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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 16, 1984

Forwarded to:

Honorable Ray A. Barnhart
Administrator
Federal Highway Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

H-84-28 and -29

At 11:35 a.m., e.d.t., on October 7, 1983, a Mack 3-axle tractor, Model No. R685ST, which was pulling an MC306 (AL) cargo tank semitrailer loaded with 8,600 gallons of gasoline, was traveling in the right lane of westbound I-76 (Schuylkill Expressway) in Philadelphia, Pennsylvania, when it veered leftward, crossed the left lane, and collided with a concrete New Jersey-type median barrier. The combination vehicle overturned on the barrier, and gasoline, which spilled from the tank, was ignited. Three eastbound vehicles, which were caught in the area of the fuel spill, subsequently burned. Two persons were fatally injured, and one person was seriously injured. 1/

The Safety Board's investigation of this accident revealed that two main bogie spring leaves on the right side of the tractor had fractured from fatigue cracks. As a result of the spring leaf separations, the right side of the rear bogie axle rotated rearward and caused the vehicle combination to veer to the left and crash into the median barrier. The spring leaves had been purchased from an after-market supplier and had been installed on the vehicle 9 months and 60,344 miles before the accident. The Safety Board's investigation also disclosed pre-existing fatigue cracks on the left end of the front axle of the tractor. The largest fatigue crack extended through approximately 15 percent of the axle cross-section adjacent to the king pin tapered hole. The front axle fractured at this location either at impact with the median barrier or during the vehicle overturn which followed. The location and path of a groove in the road surface made by the spring leaves confirmed that the fracture of the spring leaves preceded the front axle fracture.

The Safety Board's metallurgical examination of the fractured spring leaves from the accident vehicle and a spring leaf from a similar vehicle belonging to the carrier disclosed that the parts purchased from the after-market supplier did not conform with the design specifications of the original equipment manufacturer (OEM). The fractures on the Nos. 1 and 2 main spring leaves on the accident vehicle stemmed from fatigue cracks located just aft of the rearmost spring clip. An additional fatigue crack was found on the No. 1 main spring leaf between the spring clips. All fatigue cracks initiated on the tension side of the spring leaves.

1/ For more detailed information, read Highway Accident Report—"Samuel Coraluzzo Company, Inc., Tractor Cargo Tank Semitrailer Mechanical Failure, Overturn, and Fire, Interstate 76 (Schuylkill Expressway), Philadelphia, Pennsylvania, October 7, 1983" (NTSB/HAR-84/2).

The OEM drawing for the spring leaf specifies a Brinell hardness ranging from 388 to 444 (approximately equivalent to 190,000 to 225,000 pounds per square inch tensile strength). Although the interior hardness of the spring leaves from the accident vehicle and the similar vehicle appeared to meet this specification, the hardness of the outer surfaces was equivalent to only 200 Brinell (approximately 96,000 pounds per square inch). Accordingly, the tensile strength of the outer fibers on the tension surface of the after-market spring leaves was less than one-half of that specified by the OEM.

Metallographic microsections of the after-market springs disclosed a decarburized layer along the outer spring leaf surfaces. Decarburization lowers the material's resistance to fatigue crack initiation and reduces the tensile strength capability of the outer fibers. In addition, none of the after-market leaves examined disclosed evidence of shot peening on the tension side of the leaf, which is another OEM specification. Shot peening is used to increase fatigue resistance on the outer fibers. Analysis of the after-market leaves also revealed that they did not conform to the chemical composition for the required AISI 5160H steel.

The Safety Board's metallurgical examination of a new No. 2 main spring leaf (randomly selected from service parts stock by Mack Trucks, Inc., the OEM) revealed that it essentially conformed to the chemical composition requirements for AISI 5160H steel, had an excellent homogeneous martensitic microstructure, was free of decarburization, and met the hardness criteria contained on the Mack engineering drawing 4QK3234A. However, the spring leaf did not appear to have been shot peened. Further review of the engineering drawing disclosed that there were no notes or control requirements regarding decarburization.

Had the rear bogie spring leaves not broken, the magnitude of the front axle fatigue crack (15 percent of axle cross-section) was such that it might have progressed to a total failure of the front axle. The failure of such a critical part at highway speeds would cause a serious accident. The front axle king pins were replaced 2 months and 12,358 miles before the accident. The original equipment front axle had accumulated a total of 747,911 miles since new and 171,000 miles since the tractor was involved in a rollover accident in 1979. Initiation of the front axle fatigue crack could have occurred during the earlier rollover accident or when the king pins were replaced 2 months before this accident.

This accident illustrates the importance of proper maintenance and inspection of all suspension components. Particular attention must be directed to those parts, and their respective attachments, that insure proper axle alignment continuity. In this case, the accident was caused by the loss of the rear bogie axle alignment. Misalignment of any axle (front, drive, or trailer) that occurs because of a suspension part failure can result in loss of vehicle control. Springs, equalizer beams, spring shackles, U-bolts, torque arms, radius rods, and their respective attachments must be properly maintained and inspected at frequent intervals to insure operational safety.

Purchasing replacement components from after-market suppliers can be an expedient practice; however, extreme care should be taken to insure that such replacement parts have been designed and manufactured according to the original specifications of the OEM. Components purchased from after-market suppliers should have equal or superior performance capability, be metallurgically and physically compatiable with mating parts in the system, and be consistent with the basic design philosophy of the vehicle.

Therefore, the National Transportation Safety Board recommends that the Federal Highway Administration:

> Issue an "On Guard" bulletin reporting the circumstances of the accident on October 7, 1983, in Philadelphia, Pennsylvania, and warn commercial motor vehicle operators that the use of after-market parts as replacements for critical suspension components can be a dangerous practice since the parts may not meet original equipment standards. Motor carriers should be advised to physically inspect all leaf spring suspension components, directing particular attention to the tension side of all after-market leaves in the spring clip area. (Class II, Priority Action) (H-84-28)
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> Direct inspectors of the Bureau of Motor Carriers Safety to give particular attention to the examination of suspension components and axles for fatigue cracks during the conduct of roadside inspections and vehicle audits. (Class II, Priority Action) (H-84-29)

BURNETT, Acting Chairman, and GOLDMAN, and GROSE, Members, concurred in these recommendations. BURSLEY and ENGEN, Members, did not participate.

By: Jim Burnett
Acting Chairman