VEHICLE FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

Oxnard, CA

HWY15MH006

(19 pages)

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

VEHICLE FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

A. CRASH INFORMATION

Location:	Train & Utility Truck Crash on Railroad Right-of-way (not a Grade Crossing)
Vehicle #1:	2005 Ford F-450 Utility Truck towing a 2000 Wells Cargo Tandem Axle Utility Trailer
Vehicle #2:	Metrolink Commuter Train #102
Vehicle #3:	1998 Toyota Camry
Date:	February 24, 2015
Time:	5:44 a.m. Pacific Standard Time (PST)
NTSB #:	**HWY15MH006**

B. VEHICLE FACTORS GROUP

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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

This report is a collection of factual information obtained during the detailed examination of the highway vehicles involved in the collision. Detailed examinations of the 2005 Ford utility truck and the 2000 Wells Cargo utility trailer were conducted at a Metrolink rail yard located in Moorpark, California.

All major mechanical systems were examined, including the steering, braking, and suspension systems. Overall collision damage, along with any damage or anomalies within major vehicle mechanical systems were documented. Supporting photographs, vehicle specifications, maintenance records, and prior annual inspection reports were collected and reviewed. The truck's engine was displaced from the vehicle during the collision sequence. The engine was further examined by Navistar engineers, in conjunction with an NTSB investigator and an Oxnard police officer, at the Boerner International Truck Dealership located in Huntington Park, CA.

This report covers only the examination of highway vehicles. For a detailed account of the mechanical condition of the locomotive and rail cars involved in the collision, refer to the *Rail Mechanical Factors Group Chairman's Factual Report*. A passenger car parked at the nearby grade crossing at the time of the collision was struck with flying debris, and sustained minor damage. The passenger car was released from the scene prior to the arrival of NTSB investigators, and was not available for examination. A photographic examination was conducted using photos taken by the Oxnard Police Department in an effort to document the damage sustained by the passenger car. No detailed mechanical inspection was performed.

E. VEHICLE EXAMINATIONS

1. VEHICLE #1: 2005 FORD F-450 UTILITY TRUCK TOWING A 2000 WELLS CARGO UTILITY TRAILER

1.1. GENERAL INFORMATION[1]

This vehicle was manufactured in two stages. The first stage build of the Ford truck cab and chassis, known in the industry as an incomplete vehicle, or commercial cutaway, was completed on August 18, 2004. The final stage build consisted of configuring the truck with a utility box, which was completed by Carter Industries. According to records provided by Ford Motor Company, the vehicle's warranty was first activated on July 23, 2007.

Truck:

VIN:[2]	1FDXF46P55E■■■■■■
Make:	Ford
Model:	F-450 Super Duty
Model Year:	2005
Company Unit #:	T 624
Manufactured:	August 18, 2004
Placed in service[3]:	July 23, 2007
Mileage:	Unknown
GVWR:[4]	16,000 lbs.
GAWR – Axle #1:[5]	6,000 lbs.
GAWR – Axle #2:	12,000 lbs.
Engine:	International A325, 325 HP, 6.0 liter V-8 diesel, S/N: 208046367159
Transmission:	Ford Torqueshift 5-speed automatic
Brake Type:	4-wheel hydraulically activated antilock disc brakes

Trailer:

VIN:	1WC200E29Y7■■■■■■
Make:	Wells Cargo
Model:	TW122
Model Year:	2000
Company Unit #:	TR 432

[1] See *Vehicle Attachment 1 – 2005 Ford and 2000 Wells Cargo – Vehicle Specifications*.
[2] Vehicle Identification Number (VIN) with last six characters redacted.
[3] Based on date of warranty activation.
[4] 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.
[5] Gross Axle Weight Rating (GAWR) is the maximum distributed weight that a given axle is designed to support.

Date of Manufacture:	September 1, 2000
GVWR:	7,700 lbs.
GAWR – Axle #1:	3,500 lbs.
GAWR – Axle #2:	3,500 lbs.
Brake Type:	4-wheel electrically activated drum brakes

1.2. DAMAGE DESCRIPTION

The truck was removed from the scene and towed by a towing service, to a Metrolink rail yard located at 585 Moorpark Avenue, Moorpark, CA, for storage and examination. The truck was examined at this location between February 25, and March 2, 2015.

The truck and trailer combination sustained significant collision damage to all areas, and affected all major mechanical systems.[6] The truck's cab sustained significant contact damage and was displaced from the vehicle's frame.[7] The engine was also displaced from the vehicle, and sustained damage to all external surfaces, including many components having been broken off.[8] The vehicle's transmission was crushed and broken away from the engine just behind the torque converter. The torque converter remained attached to the engine, and the rear portion of the transmission remained connected to the forward driveshaft, and was also displaced from the wreckage. The forward and rear driveshafts were disconnected from each other at the spline joint[9]. The rearmost portion of the rear driveshaft was broken away from the differential at the universal joint, and was torn away from the forward portion of the rear driveshaft approximately 34 inches forward of the universal joint connection with the rear differential. The portion of the rear driveshaft that would have been located between the spline joint and the torn rear portion of the shaft was unable to be located in the wreckage. There were no signs of circumferential scrapes or markings on the driveshaft pieces available for examination. The rear axle ratio was found to be 4.88:1 by rotating the differentials input shaft until the wheel ends made one full revolution.

The truck's diesel fuel tank was found crushed inward on its right side, and ruptured along its left side and rear end. The trucks frame rails remained attached to the utility box, and were found to be crushed, bent, twisted, and torn forward of the utility box. The frame rail portions located underneath the utility box were bent. The truck's exhaust system was crushed, bent, and twisted throughout its length. The vehicle's inertial emergency fuel pump cut-off switch was located, and found in the cut-out position at the time of the examination, meaning that the fuel pump would have been disabled. In order to check the function of the fuel pump cut-off switch, it was reset by NTSB Investigators during the examination. The truck's windshield was made of laminated safety glass, and was broken out with the majority of it

[6] See *Vehicle Photograph 1 – Overall Damage to Truck Facing Front Left Corner (overturned)*, *Vehicle Photograph 2 – Overall Damage to Truck Facing Rear Right Corner (overturned)*, *Vehicle Photograph 3 – Overall Damage to Trailer Facing Front Right Corner*, and *Vehicle Photograph 4 – Overall Damage to Trailer Facing Rear Left Corner*.
[7] See *Vehicle Photograph 5 – Damage to Cab of Truck Facing Right Side Top* and *Vehicle Photograph 6 – Damage to Cab of Truck Facing Left Side Top*.
[8] See *Vehicle Photograph 7 – Damage to Truck's Engine Facing Rear Right Corner (displaced from vehicle)*.
[9] There were wooden fibers embedded in the forward driveshaft leading end, and the driveshaft was kinked.

recovered in three large pieces. The driver side window was made of tempered glass and was found broken but held together by the window tint film and rolled down inside the door panel with the smooth top factory edge just sticking out of the door panel. The passenger side window regulator was found in the up position, and a piece of window tint film with several pieces of broken tempered glass still adhered to it were found on the passenger side of the cab. The rear window was made of tempered glass, was shattered, and was not able to be located in any great amount.

The utility trailer sustained much less contact damage than the truck; however, it also sustained a post-crash fire to all areas of the trailer, causing significant fire damage. The trailer was equipped to be towed by a 2-$^{5}/_{16}$ inch ball hitch, and was to be additionally secured to the vehicle with two safety chains.[10] The safety chains were found still attached to the trailer with no bends or breaks to any components or hooks, with the exception of the spring-loaded keeper flap located in the hook of the right chain being bent such that it would no longer close automatically.[11] There were no signs of damage to the truck's towing hitch at the locations where the safety chains should have been connected. The trailer itself was constructed of three main longitudinal frame members, all of which were significantly bent and distorted. The angled tongue supports were buckled and bent. The battery used to activate the trailer's electric brakes in an emergency situation, such as the trailer becoming disconnected from the towing vehicle, was missing and unable to be located in the wreckage.

The trailer's cargo area was approximately 12 feet long, 6 feet wide and 6-$^{1}/_{2}$ feet high. The trailer was equipped with two side swing entry doors at the rear of the trailer, and a single side swing entry door near the front right side of the cargo area. Nearly all of the aluminum wall and roof panels had been destroyed by the post-crash fire, with the exception of approximately the left half of the front wall panels, which were bent, crumpled, and twisted. The leading and trailing fiberglass roof edges were also destroyed in the fire. The inside of the cargo area appeared to have been equipped with metal shelving frames on both the left and right sides, with the shelves themselves having been consumed by fire and missing at the time of the examination. Remnants of two tires mounted to steel wheels were present in the cargo area of the trailer, along with what appeared to have been a gas powered generator, a fire extinguisher, and a couple hydraulic rams.

Damage specific to many of the vehicle components will be described in greater detail later in the appropriate sections of this report.

1.3. WEIGHT AND MEASUREMENTS

Due to the post-crash condition and damage to the vehicle combination, meaningful axle weights were unable to be obtained. Both the Ford F-450 and Wells Cargo utility trailer were scanned using a 3-dimensional laser scanner that will allow for the creation of a 3-D model. From this 3-D model, scaled measurements can be taken at a later time. **Figure 1** and **Figure 2** show images of the 3-D scans performed on the truck and trailer respectively.

[10] See *Vehicle Photograph 8 – Trailer Safety Chains*.
[11] See *Vehicle Photograph 9 – Damage to Spring-loaded Chain Hook Keeper on the Trailer's Right Safety Chain*.

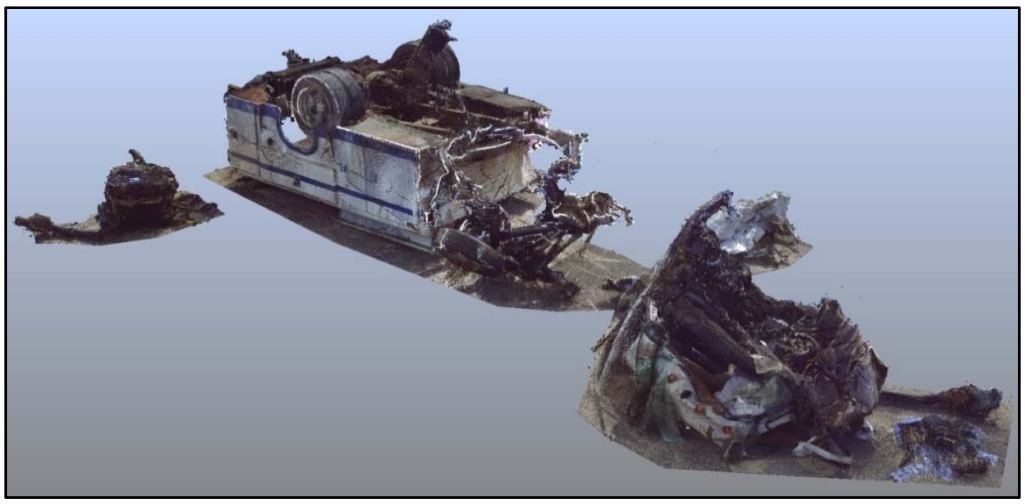

Figure 1: Image of 3-D Laser Scan of Ford F-450 Utility Truck

Figure 2: Image of 3-D Laser Scan of Wells Cargo Utility Trailer

1.4. DRIVER CONTROLS

Many of the driver's controls were destroyed or unable to be accessed due to the post-crash condition of the truck's cab. The steering wheel was broken away from the top of the steering column, and was deformed.[12] The steering wheel measured approximately 16-$^{1}/_{4}$ inches wide and 14-$^{1}/_{4}$ inches tall at the time of examination. The ignition switch was found to be in the "Run" position. The headlight switch was found to be in the position which would have activated the parking, or clearance lights. The windshield wiper control switch was found to be in the "off" position. The steering column mounted gear selector was visible; however, due to damage to the cab, investigators were unable to determine what position it was in.

[12] See *Vehicle Photograph 10 – Steering Wheel Displaced from Truck Showing Deformation and Deployed Airbag*.

The truck's accelerator pedal was approximately 2 inches wide and 5 inches long. The brake pedal was approximately 4-$^{3}/_{4}$ inches wide and 2-$^{3}/_{4}$ inches long. The accelerator and brake pedals were separated by a horizontal distance of approximately 6 inches at the time of the examination. The truck's accelerator pedal was removed from the vehicle and it's electrical resistance was checked with an ohm meter. The resistance indicated on the meter changed smoothly as the pedal was swept through its range of motion. No electrical "dead spots" were detected.

1.5. ENGINE

The truck involved in the collision was equipped with an International A325, 325 HP, 6.0 liter V-8 diesel engine. The engine and forward portion of the transmission remained attached to each other, and were displaced from the vehicle during the collision sequence. The engine and related components were transported by a local towing company from the Metrolink rail yard in Moorpark, CA to the Boerner International dealership in Huntington Park, CA, on Tuesday, March 3, 2015, for a detailed external and internal examination. This examination was conducted by Navistar engineers under the direction and in the presence of an NTSB investigator and an Oxnard police officer. The detailed visual external and internal examination did not yield any conclusive evidence that the engine was running at the time of the initial impact, however, it did show that there were no mechanical failures that would have prevented the engine from running.[13]

1.6. STEERING

Due to the extensive collision damage sustained by the vehicle, a direct functional check of the steering system was not able to be performed. Nearly all of the steering components sustained heavy damage. For reference, a diagram of the steering linkages is shown in **Figure 3**.

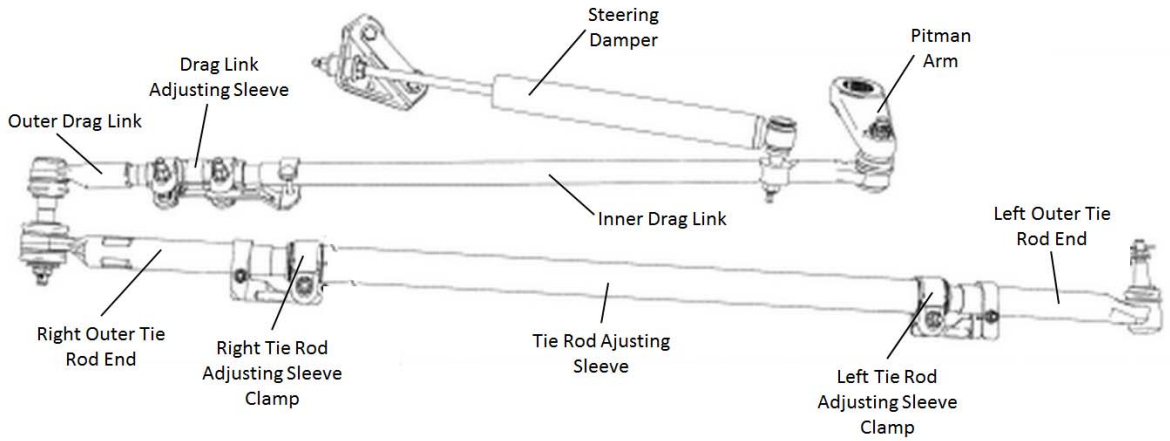

Figure 3: Diagram of 2005 Ford F-450 Steering Linkages (modified from: justanswer.com)

[13] See *Vehicle Attachment 2 – 2005 Ford – Engine Visual Inspection Report from Navistar, Inc.*

The steering wheel was found to be deformed as described in the *Driver Controls* section of this report. The steering wheel connection to the steering column was broken. The steering column connected to an intermediate steering shaft by means of a universal joint within the cab of the truck. Rotating the broken steering wheel connection caused the appropriate rotation of the upper portion of the telescoping intermediate shaft that transcended through the firewall. The lower portion of the telescoping intermediate steering shaft was pulled out of the upper portion of the shaft, and was disconnected.

The lower portion of the intermediate shaft was bent; however, it remained partially attached to the input shaft of the hydraulically assisted steering gear box by means of a dampening coupler. The output shaft from the steering gear was securely connected to the pitman arm using a splined connection. The ball joint that connects the pitman arm to the inner drag link was separated at the joint, with the ball stud remaining attached to the pitman arm, and the socket remaining attached to the inner drag link. Rotation of the lower input shaft caused smooth and unencumbered movement of the pitman arm across the full range remaining between portions of the wreckage.

The front right wheel assembly, including the steering knuckle, the right outer tie rod end and the drag link assembly (inner drag link, drag link adjusting sleeve, and outer drag link), were separated from the vehicle, and were located in the wreckage. The originally straight drag link assembly was bent significantly, and resembled a "U" shape. The drag link was connected simultaneously to the right steering knuckle and right outer tie rod end by means of another ball joint. The right outer tie rod end had been separated from the tie rod adjusting sleeve, which had also been separated from the left outer tie rod end, and was found loose in the wreckage. The tie rod adjusting sleeve was also found to be bent. The left steer axle assembly, including the left steering knuckle and left outer tie rod end remained attached to the frame of the vehicle. The left outer tie rod end remained connected to the left steering knuckle by means of a ball joint.

1.7. SUSPENSION

The truck's steer axle (axle #1) suspension consisted of a coil spring, shock absorber, and a radius arm on each side which were suspending a solid Monobeam axle. The steer axle was also connected to a sway bar for added stability and better handling. Both the left and right side coil springs were displaced from the vehicle during the collision, and were located amongst the wreckage. The upper half of the left side shock absorber was broken away from it frame mount and was separated from the vehicle. The lower half remained connected to its axle mount; however, it was severely crushed, bent, and twisted. The left radius arm was severely crushed, bent, and twisted; however, it remained connected to both the frame and the axle. The right side shock remained attached to both its top and bottom mounts, with the upper half having been crushed and bent. The leading end of the right radius arm remained bolted to the axle; however, the rear portion of the arm was displaced from the vehicle, and was unable to be located in the wreckage. The steer axle sway bar remained connected to all of its mounts; however, it was found to be bent.

The truck's drive axle (axle #2) suspension consisted of two leaf spring packs mounted to a solid axle, a set of shock absorbers, and sway bar. The left side leaf spring pack remained securely mounted to its frame mounts following the collision, however, was no longer seated in its cradle. Both "U" bolts connecting the spring pack to the axle were found to be bent. The left shock absorber was securely attached to both its upper and lower mounts. The right side spring pack remained securely mounted to its frame mounts following the collision. Both "U" bolts connecting the spring pack to the axle remained straight. The right shock absorber remained securely mounted to its frame mounts following the collision; however, there was some crushing to the inner side of the top half. The sway bar remained securely attached to all of its mounts both on the frame as well as on the axle, however had shifted from the left to the right approximately 2 inches in both of its axle mount bushings.

The trailer suspension consisted of two solid single beam axles (axles #3 and #4) being suspended from the left and right longitudinal frame members by a torsion suspension system at each axle end. No obvious damage was noted on any of the trailer's suspension components, however, the post-crash and fire damaged condition of the trailer precluded a detailed examination of these components.

1.8. TIRES AND WHEELS

According to the tire specification placard for the incomplete vehicle located inside the door frame of the truck, it was recommended that axle #1 be equipped with size 225/70R19.5 tires mounted on 19.5 x 6 inch wheels with a cold inflation pressure of 85 pounds per square inch (psi). The truck's tire specification placard also recommended that axle #2 be equipped with size 225/70R19.5 tires mounted on 19.5 x 6 inch wheels, with a cold inflation pressure of 90 psi in a dual tire configuration. The tire information label placed on the inside of the door by the final stage manufacturer was located; however, any markings that may have adjusted these recommendations were no longer visible on the label. The tire information placard that would have been located on the utility trailer was unable to be located, and was likely consumed by the post-crash fire. Information obtained from the trailer manufacturer indicated that all wheel positions on the trailer should have been equipped with size ST205/75R15 tires mounted on 15x5 wheels, with a cold inflation pressure of 35 psi. All four of the tires mounted on the trailer were partially consumed by fire to the point that no identifying information could be obtained from their sidewalls, and no reliable tread depth measurements could be taken. **Table 1** includes information on the truck tires as they were found at the time of the examination. Tire tread depth measurements were taken at no less than four locations in each of the major tread grooves of each tire. The smallest tread depth measured is displayed in the table, and represents a minimum tread depth value for that tire. The minimum tread depth regulation for commercial motor vehicle tires is $^{4}/_{32}$ in. on the steer axle, and $^{2}/_{32}$ in. for all other axles.[14] All of the tires on the truck involved in this collision had tread depths that were greater than required. All of the wheels were checked for welds and elongated lug nut holes, neither of which were found on any of the wheels. No non-collision related defects were found on any of the wheels.

[14] According to Title 49 Code of Federal Regulations (CFR), part 393.75, tread depth shall be measured in a major groove at any location on the tire and not where tie bars, humps, or fillets are located.

Table 1: Tire Information for Collision Involved Ford Utility Truck

Axle 1	Left	Right
Make	BOTO	BOTO
Model	BT926	BT926
Size	225/70R19.5	225/70R19.5
Load Rating	3970 lbs. (Single)	3970 lbs. (Single)
Pressure	Deflated	Deflated
Tread Depth	15/32 in.	15/32 in.
Rolling Radius	N/A[1]	N/A[1]
DOT #	80AW BTWH 1614	80AW BTWH 1614

Axle 2	Left		Right	
	Outside	Inside	Inside	Outside
Make	Dynatrac	Dynatrac	Dynatrac	Dynatrac
Model	PD-890	PD-890	PD-890	PD-890
Size	225/70R19.5	225/70R19.5	225/70R19.5	225/70R19.5
Load Rating	3,415 lbs. (Dual)	3,415 lbs. (Dual)	3,415 lbs. (Dual)	3,415 lbs. (Dual)
Pressure	Deflated	70 psi	60 psi	Deflated
Tread Depth	8/32 in.	8/32 in.	8/32 in.	6/32 in.
Rolling Radius	N/A[1]	N/A[1]	N/A[1]	N/A[1]
DOT #	2J2C FAC4 4911	2J2C FAC4 4911	2J2C FAC4 4911	2J2C FAC4 4911

[1] Unable to obtain accurate rolling radius information due to vehicle's post-crash condition.

During the tire examination, several areas of damage were noted to many of the wheels and tires. The tire and wheel damage, when possible, is referenced to a clock position with the valve stem being at 12:00. All damage measurements are approximate, and are meant only to provide a generalized context to the damage. The tire and wheel damage observed during the examination included the following:

- Axle 1 Left
  - One of the ten mounting lugs was bent and had signs of scraping with a bluish discoloration to the metal.
  - Outer Tire Sidewall
    - 7:00 – "U" shaped cut, 2 inches x 1-1/4 inches
  - Outer Side of Wheel
    - 6:00 – outward radial collapse of the bead flange, 5 inch chord with 1/2 inch depth
  - Inner Tire Sidewall
    - 12:30 – "V" shaped cut, 2 inches x 3 inches
    - 12:45 - 1:00 – gouge, 2-1/2 inches x 3/4 inches
    - 4:30 – cut, 2 inches
  - Inner Side of Wheel
    - 1:30 – inward radial collapse of bead flange, 3 inch chord with 1/2 inch depth

        - 7:30 – inward radial collapse of bead flange, 4 inch chord with 1/2 inch depth
    - Tire Tread Surface
        - 1:00 – large gouge to tread surface, 3-1/2 inches x 1-1/2 inches
        - 6:00 – single tread lug missing
        - 11:45 – single tread lug missing

- Axle 1 Right
    - 5 of the 10 mounting lugs were sheared off at the wheel face
    - 2 of the 5 remaining lugs showed signs of heavy abrasion with a bluish discoloration to the metal
    - Outer Tire Sidewall
        - 12:45 – major cut to outer sidewall, tire tread, and inner sidewall nearly cutting through the entire tire cross-section, with only the tire bead remaining intact on both the inner and outer sidewalls
        - 2:00 - 2:30 – shallow cut, 5 inches
        - 3:00 – shallow cut, 2-1/2 inches
        - 6:00 - 7:00 – abrasions
        - 11:00 – cut to sidewall and tread surfaces, 4 inches x 1-1/2 inches
        - 11:30 – gouge, 1-3/4 inches x 1/2 inch
    - Outer Side of Wheel
        - Major inward and outward radial collapse of entire wheel circumference
    - Inner Tire Sidewall
        - 1:00 – cut 3-1/2 inches with adjoining gouge, 3/4 inch x 1 inch
        - 4:30 - 5:30 – "U" shaped cut, 8 inches x 5 inches
        - 6:00 - 9:00 – Deep cut, 15 inches
    - Inner Side of Wheel
        - Major inward and outward radial collapse of entire wheel circumference
    - Tire Tread
        - 3:30 – small cut to tread
        - 11:00 - 11:30 – large gouge down to steel chords, 5-1/2 inches x 3 inches

- Axle 2 Left – Outboard Wheel
    - Outer Tire Sidewall
        - 3:00 - 3:15 – shallow cut, 5-1/2 inches
        - 4:00 – gouge on tire shoulder, 1 inch x 1-1/2 inches
    - Outer Side of Wheel
        - 4:30 - 5:30 – inward radial collapse of bead flange, 5 inch chord with 1/4 inch collapse.
        - 5:30 - 6:30 – outward radial collapse of bead flange 5 inch chord with 1/4 inch collapse
        - 9:15 - 9:30 – outward radial collapse, 2-1/2 inch chord with 1/8 inch collapse

- Inner Tire Sidewall
  - No visible damage
- Inner Side of Wheel
  - No visible damage
- Tire Tread
  - 2:00 – gouge, 8 inches total length x 1 inch wide at widest point
  - 5:45 – gouge, 2-$^{1}/_{2}$ inches x $^{3}/_{4}$ inch
  - 6:00 – gouge, 1-$^{1}/_{4}$ inches x 1-$^{1}/_{4}$ inches
  - 6:15 – gouge, 1-$^{1}/_{4}$ inches x $^{1}/_{2}$ inch

- Axle 2 Left – Inboard Wheel
  - No visible damage to tire or wheel

- Axle 2 Right – Outboard Wheel
  - Outer Tire Sidewall
    - 10:30 – gouge to shoulder and tread surface, 1-$^{3}/_{4}$ inches x 1-$^{1}/_{2}$ inches
  - Outer Side of Wheel
    - No visible damage
  - Inner Tire Sidewall
    - No visible damage
  - Inner Side of Wheel
    - No visible damage
  - Tread Surface
    - 11:00 - 12:15 – gouges, total area 9 inches x 2$^{1}/_{2}$ inches
    - Scuffing on tread surface of varying widths, with max width approximately 2-$^{1}/_{2}$ inches wide. Scuffing begins at one tread shoulder and continues around the circumference in a corkscrew pattern for just under two complete revolutions before reaching other tread shoulder. Rust colored transfer was observed along some portions of the scuffing.[15]

- Axle 2 Right – Inboard Wheel
  - Outer Tire Sidewall
    - 12:00 – abrasions, 1 inch x 1-$^{1}/_{4}$ inches
    - 5:00 - 5:45 – gouge to shoulder and tread surface, 2 inches x 1 inch on shoulder, and 2 inches x 5 inches on tread surface
  - Outer Side of Wheel
    - No visible damage
  - Inner Tire Sidewall
    - 4:30 - 5:30 – scrapes and gouges, total area 7 inches x 4 inches
  - Inner Side of Wheel

[15] See *Vehicle Photograph 11 – Circumferential Scuffing to Tread Surface of Outer Tire on Right Side of Axle 2.*

        - 4:30 - 7:00 – radial collapse and heavy abrasion of tire bead flange with bluish discoloration of metal, 12 inch chord length with 1 inch collapse.

- Axle 3 Left
    - Tire
        - Partially consumed by fire
    - Wheel
        - Bent outward at front and inward at rear as found mounted at time of exam
        - 6:30 - 9:00 – radial collapse of outer bead flange, 12 inch chord length

- Axle 3 Right
    - Tire
        - Partially consumed by fire
    - Wheel
        - No visible damage

- Axle 4 Left
    - Tire
        - Partially consumed by fire
    - Wheel
        - 1:30 – 4:30 – minor radial collapse of outer bead flange, 13 inch chord

- Axle 4 Right
    - Tire
        - Partially consumed by fire
    - Wheel
        - No visible damage

1.9. BRAKES

The Ford F-450 was equipped with hydraulic ABS disc brakes on all four wheels. Due to the significant damage sustained by the vehicle, including a crushed master cylinder and reservoir assembly, fractured brake lines, and a loss of brake fluid, direct functional checks of the brake system were not able to be performed. NTSB and California Highway Patrol (CHP) Investigators were able to check the function of the parking brake system by manually pulling on parking brake linkage cable while attempting to rotate the rear wheel hubs using a crowbar for leverage. Movement of the wheels was stopped when the parking brakes were activated. Function of the hydraulic brake calipers was checked by introducing compressed air into the end of the broken hydraulic brake lines while attempting to rotate the front left and both rear wheel hubs using a crowbar for leverage. Movement of the wheels was stopped when the brake lines were pressurized. Due to the significant collision damage to the front right axle end,

investigators were unable to perform similar function checks of the right front brakes. A visual check of the outer brake pad appeared to have approximately the same thickness as the other pads on the vehicle.

The wheels were removed from the front left and both rear axle ends, and an examination of the brake system components was conducted. An abrasion to approximately 2-$^{1}/_{2}$ inches of the inner edge of the right rear brake rotor with a bluish discoloration to the metal was observed. The brake rotors and outer brake pads were measured. Measurements of the rotors and pads can be found in **Table 2**. All of the brake rotors were found to be smooth to the touch. The brake rotors were free of any major cracks. As specified by the stampings on the wheel hubs, the minimum rotor thickness should be no less than 37.4 mm (1.472 inches) for all of the brake rotors on the truck. The manufacturer also specifies that the minimum brake pad thickness on all of the brakes should be no less than 3 mm (0.118 inches).[16] The FMCSRs also require all of the brake pad thicknesses for all of the brakes on the truck be $^{1}/_{16}$ inch (0.0625 inches) or greater.[17] All of the measurable brake pad thicknesses on the truck were greater than both of these specifications.

Table 2: Ford Truck Disc Brake Measurements

Axle	Side	Rotor Thickness (millimeters)	Outer Brake Pad Thickness (inches)	Inner Brake Pad Thickness (inches)
Axle 1	Left	38.94	16/32	17/32
Axle 1	Right	N/A[1]	N/A[1]	N/A[1]
Axle 2	Left	38.50	15/32	15/32
Axle 2	Right	38.39	15/32	15/32

[1] Unable to obtain measurements due to severity of collision damage to this axle end.

The Wells Cargo utility trailer was equipped with electric drum brakes on all four wheels. Due to the significant collision and post-crash fire damage sustained by the vehicle, the electrical components of the brake system were destroyed. Direct functional checks of the brake system were not able to be performed. The post-crash and fire damaged condition of the trailer precluded a detailed examination of these components.

1.10. ELECTRICAL

Due to the extent of the collision damage, the Ford F-450's electrical system was compromised, and it was not possible to check the function or integrity of this system.

[16] See *Vehicle Attachment 3 – 2005 Ford – Brake Specifications*.
[17] 49 CFR 393.47 (d)

1.11. MAINTENANCE AND INSPECTION HISTORY

Maintenance and inspection records for the Ford F-450 and Wells Cargo utility trailer involved in the collision were obtained from the truck's owner, Harvest Management, LLC.[18] According to the Federal Motor Carrier Safety Regulations (FMCSRs), vehicles with a GVWR of 10,001 pounds or greater must be inspected at a minimum of every 12 months to ensure compliance with the requirements set forth in the regulations.[19] The Ford F-450 involved in the collision was required to undergo an annual inspection under the FMCSRs; however, no annual inspection was completed or documented for the vehicle. The State of Arizona does not have a mandatory annual inspection program that meets or exceeds the federal inspection requirements. The utility trailer, weighing less than 10,001 pounds, was not required to be inspected under the FMCSRs.

The maintenance records for both the truck and trailer were reviewed in detail. The records documented a variety of regularly scheduled preventative maintenance and as needed repairs made to the vehicle.

1.12. DOCUMENTED RECALLS AND WARRANTY CLAIMS

A search of the safety recall database maintained by the National Highway Traffic Safety Administration (NHTSA) indicated there were five voluntary safety recall campaigns for vehicles with the same make, model and model year of the truck involved in this collision.[20] According to records obtained from Ford Motor Company, none of these recall campaigns applied to the particular vehicle involved in this collision. The NHTSA recall database did not list any safety recall campaigns for the make, model, and model year of the utility trailer involved in this collision. A search of the defect investigation database, also maintained by NHTSA, did not reveal any active or inactive defect investigations for either the collision involved truck or utility trailer.

Ford Motor Company records show that three field-action campaigns were completed on the vehicle on August 2, 1007. These campaigns consisted mainly of vehicle software updates, and other minor repairs.[21]

1.13. EVENT DATA

The Ford truck was equipped with an airbag control module (ACM). NTSB and CHP Investigators were able to locate and remove the ACM from within the wreckage of the cab. The ACM was able to be successfully interrogated by CHP investigators using the Bosch Crash

[18] See *Vehicle Attachment 4 – 2005 Ford – Maintenance Records*.
[19] 49 CFR 396.17(c).
[20] The safety recall and defect investigation databases were accessed via the NHTSA safety recall website: http://www-odi.nhtsa.dot.gov/owners/SearchSafetyIssues [accessed February 26, 2015]. See *Vehicle Attachment 5 – 2005 Ford – NHTSA Recall History*.
[21] See *Vehicle Attachment 6 – 2005 Ford – Field-Actions and Warranty Records*.

Data Retrieval System.[22] Following the download, the ACM was turned over to an Oxnard Police Officer who took possession of it as evidence.

2. VEHICLE #2: METROLINK COMMUTER TRAIN

For a detailed account of the mechanical condition of the locomotive and rail cars involved in the collision, refer to the *Rail Mechanical Factors Group Chairman's Factual Report*.

3. VEHICLE #3: 1997 TOYOTA CAMRY PASSENGER CAR

3.1. GENERAL INFORMATION

VIN:	4V4N19TG37N■■■■■■
Make:	Toyota
Model:	Camry
Model Year:	1998
Manufactured:	August 1997
GVWR:	4,180 lbs.
GAWR – Axle #1:	2,400 lbs.
GAWR – Axle #2:	2,400 lbs.
Engine:	2.2 liter, 4 cylinder, dual overhead cam, 16 -valve, Gasoline
Transmission:	4-speed automatic overdrive
Braking System:	Hydraulically activated front ABS disc and rear ABS drum brakes

3.2. DAMAGE DESCRIPTION

A Toyota Camry passenger vehicle parked at the nearby railroad grade crossing was struck by flying debris from the collision. Damage to the vehicle was limited to the driver's side window being broken, and several small dents to the driver's side of the vehicle.

[22] See *Vehicle Attachment 7 – 2005 Ford – Airbag Control Module Download Report*.

F. DOCKET MATERIAL

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

LIST OF ATTACHMENTS

Vehicle Attachment 1 -	2005 Ford and 2000 Wells Cargo – Vehicle Specifications
Vehicle Attachment 2 -	2005 Ford – Engine Visual Inspection Report from Navistar, Inc.
Vehicle Attachment 3 -	2005 Ford – Brake Specifications
Vehicle Attachment 4 -	2005 Ford – Maintenance Records
Vehicle Attachment 5 -	2005 Ford – NHTSA Recall History
Vehicle Attachment 6 -	2005 Ford – Field-Actions and Warranty Records
Vehicle Attachment 7 -	2005 Ford – Airbag Control Module Download Report

LIST OF PHOTOGRAPHS

Vehicle Photograph 1 -	Vehicle Photograph 1 – Overall Damage to Truck Facing Front Left Corner (overturned)
Vehicle Photograph 2 -	Vehicle Photograph 2 – Overall Damage to Truck Facing Rear Right Corner (overturned)
Vehicle Photograph 3 -	Vehicle Photograph 3 – Overall Damage to Trailer Facing Front Right Corner
Vehicle Photograph 4 -	Vehicle Photograph 4 – Overall Damage to Trailer Facing Rear Left Corner
Vehicle Photograph 5 -	Vehicle Photograph 5 – Damage to Cab of Truck Facing Right Side Top
Vehicle Photograph 6 -	Vehicle Photograph 6 – Damage to Cab of Truck Facing Left Side Top
Vehicle Photograph 7 -	Vehicle Photograph 7 – Damage to Truck's Engine Facing Rear Right Corner (displaced from vehicle)
Vehicle Photograph 8 -	Vehicle Photograph 8 – Trailer Safety Chains

Vehicle Photograph 9 -	Vehicle Photograph 9 – Damage to Spring-loaded Chain Hook Keeper on the Trailer's Right Safety Chain
Vehicle Photograph 10 -	Vehicle Photograph 10 – Steering Wheel Displaced from Truck Showing Deformation and Deployed Airbag
Vehicle Photograph 11 -	Vehicle Photograph 11 – Circumferential Scuffing to Tread Surface of Outer Tire on Right Side of Axle 2

END OF REPORT

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