

Crash Investigation Team Technical Alert: Number 14

Date: January, 2006

At 11:23 a.m. on a clear, dry Sunday morning in October, a 2003 Ford F-250 extended cab pick-up truck towing a trailer was headed east on a seven lane, divided primary road. The road passes through a heavily traveled, commercially developed area. Four eastbound lanes expand to include two left turn lanes and one right turn lane as it approaches a standard traffic controlled intersection. The lanes are marked with white dashed lines that change to single solid white lines near the intersection. On the westbound side, three travel lanes proceed from the intersection, separated by dashed white lines. The pavement edges on both sides are bordered by concrete gutters and curbs that separate the road from a grassy shoulder. The eastbound and westbound lanes are divided by a grassy median that slopes downhill from the eastbound side to a lower elevation for the westbound lanes. The median is bordered by beveled curbing and is further demarcated by solid yellow single painted lines. The road in each direction of travel is level and straight with good visibility. The speed limit is posted at 45 mph.

The driver, a 25-year-old male, owned the pick-up, which displayed valid state inspection and registration stickers. His truck had an eight-inch suspension lift and sat on 38 inch tires, elevating the vehicle above its normal height. The rear bumper was measured at 32 inches, two inches above the legal rear bumper height for this class of vehicle. He had borrowed the trailer from a friend, and he carried the license plate in his pick-up. The truck required a special drop-style hitch because of the difference in height compared to the trailer. The ball on the hitch measured 20.5 inches from the ground. The coupling mechanism on the trailer, however, was only 11.5 inches from the ground when at rest, level and unattached. This driver had rented a turf aerator, which weighed

about 250 pounds, the day before and placed it in the back of his truck. He picked up the trailer the morning of the crash. In order to get the equipment out of the pick-up bed, he had to disconnect the trailer. After using the aerator, he reconnected the trailer to the truck using a ball hitch that fit the coupler on the trailer and a worn steel chain that attached to the truck with an aluminum “carabiner” type clip for a lock.



Exemplar Carabiner Clip

The truck was equipped with a four-pin plug receptacle to connect to the trailer’s lighting system. Although the pickup was also equipped with a seven-pin receptacle, which would have accommodated powering a trailer’s lights and electric brakes, there was no corresponding control device in the cab to operate a trailer service braking system. When inspected after the crash, the four-pin plug receptacle was uncovered and separated from its mount. The corresponding plug on the trailer was distorted and its ground wire severed from the trailer frame, leading the Team to believe the lighting harness was probably connected prior to the crash. The driver loaded the aerator onto the trailer, tying it down with six inch webbing onto the center of the trailer bed partially over the rear axle. He was en route to return it to the rental company when the crash occurred.

The utility trailer was homemade and had a current registration but did not display the license plates assigned to it. The county sticker was also absent. It was licensed to carry a total combined weight of 4000 pounds, 1750 pounds of that being the weight of

the trailer. Constructed in 1985, the steel trailer was composed of parts from a mechanical automobile lift and two axles from a mobile home. It had a flat bed without sidewalls or tailgate. The coupler on the trailer was compatible with the two-inch ball hitch on the truck; however, this latching mechanism was an older style. It consisted of a shallow concave rectangular metal plate that applied pressure to keep the ball securely seated in the coupler. This device was well worn and may have been defective prior to the crash. The lever on the coupling mechanism, which was bent and rendered the device defective after the crash, did not have a location to insert a locking pin to secure it in place.



Top view from the front of the trailer coupler and chains

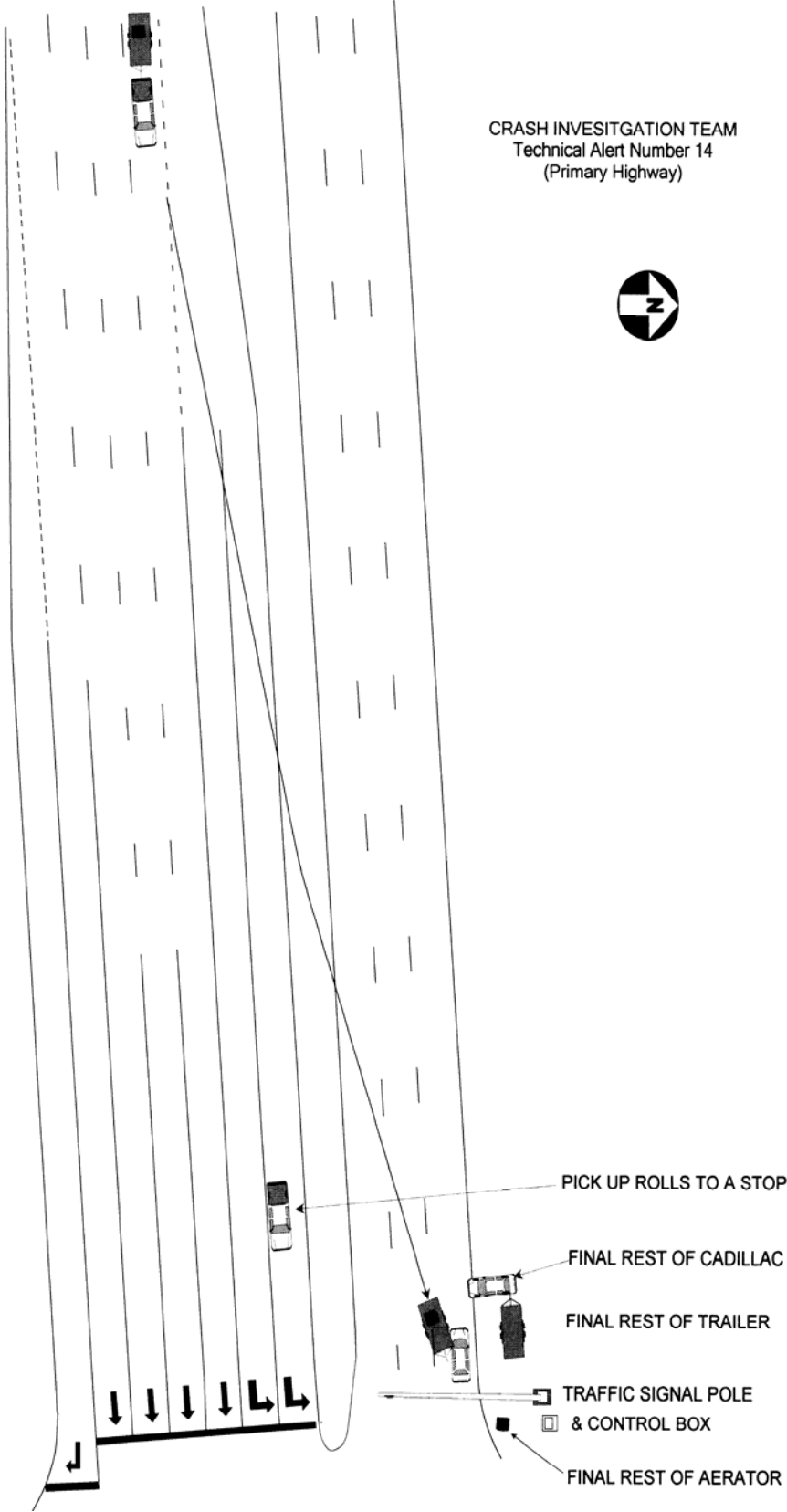
Combined brake, signal and tail light fixtures were mounted on the back end of the trailer and clearance lamps were mounted at the front corners. All the lights were wired to a harness with a plug to connect them to the towing vehicle for illumination.

Drum brakes were installed on the trailer's front wheels; however, there were no wires connecting them to the electrical harness. Consequently, the brakes were present but not operational. Without the appropriate harness, the brakes could not be connected to a power unit. Thus, they could not be activated in the towing vehicle through application of the service brake pedal or with a hand-operated lever. Additionally there was no emergency breakaway system, as required by Virginia State Code and inspection rules and regulations, to activate the brakes should the trailer come loose from the towing vehicle. Such a system would have included a switch that trips when a trailer disconnects and a battery to power the braking mechanism when the switch is tripped. Since the trailer was equipped with brakes, by State Code the brakes were required to function and the trailer was therefore required to be inspected. This trailer had no inspection approval sticker on it.



View from right side of trailer: note absence of battery box and breakaway switch.

CRASH INVESTIGATION TEAM
Technical Alert Number 14
(Primary Highway)



The pick-up and trailer had been traveling in the center lane, but moved to the left lane, then into the adjacent turn lane as it approached the intersection. On the opposite side of the road, signals for westbound traffic had just turned green. Several vehicles, including a 2000 Honda Odyssey minivan followed by a gray 2005 Cadillac CTS four-door sedan, began traversing the intersection. The driver of the Cadillac, a 51-year-old female with a valid Virginia license and a clean driving record, wore her lap and shoulder belt and was alone. Her sedan displayed valid state registration and inspection stickers and had only about 6000 miles on the odometer. As the truck slowed, the hitch and coupler separated, transferring the weight of the trailer onto the “carabiner” type clip and the emergency chain. The clip failed, releasing the chains and allowing the trailer to become a freewheeling, uncontrolled projectile.

The trailer crossed the remaining turn lane, mounted the curb and rolled down the median’s slope, into the lanes of oncoming traffic. The driver of the van braked and swerved to the left into the median to avoid it. The trailer passed in front of his vehicle and its tongue struck the right side of the Cadillac just behind the left front tire. The tongue slid along the side of the car and then the left front corner of the trailer body impacted just below the window level of the “B” pillar behind the driver’s door. The tongue and trailer body intruded into the driver’s compartment, causing extensive damage and fatally injuring the driver. The trailer and the car began to rotate in a counter-clockwise motion, crossing the curb at the north shoulder. The car rotated approximately 90 degrees, and then came to rest facing south with its rear end against a utility post. The trailer came to rest facing 180 degrees from its original direction of travel, with the tongue embedded in the deflated left rear tire of the car. The webbing that anchored the aerator gave way and it flew off the trailer, crossed onto the shoulder east of the car and trailer, and struck the control box for the traffic signals. It severely damaged the box, knocking it loose from its concrete pad and thus disabling the traffic signals for the intersection. It came to rest on the shoulder near the northwest corner of the intersection.

During the crash, the Cadillac’s front and side curtain airbags deployed on the driver’s side. This triggered an immediate alarm to police via the vehicle’s “On Star” monitoring system. The pick-up truck driver had pulled his vehicle into the left turn lane when he saw the trailer roll down the embankment. He stopped partially in the roadway

across from the final rest of the trailer and the Cadillac. Drivers in vehicles in front of and behind the Cadillac, as well as one who had been following the pick-up truck, all stopped and ran to the damaged car. Several called 911 on cell phones, requesting emergency help while others attempted to assist the driver, who was pinned in her seat, unconscious and apparently without any pulse or respiration. Minutes later, fire, police and rescue units arrived. Emergency personnel determined that the Cadillac driver was deceased and her body was transported to the local Medical Examiner's office. Police gathered evidence, interviewed witnesses and made arrangements to have the car and trailer towed to storage facilities. They cleared the scene approximately three hours after the crash; however, Virginia Department of Transportation crews required another three hours to complete repairs to the traffic signal box and restore mechanical controls to the intersection.



Left side of Cadillac: note damage starts behind front wheel and deepens at "B" Pillar

When interviewed after the crash, the driver of the minivan stated that his vehicle probably prevented other drivers from seeing the trailer heading in their direction. The physical evidence on the road indicated that the Cadillac driver made no evasive steering maneuvers, nor did she brake hard enough to leave skid marks prior to being struck. Her car was equipped with airbags and a Sensing and Diagnostic Module (SDM), which recorded data just prior to the car's rapid deceleration. A download of the SDM confirmed that the driver never braked and showed that she had been maintaining a

steady speed of about 25 mph as she moved past the intersection. All information points to the conclusion that she did not respond to the trailer bearing down on her, probably because she saw it only at the last instant, if at all.

The run-away trailer was a key item of interest for the Crash Investigation Team. The question of how and why it broke away from the pickup was an initial concern. The high rise truck violated equipment specifications and, even with the drop-style hitch, was too high for a proper mount with the coupling mechanism. The nine-inch difference between the ball on the hitch and the receptacle on the trailer lifted the tongue of the trailer and forced the bed to slant downhill from front to back. With the bed no longer level, unnecessary stress was placed on the ties securing the aerator to the trailer. The lack of a level mount between the two vehicles may also have kept the latching device from locking completely into position. The pickup driver reported that he felt the trailer come loose when he hit a very slight dip in the road as he entered the left turn lane. The dip may have been enough to jar open the latch and uncouple the hitch, transferring the full weight of the trailer to the tow chain and the aluminum “carabiner” clip. A chain is only as strong as its weakest link, and this clip was not designed to support the weight of a trailer. It stretched open and broke, releasing the trailer.



Carabiner Clip from this crash.

A second concern was the trailer itself. The Virginia Department of Motor Vehicles (DMV) permits homemade trailers to be towed on the highways of the Commonwealth if they are registered and licensed. A citizen need only obtain a “VSA22 Application for Assigned Vehicle Identification Number” (VIN) to begin the process to

title and register the trailer. The paper work, which is available online through DMV, gives instructions on how and where on the trailer the VIN plate must be attached. Once it is in place, the trailer owner is then instructed to call the State Police or local law enforcement to have the vehicle inspected. Instructions to law enforcement officers are merely to verify that the number on the VIN plate and the paper work match and that the VIN plate is properly attached to the trailer in the specified location. Once the officer signs off on the form, the owner must carry the paperwork to DMV for titling and registration.

Homemade trailers may be constructed of any available materials and do not have to demonstrate that they are roadworthy or safe in any general sense in order to be titled or registered. Those requirements are mostly administrative in nature and do not provide material, dimensional or design specifications for these vehicles, except regarding lights and brakes. The main structural components of the trailer involved in this crash appear to have been sturdy and welded solidly, probably because it was originally built to transport an automobile. However, it could have been poorly constructed of less sturdy or degrading materials, like untreated wood or rusting steel, and still met the titling and registration requirements.

Virginia State Code requires all trailers to have functional signal and tail lights that are connected to the towing vehicle. In addition, any trailer having a gross weight of 3000 pounds or more must have brakes. The Code further mandates any trailer equipped with brakes be inspected at an authorized State Inspection facility. Small utility and boat trailers that have a gross weight less than 3000 pounds and are not equipped with brakes are exempt. The inspection is performed while the trailer is attached to a towing vehicle. In addition to ensuring that the towing vehicle is in satisfactory condition to tow, the procedure calls for checking the trailer frame and the drawbar for cracks, and inspecting the trailer hitch, chains and cable for proper attachment and for signs of wear or damage. Inspection rules, however, do not provide specifications for strength of chains and wires or identify acceptable or unacceptable types of hitches. The brakes are checked to verify that they can be activated via some type of service mechanism that is tied to the brake pedal and can be operated manually. Additionally, an inspection would include checking to ensure that the trailer has an emergency breakaway system which would activate the

trailer's brakes if a disconnect occurred and would sustain the braking for at least 15 minutes.

The trailer on this vehicle had several violations that would have been obvious to an observant law enforcement officer. As a first red flag, the trailer did not display a valid license plate. The fact that it had two axles would indicate that it probably hauls sufficient weight to mandate it having brakes, giving an officer reason to look more closely at the vehicle. When viewed from the left side, the state inspection approval sticker and county sticker were not in evidence. From this vantage point, a quick glance would also reveal the absence of a battery box and emergency breakaway activation switch for the brakes. During a cursory visual inspection while driving by, an officer could have easily identified a minimum of five potential violations.



Example of trailer coupler with a seven-pin connector at bottom center, battery box at top center (attached with metal “U” bolts) and the breakaway switch and cable just right of center.

The driver in this crash was charged with reckless driving and eight different traffic infractions, five of which were equipment violations. He pleaded guilty to the reckless driving charge but was not prosecuted at that time on the remaining charges. He was convicted and sentenced to six months in jail with six months suspended and fined \$1000. His driver's license was also suspended for six months.

In summary, this crash was caused when a homemade trailer detached from the pick up that towed it. It struck a Cadillac traveling in the opposing lanes of traffic, fatally injuring the driver. Trailers are a special class of vehicle and all are subject to some requirements regarding lights and chains. While the Code exempts some smaller trailers, those designed to carry over 3000 pounds are required to have brakes and to be inspected beyond the initial visual confirmation of a VIN plate. However, Virginia State Code is silent as to any design or construction specifications for these vehicles or for towing chains and hitches. The purpose of this technical alert is to draw attention to the potential dangers of unsafe trailers on roadways in the Commonwealth. In many cases, towed trailers may be in obvious violation of safety codes that relate to lighting, braking and inspection requirements. Wherever possible, law enforcement officers should be trained in ways to quickly and easily identify such vehicles. In other cases, a trailer may meet all legal requirements but still be hazardous when used in transportation. The Team recommends that the Department of Motor Vehicles, the Department of State Police and/or members of the Virginia General Assembly review the current administrative Code and consider ways to improve safety with regard to trailers operated on Virginia roads.