VEHICLE FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

MULTIPLE VEHICLE ACCIDENT
Cranbury, NJ

HWY14MH012

(18 pages)

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

VEHICLE FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

A. CRASH INFORMATION

Location:	New Jersey Turnpike (I-95) northbound near milepost 71.4; Cranbury, Middlesex County, New Jersey
Vehicle #1:	2011 Peterbilt truck-tractor in combination with a 2003 Great Dane semitrailer
Operator #1:	Walmart Transportation, LLC
Vehicle #2:	2012 Mercedes-Benz Sprinter limo van
Operator #2:	Atlantic Transportation Services, LLC
Vehicle #3:	2011 Buick Enclave
Vehicle #4:	2011 Ford F-150
Vehicle #5:	2005 Nissan Altima
Vehicle #6:	2006 Freightliner truck-tractor in combination with a 2001 Utility semitrailer
Operator #6:	4 Way Transport, LLC
Date:	June 7, 2014
Time:	Approximately 1:00 a.m. eastern daylight time
NTSB #:	**HWY14MH012**

B. VEHICLE FACTORS GROUP

Jennifer L. Morrison, Vehicle Factors Group Chairman
NTSB, Office of Highway Safety
490 L'Enfant Plaza S.W., Washington, DC 20594

Trooper Robert Kopec
New Jersey State Police, Truck Enforcement Unit
278 Prospect Plains Road, Cranbury, NJ 08512

Mark Bennett
Principal Engineer, Systems and Products
Bendix Commercial Vehicle Systems LLC, Elyria, OH 44035

C. CRASH SUMMARY

For a summary of the crash, refer to the *Crash Summary Report* in the docket for this investigation.

D. DETAILS OF THE VEHICLE FACTORS INVESTIGATION

The Vehicle Factors Group Chairman's Factual Report is a collection of factual information regarding the vehicles involved in this crash. This report focuses on the mechanical condition of the striking vehicle, the 2011 Peterbilt combination unit. This report also includes general details on the mechanical condition of the 2012 Mercedes-Benz Sprinter van, the vehicle in which the fatality occurred. General information on the other four vehicles involved in the accident is also included.

All vehicles were examined between June 11 and 13, 2014, at George's Garage and Towing Inc., located at 2681 Route 130, Cranbury, NJ 08512. Inspections of vehicles 1, 2, and 6 were also completed by Trooper Robert Kopec of the New Jersey State Police.[1]

1. Vehicle 1 – 2011 Peterbilt Combination Unit

1.1. General information

TRUCK-TRACTOR:
Make/Model: 2011 Peterbilt 386 Conventional
VIN:[2] 1XPHD49X6BD■■■■■■
Company Unit #: 02568

Date of Manufacture:	December 2010
GVWR:[3]	50,000 lbs
GAWR (front axle):[4]	12,000 lbs
GAWR (rear axles):	19,000 lbs
Engine:	Cummins ISX15 400ST Diesel
Transmission:	Fuller FRM15210B 10-Speed Manual

Additional equipment and specifications are included in Peterbilt Chassis Final Bill.[5]

SEMITRAILER:
Make/Model: 2003 Great Dane 7311-TP-S Semitrailer
VIN: AA06253D■■■■■■
Company Unit #: 77397

Date of Manufacture:	November 2002
GVWR:	68,000 lbs
GAWR (per axle):	20,000 lbs

[1] See Vehicle Attachment 1 – New Jersey State Police Commercial Driver/Vehicle Examination Reports.
[2] Vehicle Identification Number (VIN).
[3] Gross Vehicle Weight Rating (GVWR) is the total maximum weight that a vehicle is designed to carry when loaded, including the weight of the vehicle itself plus fuel, passengers, and cargo.
[4] Gross Axle Weight Rating (GAWR) is the maximum distributed weight that a given axle is designed to support.
[5] See Vehicle Attachment 2 – 2011 Peterbilt Truck-Tractor Chassis Final Bill.

1.2. Damage Description

The 2011 Peterbilt truck-tractor sustained extensive front end damage, displacing the hood and fenders.[6] The headlights, turn signals, and forward-mounted marker lights were all destroyed in the crash. Both panes of the windshield were extensively cracked. The front end damage pushed the radiator into the engine fan and belts; damage then continued into the front axle steering and suspension systems. The U-bolts were broken off the leaf spring suspension on the right side of the front axle.[7] The suspension components on the left side of the front axle remained connected but were distorted.[8] At the time of inspection, the wheels on the front axle were noted to be at full left rotation and out of alignment with each other. The left front axle wheel was at an approximate 62-degree angle outward from the left side of the truck-tractor and the right front wheel was at an approximate 46-degree angle inward from the right side of the truck-tractor.[9] Steering wheel rotation did not result in movement of the front axle wheels due to damage at the steering input shaft connection into the steering gear box.

The semitrailer was undamaged and empty at the time of the crash. The front left leading edge damage that was present on the semitrailer was noted to be from a previous incident.[10] In addition to the observed damage, the NTSB Evidence Documentation Team mapped the combination unit using a FARO laser scanner, which generated a 3-dimensional model of the damaged vehicle (see **Figure 1**.)

Figure 1. Driver (left) side profile from the 3-dimensional model of the damaged 2011 Peterbilt combinaion unit.

1.3. Weights and Measurements

According to the Peterbilt Chassis Final Bill for the truck-tractor, it had a wheelbase of 228 inches from the center of the front axle to the center of the rear axles and an estimated overall weight of 17,566 lbs. The overall length noted on the side of the semitrailer was 53 feet. Overall dimensions of the combination unit are included in **Figure 1**. Rolling radius measurements averaged 20 inches for all axles.

[6] See Vehicle Photo 1 – Overall photograph of the 2011 Peterbilt combination unit, left front view.
[7] See Vehicle Photo 2 – View of the broken right front axle leaf spring U-bolts on the 2011 Peterbilt truck-tractor.
[8] See Vehicle Photo 3 – View of the left side engine compartment of the 2011 Peterbilt truck-tractor; the distorted leaf springs and U-bolts can be seen below the frame rail toward the bottom of the photograph.
[9] See Vehicle Photo 4 – View from the underside of the 2011 Peterbilt truck-tractor, showing the front axle wheel alignment angles noted during the postcrash inspection (Source: rendered from 3-dimensional vehicle scan).
[10] See Vehicle Photo 5 – Preexisting left front leading edge damage on the 2003 Great Dane semitrailer.

On June 11, 2014, the New Jersey State Police weighed the Peterbilt combination unit using certified portable scales on a level concrete surface in their parking lot at Troop D headquarters. **Table 1** contains the axle weights that were measured.

Table 1. Peterbilt Combination Unit Weight

	Axle	Weight (lbs)	
		Left	Right
Truck	1	5,300	4,900
	2	4,400	3,600
	3	2,500	2,600
Trailer	4	2,200	2,150
	5	2,550	2,400
Total Weight: 32,600 lbs			

1.4. Driver Controls

The interior of the truck-tractor cab provided dash mounted controls to the left and right of the driver's seat and steering wheel. To the left of the steering wheel was the keyed ignition and lighting controls, all of which were found in the off position at the time of inspection.[11] To the right of the steering wheel were a Qualcomm communication unit (detailed further in section 1.11), fifth wheel and air suspension controls, engine brake and cruise control settings, AM/FM radio, climate controls, Bendix display unit, and traction control/anti-lock braking switches.[12] Most of the on-off switches were found in the off position with exception of the cruise control switch, which was in the on (available) position. Cruise control would still have to be set for use while driving. Data contained in the engine's electronic control module (detailed further in section 1.9) indicated that the cruise control was not set and not in use at the time of the crash. The cruise control was also indicated as not set and not in use at the time of the crash, according to data contained in the Bendix Wingman system (detailed further in section 1.10).

Once power was supplied and the key was cycled on, all dash gauges located in front of the steering wheel responded. The odometer displayed 349,873 miles and 487.5 miles for the truck-tractor's overall and trip mileage, respectively. The engine hours display read 7849.6 hours. The fuel gauge was noted to be about ¾ full. Primary and secondary air pressure gauges responded as air was fed into the air tanks from an external compressor. Additionally, the "check engine" indicator light appeared in the dash.[13]

1.5. Tires and Wheels

According to the VIN plate on the inside of the truck-tractor driver door frame, the vehicle was specified to be equipped with 295/75R22.5 tires mounted on 22.5X8.25 rims. The tires were specified to be inflated to 105 psi for the front axle and 85 psi for axles 2 and 3. Tire size and inflation recommendations listed on the semitrailer VIN plate suggested 275/77R22.5 size tires mounted on 22.5X8.25 rims, to be inflated at 100 psi for both trailer axles.

[11] See Vehicle Photo 6 – 2011 Peterbilt truck-tractor driver controls to the left of the steering wheel.
[12] See Vehicle Photo 7 – 2011 Peterbilt truck-tractor driver controls to the right of the steering wheel.
[13] See Vehicle Photo 8 – 2011 Peterbilt truck-tractor center dash gauges at postcrash key-on position.

The tires on axles 2 and 3 were noted as being super single tires, rather than the traditional dual wheel and tire system. The only tire damage noted was to the tread surface of the left front axle tire. The left front axle tire exhibited an area of scuffed tread and an approximately 2-inch-long section of torn center tread about 10 to 45 degrees clockwise from the valve stem. Wheel surface damage and broken lug nut caps where noted on both sides of the front axle.[14] No tire damage was noted on the remaining truck-tractor or semitrailer axles. **Table 2** includes the tire and wheel information documented at the time of inspection.

Table 2. Peterbilt Combination Unit Tire Information

Front Axle	**Left**		**Right**	
Tire Make	Michelin XZA3+ (H)[15]		Michelin XZA3+ (H)	
Tire Size	275/80R22.5		275/80R22.5	
Pressure	98 psi		95 psi	
Tread Depth	10/32 inch		9/32 inch	
Axle 2	**Left**		**Right**	
Tire Make	Michelin XDN2 Super Single (L)		Michelin XDN2 Super Single (L)	
Tire Size	445/50R22.5		445/50R22.5	
Pressure	95 psi		98 psi	
Tread Depth	26/32 inch		26/32 inch	
Axle 3	**Left**		**Right**	
Tire Make	Michelin XDN2 Super Single (L)		Michelin XDN2 Super Single (L)	
Tire Size	445/50R22.5		445/50R22.5	
Pressure	96 psi		96 psi	
Tread Depth	24/32 inch		25/32 inch	
Axle 4	**Left**		**Right**	
	Outside	Inside	Inside	Outside
Tire Make	Bridgestone R195 (G)	Bridgestone R195 (G)	Bridgestone R195 (G)	Bridgestone R195 (G)
Tire Size	295/75R22.5	295/75R22.5	295/75R22.5	295/75R22.5
Pressure	96 psi	96 psi	95 psi	102 psi
Tread Depth	6/32 inch	5/32 inch	6/32 inch	8/32 inch
Axle 5	**Left**		**Right**	
	Outside	Inside	Inside	Outside
Tire Make	Bridgestone R197 (G)	Bridgestone R197 (G)	Bridgestone R197 (G)	Bridgestone R197 (G)
Tire Size	295/75R22.5	295/75R22.5	295/75R22.5	295/75R22.5
Pressure	96 psi	96 psi	98 psi	96 psi
Tread Depth	11/32 inch	10/32 inch	11/32 inch	11/32 inch

[14] See Vehicle Photo 9 – Left front axle tire of the 2011 Peterbilt truck-tractor, showing the area of tire tread scuffing and a 2-inch reference marker.
[15] The letter inside the parentheses indicates tire load range.

Tire pressure measurements were taken using a commercial grade tire pressure gauge. The Commercial Vehicle Safety Alliance (CVSA) Out-of-Service criteria consider a tire to be out-of-service when it is inflated to less than 50% of the maximum inflation pressure listed on the side wall of the tire, 100 to 120 psi in this case. All tires were found to be inflated to acceptable in-service pressures. Tread depth measurements were taken in 3 locations within the major tread grooves of a given tire, the lowest of which is entered in **Table 2** and represents the minimum tread depth. All tread depths measured were within the minimum tread depth regulation for commercial vehicle tires, which is 4/32 of an inch for the steer axle and 2/32 of an inch for all other axles.[16]

The only vehicle-related defect noted by the New Jersey State Police in its postcrash examination of the combination unit was a set of minor inner wheel seal leaks on both sides of axle 4. The NTSB also observed that there was some very minor axle grease seepage in the noted areas. The trailer wheels were not removed for further inspection.

1.6. Steering

As noted in the damage description, at the time of inspection the front axle wheels of the truck-tractor were found to be turned to the left and out of alignment with each other. The steering input shaft connection into the steering gear box was pulled outward, shearing off the four bolts at the input bearing cap.[17] As a result, steering wheel movement resulted in movement of the steering input shaft but did not result in movement of the front wheels due to the damage and disconnect at the steering gear box. With exception of the far leftward extension of the left front axle steering linkage, no damage was noted to any of the lower steering linkage components aft of the steering gear box, to include the pitman arm, drag link, ball joints, steering knuckles, and steering cross member. All connections remained intact and free of excessive wear or play.

The steering gear box was removed from the truck-tractor and taken to RH Sheppard in Hanover, Pennsylvania on June 18, 2014, for disassembly and examination. RH Sheppard produced a report detailing the examination, concluding that the steering gear was subjected to an impact load, driving the pitman arm toward the rear of the vehicle, which occurred when the steering wheel was 170 degrees into a left steer.[18] RH Sheppard further noted that given the setup of the 2011 Peterbilt truck-tractor front axle components, 170 degrees of steering wheel rotation to the left would have resulted in the front wheels being at 8.3 degrees to the left at the time the steering gear was subjected to the impact load.

1.7. Suspension

The truck-tractor front axle suspension consisted of 2-ply leaf springs and shock absorbers mounted on either side of the axle. As noted in the damage description, the U-bolts containing the leaf springs on the right side of the front axle were broken, and the same attachment at the left side of the front axle was distorted. The suspension on axles 2 and 3 of the truck-tractor consisted of solid axle supports, sway bars, and torsion bars. Air cushions were also

[16] Measured in two adjacent tread grooves at any location on the tire, according to the *Federal Motor Carrier Safety Regulations*, Title 49 of the US *Code of Federal Regulations* 393.75 (49 CFR 393.75).
[17] See Vehicle Photo 10 – Showing the damaged input shaft connection into the steering gear box and sheared bolts at the input bearing cap.
[18] See Vehicle Attachment 3 – RH Sheppard Steering Gear Inspection Report.

mounted aft of axle 3. The semitrailer suspension for axles 4 and 5 consisted of 3-ply leaf springs and torsion/stabilizer bars mounted forward of each axle. All attachments and bushings were found to be intact and free of excessive wear or play.

1.8. Braking

The truck-tractor and semitrailer were equipped with a pneumatic drum brake system with 5 ½ inch automatic slack adjusters on all axles. The front axle was equipped with 15- x 4-inch brake drums and size 20 (Type 20) service brake chambers. Axles 2 through 5 were all equipped with 16 ½- x 7-inch brake drums and size 30 long stroke (or 3-inch stroke) service and parking brake chambers (Type 30/30L).

Brake pushrod stroke measurements were taken for the truck-tractor and semitrailer by building air pressure to 90 psi, releasing the parking brakes, marking the pushrods, and then applying a full pressure application of the brake pedal. The front axle brake chambers were plumbed into individually with a regulated 90 psi of air pressure. The distance the pushrod traveled during the brake applications was recorded as "Pushrod Stroke," shown in **Table 3**. The adjustment limit for the Type 20 front axle brakes was 2 inches, and the adjustment limit for the Type 30/30L brakes on the remaining axles was 2 ½ inches.[19] None of the brakes were found to be out of adjustment.

Table 3. Peterbilt Combination Unit Brake Measurements

Brake Location		Brake Type	Pushrod Stoke (**inches**)
Front Axle	Left	20	1 ½
	Right	20	1 ¼
Axle 2	Left	30/30 L	1 3/8
	Right	30/30 L	1 3/8
Axle 3	Left	30/30 L	1 ½
	Right	30/30 L	1 3/8
Axle 4	Left	30/30 L	1 ½
	Right	30/30 L	1 ½
Axle 5	Left	30/30 L	1 ¾
	Right	30/30 L	1 ½

The brake drums and brake pads on all axles were visually inspected. All brake pads were found to be in excess of the minimum thickness limit of 1/4 inch.[20] No brake pad or brake drum cracks or defects were observed. Low air pressure warning tests were conducted on the combination unit. The air systems were bled down from over 120 psi by pumping the brakes with the air supply removed. Red low air warning lights for both the primary and secondary air systems illuminated once the pressure was below 65 psi.[21] The tractor protection valve is

[19] According to the CVSA Out-of-Service Criteria, pushrod strokes have to be 1/8 inch or more beyond the adjustment limits to be counted towards the allowable 20% defective brakes before a vehicle is considered to be out of service.
[20] Title 49 CFR 393.47(d) states 1/4 inch minimum for air-braked non-steering axles, or 3/16 inch minimum for air-braked front steering axle brakes.
[21] In compliance with low air warning devices specified in 49 CFR 393.51 (c).

designed to keep at least 20 psi of air supplied to the tractor for a controlled stop in the event of a sudden loss of air. The air systems were built back up to over 120 psi, and a leak was introduced by disconnecting the emergency side glad hand at the front of the semitrailer (red glad hand). Once the leak was introduced air pressure gauges in the dash were observed to drop until they stopped and held air at just under 80 psi.

1.8.1. Anti-lock Braking Systems

All air-braked truck-tractors manufactured after March 1997, and all other commercial vehicles (such as semitrailers) manufactured after March 1998, are required to be equipped with anti-lock braking systems (ABS).[22] The Peterbilt truck-tractor was equipped with Bendix ABS sensors and modulators on all six wheels, known as a 6S/6M system. The semitrailer was equipped with a self-contained single axle Meritor 2S/2M ABS system on axle 4.

1.9. Vehicle Recorded Event Data

The accident truck was equipped with an electronically controlled Cummins ISX engine. The engine control module (ECM) has the capability to record parameters that often include vehicle speed, engine rpm, brake circuit status, throttle percentage, and other associated data in the event of sudden deceleration or hard braking events. The ECM was successfully downloaded by an NTSB Recorders Specialist on June 11, 2014. The data included a constant vehicle speed of 65 mph, the maximum speed at which the truck-tractor was governed, prior to a sudden deceleration associated with the time of the crash through its occurrence at an engine mileage of 349873.5 miles. The full data set and additional details are available in the *NTSB Recorder Specialist's Factual Report*, which is included in the docket for this investigation.

1.10. Bendix Wingman ACB System

The Peterbilt truck-tractor was equipped with a Bendix Wingman Active Cruise with Braking (ACB) system. The Bendix Wingman ACB system operator's manual was located in the cab of the truck. [23] According to the operator's manual, and guidance received from consultation with from Bendix engineers, the following bullets describe the intent and capabilities of the system:

- The Bendix Wingman ACB system is an additional feature integrated into the vehicle's normal cruise control. Once the driver switches on and sets cruise control, Bendix Wingman ACB is automatically engaged to help maintain a set following distance using a radar sensor (with a range of approximately 500 feet) mounted to the front of the vehicle.

- All vehicles equipped with Bendix Wingman ACB are also equipped with the Bendix Electronic Stability Program (ESP), which is a constantly on, stability control system that helps you maintain vehicle stability during potential loss-of-control and/or rollover events.

- When warranted, interventions by either the Bendix Wingman ACB or Bendix ESP can include automatic reduction of the throttle, and application of up to one-third of the

[22] Title 49 CFR Part 393.55 (c).
[23] See Vehicle Attachment 4 – Bendix Wingman ACB Active Cruise with Braking Operator's Manual.

vehicle's potential braking power. The Bendix Wingman ACB system uses the Bendix ESP system to help maintain vehicle stability during automatic brake applications.

- Optimal system performance requires properly maintained foundation brakes that meet appropriate safety standards and regulations and a defect-free ABS. Any active ABS diagnostic trouble codes will cause the system to deactivate.

- Although the Bendix Wingman ACB system is mainly intended as following distance aid while cruise control is in use, it offers three different types of alerts to the driver–all of which are available whether or not your cruise control is in use. These are:

  - Following Distance Alert (FDA) provides both audible and visual alerts whenever the distance between the equipped vehicle and a tracked vehicle ahead is less than the set distance and getting closer. To track a vehicle ahead, the system must qualify that vehicle based on various factors including metallic signature, persistence in lane, direction motion, and speed. If the following distance continues to decrease, the driver will hear more rapid audible alerts. When the distance interval reaches a critical point, typically a red LED also illuminates on the instrument cluster. The FDA may be accompanied by a message to the driver saying "Distance Alert," or similar text. The FDA is active whenever the vehicle is moving (whether or not cruise control is engaged.) Alerts can come out and go off at various frequencies and durations ranging from just fractions of a second to continuous tones.

  - Stationary Object Alert (SOA) can deliver up to 3.0 seconds warning to the driver when approaching sizable stationary objects with reflective surfaces determined to be ahead and in the same lane of travel. The SOA is active whenever the vehicle is moving (whether or not cruise control is engaged.)

  - The Impact Alert warning is the most severe warning issued. This alert indicates the driver must take immediate evasive action by applying more braking power and/or steering clear of the vehicle ahead to avoid a potential collision. When activated, text appears along with a loud continuous tone. The Impact Alert is active whenever the vehicle is moving (whether or not cruise control is engaged.)

- The Bendix Wingman ACB system will not react to pedestrians, animals, non-metallic objects, and limited metallic objects. Entering a curve will reduce the alert time to less than 3 seconds. Objects that are reflective, such as crash barriers, guard rails, construction zone barricades, and tunnel entrances, may impair the function of the radar sensor.

- The Bendix Wingman ACB system reacts to vehicles moving in the same direction as the equipped vehicle. The system does not attempt to intervene when approaching stopped vehicles, side-to-side moving traffic, or oncoming traffic.

- Ultimate responsibility for the safe operation of the vehicle remains with the driver at all times. When approaching a much slower-moving vehicle ahead, drivers should anticipate this and begin applying the vehicle's brakes early. Drivers should not wait for the system to intervene. Once the driver intervenes with more powerful braking or other evasive maneuvers, system alerts and interventions are suppressed.

The Bendix Wingman ACB radar sensor module was located during the postcrash inspection. It was found to be mounted on the front bumper of the truck-tractor and was damaged and crushed.[24] The Bendix driver interface unit was undamaged and located in the cab of the truck. When the key was cycled into the on position after the crash, the unit displayed "ACB COMM ERROR."[25] A control module for the Bendix Wingman system, which manages communication with the ABS modulators, pneumatic braking system, and radar sensor module, was located behind the center dash inside the cab of the truck-tractor. The Bendix control module was undamaged and labeled as part number Q27-6040-1101, the same part number as indicated in the original build records for the truck-tractor.

The Bendix control and radar modules were removed from the Peterbilt truck by the NTSB Recorders Specialist on June 11, 2014, and downloaded at Bendix headquarters on June 24, 2015. Data from the download indicated that in the moments preceding a loss of communication event, the truck-tractor was traveling at 65 mph, at 100 percent throttle, and at a 0-degree steering wheel angle, with cruise control not set and not in use. The data indicated that there were no active diagnostic trouble codes and that the system was functional and available prior to the time of the loss of communication event. The audible alert status was recorded as "off" for all snapshots taken at half-second intervals preceding the loss of communication event. The full data set and additional details are available in the *NTSB Recorder Specialist's Factual Report*, which is included in the docket for this investigation.

1.11. Maintenance History

Maintenance and inspection records for the Peterbilt truck and Great Dane semitrailer were obtained from Walmart by the NTSB Motor Carrier Factors Group Chairman and are included as attachments to the *Motor Carrier Factors Group Chairman's Factual Report*, which is included in the docket for this investigation.

Three months of Daily Vehicle Inspection Reports (DVIRs) for the truck-tractor (#02568) contained various driver reported issues with the vehicle ranging from engine performance to cosmetic scratches. One report of note occurred on May 30, 2014, from another Walmart driver (not the accident driver) that the truck "wanders bad over bumps rough road. Had 2 medium pot holes rip steering wheel from my hand. Tires shake steering." Maintenance action was taken the following day and logged under work order #9218003.[26] The shop remarks included "Inspected all suspension driveline components. Greased front and took steering shaft apart was stiff cleaned and greased." The same Walmart driver then drove to truck-tractor from June 1 to June 5, 2014, with no issues noted in the DVIRs.

In a DVIR for tractor #02568 dated June 6, 2014, another Walmart driver (not the driver who reported the previous steering problem or the accident driver) reported: "Steering shakes when you hit a bump in the road." When the accident driver reported to work and saw the DVIR

[24] See Vehicle Photo 11 – Showing damaged Bendix radar module on the front bumper of the 2011 Peterbilt truck-tractor.
[25] See Vehicle Photo 12 - Showing postcrash Bendix display unit and error message in the cab of the 2011 Peterbilt truck-tractor.
[26] The DVIR and work order are included in the docket as attachments to the Motor Carrier Group Chairman's Factual Report.

for tractor #02568, he reported to the transportation office and was issued tractor #20449. The accident driver made his first delivery with truck #20449 then returned to the maintenance shop to check on the status of tractor #02568. The mechanic on duty stated that he had not had a chance to inspect the truck. The accident driver asked if he could go ahead and test it out for a local trip. Upon return, the accident driver reported to the mechanic that he did not encounter any issues with the truck-tractor. The mechanic then annotated on the DVIR: "Driver test drove truck, no problems noted."

The Peterbilt truck-tractor was last subject to and passed an annual inspection on September 7, 2013. The Great Dane semitrailer was last subject to and passed an annual inspection on April 14, 2014.

2. Vehicle 2 – 2012 Mercedes-Benz Sprinter Van

2.1. General information

Make/Model: 2012 Mercedes-Benz 2500 EXT Sprinter HT
VIN: WD3PE8CC1C5■■■■■■

Date of Manufacture:	February 2012
GVWR:	8,550 lbs
GAWR (front axle):	3,970 lbs
GAWR (rear axles):	5,360 lbs
Engine:	Mercedes-Benz 3.0L V6 Turbo Diesel
Transmission:	5-speed Automatic, Rear Wheel Drive
Trim level:	High Roof, 170 inch Wheelbase, EXT

2.2. Damage Description

The damage to the 2012 Mercedes-Benz Sprinter van was concentrated at the left rear and left side, with significant damage to the entire rear of the van, aft of the rear wheels. Damage crushed the rear of the van such that the left rear taillight assembly was in the proximity of the left rear wheel and the rear axle and was pushed forward.[27] There was also damage to the front and right front corner of the van. The windshield and left side passenger area window were broken out.

Further exterior and interior damage description is contained in the *Survival Factors Group Chairman's Factual Report*, which is included in the docket for this investigation. In addition to the observed damage, the NTSB Evidence Documentation Team mapped the Sprinter van using a FARO laser scanner, which generated a 3-dimensional model of the damaged vehicle, as shown in **Figure 2**.

[27] See Vehicle Photo 13 – 2012 Mercedes Sprinter van, view of left rear corner damage.

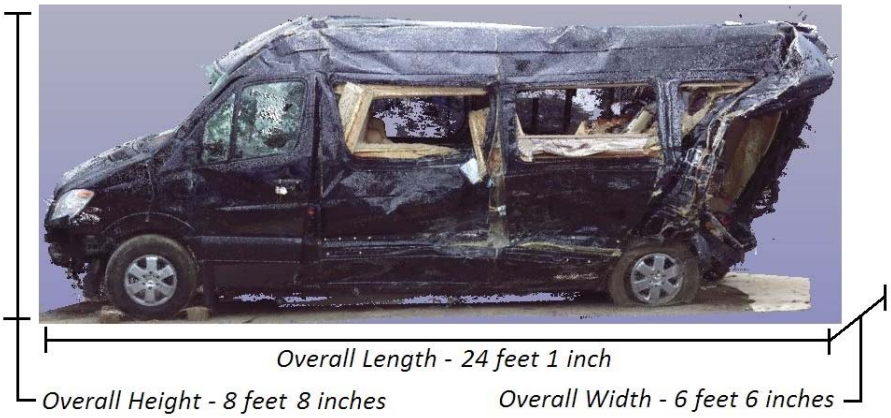

Figure 2. Driver (left) side profile from the 3-dimensional model of the damaged 2012 Mercedes-Benz Sprinter van.

2.3. Weights and Measurements

On June 12, 2014, the New Jersey State Police weighed the Sprinter van using certified portable scales on a level concrete surface at George's Garage and Towing. **Table 4** contains the axle weights that were measured.

Table 4. Mercedes-Benz Sprinter Van Weight

Axle	Weight (lbs)	
	Left	Right
Front	2,300	800
Rear	1,000	2,850
		Total Weight: 6,950 lbs

According to Canadian Vehicle Specifications for the make and model of the van, it had a curb (empty) weight of 6,336 lbs.[28, 29] This curb weight indicates the weight of the vehicle as built as a cargo van prior to the interior seating and modifications that were added by Midwest Automotive Designs Corporation.[30] According to Midwest Automotive, a similarly configured van with limousine-style interior modifications would weigh approximately 6,910 lbs.[31] Overall dimensions of the combination unit are included in **Figure 2**.

2.4. Tires and Wheels

No tire specifications were noted on the VIN plate located at the base of the driver's seat; however, the invoice for the vehicle and online specifications indicated that it was originally specified to be equipped with 245/75R16 tires mounted on 16 inch rims. **Table 5** includes the tire and wheel information documented on the Mercedes-Benz Sprinter at the time of inspection. The maximum inflation pressure noted on each tire was 80 psi. The left rear tire was flat and in

[28] Canadian Vehicle Specifications version 2014.2.
[29] See Vehicle Attachment 5 – Specifications for the 2012 Mercedes Sprinter Van.
[30] For more information on the reconfiguration of the cargo van to the vehicle with seating and entertainment, see the Survival Factors Group Chairman's Factual Report and attachments.
[31] See Vehicle Attachment 6 – Sprinter Van Weight Report from Midwest Automotive

contact with the crushed-in rear of the van.[32] All other tires remained inflated to adequate tire pressures and were found to have sufficient tread depth.

Table 5. Mercedes-Benz Sprinter Van Tire Information

Front	**Left**	**Right**
Tire Make	Continental Vanco FourSeason	Continental Vanco FourSeason
Tire Size	LT 245/75R16	LT 245/75R16
Pressure	64 psi	63 psi
Tread Depth	7/32 inch	5/32 inch
Rear	**Left**	**Right**
Tire Make	Continental Vanco FourSeason	Continental Vanco FourSeason
Tire Size	LT 245/75R16	LT 245/75R16
Pressure	0 psi	79 psi
Tread Depth	7/32 inch	6/32 inch

2.5. Steering and Suspension

The Sprinter van was equipped with an independent front axle, front struts, and a rack and pinion steering system. The left side components were intact and undamaged by the crash. The right side components showed damage; specifically, the right tie rod end was pulled out to the right, and the ball joint at the wheel was bent. The rear axle (drive) was equipped with 2-ply leaf springs, shock absorbers, a torsion bar, and air-ride suspension cushions. The rear axle was pushed forward, damaging and altering the alignment of the rear suspension. The leaf springs on the left side of the axle were broken and had come apart. Examination of the underside of the vehicle found no body extensions or structural modifications.

2.6. Braking

The Mercedes-Benz Sprinter van was equipped with hydraulic disc brakes on the front and rear axles. The front brake calipers were dual piston and the rear calipers were single piston. The master cylinder and reservoir were undamaged and contained adequate brake fluid. A visual trace of the hydraulic brake lines revealed no leaks or defects. The New Jersey State Police removed all four tires and wheels to observe the brake rotors and pads and reported adequate brake pad thickness and no defects.

The vehicle was equipped with ABS sensors on all four wheels and a centralized hydraulic ABS modulator near the master cylinder. The van was also equipped with electronic brake assist, which can supplement braking force in emergency situations depending on the speed of the vehicle and the force at which the brake pedal is being applied.

2.7. Vehicle Recorded Event Data

The frontal airbags of the Mercedes-Benz Sprinter van deployed; the airbag control module was downloaded by a Mercedes-Benz technician and the NTSB Recorders Specialist on June 13, 2014. See the *NTSB Recorder Specialist's Factual Report* for details of the data that

[32] See Vehicle Photo 14 – Showing the deflated left rear tire and left rear wheel damage in contact with the crushed-in rear portion of the van.

were obtained. In order to complete the download, the vehicle was powered on and the key was cycled to the on position. With the key in the on position, the dash displayed a vehicle mileage of 36,237 miles. It was also noted that the low tire pressure indicator light appeared in the dash, and the transmission gear indicator was in reverse.

3. Vehicle 3 – 2011 Buick Enclave

3.1. General information[33]

Make/Model: 2011 Buick Enclave CXL
VIN: 5GAKVCED5BJ■■■■■■

GVWR:	6,459 lbs
GAWR (front axle):	3,196 lbs
GAWR (rear axles):	3,527 lbs
Engine:	General Motors 3.6L V6
Transmission:	6-speed automatic

The Buick Enclave sustained damage to the right front corner and rear of the vehicle.[34] The right front tire was flat and the wheel damaged. The rear hatch door was crushed inward and the rear window was broken out.[35] The right rear quarter panel was dented and scraped and the region just behind the rear portion of the wheel well was partially separated from the vehicle.

The driver and passenger airbags deployed, but the side airbags did not. The airbag control unit (or ACM) was removed by the NTSB Recorders Specialist and downloaded at NTSB headquarters. See the *NTSB Recorder Specialist's Factual Report* for details of the data that was obtained.

4. Vehicle 4 – 2011 Ford F-150

4.1. General information[36]

Make/Model: 2011 Ford F-150 XLT Crew Cab with 5 ½ Foot Bed
VIN: 1FTFW1EF0BK■■■■■■

Date of Manufacture:	May 2011
GVWR:	7,200 lbs
GAWR (front axle):	3,750 lbs
GAWR (rear axles):	3,850 lbs
Engine:	Ford 5.0L V8
Transmission:	4-speed Automatic, 4WD

The Ford F-150 sustained damage at the left rear corner and the rear bumper and tailgate area only.[37] The airbags did not deploy. The airbag control unit (or ACM) was removed by the NTSB Recorders Specialist and downloaded at NTSB headquarters. See the *NTSB Recorder Specialist's Factual Report* for details of the data that was obtained.

[33] For additional information see Vehicle Attachment 7 – Specifications for the 2011 Buick Enclave.
[34] See Vehicle Photo 15 – 2011 Buick Enclave, showing right front corner damage.
[35] See Vehicle Photo 16 – 2011 Buick Enclave, showing rear damage.
[36] For additional information see Vehicle Attachment 8 – Specifications for the 2011 Ford F-150.
[37] See Vehicle Photo 17 – 2011 Ford F-150, showing rear damage.

5. Vehicle 5 – 2005 Nissan Altima

5.1. General information[38]

Make/Model: 2005 Nissan Altima
VIN: 1N4AL11DX5N■■■■■■
Date of Manufacture: July 2005
GVWR: 4,202 lbs
GAWR (front axle): 2,249 lbs
GAWR (rear axles): 1,969 lbs
Engine: Nissan 2.5L In-line 4 DOHC
Transmission: 5-speed Automatic

The Nissan Altima sustained damage mainly at the left rear corner, left rear quarter panel, and fuel filler door area.[39] The airbags did not deploy. Due to the make and model year of the vehicle, the airbag control module could not be downloaded.

6. Vehicle 1 – 2006 Freightliner Combination Unit

6.1. General information

TRUCK-TRACTOR:
Make/Model: 2006 Freightliner ST 120 Conventional
VIN: 1FUJBBCK46L■■■■■■
Company Unit #: 786
Date of Manufacture: October 2005
GVWR: 52,000 lbs
GAWR (front axle): 12,000 lbs
GAWR (rear axles): 20,000 lbs
Engine: Detroit Diesel 14.0L In-line 6
Transmission: Fuller 10-Speed Manual

SEMITRAILER:
Make/Model: 2001 Utility VS2R4 Refrigerated Semitrailer
VIN: 1UYVS25322U■■■■■■
Company Unit #: 427
Date of Manufacture: April 2001
GVWR: 29,500 lbs
GAWR (per axle): 19,000 lbs

The Freightliner had damage to the left side of the truck, on the body flange behind the sleeper berth.[40] The New Jersey State Police conducted a full postcrash inspection of the truck-tractor and semitrailer and found 10 driver- and vehicle-related defects, 5 of which were considered to be out-of-service defects. See Vehicle Attachment 1 for further details. The Detroit Diesel Electronic Control (DDEC) module was successfully downloaded by the NTSB Recorder

[38] For additional information, see Vehicle Attachment 9 – Specifications for the 2005 Nissan Altima.
[39] See Vehicle Photo 18 – 2005 Nissan Altima, showing left rear corner damage.
[40] See Vehicle Photo 19 – 2006 Freightliner combination unit, showing damage to the left side of the truck-tractor.

Specialist. See the *NTSB Recorder Specialist's Factual Report* for details of the data that was obtained.

E. DOCKET MATERIAL

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

LIST OF ATTACHMENTS

Vehicle Attachment 1 – New Jersey State Police Commercial Driver/Vehicle Examination Reports

Vehicle Attachment 2 – 2011 Peterbilt Truck-Tractor Chassis Final Bill

Vehicle Attachment 3 – RH Sheppard Steering Gear Inspection Report

Vehicle Attachment 4 – Bendix Wingman ACB Active Cruise with Braking Operator's Manual

Vehicle Attachment 5 – Specifications for the 2012 Mercedes-Benz Sprinter Van

Vehicle Attachment 6 – Sprinter Van Weight Report from Midwest Automotive

Vehicle Attachment 7 – Specifications for the 2011 Buick Enclave

Vehicle Attachment 8 – Specifications for the 2011 Ford F-150

Vehicle Attachment 9 – Specifications for the 2005 Nissan Altima

LIST OF PHOTOGRAPHS

Vehicle Photo 1 – Overall photograph of the 2011 Peterbilt combination unit, left front view

Vehicle Photo 2 – View of the broken right front axle leaf spring U-bolts on the 2011 Peterbilt truck-tractor

Vehicle Photo 3 – View of the left side engine compartment of the 2011 Peterbilt truck-tractor; the distorted leaf springs and U-bolts can be seen below the frame rail toward the bottom of the photograph

Vehicle Photo 4 – View from the underside of the 2011 Peterbilt truck-tractor, showing the front axle wheel alignment angles noted during the postcrash inspection

Vehicle Photo 5 – Preexisting left front leading edge damage on the 2003 Great Dane semitrailer

Vehicle Photo 6 – 2011 Peterbilt truck-tractor driver controls to the left of the steering wheel

Vehicle Photo 7 – 2011 Peterbilt truck-tractor driver controls to the right of the steering wheel

Vehicle Photo 8 – 2011 Peterbilt truck-tractor center dash gauges at postcrash key-on position

Vehicle Photo 9 – Left front axle tire of the 2011 Peterbilt truck-tractor, showing the area of tire tread scuffing and a 2-inch reference marker

Vehicle Photo 10 – Showing the damaged input shaft connection into the steering gear box and sheared bolts at the input bearing cap

Vehicle Photo 11 – Showing damaged Bendix radar module on the front bumper of the 2011 Peterbilt truck-tractor

Vehicle Photo 12 – Showing postcrash Bendix display unit and error message in the cab of the 2011 Peterbilt truck-tractor

Vehicle Photo 13 – 2012 Mercedes-Benz Sprinter van, view of left rear corner damage

Vehicle Photo 14 – Showing the deflated left rear tire and left rear wheel damage in contact with the crushed-in rear portion of the van

Vehicle Photo 15 – 2011 Buick Enclave, showing right front corner damage

Vehicle Photo 16 – 2011 Buick Enclave, showing rear damage

Vehicle Photo 17 – 2011 Ford F-150, showing rear damage

Vehicle Photo 18 – 2005 Nissan Altima, showing left rear corner damage

Vehicle Photo 19 – 2006 Freightliner combination unit, showing damage to the left side of the truck-tractor

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END OF REPORT

Jennifer Morrison
Vehicle Factors Engineer