VEHICLE GROUP CHAIRMAN'S FACTUAL REPORT

HWY-09-MH-015

Miami, OK

(15 pages)

NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF HIGHWAY SAFETY
WASHINGTON, DC 20594

VEHICLE GROUP CHAIRMAN'S FACTUAL REPORT

A. ACCIDENT

LOCATION:	Interstate 44 (I-44) East, Will Rogers Turnpike, at Milepost 321.5, in Ottawa County, Oklahoma, approximately 8 miles northeast of Miami, Oklahoma
VEHICLE 1:	2008 Volvo Truck Tractor and 2009 Great Dane Refrigerated Semi-Trailer Combination Unit
OPERATOR:	Associated Wholesale Grocers Inc. of Springfield, Missouri
VEHICLE 2:	2003 Land Rover SUV
VEHICLE 3:	2003 Hyundai Sonata Passenger Car
VEHICLE 4:	2004 Kia Spectra Passenger Car
VEHICLE 5:	2000 Ford Windstar Minivan
VEHICLE 6:	2004 Ford F350 Pickup Truck and 16-foot Livestock Trailer
VEHICLE 7:	2008 Chevrolet Tahoe SUV
DATE:	June 26, 2009
TIME:	Approximately 1:22 p.m. CDT
CASE NR:	HWY-09-MH-015

B. VEHICLE GROUP

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C. ACCIDENT SUMMARY

About 1:13 p.m. CDT on Friday June 26, 2009 an 18-year-old driver operating a 2001 Ford Focus passenger car eastbound on I-44 Will Rogers Turnpike near milepost 321.76 drifted into a parked truck tractor semi-trailer on the right-hand shoulder. After the Ford side-swiped the semi-trailer wheels the driver overcorrected, lost control and struck the concrete median barrier twice, before coming to rest in the roadway and blocking the dual eastbound lanes. Traffic began stopping and a queue developed before passing motorists could push the disabled vehicle to the right-hand shoulder. The queue of stopped and slowing vehicles extended back approximately 1500 feet to milepost 321.5.

Meanwhile, a 76-year-old truck driver operating a 2008 Volvo truck tractor and a 2009 Great Dane refrigerated semi-trailer was traveling eastbound in the outside lane. The combination unit had crested a vertical curve down a 2.75 percent grade toward the stopped traffic, approximately 1,735 feet away. Witnesses stated the combination unit was traveling about 70 mph in the posted 75 mph zone, did not brake to slow down and collided into the rear of the stopped and slow moving traffic. This accident occurred at 1:16 p.m. CDT or about three minutes after the first accident.

At initial impact, the combination unit struck a 2003 Land Rover SUV, pushing it forward into a 2003 Hyundai Sonata passenger car; the Land Rover continued off to the right where it came to rest on the right-hand grassy right-of-way. The combination unit continued forward approximately 42 feet and collided into the Hyundai, overriding it and pushing it forward about 29 feet to where the combination unit then struck and overrode a 2004 Kia Spectra passenger car. The combination unit and the two passenger vehicles continued forward into the rear of a 2000 Ford Windstar minivan, which was also partially overridden by the combination unit. The Ford minivan was pushed forward into the rear of a 16-foot livestock trailer (loaded

with 10 head of sheep) being towed by a 2004 F350 pickup truck. The F350 pickup truck was then pushed forward into a 2008 Chevrolet Tahoe. The combination unit came to final rest on top of the Hyundai, Kia, and a portion of the Ford minivan. From the initial impact to final rest, the combination unit traveled approximately 270 feet, leaving gouges and friction tire marks on the pavement.

At the time of the accident the weather was clear and the pavement was dry.

As a result of the collision, 10 occupants in the passenger vehicles were fatally injured; nine passengers were fatally injured at the crash site and one passenger died at an area hospital and four passengers received minor to serious injuries. The driver of the combination unit received serious injuries. Four of the passenger cars were destroyed from impact. The Ford F350, livestock trailer, and Chevy Tahoe had moderate damage. The Volvo truck tractor sustained extensive damage, and the Great Dane semi-trailer was undamaged.

D. VEHICLE INSPECTION

NTSB staff inspected Vehicle #1 at Bob Garner's Garage and Wrecker Service at 7300 S. HWY 137 in Miami, Oklahoma between the dates of June 30 and July 2, 2009. The Oklahoma Highway Patrol also inspected the truck tractor and semi-trailer at the accident location on June 26, 2009, at which time Trooper Bill Overbey conducted the post crash Level 1 commercial vehicle inspection.[1]

Vehicles #2 thru #7 were documented July 1 and 2, 2009 at various locations in the Miami, OK area where they had been towed after the accident. Documentation of these vehicles included general make and model information along with pre-crash vehicle specifications according to Canadian Vehicle Specifications version 2009.1, which are detailed in the sections for each vehicle below.[2] While documenting the accident vehicles, the vehicle that was involved in the initial single vehicle accident, the 2001 Ford Focus, was located at a Miami, OK area salvage lot. The last six digits of the Vehicle Identification Number (VIN) of the Ford Focus were redacted; 1FAFP34351W(- - - - - - -).

1. VEHICLE #1: 2008 Volvo Truck Tractor and 2009 Great Dane Refrigerated Semi-Trailer Combination Unit

1.1. GENERAL INFORMATION

1.1.1. TRUCK TRACTOR:

Manufacturer: Volvo
VIN: 4V4NC9TG18N261165
Date of Manufacture: November 2007
Inspection Sticker: Missouri State 08 and 09, DOT inspection completed 3/09
License Plate: Missouri 52AN9Y
Company DOT#: 00090053

[1] See Vehicle Attachment 1 - Oklahoma Highway Patrol Post Crash Commercial Vehicle Inspection Report
[2] See Vehicle Attachment 2 – Pre-crash Specifications for Vehicles #2 - #7

Odometer: 144,271.8 miles
GVWR[3] (gross vehicle weight rating): 52,000 lbs
Front GAWR[4] (gross axle weight rating): 20,000 lbs
Rear GAWR (both axles): 20,000 lbs
Engine: Cummins ISX 385 Horsepower Diesel
Transmission: Eaton Fuller 10-Speed Automatic
The truck tractor was equipped with an anti-lock braking system (ABS) with electronic stability control (ESC) by Knorr Bremse/Bendix

1.1.2. SEMI-TRAILER:
Manufacturer: Great Dane
VIN: 1GRAA062X9W703213
Date of Manufacture: October 2008
Inspection Sticker: DOT inspection completed 4/09
License Plate: Missouri 1584PB
GVWR: 68,000 lbs
GAWR (both rear axles): 20,000 lbs
ABS by WABCO

1.2. DAMAGE DESCRIPTION

The truck tractor sustained frontal damage, more so to the right than to the left.[5] The fiberglass hood and front bumper were partially torn from the front of the truck tractor, remaining attached just at the far left corner. The body of the truck tractor was shifted to the right, with right side damage to the front of the frame. Oklahoma Highway Patrol informed staff that damage between the rear of the truck tractor cab and the front of the semi-trailer on the left side was caused by the tow truck boom, while moving the vehicle after the accident. Remaining damage to the truck tractor was to the undercarriage, mostly in the area of the 2nd axle. This damage included gouges and scrapes to the driveshaft, 2nd axle housing, and bent 2nd axle brake components causing the 2nd axle brake chambers to be out of alignment with the axle. Additionally, the right side saddle fuel tank was damaged at its underside causing separation and a hole at its rearward seam and loss of all fuel in that tank. The semi-trailer was undamaged.

The interior of the truck tractor was also examined. The frontal air bag located in the steering wheel was not deployed. The cruise control selector on the lever to the left of the steering wheel was found in the "ON" position. At the time of inspection the windows were found to be rolled up.[6] At the time of the accident the outside temperature was just over 100 degrees Fahrenheit. Three ventilation controls to the right of the steering wheel indicated that the temperature was set to cold; the fan was set to a medium strength; and the fan was set to blow

[3] Gross vehicle weight rating is the maximum allowable total weight of a vehicle when loaded, including the weight of the vehicle itself plus fuel, passengers, and cargo
[4] Gross axle weight rating is the maximum distributed weight that can be supported by a given axle
[5] See VEH Photos 01 thru 04
[6] Police photographs show that the driver side window appears to be rolled down while it was at the accident scene; it is not known if the driver side window was rolled down at the time of the accident.

at both upper and lower vents. It could not be determined by looking at the air conditioning On/Off button if the air conditioning was on or off at the time of the accident.

1.3. TIRES AND WHEELS

Recommendations on the placard on the driver's door panel of the truck tractor suggest 295/75R22.5 tires mounted on 22.5X8.25 rims, to be inflated at 110 pounds per square inch (psi) for all axles. Recommendations on the placard on the front of the semi-trailer suggest 295/75R22.5 tires mounted on 22.5X8.25 rims, to be inflated at 110 psi for both axles. **Table 1** below includes the tire and wheel information documented on the accident vehicle at the time of inspection. Tread depth measurements were taken in at least 3 locations in the tread grooves of a given tire, the lowest of which is entered in the table below and represents a minimum tread depth for each tire. The minimum tread depth prescribed by the Federal Motor Carrier Safety Regulations is 4/32 inch for the front axle (also referred to as the 1st axle, or steer axle) and 2/32 inch for all rearward axles.[7]

The right tire on the steer axle was damaged and flat upon inspection. The right outside tire on the 2nd axle was also flat and had a broken valve stem. Both dual tires on the right side of the 2nd axle had large flattened areas in the tread. The tread of both dual tires on the right side of the 3rd axle appeared to have been melted or overheated; the tread area had softened and contained absorbed dirt and rock.

The 275/80R22.5 size tires found on the truck tractor varied slightly from the recommended tire size of 295/75R22.5.[8] The Director of Transportation at Associated Wholesale Grocers informed staff that this tire size variance was due to the truck tractor being originally equipped with Bridgestone tires; however the company prefers to use Michelin tires as their standard fleet tire. The Michelin tires that they use are all size 275/80R22.5 tires. The Michelin tires carried the same recommended load rating of G.

[7] Title 49 of the United States Code of Federal Regulations part 393.75

[8] 275/R8022.5 refers to a tire that has a section width of 275 mm and a section height that is 80 percent the section width, or 220 mm. 295/75R22.5 refers to a tire that has a section width of 295 mm and a section height that is 75 percent the section width, or 221 ¼ mm. 22.5 at the end of the tire size refers to the diameter of the wheel rim in inches.

Table 1: Vehicle 1 Tire Information

	Left Steer Axle		**Right Steer Axle**	
Tire Make	MichelinXZE2		MichelinXZE2	
Tire Size	275/80R22.5		275/80R22.5	
Load Rating	G		G	
Pressure	98 psi		-flat-	
Tread Depth	15/32 inch		10/32 inch	
2nd Axle	**Left**		**Right**	
	Outside	Inside	Inside	Outside
Tire Make	Michelin XDN2	Michelin XDN2	Michelin XDN2	Michelin XDN2
Tire Size	275/80R22.5	275/80R22.5	275/80R22.5	275/80R22.5
Load Rating	G	G	G	G
Pressure	100 psi	100 psi	104 psi	-flat-
Tread Depth	14/32 inch	14/32 inch	15/32 inch	15/32 inch
3rd Axle	**Left**		**Right**	
	Outside	Inside	Inside	Outside
Tire Make	Michelin XDN2	Michelin XDN2	Michelin XDN2	Michelin XDN2
Tire Size	275/80R22.5	275/80R22.5	275/80R22.5	275/80R22.5
Load Rating	G	G	G	G
Pressure	96 psi	98 psi	100 psi	98 psi
Tread Depth	12/32 inch	15/32 inch	17/32 inch	18/32 inch
4th Axle	**Left**		**Right**	
	Outside	Inside	Inside	Outside
Tire Make	Bridgestone R195	Bridgestone R195	Bridgestone R195	Bridgestone R195
Tire Size	295/75R22.5	295/75R22.5	295/75R22.5	295/75R22.5
Load Rating	G	G	G	G
Pressure	106 psi	104 psi	104 psi	105 psi
Tread Depth	9/32 inch	9/32 inch	9/32 inch	9/32 inch
5th Axle	**Left**		**Right**	
	Outside	Inside	Inside	Outside
Tire Make	Bridgestone R195	Bridgestone R195	Bridgestone R195	Bridgestone R195
Tire Size	295/75R22.5	295/75R22.5	295/75R22.5	295/75R22.5
Load Rating	G	G	G	G
Pressure	106 psi	106 psi	106 psi	80 psi
Tread Depth	8/32 inch	8/32 inch	7/32 inch	8/32 inch

1.4. WEIGHT AND MEASURESMENTS

Oklahoma Highway Patrol weighed the truck tractor and semi-trailer using certified portable scales on-scene after rescue and recovery operations were completed. The reported individual axle weights are shown in **Table 2** below. Due to the damage and weight shift as a result of the accident these measurements do not represent the exact axle weights at the time of the accident.

Table 2 – Measured Axle Weight (in pounds)

	Weight	
	Left	Right
Steer Axle	5,600	1,300
2nd Axle	2,900	11,100
3rd Axle	3,500	2,100
4th Axle	3,600	3,400
5th Axle	3,400	3,500
Total	**40,400 lbs**	

NTSB staff took the following measurements of the truck tractor and semi-trailer at the inspection location:

- Truck tractor Wheelbase (center 1st axle to center 3rd axle): Left side - 204 inches
- Truck tractor Wheelbase (center 1st axle to center 3rd axle): Right side - 174 inches
- Truck tractor Axle Spacing (center 2nd axle to center 3rd axle): 52 inches
- Semi-trailer Axle Spacing (center 4th axle to center 5th axle): 50 inches
- Trackwidth for Axles 2 and 3 (between center of duals): 71 ½ inches
- Trackwidth for Axles 4 and 5 (between center of duals): 77 ½ inches

The rolling radius of each tire was measured. This measurement is from the center of wheel rotation to the ground. Due to the damage to the front and right of the truck tractor these measurements do not represent the conditions at the time of the accident. **Table 3** below lists the measurements found.

Table 3 – Rolling Radius (in inches)

	Left	Right
1st Axle (Steer)	19 ½	13 ½
2nd Axle	19 ½	18 ½
3rd Axle	19 ½	19 ½
4th Axle	19	19
5th Axle	19	19

1.5. STEERING

The steering wheel of the Volvo truck tractor was equipped with an airbag, which was not deployed. The steering wheel was undamaged, remained concentric, and would rotate approximately 5-degrees in each direction. Movement of the steering wheel transcended into the upper steering shaft, to the steering input arm into the steering gear box, causing that shaft to move slightly back and forth. No further movement was possible and no movement of the pitman arm or lower steering linkage past the steering gear box was noted. The steering linkage was damaged in multiple locations at the center of the steer axle under the truck tractor, and to the right side of the steer axle. The steering gear box was manufactured by TRW, Inc. and displayed a part number of 7101 II 1 THP605299.

1.6. BRAKING

The truck tractor semi-trailer combination unit was equipped with a pneumatic brake system. Both the 2008 model year truck tractor and the 2009 model year semi-trailer were equipped with anti-lock braking systems (ABS). Additionally, the truck tractor was equipped with Electronic Stability Control (ESC), see additional information on safety technologies in Section 1.9 below.

1.6.1. TRUCK TRACTOR BRAKES

Due to the extent of the accident damage to the undercarriage and front of the truck tractor, air pressure gauges, valves, and hoses in that area were not available to pressurize and deliver appropriate air pressure to the brake system for push rod stroke measurement and testing of the air brake system. The spring brakes (or parking brakes) of the brake chambers on the 2nd and 3rd axles had been caged at the accident scene so that the truck tractor could be moved.[9] Upon inspection the caging bolts were still in the brake chambers on the 2nd and 3rd axles. The brake chambers on the 2nd axle were bent so that the pushrods were no longer in alignment with the axle and no measurements of the pushrods could be taken.

The brake chambers on the steer axle and 3rd axle were plumbed into individually with 100 psi of air pressure to measure the push rod stroke.[10] The pushrod was first marked, and then the brakes were applied using 100 psi to the service side of the brakes while the spring side of the brake chamber remained caged. The length the pushrod travel is recorded as push rod stroke in **Table 4** below.

1.6.2. SEMI-TRAILER BRAKES

The semi-trailer brakes were undamaged. Push rod measurements were taken at the accident scene by the Oklahoma Highway Patrol using air pressure from a commercial vehicle

[9] In the absence of air pressure the parking brake spring is allowed to expand, applying the brakes under spring force. Under normal operation air pressure is supplied to the parking brake side of a pneumatic brake chamber to compress the parking brake spring and release the brakes prior to the vehicle being set in motion. Caging refers to the compression of the parking brake spring using a bolt and nut to retract the spring and release the brakes.
[10] The auxiliary air compressor that as used had a gauge of 100 psi and no limiting value, so 100 psi was used.

tow truck to release and apply the brakes at an estimated 100 psi.[11] The length the pushrod travel between released and applied is recorded as push rod stroke in **Table 4** below.

Table 4 also contains information on the type of brakes, type of slack adjusters, and brake adjustment limits for the truck tractor semi-trailer combination unit. The semi-trailer was equipped with long stroke brake chambers, noted with an "L" below.

Table 4 – Brake Adjustment

	Brake Type	Slack Adjusters	Push Rod Stoke (inches)	Adjustment Limit[12] (inches)
L Steer Axle	20	5 ½ inch Automatic	1 ¼	1 ¾
R Steer Axle	20	5 ½ inch Automatic	1 ½	1 ¾
L 2nd Axle	30/30	5 ½ inch Automatic	N/A	2
R 2nd Axle	30/30	5 ½ inch Automatic	N/A	2
L 3rd Axle	30/30	5 ½ inch Automatic	1 5/8	2
R 3rd Axle	30/30	5 ½ inch Automatic	1 3/8	2
L 4th Axle	30/30 L	5 ½ inch Automatic	1 5/8	2 ½
R 4th Axle	30/30 L	5 ½ inch Automatic	1 3/8	2 ½
L 5th Axle	30/30 L	5 ½ inch Automatic	1 ½	2 ½
R 5th Axle	30/30 L	5 ½ inch Automatic	1 3/8	2 ½

1.7. MAINTENANCE HISTORY

Associated Wholesale Grocers has an in-house maintenance facility at their terminal in Springfield, Missouri where the approximate 100 power units (truck tractors) and associated semi-trailers domiciled there are maintained by company mechanics. Truck tractors are on a service inspection program where they are inspected and serviced by mechanics every 13,500 miles and the semi-trailers are inspected and serviced every 4 months.

Maintenance records for the truck tractor and semi-trailer were obtained from the motor carrier. Pre-trip Daily Vehicle Inspection Reports (DVIRs) that had been completed for the accident truck tractor and semi-trailer were also obtained from the motor carrier. Annual DOT inspections had been completed on the truck tractor and semi-trailer in March and April of 2009, respectively.[13]

The maintenance records indicated that the accident truck tractor had last been serviced on 6/16/2009 when it was in the shop for preventative maintenance and new air filters. The semi-trailer had last been serviced on 4/6/2009 when it was in for its annual DOT inspection.

[11] The same tow service and auxiliary compressor was used for the tractor and trailer brakes.
[12] According to 2009 Commercial Vehicle Safety Alliance North American Standard Out-of-Service Criteria for clamp type pneumatic brakes.
[13] As required by Title 49 of U.S. Code of Federal Regulations Part 396.

1.8. VEHICLE RECORDED EVENT DATA

The 2008 Volvo truck tractor was equipped with a Cummins engine which was electronically controlled by an engine control module, or ECM, which serves as the engine's computer to control fuel injection, timing, idle speed, etc. In some cases the ECM also has the ability to record certain parameters such as engine speed and braking in the event of a sudden deceleration. In order to review the recording capabilities for this engine, the ECM was removed by the Oklahoma Highway Patrol on June 28, 2009. The ECM was then transferred to the NTSB on July 1, 2009 and shipped to NTSB staff in Atlanta, GA to be downloaded. Additionally, inside the cab of the truck tractor was a Cadec computerized log unit with GPS and accident recording capabilities. For further information on the Engine ECM and Cadec data see the Event Data Recorder Group Chairman's Factual Report.

1.9. VEHICLE SAFETY TECHNOLOGIES

1.9.1. Anti-lock Braking Systems (ABS)

The truck tractor and semi-trailer were both equipped with anti-lock braking systems, as required by Federal Motor Vehicle Safety Standards (FMVSS) for all pneumatically braked trucks, buses and trailers manufactured after March of 1998.[14] Anti-lock braking systems are safety systems that monitor wheel speed and modulate the brakes of a vehicle to prevent wheel lock up and increase controllability in the event of emergency braking.

1.9.2. Electronic Stability Control (ESC)

The truck tractor was additionally equipped with an electronic stability control system, which is not required by the FMVSS for vehicles over 10,000 pounds GVWR. However, there is a requirement for ESC in the FMVSS that will be applicable to all passenger vehicles, trucks, and buses with a GVWR of 10,000 pounds or less manufactured after September of 2011.[15] ESC is a safety system that builds onto the ABS of a vehicle by monitoring steering angle against directional acceleration and rotation to help guide the vehicle in direction that the driver intends to steer.

Although ESC is not required by the FMVSS for vehicles over 10,000 pounds GVWR, the National Highway Traffic Safety Administration (NHTSA) has been researching the effectiveness of ESC on heavy vehicles as part of their Crash Avoidance Research Program.[16] This program is conducting tests to understand the performance and limitations of ESC to help estimate potential safety benefits, and ultimately define test maneuvers to be used in objective test requirements if ESC systems were to be required for heavy vehicles.

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[14] Title 49 of the U.S. Code of Federal Regulations Part 571, Standard No. 121

[15] Title 49 of the U.S. Code of Federal Regulations Part 571, Standard No. 126 – Phase-in started with 55 percent production of vehicles with GVWR of 10,000 pounds or less that are manufactured after September 2008.

[16] NHTSA Crash Avoidance Research Homepage – http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.346aef7b3d1b54c5cb6aab30343c44cc/

1.9.3. Collision Warning Systems (CWS)

Another area of NHTSA's Crash Avoidance Research Program for heavy vehicles is collision warning systems, also known as forward collision warning. The truck tractor involved in this accident was not equipped with a CWS, nor was it required to be, as there are currently no safety standards for collision warning systems in any vehicle.

Collision warning systems utilize radar technology and provide audible and visual alerts to warn the driver when other vehicles or stationary objects are within predefined distances or closing speeds in the forward path of the vehicle. Some collision warning systems can actively brake the vehicle when an imminent hazard is detected. Adaptive Cruise Control (ACC) uses the same technology to adjust or disengage conventional cruise control when it is in use. Collision warning systems currently on the market are able to detect and display warnings at a distance of 350 feet, or at following distances up to 3 seconds.[17]

As part of the USDOT's Intelligent Vehicle Initiative, the FHWA sponsored a field operational test involving large trucks to evaluate the viability of rear-end CWS, as well as ACC, and an electronically controlled brake system (ECBS). One hundred new Volvo truck tractors were operated over a 3-year period beginning in 2001; 50 were equipped with a commercially available CWS and another 50 were equipped with the CWS, and an ACC system that used conventional cruise control, Volvo disc brakes, and an ECBS.[18,19]

The FHWA sponsored field operational test showed a 28% reduction in rear-end crashes as a result of the CWS, ACC, and brake systems bundled together and a 21% benefit from the CWS alone. Deployment of the CWS system to the 1.8 million vehicle truck fleet was projected to prevent 4,700 rear-end crashes, 2,500 injuries, and 96 fatalities each year. The field test included a driver survey to evaluate driver acceptance. Most drivers said they believed the technologies made them drive safer and over 80% indicated that they would prefer to drive a truck equipped with a CWS. The major complaint about the CWS was the incidence of false alarms.

NHTSA's Crash Avoidance Research Program also includes the Integrated Vehicle-Based Safety Systems (IVBSS) initiative that addresses forward collision warning, lane

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[17] Eaton VORAD VS-400 Driver Instructions Publication VODR0100, February 2009; Collision warning system provides the driver with both visual and auditory warnings. If a vehicle is detected in the same lane within 350 feet from the radar, but greater than a three second following distance, the driver interface unit will display "Object Detected" in the LCD screen. The driver is alerted with a series of yellow LED indicator lamps at three, two, and one second following distances with the text and warnings displayed on the LCD screen. Audible tones are also introduced when following distance closes to less than two seconds or if the following distance is closing in, warning the driver that the following distance is becoming unsafe. If the headway following distance closes to less than one-half second, or the radar detects slow moving or stopped traffic within 350 feet of the vehicle, the driver will be alerted with the three red LED indicators along with an audible tone. The LCD screen will display "Collision Alert", warning that a collision may occur if the driver does not take immediate action.

[18] U.S. Department of Transportation, *Intelligent Vehicle Initiative Final Report*, FHWA-JPO-05-057 (Washington, DC: USDOT, 2005).

[19] The CWS used in the U.S. Department of Transportation *Intelligent Vehicle Initiative Final Report* was the Eaton VORAD EVT-300.

departure warning, lane change warning, and curve speed warning. According to the Field Operational Test Plan, published in December 2008, 10 commercial trucks will be included in the fleet of vehicles that are being equipped and tested with crash avoidance technology.[20]

Staff has prepared a *Collision Warning Systems Supplemental Information Report*, which is included in the docket for this accident investigation. This report discusses the history of CWS and explains the technology behind the systems that are currently available for heavy truck applications. Details regarding the market for these systems, sales, and cost are also covered, along with a discussion of research, fleet experience, and accident reduction rates.

2. VEHICLE #2: 2003 Land Rover Discovery SUV

VIN: SALTY16463A(- - - - - -)[21]

-- Pre-Crash Specifications --

Curb Weight[22]:	4,565 lbs
Weight Distribution:	47% front / 53% rear
Wheelbase:	100.1 inches
Overall Length:	184 inches
Overall Width:	74.5 inches
Overall Height:	76.4 inches
Front Trackwidth:	61.1 inches
Rear Trackwidth:	60.7 inches

3. VEHICLE#3: 2003 Hyundai Sonata Passenger Car

VIN: KMHWF25S03A(- - - - - -)

-- Pre-Crash Specifications --

Curb Weight:	3,210 lbs
Weight Distribution:	61% front / 39% rear
Wheelbase:	106.4 inches
Overall Length:	187.2 inches
Overall Width:	71.7 inches
Overall Height:	55.6 inches
Front Trackwidth:	61.5 inches
Rear Trackwidth:	60.7 inches

[20]. U.S. Department of Transportation, National Highway Traffic Safety Administration, *Integrated Vehicle-Based Safety System Field Operational Test Plan*, DOT-HS-811-058 (Washington, DC: USDOT, 2008).

[21] Last six digits of personal vehicle VINs have been redacted.

[22] Curb weight is the total weight of a vehicle with all standard equipment, oil, coolant, and fuel, while not loaded with passengers or cargo.

4. VEHICLE#4: 2004 Kia Spectra Passenger Car

VIN: KNAFE121745(- - - - - -)

-- Pre-Crash Specifications --

Curb Weight:	2,655 lbs
Weight Distribution:	63% front / 37% rear
Wheelbase:	100.9 inches
Overall Length:	177.7 inches
Overall Width:	67.8 inches
Overall Height:	55.9 inches
Front Trackwidth:	57.1 inches
Rear Trackwidth:	56.7 inches

5. VEHICLE#5: 2000 Ford Windstar Minivan

VIN: 2FMDA5348YB(- - - - - -)

-- Pre-Crash Specifications --

Curb Weight:	3,725 lbs
Weight Distribution:	59% front / 41% rear
Wheelbase:	121 inches
Overall Length:	200.9 inches
Overall Width:	75.6 inches
Overall Height:	65.8 inches
Front Trackwidth:	64.2 inches
Rear Trackwidth:	63 inches

6. VEHICLE#6: 2004 Ford F350 Pickup Truck and 16-foot Livestock Trailer

VIN: 1FTSW30P64E(- - - - - -)

-- Pre-Crash Specifications --

Curb Weight:	6,127 lbs
Weight Distribution:	59% front / 41% rear
Wheelbase:	172.6 inches
Overall Length:	257.7 inches
Overall Width:	80 inches
Overall Height:	81.2 inches
Front Trackwidth:	68.6 inches
Rear Trackwidth:	68.6 inches

The 16-foot Livestock Trailer was a Featherlite Model 8107; general specifications according to the manufacturer's website are included in Vehicle Attachment 2.

7. VEHICLE#7: 2008 Chevrolet Tahoe SUV

VIN: 1GNFC13J18R(- - - - - -)

-- Pre-Crash Specifications --

Curb Weight:	5,254 lbs
Weight Distribution:	59% front / 41% rear
Wheelbase:	116.2 inches
Overall Length:	202.1 inches
Overall Width:	77.6 inches
Overall Height:	77.2 inches
Front Trackwidth:	68.2 inches
Rear Trackwidth:	66.6 inches

SUMMARY OF ATTACHMENTS:

- Vehicle Attachment 1 – Oklahoma Highway Patrol Post Crash Commercial Vehicle Inspection Report
- Vehicle Attachment 2 – Pre-crash Specifications for Vehicles #2 - #7