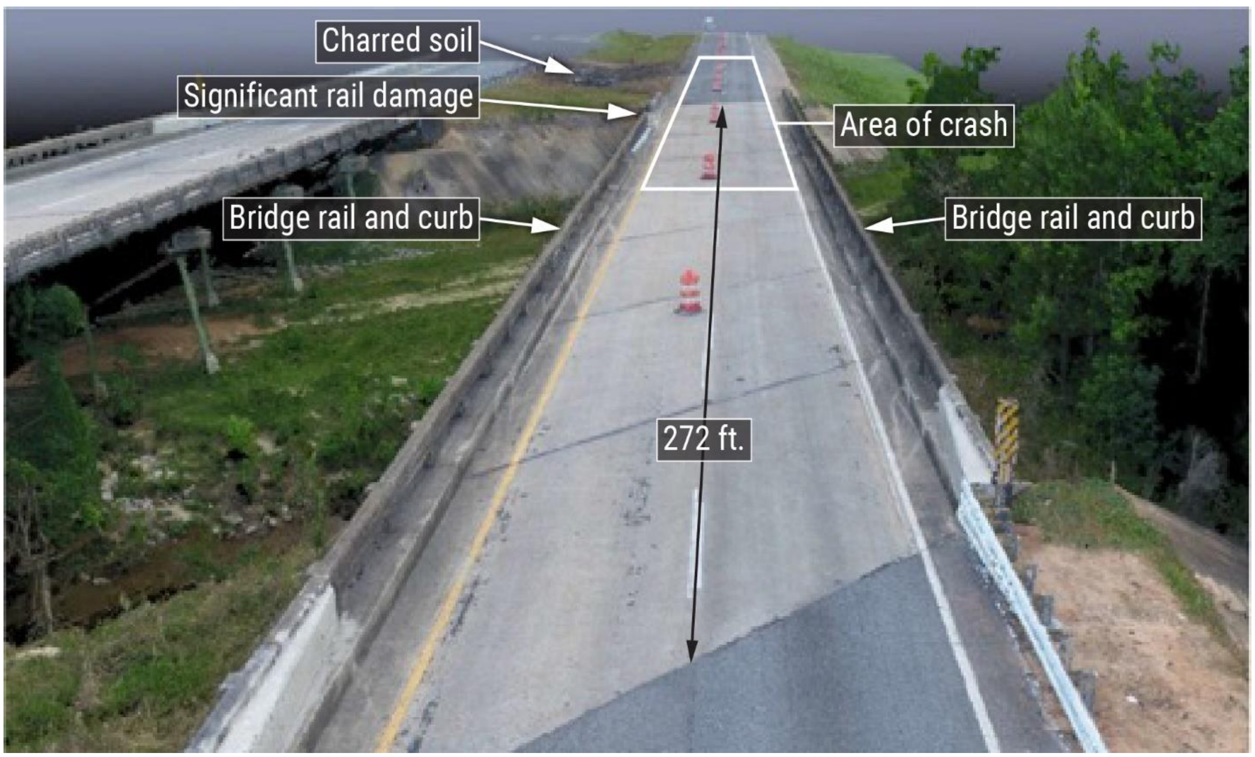

Figure 3. Overhead view of I-65 northbound near mile marker 138.

Light rain was falling at the time of the crash; earlier in the day, bands of moderate-to-heavy rain had been reported along I-65. The highway surface was wet. Video footage captured from a forward-facing camera on the 2020 Volvo auto-transporter indicated that the rain and spray from the vehicle tires on the wet road reduced visibility.

1.2 Event Sequence

This investigation focuses on 10 passenger vehicles and 2 commercial trucks (see table 1) and does not include additional vehicles involved in other crashes before and after this crash sequence.[2] Three of the vehicles are considered to be striking vehicles that came upon the traffic queue and struck vehicles in the queue. The precrash locations of two vehicles are unknown.

Table 1. Vehicles involved in crash sequence, with abbreviated name used in report text for each vehicle.

Striking Vehicles	
2020 Ford Explorer sport utility vehicle	Ford Explorer
2005 Freightliner Cascadia with 2009 Wabash National Corporation van trailer	Freightliner truck
2020 Volvo truck-tractor with 2020 Cottrell auto-trailer	Volvo auto-transporter
Vehicles in Queue	
2017 Ford F-350 transit van	Ford F-350 transit van
2017 Volkswagen (VW) Passat	VW Passat
2019 Ford F-150 King Ranch Crew Cab	Ford F-150
2021 Chrysler Pacifica	Chrysler Pacifica
2020 Acura TLX	Acura TLX
2017 Buick Lacrosse	Buick Lacrosse
2017 Kia Sedona	Kia Sedona
Vehicles with Unknown Precrash Locations	
2016 Ram 1500	Ram 1500
2017 Toyota Camry	Toyota Camry

As the Ford Explorer and the Volvo auto-transporter were traveling across the bridge, several other vehicles ahead of them at the northbound end of the bridge were slowing, were already stopped, or had been involved in minor collisions, creating a

[2] See the Technical Reconstruction Group Factual Report in the public docket for this NTSB investigation (case no. HWY21MH009) for a summary of events that occurred before the crash.

traffic queue.[3] In the right northbound lane, a Buick Lacrosse was stopped; behind the Buick was a Chrysler Pacifica that struck the rear of the Buick at a vehicle-recorded speed of 30 mph. An Acura TLX was traveling behind the Chrysler Pacifica, and it came to a stop. In the left northbound lane, a Volkswagen (VW) Passat was stopped next to the Buick Lacrosse. Ahead of the VW Passat was a Kia Sedona, a Ford F-150, and a Ford F-350 transit van. The exact precrash locations of the Ram 1500 and the Toyota Camry could not be determined but, based on their positions at final rest, they were likely further north on I-65.

About 5 seconds before a recorded impact, the Ford Explorer was traveling in the northbound left lane of I-65, approaching the bridge at a recorded speed of 81.5 mph, and the Volvo auto-transporter was traveling in the right lane. After passing the Volvo auto-transporter, the Ford Explorer slowed to about 77 mph; the calculated speed of the Volvo auto-transporter was 72(±2.3) mph. The Ford Explorer continued to decrease its speed, and its driver steered it into the right lane ahead of the Volvo auto-transporter.

About 1.5 seconds after moving into the right lane, the Ford Explorer struck the Acura TLX at an estimated speed 27–30 mph. When the Ford Explorer collided with the rear of the Acura, the Acura was pushed into the Chrysler Pacifica, which in turn struck the Buick Lacrosse a second time. Figure 4 shows the video footage after the Ford Explorer collided with the Acura TLX but before the Volvo auto-transporter collided with the vehicles. The Volvo auto-transporter's driver braked and steered it toward the left, but it struck the Ford Explorer at the rear corner on the passenger side at a speed of about 51 mph. The Volvo auto-transporter made subsequent contact with the vehicles in the right lane, displacing them as it moved into the left lane.

[3] The speed and time details in the sequence of events have been determined by analysis of a 10-second segment of video footage from a forward-facing camera on the Volvo auto-transporter (5 seconds precrash and 5 seconds postcrash); passenger vehicle-recorded data when accessible; and roadway markings, impressions, and damage. Information from driver and witness interviews was also used to explain the sequence of events. Additional information can be found in section 1.5.1 and the Technical Reconstruction Group Factual Report.

Figure 4. Capture of the video from Volvo auto-transporter's forward-facing camera about 0.5 seconds before collision between Volvo and Ford Explorer.

When the Volvo auto-transporter entered the left lane, it collided with the VW Passat, pushing it into the Kia Sedona and displacing the Kia into the right lane. The VW Passat continued moving toward the Ford F-150, underriding it on the left side. The Volvo auto-transporter continued to move left toward the median.

The Freightliner truck driver, who was traveling in the right lane behind the Volvo auto-transporter, later told investigators that he estimated that he had been traveling at 60 mph, that he had steered from the right lane to the left lane as traffic slowed, and that he had braked to try to control his vehicle.[4] He also said that his truck contacted the bridge rail. The Freightliner truck followed a path similar to the Volvo auto-transporter's into the median. The Freightliner struck the Ford F-350 transit van as it traveled through the median and forced the van into the Volvo auto-transporter.

At final rest (as shown in figure 1), the Ford Explorer, Acura TLX, Chrysler Pacifica, Buick Lacrosse, and Kia Sedona remained on the road in the right lane. The Toyota Camry was off the road beyond the right shoulder. The Volvo auto-transporter's truck-tractor and part of its auto-trailer, the Freightliner and its box trailer, the Ford F-350 transit van, the Ram 1500, the Ford F-150, and the VW Passat were in the earthen median between the north- and southbound lanes at final rest. A portion of the Volvo's (Cottrell) auto-trailer remained in the left lane (see postcrash photograph in figure 5).

[4] The Freightliner's data records were used for monitoring overall vehicle movement but were insufficient for compiling a crash record. The data contained no indication of the Freightliner's speed as it neared the bridge or information as to whether braking was initiated. The last reported speed for the Freightliner was 73 mph about 2 minutes before the crash.

Figure 5. Postcrash witness photograph of crash and fire taken from northbound lanes of I-65 on bridge crossing for Pigeon Creek. (Source: Alabama Law Enforcement Agency [provided to law enforcement by witness], annotated by the NTSB)

1.3 Postcrash Fire

Following the multivehicle collision, a postcrash fire engulfed the six vehicles at final rest in the median. The vehicles sustained extensive fire- and heat-related damage. Witness photographs showed the fire initially burning along the right side of the Freightliner truck; however, neither the exact origin of the fire nor the exact ignition source could be determined due to the extent and severity of the fire damage.

1.4 Injuries and Emergency Response

As a result of the crash and fire, the occupants of the Ford F-350 transit van and Ford Explorer sustained serious and fatal injuries; occupants of the other vehicles sustained either minor or no injuries.[5]

The driver of the Ford F-350 transit van survived but sustained serious injuries. The eight transit van passengers died from thermal and blunt-force trauma injuries. The autopsy reports indicated soot in the airways of all the deceased van passengers. The adult passenger in the front passenger seat and the 9-month-old passenger seated in a rear-facing child restraint on the right side of the Ford Explorer were both in the impact

[5] The injury level for the Acura TLX driver is unknown. She did not receive on-scene treatment.

and intrusion area and were fatally injured. The driver of the Ford Explorer sustained serious injuries and the 5-year-old child seated in a forward-facing child restraint behind the driver had minor injuries.

Within 10 minutes of being notified of the crash, law enforcement, emergency medical services, and fire/rescue services had initiated a response, and units had begun arriving on scene. The Alabama Law Enforcement Agency (ALEA) had primary jurisdiction for the crash and was assisted by several other law enforcement agencies. The Greenville Fire Department was the primary fire/rescue agency and responded with four units. Additional water and tanker support was provided by other agencies.[6] Injured vehicle occupants were transported to three area hospitals by ground ambulance. At 5:24 a.m. on June 20, 2021, the southbound lanes and one northbound lane of I-65 were reopened. The interstate was fully reopened at 3:10 p.m.

1.5 Additional Information

1.5.1 Highway Information

In the area of the collision, the northbound I-65 asphalt travel lanes north of the bridge are about 12 feet wide; the northbound portion of the highway has a 10.5-foot-wide asphalt paved right shoulder and a 4.5-foot-wide asphalt paved left shoulder. The travel lanes on the bridge are 11.5 feet wide, and the roadway is flanked with 2.5-foot-wide shoulders and 31-inch-wide, 11-inch-high concrete curbs on both sides. Fourteen-inch-high reinforced concrete bridge rails are on the left and right sides of the northbound roadway.

To remove storm water from the roadway, numerous scupper drains are located on the bridge, and there are drainage ditches and area drains in the crash location. The roadway grade and cross-slopes were constructed to effectively move water from the roadway to the drainage appliances. At the time of the crash, the roadway was surfaced with a top layer of stone matrix asphalt, which was added in 2014.[7] The results of

[6] ALEA was assisted by more than a dozen agencies and entities in the emergency response. (See the Survival Factors Group Factual Report and Attachments for additional details.)

[7] A stone matrix asphalt surface uses larger aggregate to provide better wearability and a longer service life, while still permitting some water permeability and surface drainage.

postcrash surface friction testing showed that all the friction levels met or exceeded the recommended minimum value.[8]

In the 8 miles preceding the crash location, there were several warning and regulatory signs, including signs reading as follows: "SPEED LIMIT 70," "LIGHTS ON WHEN RAINING," and "BRIDGE MAY ICE IN COLD WEATHER." There were no variable message signs, portable changeable message signs, or highway advisory radio transmitters in this area.

According to Alabama Department of Transportation (ALDOT) crash data for northbound I-65, 100 crashes took place between mile marker 137 and 139 in 2016–2020; of these, 75 (75%) were wet weather crashes. A total of 54 crashes occurred in this same area in 2009–2013; of these, 13 (24%) were wet weather-related.

1.5.2 Vehicle Information

Postcrash examination of the 10 passenger vehicles involved in the crash indicated that the damage was consistent with one or more impacts during the crash sequence (see figure 6 for six passenger vehicles not involved in the postcrash fire).

Figure 6. Passenger vehicles not involved in postcrash fire.

[8] Surface friction tests were conducted in the northbound lanes of I-65 in the vicinity of the crash from milepost 137.53 to 139.04. All the values collected in the postcrash testing met or exceeded the friction number value of 37 for main rural highways as recommended in National Cooperative Highway Research Program 37, *Tentative Skid-Resistance Requirements for Main Rural Highways* (Kummer and Meyer 1967).

The Ford F-350 transit van, VW Passat, Ford F-150, and Ram 1500 sustained severe fire damage (see figure 7).

2017 Ford F-350 transit van

2017 Volkswagen Passat

2019 Ford F-150 King Ranch Crew Cab

2016 Ram 1500

Figure 7. Passenger vehicles involved in postcrash fire.

Postcrash examination of the Volvo auto-transporter and the Freightliner truck indicated that the damage to the two trucks was consistent with frontal impacts and the postcrash fire (see figure 8). Investigators examined all major mechanical systems on the two commercial trucks, including the steering, braking, and suspension systems. They found no evidence that there had been any precrash mechanical problems with either truck.[9] There were no recalls on the trucks that had not been addressed by the carriers.

2020 Volvo truck-tractor with 2020 Cottrell auto-trailer

2005 Freightliner Cascadia with 2009 Wabash National Corporation van trailer

Figure 8. Commercial trucks involved in postcrash fire.

[9] Some areas of the commercial trucks could not be evaluated due to the extensive collision and fire damage they experienced.

An aluminum fuel tank from the passenger (right) side of the truck-tractor of the Volvo auto-transporter was found still attached to the vehicle. The tank had a hole in it measuring about 3 inches by 3 inches (location of hole is circled in yellow in figure 9).[10] The left fuel tank was missing, presumably destroyed in the fire. The fuel tanks from the other vehicles involved in the fire were missing and presumed consumed by the fire, including the Freightliner's two fuel tanks.

Figure 9. Fuel tank from passenger side of Volvo auto-transporter's truck-tractor, showing location of hole (circled in yellow) found in it postcrash.

The postcrash fire consumed the electronic data recorders that had been on four passenger vehicles involved in the crash, as well as the engine control modules from both commercial trucks, all which could have retained electronic data useful for crash reconstruction.[11] Travel speed information was obtained from two of the passenger vehicles not involved in the fire. The data record from the Ford Explorer indicated that the speed of the vehicle 5 seconds before impact was 81.5 mph; the recorded data from the Chrysler Pacifica indicated that it was traveling at 83 mph 5 seconds before its impact with the Buick Lacrosse.[12]

---

[10] The truck-tractor of the Volvo auto-transporter was damaged in the fire, but its auto-trailer was intact, although it was marked by thermal discoloration and soot.

[11] See 49 *Code of Federal Regulations* (*CFR*) Part 563 for additional information on event data recorders.

[12] The modules from three other involved vehicles (Acura TLX, Buick Lacrosse, and Toyota Camry) were imaged, but no travel speed information was reported because they were already stopped or slowing when struck. The module from the Kia Sedona was not imaged.

The Volvo auto-transporter was equipped with a forward (outward)-facing camera, which was part of a telematics system designed to upload video footage and data to a server in response to a trigger event.[13] Using the video footage, NTSB investigators calculated that the Volvo was initially traveling at a speed of 72(±2.3) mph about 5 seconds before impact, and it struck the Ford Explorer while traveling about 51 mph.

Investigators also reviewed the Freightliner's electronic logging telemetry data, including date, time, location, position (latitude/longitude), and speed.[14] The truck's last reported speed was 73 mph, recorded about 2 minutes before the crash. The Freightliner's driver said that he was traveling about 60 mph before the crash.

Neither of the commercial trucks were equipped with collision avoidance systems (also referred to as collision mitigation systems). Data records for the Ford Explorer and the Acura TLX indicated that the vehicles were equipped with collision mitigation systems with braking that were enabled but did not activate during the crash sequence. The Chrysler Pacifica was equipped with a forward collision warning system, but the recorded data indicated that it was "present but not tracking" at the time of the crash.

1.5.3 Striking Vehicle Drivers and Motor Carrier Operation Information

Driver information is provided for the drivers of the three striking vehicles (the Ford Explorer and the two commercial trucks).

Ford Explorer driver. The driver of the Ford Explorer was a 26-year-old female. She had a Tennessee class D license.[15] Police investigators found no signs of impairment from alcohol or other drugs for this driver, and no toxicology tests were performed.[16]

---

[13] Hansen & Adkins Auto Transport, the motor carrier operating the Volvo auto-transporter, had a subscription service with Samsara, a fleet management company. Investigators analyzed the video footage to calculate the vehicle speed to provide data at a more detailed level. Other telematics speed data were updated at longer intervals. See the Greenville Alabama Video Study report in the public docket for this NTSB investigation (case no. HWY21MH009) for more information.

[14] The documents were managed by LB Technology, a fleet services software company based in Memphis, Tennessee, which provides transportation technology systems.

[15] A class D license is required to drive any passenger vehicle with a gross vehicle weight rating of 26,000 pounds or less.

[16] Alabama does not require noncommercial drivers involved in fatal crashes to be tested for alcohol or other drugs unless there is probable cause. NTSB Safety Recommendation H-12-35 calls for states to increase blood alcohol concentration reporting rates for fatally injured drivers and drivers who survive fatal crashes. For the state of Alabama, the recommendation is classified Open—Unacceptable Response.

Volvo auto-transporter driver and Hansen & Adkins Auto Transport. The driver of the Volvo auto-transporter was a 57-year-old male who obtained his first commercial driver's license (CDL) in 2001. His Alabama class A CDL with tank and doubles/triples endorsements and no restrictions was issued in February 2021, and it had an expiration date in February 2025.[17] The driver's medical certificate was issued in March 2021 and was valid for 1 year.[18] His driving record showed no driving violations or crashes for the 10 years before the crash. He worked a regular schedule, beginning work in the early morning (4:30–7:30 a.m.) and ending in the evening (5:00–7:00 p.m.). The driver was in compliance with hours-of-service (HOS) regulations at the time of the crash. The driver said he had slept for 5 hours, 45 minutes on the night before the crash. Cell phone records did not indicate that the driver was texting or talking on his cell phone at the time of the crash. Postcrash toxicological testing, including blood testing by the Alabama Department of Forensic Sciences (ADFS) and the Federal Aviation Administration (FAA) Forensic Sciences Laboratory, found no potentially impairing tested-for substances.[19]

The Volvo driver was employed by Hansen & Adkins Auto Transport (Hansen), an interstate carrier established in 1994. Hansen provides new employee training as well as continuing training to its drivers. Included in the continuing training is a video segment on driving in extreme weather conditions, which the driver completed. As a result of a Federal Motor Carrier Safety Administration (FMCSA) postcrash compliance review of Hansen, the carrier received a Conditional rating, which was updated to a final safety

[17] A class A license allows the holder to operate any combination of motor vehicles with a gross combined weight rating of 26,001 pounds or more, in combination with a trailer in excess of 10,000 pounds, in commerce. A doubles/triple trailer endorsement allows the holder to operate a combination vehicle towing two or three trailers simultaneously; a tank endorsement allows the holder to operate a vehicle designed to carry any liquid or gaseous material within a tank(s) that is permanently or temporarily attached to the vehicle. Restrictions prohibit the operation of certain commercial vehicles.

[18] The maximum duration for a medical certificate is 2 years. This driver was issued a 1-year medical certificate with periodic monitoring required because of high blood pressure and diabetes, which were being treated with prescription medications that generally are not considered impairing.

[19] The ADFS Toxicological Analysis Report listed the tested-for substances as the following: ethanol, acetone, isopropanol, methanol, meth/amphetamine class, barbiturate class, benzodiazepine class, buprenorphine, cannabinoids, carisoprodol/meprobamate, cocaine and/or metabolite(s), cyclobenzaprine, dextromethorphan, fentanyl, methadone, opiates/opioids, phencyclidine (PCP), tramadol, tricyclic antidepressants, and zolpidem. At the request of the NTSB, the FAA Forensic Sciences Laboratory also performed a general drug screen on the remaining portion of the ADFS blood specimen.

rating of Satisfactory, after the carrier submitted a corrective action plan. One of the violations the FMCSA cited was for unsafe driving.[20]

Freightliner driver and Asmat Express. The 41-year-old male driver of the Freightliner combination vehicle held a Georgia class A CDL with no endorsements or restrictions, issued in June 2019 and expiring in September 2022. He obtained his first CDL in 2016. His medical certificate was issued in January 2021 and was valid for 2 years. Driving records and insurance claims showed that the driver had been involved in three crashes in the 10 years before the crash; none were speeding-related. The driver said he usually sleeps in his truck on long-haul trips. In the days preceding the crash, electronic logging reports and cell phone records indicated that the driver had about 9–10 hours per night available for sleep. Although ALEA found that the driver had not accounted for all mileage and had been in violation of driver HOS regulations in the days before the crash, he was not in violation of the HOS regulations on the day of the crash. According to cell phone records, the Freightliner driver was not texting or talking on a cell phone at the time of the crash. Postcrash toxicological testing conducted by ADFS and the FAA Forensic Sciences Laboratory found no potentially impairing tested-for substances for this driver.[21]

The Freightliner driver was employed by Asmat Express (Asmat). Asmat went into business in 2014 as an interstate carrier. The carrier did not offer any training, although it provided drivers with a manual outlining company policies and procedures. An FMCSA postcrash compliance review found several violations, including unsafe driving and failure to operate at a reasonable and prudent speed.[22] The compliance review resulted in an Unsatisfactory rating, and the carrier was placed out of service on September 15,

[20] As a result of the Greenville crash, the carrier was found to be in violation of 49 *CFR* 392.2 for operating a commercial motor vehicle not in accordance with the laws, ordinances, and regulations of the jurisdiction in which it is being operated—Unsafe Driving. The violation was of Alabama statute section 32-5A-170, Reasonable and prudent speed: "No person shall drive a vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing."

[21] The ADFS Toxicological Analysis Report listed the tested-for substances as the following: ethanol, acetone, isopropanol, methanol, meth/amphetamine class, barbiturate class, benzodiazepine class, buprenorphine, cannabinoids, carisoprodol/meprobamate, cocaine and/or metabolite(s), cyclobenzaprine, dextromethorphan, fentanyl, methadone, opiates/opioids, phencyclidine (PCP), tramadol, tricyclic antidepressants, and zolpidem. At the request of the NTSB, the FAA Forensic Sciences Laboratory also performed a general drug screen on the remaining portion of the ADFS blood specimen.

[22] As noted with respect to the carrier Hansen, the FMCSA found Asmat to be in violation of 49 *CFR* 392.2—operating a commercial motor vehicle not in accordance with the laws, ordinances, and regulations of the jurisdiction in which it is being operated. As with Hansen, Asmat's violation resulted from the Greenville crash and was of Alabama statute section 32-5A-170, Reasonable and prudent speed.

2021.[23] After the carrier submitted a corrective action plan, the rating was upgraded to Conditional and the out-of-service order was rescinded on October 4, 2021. However, as of April 2023, the carrier had not resumed operations.

2. Analysis

The drivers of the Volvo auto-transporter and the Freightliner truck were properly licensed and held valid medical certificates. At the time of the crash, neither commercial driver was in violation of HOS regulations, there was no evidence of cell phone use, and postcrash toxicological tests for both truck drivers were negative for alcohol and other potentially impairing tested-for substances. Braking and steering maneuvers suggest that both drivers attempted to avoid the collisions precrash. There was no evidence of impairment for the Ford Explorer driver. The data record for the Ford Explorer indicated that it had been steered and braked before the impact with the Acura TLX.

As far as they could be pursued (given fire damage), the postcrash examinations of the Volvo auto-transporter and Freightliner truck did not reveal any preexisting mechanical defects or deficiencies in the major mechanical systems that could have contributed to the crash.

The emergency response was timely and adequate.

2.1 Highway Conditions

At the time of the crash, light rain was falling. The video footage from the Volvo auto-transporter's camera showed spray from the roadway, indicating that it was wet, and the spray reduced visibility for drivers.

The design of northbound I-65 conformed to current design guidance, the surface friction in the area of the collision met recommended minimums for an in-service roadway, and the roadway had adequate drainage.

The ALDOT had identified an increase in the percentage of motor vehicle crashes in the area of the crash when the roadway was wet and, in May 2021 (before this crash), the ALDOT awarded a $2.86 million pavement preservation resurfacing project. The stone matrix asphalt wearing surface was replaced with an open-graded friction course

[23] Motor carriers can be placed out of service for having an Unsatisfactory rating (49 *CFR* 385.13).

(OGFC) on top of a traditional wearing surface.[24] The application of the OGFC layer was begun in July 2021 (after the crash) and completed (except for the bridge ends) in October 2021. For the project, the bridge ends required milling and placement of the OGFC layer (about 100 feet for each bridge end) and was completed, including final striping, in September 2022.[25]

2.2 Vehicle Speed During Inclement Weather

According to the data retrieved from various sources, the Chrysler Pacifica and Ford Explorer were traveling at speeds in excess of 80 mph, above the posted speed limit of 70 mph. The Volvo auto-transporter's travel speed was estimated to be 72(±2.3) mph. Although the Freightliner's speed at the time of the crash is unknown, its last recorded speed was 73 mph, recorded about 2 minutes before the crash. The Freightliner driver recalled that he was traveling at 60 mph at the time of the crash, but this recollection could not be verified.

According to the Federal Highway Administration (FHWA), wet roadways reduce vehicle traction, vehicle maneuverability, and visibility for drivers, all factors which increase crash risk.[26] The FMCSA and the Alabama Law Enforcement Agency provide generalized guidance for driving in wet weather, including adjusting speed as appropriate for road conditions, visibility, and traffic. According to guidance for driving on wet roadways, commercial drivers should (1) reduce speeds by one-third, (2) avoid using engine retarders, (3) increase following distance, and (4) avoid distractions like using a cell phone.[27] AAA suggests that drivers slow down, avoid hard braking, and allow ample stopping distance.[28]

In 2020, 28% of fatal crashes in the United States were speeding-related, and speeding was a factor in more fatal crashes on wet roadways than dry roads (NHTSA

[24] (a) The pavement project covers a 7.2-mile-long segment of I-65 in Butler County between County Road 41 and a point about 1 mile south of the Lowndes County line, including this crash location. (b) An OGFC is a layer of hot-mix asphalt designed to be water-permeable with interconnecting voids that provide improved surface drainage during rainfall events. The better drainage from the application of the OGFC could help decrease the number of wet weather crashes.

[25] The application of the OGFC layer was begun in July 2021, and the project was completed, including final striping, in September 2022.

[26] For more information on driving on wet roads, see FHWA guidance on driving in rain or flooding.

[27] For guidance on driving commercial motor vehicles in inclement weather, see FMCSA tips for commercial vehicle drivers on driving too fast for conditions and the Alabama Law Enforcement Agency's *Alabama Driver Manual*, February 2021 version (chapter 7, "Adjust to Driving Conditions").

[28] For more information, see AAA wet weather driving tips.

2022).[29] According to data from the FMCSA's *Large Truck Crash Causation Study*, an estimated 14% of large truck crashes were weather-related, and 23% occurred when the driver was traveling too fast for conditions (FMCSA 2006).

Excessive speed and unsafe speed for conditions have been cited in the probable causes of several crashes recently investigated by the NTSB (NTSB 2022a, 2022b, and 2023). The NTSB has also conducted a safety study examining the role of speed in passenger car crashes (NTSB 2017a). The NTSB has issued multiple safety recommendations involving various strategies intended to reduce speeding-related crashes, including driver training and education, enforcement activities, highway technology, and vehicle technology (described below). Driver training and education, as well as highway technology, could have been particularly effective strategies in preventing the Greenville crash.

Although Hansen, the carrier operating the Volvo auto-transporter, offered its drivers training on driving during inclement weather, the Freightliner carrier Asmat did not offer any training to its drivers, and the degree of training the passenger car drivers may have had is unknown. The recorded data, video footage, and witness statements suggest that the commercial trucks and passenger vehicles were traveling at speeds too high for the wet roads and reduced visibility, and that some were traveling more than 10 mph above the posted 70-mph speed limit. Previously, the NTSB has recommended that NHTSA collaborate with other traffic safety stakeholders to develop and implement an ongoing program to increase public awareness of speeding as a national traffic safety issue (NTSB 2017a).[30] In June 2022, NHTSA launched the "Speeding Wrecks Lives" campaign, a public education effort to change attitudes toward speeding and its consequences.[31] In its investigation of a bus roadway departure in Pala Mesa, California, the NTSB recommended that guidance be developed for bus drivers operating in inclement weather conditions (NTSB 2022b).[32]

Posted speed limits are maximum speeds set for optimal conditions; they do not take into account less-than-ideal weather conditions, such as rain and wet roads. Highway technology such as variable speed limit signs, which can be dynamically reset to adjust for conditions such as road surface, weather, and traffic volume have been

[29] NHTSA defines a speeding-related crash as one in which any driver was charged with a speeding-related offense or if the police officer indicated that racing, driving too fast for conditions, or exceeding the posted speed limit was a contributing factor in the crash.

[30] See NTSB Safety Recommendation H-17-25.

[31] See NHTSA announcement of Speeding Wrecks Lives campaign for additional information.

[32] See NTSB Safety Recommendation H-22-19.

shown to be an effective countermeasure by "decreasing the risks associated with traveling at speeds that are higher than appropriate for the conditions and by reducing speed variance in traffic" (FHWA 2017). In 2012, the FHWA issued a report on the use of variable speed limit systems in response to a recommendation issued by the NTSB asking that the FHWA issue guidance on the use of variable speed limit signs in wet weather (FHWA 2012).[33] Recent NTSB investigations have found that variable speed limit signs could have mitigated the crash results, and the NTSB has recommended the use of such signs (NTSB 2022a and 2023).[34] Variable speed limit signs have been found to be more effective if automatically enforced (FHWA 2017). The NTSB has previously asked states to authorize the use of speed safety cameras (NTSB 2017a, 2022a, and 2023).[35] Variable speed limit signs and speed safety cameras are highlighted in the FHWA's Proven Safety Countermeasures initiative.[36]

Collision avoidance systems are advanced driver assistance systems that use radar, cameras, and other sensors to monitor a vehicle's environment for potential conflicts, such as slow-moving or stopped vehicles in its lane of travel. When the system detects a potential conflict, it typically sends a warning to the driver, and, if the driver does not respond or brake with sufficient force, the system automatically engages emergency braking. Even if a frontal crash is not avoided, the system's action to reduce vehicle speed will lessen the severity of the crash. Collision avoidance systems, such as automatic emergency braking, may not engage effectively under low visibility conditions, at certain speeds, or if the driver has initiated an evasive maneuver. Neither of the commercial trucks involved in this crash were equipped with collision avoidance systems, and, although collision avoidance systems were enabled on three of the passenger vehicles, they did not engage during the crash sequence, possibly because the drivers had taken evasive action or because the systems did not operate under the prevailing weather conditions. The NTSB has issued several recommendations related to collision avoidance systems (NTSB 2015).[37]

---

[33] See NTSB Safety Recommendation H-05-14.

[34] See NTSB Safety Recommendations H-22-8 and H-23-3.

[35] See NTSB Safety Recommendations H-17-32 and H-22-7.

[36] See FHWA Proven Safety Countermeasures for additional information.

[37] See NTSB Safety Recommendations H-15-5 and -8 and -9.

2.3 Fuel Tank Crashworthiness

The postcrash fire consumed six vehicles and contributed to the fatal injuries of the eight passengers of the Ford F-350 transit van. The initial source of the fuel for the fire was likely from one of the damaged or destroyed commercial truck fuel tanks, given their vulnerability to rupture during a crash. The NTSB has investigated several crashes where the impact damage to fuel tanks on commercial truck-tractors has led to rupture and fire (NTSB 2011, 2015, and 2017b).The NTSB has issued recommendations to SAE International to work with the FMCSA and NHTSA to improve the crashworthiness of side-mounted fuel tanks on truck-tractors to prevent catastrophic tank ruptures and limit post-collision fuel spillage, as well as to develop and promulgate an updated standard (NTSB 2017b).[38]

3. Conclusions

3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the Greenville, Alabama, crash was the unsafe speeds of multiple vehicles during rain, low visibility, and wet road conditions. Contributing to the fatal injuries of the transit van passengers was the postcrash fire.

3.2 Lessons Learned

3.2.1 Safe Speed for Conditions

Driving at speeds above the speed limit or too fast for conditions can have serious consequences, including a loss of vehicle control, increased crash severity, and more severe injuries. Drivers should be knowledgeable about driving in inclement weather and the need to reduce their vehicle speed in response to conditions. The NTSB has identified a need for increased public awareness about the dangers of speeding and driving too fast for inclement weather. The NTSB also has previously issued safety recommendations for highway and vehicle technologies addressing speeding that may prevent or reduce the severity of crashes.

[38] In the St. Marks, Florida, report (NTSB 2017b), the NTSB issued corresponding Safety Recommendations H-17-61 to the FMCSA, H-17-62 to NHTSA, and H-17-65 to SAE International.

3.2.2 Fuel Tank Crashworthiness

Fuel tanks on commercial trucks involved in crashes are susceptible to high impact forces, resulting in ruptures, postcrash fuel spillage, and fire. The NTSB has previously recommended that federal regulators work to improve vehicle safety standards to improve the crashworthiness of side-mounted fuel tanks on truck-tractors.

References

FHWA (Federal Highway Administration). 2012. *Guidelines for the Use of Variable Speed Limit Systems in Wet Weather*. Report FHWA-SA-022. Washington, DC: FHWA. See https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa12022/index.cfm#toc.

_____. 2017. *Synthesis of Variable Speed Limit Signs*. Report FHWA-HOP-17-003. Washington, DC: FHWA. See https://ops.fhwa.dot.gov/publications/fhwahop17003/index.htm.

FMCSA (Federal Motor Carrier Safety Administration). 2006. *Report to Congress on the Large Truck Crash Causation Study*. See https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/ltccs-2006.pdf.

Kummer, H. W. and W. E. Meyer. 1967. *Tentative Skid-Resistance Requirements for Main Rural Highways*. Transportation Research Board.

NHTSA (National Highway Traffic Safety Administration). 2022. *Traffic Safety Facts, 2020 Data, Speeding*. DOT HS 813 320. See https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813320.

NTSB (National Transportation Safety Board). 2011. *Truck-Tractor Semitrailer Median Crossover Collision with 15-Passenger Van, Munfordville, Kentucky, March 26, 2010*. NTSB/HAR-11/02. Washington, DC: NTSB. See https://www.ntsb.gov/investigations/AccidentReports/Reports/HAR1102.pdf.

_____. 2015. *Truck-Tractor Double Trailer Median Crossover Collision With Motorcoach and Postcrash Fire on Interstate 5, Orland, California, April 10, 2014*. NTSB/HAR-15/01. Washington, DC: NTSB. See https://www.ntsb.gov/investigations/AccidentReports/Reports/HAR1501.pdf.

_____. 2017a. *Reducing Speeding-Related Crashes Involving Passenger Vehicles*. NTSB/SS-17/01. Washington, DC: NTSB. https://www.ntsb.gov/safety/safety-studies/Documents/SS1701.pdf.

_____. 2017b. *Agricultural Labor Bus and Truck-Tractor Collision at US-98–SR-363 Intersection Near St. Marks, Florida, July 2, 2016*. NTSB/HAR-17/05. Washington, DC: NTSB. See https://www.ntsb.gov/investigations/AccidentReports/Reports/HAR1705.pdf.

_____. 2022a. *Multivehicle Crash Near Mt. Pleasant Township, Pennsylvania, January 5, 2020.* NTSB/HIR-22/01. Washington, DC: NTSB. See https://www.ntsb.gov/investigations/AccidentReports/Reports/HIR2201.pdf.

_____. 2022b. *Bus Roadway Departure and Rollover, Pala Mesa, California, February 22, 2020*. NTSB/HIR-22/02. Washington, DC: NTSB. See https://www.ntsb.gov/investigations/AccidentReports/Reports/HIR2202.pdf.

_____. 2023. *Multivehicle Crash in Icy Conditions on Interstate 35 West, Fort Worth, Texas, February 11, 2021*. NTSB/HIR-23-01. Washington, DC: NTSB. See https://www.ntsb.gov/investigations/AccidentReports/Reports/HIR2301.pdf.

NTSB investigators worked closely with the following organizations throughout this investigation: **Federal Motor Carrier Safety Administration**, **Alabama Law Enforcement Agency**, **Alabama Department of Transportation**.

National Transportation Safety Board
Records Management Division, CIO-40
490 L'Enfant Plaza, SW
Washington, DC 20594
(800) 877-6799 or (202) 314-6551