National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Log #H642B

Date: FEB 15 2006

In reply refer to: H-06-3 and -4

26 States that do not have commercial vehicle inspection programs
(See distribution list)

The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating transportation accidents, determining their probable cause, and making recommendations to prevent similar accidents from occurring. We are providing the following information to urge your State to take action on the safety recommendations in this letter. The Safety Board is vitally interested in these recommendations because they are designed to prevent accidents and save lives.

These recommendations address the maintenance of air brakes equipped with automatic slack adjusters (ASAs) and the knowledge and skills needed to drive air brake-equipped vehicles. The recommendations are derived from the Safety Board's investigation of the collision between a Ford dump truck and four passenger cars in Glen Rock, Pennsylvania, that took place on April 11, 2003, and are consistent with the evidence we found and the analysis we performed. As a result of this investigation, the Safety Board has issued 11 safety recommendations, 2 of which are addressed to the 26 States that do not have commercial vehicle inspection programs. Information supporting the recommendations is discussed below. The Safety Board would appreciate a response from you within 90 days addressing the actions you have taken or intend to take to implement our recommendations.

About 3:36 p.m., eastern daylight time, on April 11, 2003, in the Borough of Glen Rock, Pennsylvania, a 1995 Ford dump truck owned and operated by Blossom Valley Farms, Inc., was traveling southbound on Church Street, a two-lane, two-way residential street with a steep downgrade, when the driver found that he was unable to stop the truck. The truck struck four passenger cars, which were stopped at the intersection of Church and Main Streets, and pushed them into the intersection. One of the vehicles struck three pedestrians (a 9-year-old boy, a 7-year-old boy, and a 7-year-old girl), who were on the sidewalk on the west side of Church Street. The truck continued across the intersection, through a gas station parking lot, and over a set of railroad tracks before coming to rest about 300 feet south of the intersection. As a result of the collision, the driver and an 11-year-old occupant of one of the passenger cars received fatal injuries, and the three pedestrians who were struck received minor-to-serious injuries. The six remaining passenger car occupants and the truck driver were not injured.[1]

[1] For additional information read National Transportation Safety Board, *Collision Between a Ford Dump Truck and Four Passenger Cars, Glen Rock, Pennsylvania, April 11, 2003*, Highway Accident Report NTSB/HAR-06/01 (Washington, DC: NTSB, 2006).

The National Transportation Safety Board determines that the probable cause of this accident was the lack of oversight by Blossom Valley Farms, Inc., which resulted in an untrained driver improperly operating an overloaded, air brake-equipped vehicle with inadequately maintained brakes. Contributing to the accident was the misdiagnosis of the truck's underlying brake problems by mechanics involved with the truck's maintenance; also contributing was a lack of readily available and accurate information about automatic slack adjusters and inadequate warnings about the safety problems caused by manually adjusting them.

With respect to the issue of maintaining air brakes equipped with ASAs, the Safety Board noted that the majority of heavy trucks on the road are equipped with ASAs. All air-braked vehicles manufactured after 1994 are required to have them and, in 1992, the Safety Board found that about 65 percent of the vehicles inspected during the *Heavy Vehicle Airbrake Performance* safety study[2] were already equipped with ASAs. These safety devices were introduced without a concentrated education effort being employed.

The postaccident inspection of the Glen Rock accident truck revealed that the two rear axle brakes were out of adjustment and produced little or no braking force. The front axle air chambers, which were slightly more than half the size of the rear chambers, were in proper adjustment. Yet, because the larger T-30 rear brakes produced little or no braking force, excessive strain was placed on the significantly smaller T-16 front brakes, which caused them to quickly overheat, resulting in severely diminished truck braking capability.

The truck was equipped with Gunite ASAs on all four brakes. After the accident, when the two rear adjusters were tested at the Gunite facility with the worn "quick-connect" clevises and clevis pins from the accident truck, the pushrod stroke would not go below 2 1/2 inches, which is outside the adjustment limits, rendering the system incapable of producing braking force. However, when the ASAs were tested with new clevises and clevis pins, they functioned properly and the adjustment stayed well under 2 inches, which is within the adjustment limits and would provide adequate braking forces. Therefore, the Safety Board concludes that at the time of the accident, the ASAs for all four of the accident truck's brakes were capable of working properly; however, the quick-connect clevises and clevis pins for both rear brakes were worn to the extent that they prevented the ASAs from properly adjusting the brakes, thereby reducing the capability of the rear brakes.

The Safety Board reviewed the maintenance and inspection history of the accident truck, which had undergone four vehicle inspections between 2001 and the April 2003 accident—three Pennsylvania State annual inspections (August 2001, March 2002, and January 2003) and one roadside inspection (April 2002). During two of these inspections—the 2002 roadside inspection and the 2003 State annual inspection—the rear brakes were found to be out of adjustment. After the 2002 roadside inspection, when the accident truck was placed out of service for out-of-adjustment brakes, the driver of the vehicle, who was also a truck mechanic, manually adjusted the ASAs. The Safety Board could find no record of further examination of the brakes by the company or the mechanic to discover why the brakes had been out of adjustment. During the 2003 State annual inspection, a Ford dealership mechanic found the rear brakes to be out of

[2] National Transportation Safety Board, *Heavy Vehicle Airbrake Performance*, Safety Study NTSB/SS-92/01 (Washington, DC: NTSB, 1992).

adjustment, and he manually adjusted the ASAs. In an interview with Safety Board investigators, he said he had adjusted the brakes and thought he had fixed the problem. Had he performed a more in-depth examination of the brake system, he probably would have found and replaced the worn clevises and clevis pins, which would have enabled the ASAs to adjust the brakes properly and might have prevented the accident.

The Gunite service manual gives specific instructions on how to conduct a torque test by turning the adjustment nut. If the Ford dealership mechanic had done a torque test, he might have realized that the adjuster itself was working properly. In addition, the Gunite service manual indicates that mechanics should "check the foundation brake for proper function; worn cam bushings, pins and rollers, broken springs, worn quick-connect clevis, worn clevis bushings and clevis pins. Repair as necessary and repeat the function test."[3]

One reason that ASAs should not be manually adjusted is that every time the adjusting nut is turned in a counterclockwise direction, the internal components experience additional wear because the action abrades the internal adjusting mechanism. In the El Cerrito, California, brake loss accident (also addressed in the Glen Rock accident report), the driver stated that he manually adjusted the slack adjusters twice a week and had done so on the morning of the accident. Postaccident testing of the El Cerrito accident truck at the Gunite factory showed that three of the adjusting clutches were worn to the point that they could not hold an adjustment, probably due to their age and the deterioration caused by frequent manual adjustment. For the majority of ASAs, regular manual adjustment will cause premature wearing of the internal clutch, which is a necessary component for the automatic adjustment feature to work properly.

Various brake component problems can cause a pushrod stroke to go beyond the limits for producing adequate braking capability, causing the brakes to be out of service. These problems include, but are not limited to, worn cam bushings, worn or broken pins and rollers, broken springs, worn clevises (both quick-connect and standard), and worn clevis bushings and pins. When a driver or mechanic finds a pushrod stroke to be long and manually adjusts an ASA to correct the long stroke, he or she is masking the true problem with the brake, not fixing it. In all likelihood, the adjustment will be temporary. ASA manufacturers Gunite, Haldex, and Bendix indicated to Safety Board investigators that they do not know how long (how many brake applications) a manually adjusted ASA will hold an adjustment.

The drivers and mechanics who manually adjusted the ASAs on the trucks involved in the Glen Rock and El Cerrito accidents apparently did not understand that they were not fixing the underlying problem with the braking systems. They did not appreciate that when an ASA does not hold an adjustment, something is wrong with the adjuster itself or with some other foundation brake component. Therefore, the Safety Board concludes that the drivers and mechanics who manually adjusted the ASAs on the trucks involved in the Glen Rock and El Cerrito accidents did not look for underlying problems with the adjusters or related foundation brake components; consequently, they misdiagnosed the brake problems, probably because they were not properly educated on the function and care of ASAs and how they relate to foundation brake systems.

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[3] Gunite *Automatic Slack Adjuster Service Manual*, ASA 100-1 (Gunite Corporation, June 1994) 7.

Manually adjusting ASAs to fix an out-of-adjustment brake is a dangerous practice that can have serious consequences. If an ASA is manually adjusted, the operator may wrongly assume the adjustment has "fixed" the braking problem, which gives the operator a false sense of security about the effectiveness of the braking system. The operator may believe that the brakes are fully reliable, when in fact they can go out of adjustment at any time, particularly in the case of vehicles that operate in hilly or mountainous environments. As the Glen Rock and El Cerrito accidents demonstrate, manually adjusting ASAs can create a situation in which brakes will not be capable of responding properly when they are desperately needed.

Although the Commercial Vehicle Safety Alliance's (CVSA's) Operation Air Brake data indicate that trucks with ASAs are placed out of service for out-of-adjustment brakes only half as frequently as those with brakes that have manual adjusters, ASA-equipped trucks are still being placed out of service for this deficiency, which suggests that ASAs have not solved the problem of out-of-adjustment brakes. Lack of knowledge about ASAs is one reason for the continuing problem. Since the Glen Rock and El Cerrito accidents, Safety Board investigators have questioned a number of randomly selected mechanics on the practice of manually adjusting ASAs. The majority indicated that they manually adjust ASAs when they are out of adjustment, a practice that ASA manufacturers neither suggest nor endorse.

In addition, results of the driver survey conducted in 2000 by the Owner-Operator Independent Drivers Association[4] showed that a majority of drivers, particularly owner-operators, are performing brake adjustments on both manual slack adjusters and ASAs. The 2003 Operation Air Brake driver survey showed that about half of the drivers responding believed that ASAs never go out of adjustment and about one-third thought that a driver with proper tools could readjust ASAs. The Safety Board therefore concludes that the warnings in existing materials available to owners, drivers, mechanics, and inspectors of air-braked vehicles equipped with ASAs have not been successful in communicating the inherent dangers of manually adjusting ASAs to correct out-of-adjustment brakes. Operation Air Brake Committee members told Safety Board investigators that during the 2003 Operation Air Brake driver survey, drivers who obtained information about air brakes from manuals, rather than classroom training, their companies, or other truckers, knew more about the safe operation of air-braked vehicles and had fewer brake out-of-service violations.

In August 2004, a coalition of five ASA manufacturers endorsed and submitted to the American Association of Motor Vehicle Administrators (AAMVA) language about ASAs to be included in the AAMVA's new model *Commercial Driver License Manual*, which was distributed on January 3, 2006. The new manual includes language on manual adjustment of ASAs stating (in part) that ASAs should not have to be manually adjusted except during the installation of the ASAs and when performing brake maintenance. It also states that manual adjustment of an ASA to bring a brake pushrod stroke within legal limits is masking a mechanical problem, not fixing it, and that manual adjustment of most ASAs is likely to result in premature wear of the adjuster. Further, the new language states that manual adjustment of an ASA should be used only in an emergency, as a temporary measure to correct the adjustment,

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[4] Rick Craig, "The Driver Perspective," *Report of Proceedings of the North American Brake Safety Conference, September 15-16, 2000* (Toronto, Canada: CVSA, 2001).

because the brake will soon be back out of adjustment, given that manual adjustment will not fix the underlying braking problem.

The Safety Board commends both the ASA manufacturers and the AAMVA for adding this language to the model manual. However, the new language concerning ASAs omits one vital element. It should also state that the manual adjustment of ASAs is actually dangerous because it gives the operator a false sense of security about the effectiveness of the braking system. The Safety Board understands that AAMVA revises the model *Commercial Driver License Manual* about every 10 years and the 2005 version has already been distributed, so it is not possible to add this language to the current version. All 50 States use the information in the AAMVA model manual. Because the new model manual has only recently been distributed, the States probably have not yet been able to adopt it for their use. Therefore, to ensure that the State commercial driver's license (CDL) manuals reflect the full range of risks posed by manual adjustment of ASAs, the Safety Board recommends that when the 50 States and the District of Columbia incorporate the information on ASAs from the new AAMVA model *Commercial Driver License Manual* into their CDL manuals, they include a statement that the manual adjustment of ASAs is dangerous because it gives the vehicle operator a false sense of security about the effectiveness of the braking system.

The issue of the knowledge and skills needed to drive air brake-equipped vehicles was also addressed during the Glen Rock investigation. Although the Glen Rock accident driver said that he slowed the truck before starting down the hill, he did not select a lower gear, which would have provided engine braking, an action recommended by the AAMVA model *Commercial Driver License Manual* and experienced truck drivers. Had he used a lower gear, the vehicle would have slowed due to normal engine compression. In addition, he pumped the brakes, reducing the capability of the front brakes and exacerbating the loss of braking capability in the out-of-adjustment rear brakes. Until recent widespread use of antilock brake system (ABS) brakes, drivers of hydraulically braked vehicles (passenger cars, sport utility vehicles, and pickups and other light-duty trucks) were taught to pump their brakes in emergencies.[5] But in an air-braked vehicle, pumping the brakes depletes the air pressure, thereby drastically reducing the brakes' capability.

The Glen Rock accident driver did not hold a CDL and he had not passed an air brake knowledge test; neither was required by regulation for him to drive the accident truck. The Glen Rock accident truck had a gross vehicle weight rating (GVWR) of 26,000 pounds and, for CDL licensing purposes, 49 *Code of Federal Regulations* (CFR) 383.5 defines a commercial vehicle as a motor vehicle that has a GVWR of 26,001 pounds or more. Consequently, the accident driver was not required to have a CDL to drive the accident truck. According to his statement, the driver had never received instruction on air brake operation. Also, although a road test is required by regulation, the motor carrier had not given the driver such a test in the accident truck. The accident driver said that he had been told that if the brake light came on, he had no [air] pressure, but it is not clear whether he understood what this meant. Therefore, the Safety Board concludes that the Glen Rock accident driver lacked the knowledge and skills required to safely

[5] Although ABS brakes were introduced in the 1970s, they were not widely used until the 1990s. ABS brakes are designed to help prevent a vehicle from skidding. The brakes are controlled by a computer that senses whether the tires are maintaining friction with the pavement or are sliding. For ABS brakes, steady brake pedal pressure is prescribed. Pumping the brake pedal defeats the purpose of ABS.

drive an air brake-equipped vehicle; as a result, he did not select a lower gear before proceeding down the hill and he pumped the brakes, which depleted the available brake air pressure.

Air brakes and hydraulic brakes operate differently. Because of these differences, drivers of air-braked vehicles need special instruction about how they function. In the United States, licensed drivers who do not hold CDLs are not typically given information about the operation of air brake systems, and they are not tested about air brakes before they are permitted to drive vehicles equipped with them. In contrast, the CDL licensing program recognizes that drivers need to be aware of the special characteristics of air brake systems and has established knowledge and skill requirements for operating them safely.

The AAMVA model *Commercial Driver License Manual* contains a section that specifically addresses air brake knowledge. If a CDL applicant wants to be licensed to drive an air brake-equipped vehicle, the applicant is required[6] to take a separate knowledge test and demonstrate proficiency in the inspection and operation of air brake systems. If a CDL applicant fails to pass the air brake knowledge and skills tests, the applicant is prohibited from driving vehicles with air brake systems. However, a non-CDL driver is not restricted from driving an air brake-equipped vehicle, whether in commercial or noncommercial use. Thus, no measures are in place to ensure that the drivers of air brake-equipped vehicles weighing less than 26,000 pounds have the knowledge and skills necessary for their safe operation.

Canada has recognized the importance of air brake system proficiency in its licensing system. Since 2001, Transport Canada has required that all drivers who drive any vehicle equipped with air brakes obtain an air brake endorsement. Transport Canada reports that Canada has experienced a reduction in brake-related accidents since the adoption of this requirement. Also, between September 1999 and September 2004, Canada experienced a 25-percent reduction in brakes found to be out of adjustment to the point of being out of service.[7]

U.S. accident statistics show that about one-third of straight truck accidents involve drivers who do not have CDLs.[8] Studies suggest that a significant portion of these accidents involve braking problems.[9] Data from the 2002 vehicle inventory and use survey[10] indicate that at least 30 percent (516,110) of trucks in the 19,501- to 26,000-pound weight class are equipped with air brakes. In addition, Freightliner and International data for new vehicles indicate that about 80 percent and 40 percent, respectively, of these manufacturers' new vehicles in this weight class are equipped with air brakes. These vehicles are in operation today (both in

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[6] Title 49 CFR 383.95 and 383.113(c).

[7] From Operation Air Brake data for 1999 through 2004.

[8] Anne Matteson and Dan Blower, *Trucks Involved in Fatal Accidents Factbook 2000*, Center for National Truck Statistics, University of Michigan Transportation Research Institute, UMTRI 2003-20 (Ann Arbor, MI: July 2003).

[9] U.S. General Accounting Office, *Highway Safety: Research Continues on a Variety of Factors that Contribute to Motor Vehicle Crashes*, GAO-03-436 (Washington, DC: GAO, March 2003). (Note: The General Accounting Office has since changed its name to the Government Accountability Office.) Also, U.S. Department of Transportation, Federal Motor Carrier Safety Administration, *On-Board Sensors for Determining Brake System Performance*, Task Order 3 of the Commercial Motor Vehicle Technology Diagnostics and Performance Enhancement Program, FMCSA-PSV-04-001 (Washington, DC: USDOT, December 2003).

[10] The Safety Board analyzed the raw data from the *2002 Economic Census, Vehicle Inventory and Use Survey*, using the GVWR information from the Vehicle Identification Numbers.

commercial and noncommercial use), and drivers without CDLs may legally operate them. Therefore, the Safety Board concludes that more than 500,000 vehicles equipped with air brakes may be operated by drivers who, like the Glen Rock truck driver, have no air brake training and thus may not be able to operate their vehicles safely.

To summarize, under the CDL program, each State has an air brake testing requirement, information in its CDL manual concerning air brakes, and a test for air brake systems. However, non-CDL drivers are not required to fulfill any air brake knowledge or testing requirement before driving an air brake-equipped vehicle. Further, a CDL is not required to drive a commercial vehicle with a GWVR of 26,000 pounds or less. So two major categories of drivers—commercial drivers who are not required to hold CDLs and noncommercial drivers—may not receive any air brake training or testing before they drive air brake-equipped vehicles.

As the Glen Rock accident demonstrates, all drivers should receive specialized training in using air brakes before driving a vehicle equipped with them. The Federal Motor Carrier Safety Administration (FMCSA) regulates commercial vehicle operations and commercial driver licensing. Therefore, the Safety Board has recommended that the FMCSA require drivers of commercial vehicles that weigh less than 26,000 pounds and are equipped with air brakes to undergo training and testing to demonstrate proficiency in the inspection and operation of air-braked vehicles; the training should emphasize that manually adjusting ASAs is dangerous and should not be done, except during installation or in an emergency to move the vehicle to a repair facility. Further, to address the issue of untrained noncommercial drivers driving air brake-equipped vehicles, the Safety Board recommends that the 50 States and the District of Columbia adopt an air brake endorsement for drivers' licenses that would require training and testing of drivers who drive air brake-equipped vehicles to ensure their proficiency in the operation of air-braked vehicles; the training should emphasize that manually adjusting ASAs is dangerous and should not be done, except during installation or in an emergency to move the vehicle to a repair facility.

Therefore, the National Transportation Safety Board makes the following safety recommendations to the 26 States that do not have commercial vehicle inspection programs:

> When you incorporate the information on automatic slack adjusters from the new American Association of Motor Vehicle Administrators model *Commercial Driver License Manual* into your Commercial Driver's License manual, include a statement that the manual adjustment of automatic slack adjusters is dangerous because it gives the vehicle operator a false sense of security about the effectiveness of the braking system. (H-06-3) [This recommendation is also being sent to the District of Columbia and the 24 States that have commercial vehicle inspection programs.]
>
> Adopt an air brake endorsement for drivers' licenses that would require training and testing of drivers who drive air brake-equipped vehicles to ensure their proficiency in the operation of air-braked vehicles; the training should emphasize that manually adjusting automatic slack adjusters is dangerous and should not be done, except during installation or in an emergency to move the vehicle to a repair

facility. (H-06-4) [This recommendation is also being sent to the District of Columbia and the 24 States that have commercial vehicle inspection programs.]

The Safety Board also issued safety recommendations to the Federal Motor Carrier Safety Administration, the District of Columbia and the 24 States that have commercial vehicle inspection programs, the Commercial Vehicle Safety Alliance, manufacturers and marketers of automatic slack adjusters, manufacturers of vehicles equipped with air brakes, the National Institute for Automotive Service Excellence, and publishers of National Institute for Automotive Service Excellence certification test study guides.

Please refer to Safety Recommendations H-06-3 and -4 in your reply. If you need additional information, you may call (202) 314-6177.

Acting Chairman ROSENKER and Members ENGLEMAN CONNERS, HERSMAN, and HIGGINS concurred in these recommendations.

By: Mark V. Rosenker
Acting Chairman

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