National Transportation Safety Board

Washington, DC 20594

Highway Accident Brief

Rear-End Crash Involving Truck-Tractor Semitrailer and Sport Utility Vehicle, Goodland, Kansas, June 29, 2016

Accident Number:	HWY16FH017
Accident Type:	Rear-end crash
Location:	Milepost 30.1, eastbound Interstate 70, Goodland, Sherman County, Kansas
Date and Time:	June 29, 2016, about 2:15 a.m. mountain daylight time (MDT)
Vehicle 1:	2016 Volvo truck-tractor in combination with a 2007 Great Dane semitrailer
Vehicle 2:	2004 Toyota Sequoia sport utility vehicle (SUV)
Fatalities:	6
Injuries:	5

Crash Description

About 2:15 a.m. MDT on Wednesday, June 29, 2016, a 2004 Toyota Sequoia 7-passenger SUV, occupied by a 22-year-old male driver and 10 passengers, was traveling eastbound in the right lane of US Interstate 70 (I-70) approaching milepost 30.1. The SUV was taking the passengers from Houston, Texas, to Los Angeles, California (one passenger was to be dropped off in Denver, Colorado).[1]

During postcrash interviews, SUV passengers stated that, shortly before the crash, the SUV had experienced a mechanical problem that kept it from traveling at highway speeds. None of the passengers recalled looking at the SUV's speedometer, but they speculated that the SUV may have been traveling 35–45 mph immediately before the crash. Some passengers said that the mechanical problem began after the most recent fuel stop, and they speculated that the driver might have purchased the wrong type of fuel or that the fuel had been contaminated.

About the same time that the SUV reached milepost 30, a 2016 Volvo truck-tractor in combination with a 2007 Great Dane semitrailer, operated by Precision Truck Lines Inc. and occupied by a 27-year-old male driver, was traveling eastbound on 1-70 behind the SUV; it was also in the right lane. The truck was transporting a load from Sacramento, California, to Afton, Missouri, and it had departed Sacramento on June 27.

[1] Based on interviews with surviving vehicle occupants, the driver and passengers were undocumented immigrants relocating from Texas to Colorado and California.

The SUV was traveling at a slower speed than the truck, which overtook the SUV and rear-ended it. The truck driver told investigators that, to avoid an imminent collision with the SUV, he took evasive action by applying the brakes and steering to the left. Roadway mark evidence supports that he did take such action when he was about 100 feet away from the SUV. According to data from the truck's engine control module (ECM), the truck was traveling about 75 mph when it struck and overrode the rear of the SUV. (See figures 1 and 2 for location and crash site information.)

The posted maximum and minimum speed limits for this section of I-70 are 75 mph and 40 mph, respectively.

Figure 1. Map of crash location in Kansas.

Figure 2. Aerial view of crash location near milepost 30 eastbound on US-70, indicating area of impact. (Source: Google Earth modified)

After being struck by the truck, the SUV traveled off the south edge of the pavement, rotated clockwise, and overturned, coming to rest on its roof, facing southwest.[2] The truck continued for a short distance on I-70 before coming to a controlled stop on the south shoulder of the eastbound lanes. (See figure 3 for the area of impact and the vehicles' final rest positions.)

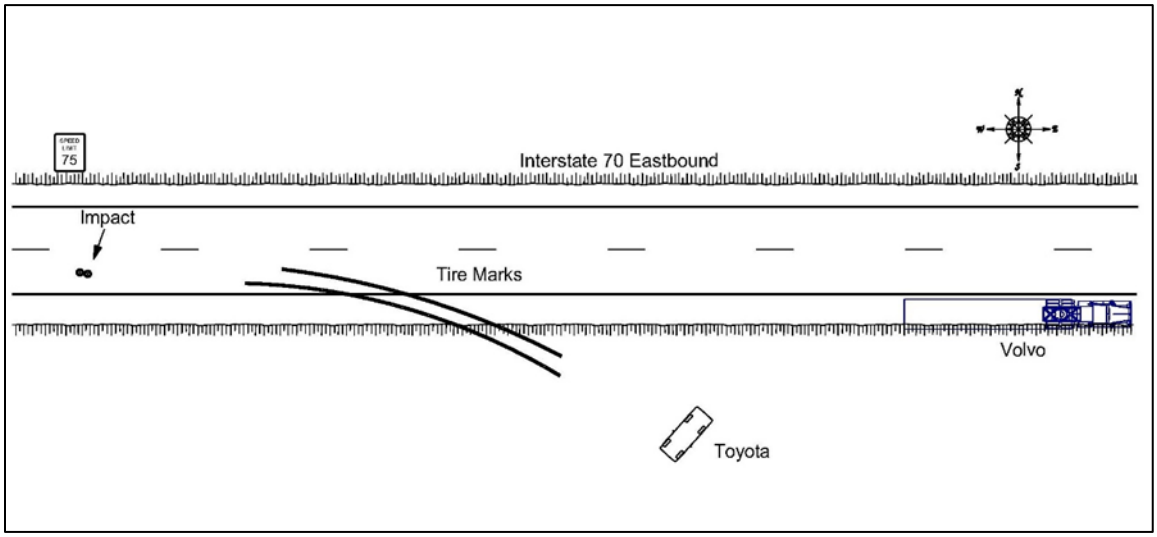

Figure 3. Diagram of collision area showing location of impact, tire marks, and final rest positions of the SUV and the truck.

As a result of the crash, six SUV passengers died and four received serious injuries. The SUV driver was seriously injured, and the truck driver was uninjured.

Highway Information

The crash occurred about 13 miles east of Goodland, Kansas, on I-70 near milepost 30.1. I-70 is a controlled access highway with entrance and exit to the roadway managed by access ramps. In the collision location, I-70 consists of two eastbound and two westbound travel lanes separated by a 47-foot-wide earthen median. The lanes are separated by evenly spaced, broken white pavement stripes. A solid yellow pavement stripe delineates the left travel lane from the paved left shoulder, and a solid white pavement stripe delineates the right travel lane from the paved right shoulder. Both shoulders adjacent to the travel lanes have rumble strips.

The collision location is not illuminated by highway safety lighting or other ambient lighting. At 1:53 a.m. MDT, the National Weather Service recorded the surrounding area as having a temperature of 62°F, with 6 mph winds out of the east. Visibility was 10 miles. It had been raining on the night of the crash, but the rain had stopped about 1 hour before the collision. The roadway surface was still wet at the time of the crash.

[2] The clockwise rotation of the SUV was consistent with the truck's swerving to the left before impact.

Vehicle Damage and Related Information

2004 Toyota SUV

The SUV was extensively damaged. It had contact damage that went across its entire rear and reduced the interior rear occupant space. The rear frame rail was deformed and pushed down and forward, almost to the rear axle. First responders removed both left side doors during extrication efforts at the crash scene. The entire front of the SUV also had contact damage resulting from the overturn sequence. (See figure 4 for a photograph of the SUV postcrash.)

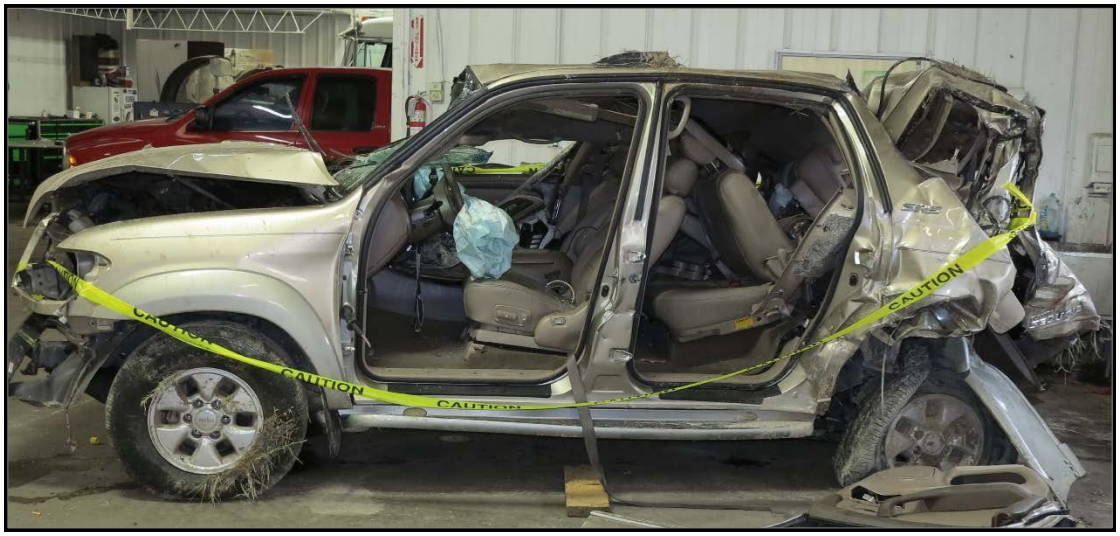

Figure 4. Damaged SUV; photograph taken facing the left side of the vehicle.

The SUV driver's seat was in place and appeared undamaged. The driver's control panel was intact, and the foot pedals were undamaged. During the postcrash inspection, investigators found that the vehicle's headlight switch, which was located on the turn signal stalk, was in the "ON" position. Bulbs from the SUV's tail lights and brake lights were damaged and could not be checked to determine whether they had been illuminated at the time of the collision. When he was interviewed postcrash, the truck driver reported that he had seen the SUV's tail lights immediately before the crash; he did not report seeing flashing hazard lights on the vehicle.

The second row of seats was deformed, pushed forward and downward from the rear. The third row of seats had also been displaced forward and, because of floorboard deformation, the tops of the seats were near the headliner.[3]

All eight seating positions in the SUV were equipped with seat belts. Only the SUV driver and front seat passenger had used the available lap/shoulder belts. (The driver's seat belt had been cut during the extrication process and was found hanging out of the driver's door opening.) Both the driver and front passenger front airbags deployed. The SUV, which was designed to hold 8 occupants, was overloaded with 11 occupants, which meant that, although seat belts were available in the rear passenger seating positions, too many people were crowded into some

[3] A headliner is protective material that is glued (or otherwise adhered) to the inside roof of an enclosed vehicle.

locations to permit use of the belts. In summary, the rear seat passengers of the SUV either did not have seat belts available at their positions or were not wearing the available seat belts.

Most major mechanical systems were severely damaged in the collision; consequently, investigators were unable to corroborate passengers' reports of a mechanical problem keeping the SUV from traveling at highway speeds. Because some SUV passengers stated that the mechanical problem had begun at their last fuel stop, investigators took a sample from the SUV fuel tank to determine whether the fuel was the correct type and to evaluate it for possible water contamination. Testing performed by the National Transportation Safety Board (NTSB) Materials Laboratory confirmed that the fuel was gasoline with 0.43 percent of water per weight, which is within the regulatory allowable level of 1 percent.

2016 Volvo Truck

The entire front end of the truck-tractor sustained contact damage. No damage or intrusion affected the truck's passenger compartment. All driver controls were intact and undamaged. The semitrailer was not damaged in the collision. (See figure 5 for a postcrash photograph of the truck-tractor.)

Figure 5. Damage to the right front of the truck-tractor.

During their postcrash inspection of the truck, NTSB and Kansas Highway Patrol investigators found no preexisting mechanical issues that might have caused or contributed to the collision. Although the driver's seat was equipped with a lap/shoulder belt, investigators could not determine from on-scene evidence whether the driver had been wearing it at the time of the crash.

The truck was equipped with an ECM, which is an electronic engine control and data storage system. The ECM interfaces with onboard sensors that monitor and control engine performance. Data retrieved from the ECM indicated that the cruise control was engaged and set at 75 mph when the crash took place.

Truck Motor Carrier

Precision Truck Lines Inc. was an authorized interstate carrier with the US Department of Transportation number 1817667. The carrier had entered the Federal Motor Carrier Safety Administration (FMCSA) New Entrant program in October 2008.[4] It underwent a safety audit in August 2009, which resulted in a passing score, and the carrier successfully completed the New Entrant program in April 2010. Because it had an alert in the "unsafe driving" category of the FMCSA Behavior Analysis and Safety Improvement Categories (BASICs), the carrier had a focused (non-rated) compliance review in June 2012.[5] Following the Goodland crash, the FMCSA performed a postcrash compliance review of the carrier and gave it an unsatisfactory rating. Precision Truck Lines did not improve its rating, and the FMCSA subsequently placed it out of service for the period from September 11 to November 16, 2016, and imposed a fine. The carrier was then placed in a Motor Carrier Safety Improvement Process and issued a conditional rating until February 6, 2017, at which time the carrier's operating authority was revoked due to a canceled insurance policy.

Human Performance

SUV Driver

NTSB investigators were unable to determine whether the 22-year-old male driver had a driver's license.[6] During his postcrash admission to the hospital, the driver's urine sample was screened and found positive for methamphetamines and cocaine; however, the hospital had no residual sample available for confirmatory tests. Due to the driver's medical condition, the Kansas Highway Patrol was unable to obtain additional toxicology samples. The driver left the hospital before being discharged and without the knowledge of hospital staff. The driver was not interviewed before his unapproved departure from the hospital.

[4] This program consists of an 18-month safety-monitoring interval for all new entrant carriers, during which the FMCSA conducts a safety audit of the carrier and evaluates its accident and roadside inspection data. According to the FMCSA, the safety audit should cover the following areas: driver qualifications, driver duty status, vehicle maintenance, accident register, and controlled substance and alcohol use testing requirements. If the FMCSA identifies deficiencies during the audit, the carrier must provide evidence that it is correcting the faults.

[5] (a) An alert in the BASICs indicates that a carrier has exceeded the allowable threshold in a category. (b) A focused review is typically referred to as a "non-rated" or "non-ratable review." During these types of reviews, the carrier may not receive a satisfactory rating, but its rating can be changed from satisfactory to conditional or unsatisfactory.

[6] Investigators conducted a 50-state check for a driver's license but could not find one. It is unknown whether the name and/or birth date information that the undocumented immigrant driver provided to investigators was incorrect or whether he was unlicensed.

Truck Driver

Background

At the time of the crash, the 27-year-old truck driver had a class A commercial driver's license that had been issued by the state of California in March 2015. The license showed no restrictions, and it had endorsements for double and triple trailers, combination tanks, and hazardous materials. The truck driver had been operating commercial motor vehicles for 3 years. He had been hired by Precision Truck Lines in June 2016 and was engaged in his second trip for the company when the crash occurred. In addition to working for Precision Truck Lines, he worked for a moving company, Lugg.com.[7] He had been employed as a driver for Lugg.com since January 2016.

During a postcrash interview, the truck driver reported that he was in good health and not under a doctor's care. The truck driver's most recent medical fitness examination (US Department of Transportation physical) took place in March 2016. He received a medical certificate valid for 2 years from the date of the examination.

While performing their initial investigation, Kansas Highway Patrol officers did not observe or detect in the driver any signs of alcohol or drug impairment. The driver reported that he was not taking any prescription or over-the-counter medications. The driver submitted a blood sample for toxicological testing, which was analyzed by the Kansas Bureau of Investigation. The test results were negative for alcohol and other drugs.[8]

Investigators examined the truck driver's cell phone records. Data showed that, although the driver had used his cell phone several times while the vehicle was in motion, he was not talking or texting at or near the time of the crash.

The truck driver was required to maintain a record-of-duty status or logbook.[9] Investigators compared time-stamped supporting documents from the crash trip and other available sources, such as the truck's "Pre-pass" toll/scale transponder, to the logbook and found that more than half of the logbook entries were inconsistent with the other documentation.

Perception

Because this crash occurred during nighttime hours and at a time when few vehicles were using the highway, the visual information available to the driver was less than he would have had during daylight hours. Although the rear of the SUV was illuminated by tail lights, these sources of light, at a distance and without additional cues, might have made it difficult for the truck driver to recognize that the SUV was moving significantly slower than his truck. In a postcrash interview, the truck driver stated that he did not observe the SUV's tail lights until he was about 100 feet

[7] Lugg.com is an internet-based, on-demand moving company that provides services through a mobile application. The company provides moving services for the greater San Francisco Bay area, San Jose, Palo Alto, and Silicon Valley in California. Company drivers provide their own vehicles and are paid electronically at a fixed rate.

[8] The analysis for ethyl alcohol showed a result of 0.00 grams per 100 milliliters of blood. The analysis for other drugs included, but was not limited to, barbiturates, benzodiazepines, cannabinoids, cocaine metabolites, methamphetamine, opiates, and phencyclidine.

[9] Title 49 *Code of Federal Regulations* 395.8 requires motor carriers to ensure that each driver maintains a daily record-of-duty status detailing the hours driven and the hours spent off duty.

behind the vehicle. He also stated that he could not determine whether the SUV was stopped in the travel lane or traveling at an excessively slow speed. The truck driver's statement indicates that he was having trouble judging his approach to the SUV but, given that he had sufficient opportunity to observe the vehicle, the question remains as to why he did not notice the SUV until he was nearly upon it.

Fatigue

Investigators considered whether fatigue might account for the truck driver's failure to notice the SUV sooner. Lapses in vigilance can result when a driver is fatigued due to chronic or acute sleep loss, excessive time awake, or circadian factors that result from a nondiurnal sleep/wake schedule.

In the week before the crash, the driver had primarily worked a daytime schedule for Lugg.com; he reported that he slept at night for that period. The driver said that on June 26, he went to bed between 8:00 and 9:00 p.m. and awoke at 7:00 a.m., which would have provided a 10- to 11-hour opportunity for sleep.

On June 27, the driver began the trip for Precision Truck Lines at the company's Sacramento terminal. Only a few documents were available to reconstruct the driver's activities from the time he started the trip until the crash occurred on June 29; however, there is evidence that the driver inverted his sleep/wake schedule during the trip. For example, based on the arrival time of the truck's previous load at the Sacramento terminal, the truck driver could not have begun his trip from this terminal before 6:30 p.m. Pacific daylight time (PDT) on June 27. A time-stamped fuel receipt from a facility in Carlin, Nevada, documented that the truck driver purchased fuel there at 3:50 a.m. PDT, June 28. The 405-mile-long driving distance from Sacramento to Carlin would have required at least 7 hours to complete, indicating that the truck driver was awake and driving during most of this nighttime period, a time during which he would normally have been asleep in the preceding days.

After departing Carlin, the driver then traveled about 957 miles within the 21.5-hour-long period before the crash occurred. Given this distance, the trip would have required at least 16.5 hours to complete; therefore, the driver's maximum opportunity for rest during this period would have been about 5 hours.

The driver's actual sleep time within this timeframe would necessarily have been shorter than the 5-hour opportunity indicated, because he would also have had to use some of the available 5 hours for other nondriving activities, such as eating and personal hygiene. Moreover, it might have been difficult for the driver to obtain quality sleep during the day, due to his recent inversion from a daytime to a nighttime driving schedule. Finally, the time of day when the crash occurred—2:15 a.m. MDT—is within a period during which the driver had typically slept, and during which humans are predisposed to performance decrements.[10]

In summary, although investigators were unable to obtain complete information about the truck driver's sleep/wake history immediately preceding the crash, his recent schedule inversion,

[10] H.P.A. Van Dongen and D. F. Dinges, "Circadian Rhythms in Sleepiness, Alertness, and Performance," in M. H. Kryger, T. Roth, and W. C. Dement (eds.), *Principles and Practice of Sleep Medicine*, 4th ed. (Philadelphia, Pennsylvania: Elsevier, 2005).

the relatively short window of opportunity for sleep during the trip, and the early morning time at which the crash occurred, are indicators that he was likely to have been fatigued at the time of the crash. The truck driver's delay in responding to the slow-moving SUV until he was only about 100 feet behind it is consistent with a fatigue-related lapse in vigilance.

Collision Avoidance Systems

Collision avoidance systems use technologies such as radar, cameras, or a combination of both to monitor and detect vehicles and stationary objects that come within the system's prescribed range. When other vehicles or objects come within range, the system notifies the driver with an audible, visual, or combination alert. Some systems are also capable of automatically applying the foundation brakes when they detect an imminent hazard.

The 2016 Volvo truck involved in this crash was prewired for such a system, the Bendix Wingman Fusion. The Wingman Fusion combines several safety systems, including electronic stability control, lane departure warning, following distance and collision warning, and automatic emergency braking. This system is optional equipment for the truck. The motor carrier chose not to buy the system for the truck, and the crash-involved truck was not equipped with any in-vehicle collision avoidance technology. Given the circumstances of this crash, a collision avoidance system, especially one capable of automatically applying the brakes, might have prevented, or at least lessened the severity of, the crash.

For years, the NTSB has been advocating for increased implementation of collision avoidance technologies. Reducing fatigue-related crashes is also a major advocacy issue for the Board. Both items are on the 2017–2018 NTSB Most Wanted List.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the Goodland, Kansas, crash was the truck driver's failure to perceive and take effective action to avoid rear-ending the sport utility vehicle (SUV), due to his fatigue and lack of expectancy to encounter the slow-moving SUV on the highway ahead of him. Contributing to the crash was the SUV driver's decision to continue traveling on the highway at a reduced speed without using his vehicle's flashing hazard lights to make the slow-traveling SUV more conspicuous to other drivers. Contributing to the severity of the SUV passengers' injuries were the SUV's overloaded condition, which resulted in an insufficient number of rear passenger seat belts, and the lack of a collision avoidance system on the truck.

Adopted: March 8, 2018

For additional details about this crash, visit the NTSB public docket at the following link https://dms.ntsb.gov/pubdms and search for NTSB accident ID HWY16FH017.

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