



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: October 23, 1992

In Reply Refer To: H-92-102

To the attached mailing
list

Throughout its 25-year history, the Safety Board has conducted in-depth investigations of hundreds of highway accidents involving commercial vehicles over 10,000 pounds. Prior to the fall of 1991, Safety Board investigators cited a wheel failure as the causal factor in only one fatal case.

Beginning in fall 1991, the Safety Board investigated a spate of five truck-wheel runoff accidents in which a total of seven people died. In the 3-week period alone between October 14 and November 4, 1991, three fatal heavy truck-wheel separation accidents occurred, including an accident in which the front left wheel broke off of a two-axle cargo van truck and careened into the path of an oncoming schoolbus carrying 46 fourth-graders and their chaperones. The 365-pound wheel slammed through the bus windshield, killing two children and a chaperone.

The seemingly high incidence of similar fatal accidents aroused public and Congressional concerns about the potential magnitude of the wheel separation problem. Currently more than 1.5 million heavy trucks log more than 90 billion miles annually in the United States. The Safety Board therefore initiated a special investigation in November 1991 in order to determine the magnitude of the wheel separation problem, the types and causes of failures, and the adequacy of current truck wheel inspection and maintenance guidance and procedures.¹

Because the Safety Board had investigated only six fatal accidents that had resulted from wheel separations, we recognized that we did not have a sufficient

¹For detailed information, read Special Investigation Report--"Medium/Heavy Truck Wheel Separations" (NTSB/SIR-92/04)

database with which to perform a comprehensive analysis. To compile the data needed for this special investigation, the Safety Board researched numerous sources and worked with several transportation agencies, including the Federal Highway Administration's Office of Motor Carriers (OMC) and the National Highway Traffic Safety Administration (NHTSA).

The Safety Board found that no data source was sufficient by itself to enable us to determine the leading causes of wheel separations. However, we believe that the databases examined showed similar patterns and, in combination, enabled us to identify the most probable causes of wheel separation. The Safety Board believes that the most common cause of truck-wheel separations is the loss or breakage of wheel fasteners.

Wheel failures involving broken studs, lugs, or loose nuts most frequently result from the improper tightening of the nuts or failure to retighten the nuts after the initial seating of the fasteners. The Safety Board identified undertightening as the causal factor in its 1991 investigations of fatal accidents near Warrior, Alabama, and Marion, North Carolina.

In addition to the accident cases noted above, OMC violation data and maintenance records provided by one of the nation's largest carriers support the Safety Board's findings that the undertightening of fasteners results in most wheel separations. The carrier's maintenance records showed that 65 percent of the wheel separations that the company's fleet experienced resulted from undertightening and 20 percent resulted from overtightening.

The OMC's MCSAP data shows that in commercial vehicle inspections conducted by the States, 40 percent of all wheel violations issued were for loose or missing nuts or studs. Stud hole elongation, which results when fasteners are loose during wheel use, was the third leading violation.

The Safety Board found that numerous sources identified the failure to follow proper maintenance practices as the primary cause of improper tightening of wheel fasteners. The OMC surveyed 16 carriers who performed their own wheel maintenance and found that 9 admitted to not following manufacturers' procedures.

Several manufacturers stated that when they performed metallurgical analyses on failed studs, they determined the failures were caused by fatigue that most likely resulted from the improper tightening of wheel nuts by various service facilities.

To determine what guidance was available to installers, the Safety Board looked at several truck and wheel manufacturers' manuals. Included in our review was the National Wheel & Rim Association's manual,² which contains safety information, operating procedures, and wheel and rim maintenance information for 12 of the nation's leading wheel manufacturers. The manuals all identified deficiencies and practices that could affect the tightness of fasteners. However, the maintenance manuals were not uniform in content and presentation. The Safety

²"Wheel & Rim Manual," National Wheel & Rim Association, Form W-770, 1992 Issue, September 1991. The manual contains recommended procedures for Accuride, Alcoa, Budd, Dayton Walther, Erie, Firestone, Goodyear/ Motor Wheel, Gunitite, Kelysey-Hayes, Redco, and Webb.

Board also determined from examining the manuals and from conducting interviews with wheel manufacturers and motor carriers that the recommended inspection frequency varied greatly among them. The Board also found that industry has not adopted standard guidelines for replacing broken wheel studs.

In summary, the Safety Board believes that to reduce wheel separations due to improper tightening, the wheel and truck manufacturers need to develop a comprehensive service manual that addresses all of the above areas and the manual should be disseminated to all involved in heavy-truck maintenance. The manual needs to address those maintenance procedures that are often not observed by mechanics, as well as uniform procedures on matters where conflict currently exists. Once this manual is available, the industry should launch an intensive training effort through manufacturers, carriers media, truck stops, and repair facilities to highlight the need to follow recommended practices for mounting wheels.

Therefore, the National Transportation Safety Board recommends that the Federal Highway Administration, in cooperation with the American Trucking Associations, the National Wheel & Rim Association, the Motor Vehicle Manufacturers Association of the United States, Truck Trailer Manufacturers Association, and the Society of Automotive Engineers:

Support the development of an educational program on proper wheel tightening procedures by the carriers and manufacturers.
(Class II, Priority Action) (H-92-102)

Also the Safety Board issued Safety Recommendations H-92-98 through -101 to the American Trucking Associations in cooperation with the National Wheel & Rim Association, the Motor Vehicle Manufacturers Association of the United States, Truck Trailer Manufacturers Association, and the Society of Automotive Engineers, and H-92-103 to the Department of Transportation.

VOGT, Chairman, COUGHLIN, Vice Chairman, and LAUBER, HART, HAMMERSCHMIDT, Members, concurred in this recommendation.



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