U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

1200 New Jersey Avenue SE.
Washington, DC 20590

JUN 0 3 2010

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Timothy LaFon, Manager
Regulatory Affairs Customer Satisfaction
Volvo Trucks North America
7900 National Service Road
Greensboro, NC 27409-6115

NVS-214bby
EA09-003

Dear Mr. LaFon:

On January 15, 2009, the Office of Defects Investigation (ODI) of the National Highway Traffic Safety Administration (NHTSA) opened Engineering Analysis EA09-003 to investigate an alleged safety-related defect concerning drag link ball joint failures resulting in a loss of steering control in Model Year ("MY") 1998 – 2005 Volvo VN and VNL vehicles ("subject vehicles") equipped with a "sealed" or "maintenance-free" 35mm ball joints. ODI has completed its investigation.

The subject vehicles are class 8 trucks, meaning that the vehicles' gross vehicle weight ratings ("GVWR") are over 33,000 pounds. These vehicles are commonly referred to as tractors, in the context of tractor-trailers. Volvo manufactured the subject vehicles with a drag link containing a 35mm "Maintenance Free" ball joint manufactured by TRW ("subject ball joint").[1] The subject ball joint is sealed and does not have a grease or "zerk" fitting. Instead, grease is applied inside the ball joint at the time of manufacture. We understand that no other major manufacturer of class 8 trucks in the U.S., other than Volvo, used a drag link with a sealed ball joint.

Over time, the subject ball joints become loose. Separations occur when the throat of the ball joint is sufficient to allow the ball stud to effectively "pop out." When the ball joint separates, there is a loss of steering control. ODI's investigation revealed that drag link separations can

[1] As an option, Volvo sold some of the MY 1998-2005 VN and VNL models with a 35mm ball joint with a greaseable "zerk" fitting manufactured by TRW. After 2005, Volvo equipped the VN and VNL trucks with a 40mm sealed ball joint manufactured by Lemforder or USK.

occur at any point when the vehicle is in motion. Nearly half (48%) of the separations reported to ODI resulted in a crash.

ODI's Investigation

During its investigation, ODI collected and reviewed information from a number of sources. This included collecting and reviewing owner complaints, interviewing individuals and fleet operators that complained to NHTSA or Volvo, and inspecting vehicles. ODI also conducted vehicle and component testing, and analyzed failed and new parts. After collecting the information, ODI compiled data, identified trends, made comparisons to peer vehicles, made comparisons to other safety recalls regarding failed ball joints, reviewed Volvo's responses to ODI Information Request (IR) letters, and evaluated Volvo's assertions. There have been 49[2] reports of ball joint separation in the subject vehicles. This equates to a failure rate of approximately 42/100K vehicles.

ODI collected detailed information on 14 of these reports from fleet operators, owners, and drivers. In at least 12 of the 14 instances, a ball joint separation occurred within 25,000 miles of the steering system having been through a periodic maintenance inspection, an annual DOT level inspection, or having had alignment work done on the vehicle. In at least 5 instances, the inspection or maintenance work had been done within 5,000 miles of the separation.

According to Volvo, the drag link has a design life of 625,000 miles. On the subject vehicles, the subject ball joints are separating at an average of 435,611 miles, with close to a third of their design life left. Based on Volvo warranty data, the subject vehicles average about 120,365 miles per year. When the subject ball joints fail, the truck loses the steering on both wheels.

Volvo's warranty data shows that the subject ball joint has been replaced at the relatively high rate of close to 1%. In the subject vehicles, Volvo offered the option of equipping the drag link with a 35mm greaseable ball joint manufactured by TRW. This greaseable ball joint has the lowest warranty rate of all the ball joints used on the subject vehicles at approximately 0.24%. The subject ball joints are replaced at a rate more than three times higher than the 35mm greaesable ball joints.

In 2005, Volvo changed the drag link ball joints in the VN and VNL models from a 35mm ball joint manufactured by TRW to a sealed 40mm ball joint manufactured by Lemforder. In 2008, Volvo changed the drag link ball joints in the VN and VNL models to a sealed 40mm ball joint manufactured by USK. The warranty claim rate for the subject ball joints is 2.7 times higher the warranty claim rates for the subsequent Lemforder or USK ball joints. Furthermore, the difference in warranty claim rate exists regardless of whether the ball joint is sealed or greaseable, as the rates for both Lemforder and USK 40mm ball joints is only slightly higher than the warranty claim rates of the 35mm greaseable ball joint manufactured by TRW.

The failures are continuing. In the year leading to this letter, ODI received 2 reports of drag link separation on the subject vehicles. One of those separations resulted in a crash.

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[2]Volvo collected data through November 3, 2009 for its response to ODI dated November 6, 2009.

The Agency believes that the collected data represents a significant number of failures.

Volvo's Position:

In Volvo's November 6, 2009, letter to the agency, Volvo stated that the drag link separations do not pose an unreasonable risk to safety. As the agency understands Volvo's position, there is no risk to motor vehicle safety if the vehicle is properly maintained by completing inspections. Volvo argues that the drag link separations are occurring because the drivers and owners of the subject vehicles are not performing basic preventive maintenance. To date, Volvo has not produced any evidence indicating that owners and drivers are failing to properly maintain their vehicles.

ODI's Response:

For class 8 trucks, there are several mandated inspections that must occur. The Federal Motor Carrier Safety Administration ("FMCSA") requires daily inspections, where the person inspecting the vehicle should check for broken seals and visually inspect the steering system. The FMCSA also requires in-depth annual inspections. Volvo and TRW suggest inspections to be completed every three months or 25,000 miles.

There are two main ways to check for looseness in the drag links. The first involves measuring play in the steering system by rocking the steering wheel manually. Both the FMCSA annual inspection regulations and the Commercial Vehicle Safety Alliance (CVSA) Out-of-Service Manual require that a vehicle's steering system be checked in this manner. Depending on the steering wheel diameter, there is a prescribed amount of movement (free play) that is allowed. Second, according to the FMCSA's regulations on the annual inspection of the ball and socket joints on the vehicle, a vehicle should be placed out of service if there is any motion, other than rotational, between any linkage member and its attachment point of more than 1/4 inch (6.35mm). *See* 49 C.F.R. Chapter III, Subchapter B, Appendix G (7)(g)(2). The CVSA Out-of-Service Manual has the same requirement except that the motion cannot be greater than 1/8 of an inch (3.175mm). TRW's LNK-105, a service bulletin, recommends placing the vehicle out of service when there is 3mm of play.

Volvo's inspection procedures are different than the industry standards described above. After numerous reports of failures, in a February 22, 2010, letter, Volvo described its inspection procedures to owners of the subject vehicle. The letter indicated that the person conducting the inspection should lean over the driver's side front tire, grab the drag link at the adjustable end, push and pull on the drag link in an axial manner by applying 50 lbs of hand pressure. Neither the FMCSA regulations nor the CVSA Out-of-Service manual requires the application of 50 lbs. of hand pressure in an axial manner on a specific end of the drag link. A person inspecting the vehicle could conduct the required, industry standard inspections but fail to comply with Volvo's inspection requirements. For example, the person inspecting could push and pull on the drag link on the non-adjustable end. Likewise, a person inspecting could push and pull on the drag link in a manner that is parallel to the ground, and not axially. Both inspection procedures are allowable under FMCSA regulations and the CVSA Out-of-Service manual. In both inspection procedures, the person inspecting might not detect free play in the subject drag links.

According to Volvo, one causal or contributing factor for the drag link separations is the "[l]ack of required inspection and replacement as specified in Volvo's service literature." However,

Volvo's instructions have been less than clear and, until the February 22, 2010, letter, have not been disseminated to all owners of the subject vehicle. Volvo's instructions on how to inspect the "maintenance free" ball joints in the Volvo Owner's Manuals and Volvo's Service Manuals are vague and contain different descriptions on how to inspect the drag links. For example, the 2001 Operator's Manual for the subject vehicles merely states, "[c]heck steering wheel for excessive free play." It was not until 2007 that more detailed inspection procedures for inspecting the subject ball joints were contained in a Volvo Service Manual, and, even then, the procedure was isolated in the manual from the inspection checklist that drivers would commonly refer to.[3] There is no reference to it elsewhere in the manual. At this time, the detailed ball joint inspection procedures are still not contained in the Owner's Manuals for the subject vehicles.

In 2001, TRW published a service bulletin, LNK-105, that describes the detailed inspection procedures for the subject ball joints. However, this bulletin and other Volvo bulletins are only sent to Volvo dealers and repair facilities automatically. Other customers, fleet operators, or maintenance facilities outside the Volvo network must take affirmative steps to get the service information from Volvo or a Volvo dealer. This discrepancy was highlighted by internal Volvo emails, where a Volvo employee wrote "there is no inspection procedure in place for the typical North American technician to use."

Throughout this investigation, Volvo argued that the subject ball joints are failing due to a lack of inspection and maintenance. However, there are some key differences between the subject ball joints and ball joints typically used in class 8 trucks in the U.S. First, and most notably, ball joints typically contain a grease or "zerk" fitting. By greasing the ball joint, the mechanic introduces new grease and expels water or contaminants from the ball joint. That is not done on the subject ball joints. Second, the subject ball joints are spring-loaded and face upwards, meaning that a spring under the ball stud takes up wear by putting pressure upwards. This makes the detection of free play more difficult. Furthermore, according to internal Volvo e-mails, the North American version of the subject ball joints were designed with "a very stiff spring with a short spring travel, whereas the European design has a softer spring with longer travel." The stiff spring would make it difficult to detect free play when inspecting the subject ball joints, even if a person pushed and pulled on the drag link in an axial manner.

VRTC Testing

The Vehicle Research and Test Center ("VRTC") examined the subject ball joints to determine if one could detect free play following the industry standard inspection requirements. In terms of a warning before the subject ball joints failed, Volvo stated that one would either (1) feel looseness in ball socket assembly as felt when performing required inspections; (2) "loose feeling in steering ("play");" or (3) "possible noise ("popping")."

VRTC tested three different subject ball joints on the subject vehicles to determine if play could be detected in the steering. One of the drag links had a ball joint with 4mm of play, a second drag link had a ball joint with 4.8mm of play, and a third drag link was equipped with a brand new ball joint. According to TRW, the subject ball joints experience separation at 8mm of play, and should be replaced with 3mm of play. When using the traditional method of detecting play in the steering system, *e.g.* rocking the steering wheel with the engine running and measuring the

[3] The 2007 Service Manual contains a master check list for the person inspecting the vehicle to use. The detailed instructions on inspecting the ball joint are contained in a separate section from the steering section, and there is no reference to inspecting the ball joint on the master checklist.

amount of free play at the steering wheel, VRTC could not detect play in the three different ball joints by rocking the steering wheel. Likewise, VRTC could not detect any significant difference between the drag link with the new ball joint and the drag link with 4.8mm of play by rocking the steering wheel.

VRTC conducted additional testing to determine whether significant wear and play in the ball socket assembly in the subject ball joints could be masked by corrosion products that would make it appear that there was less free play than there actually was. Testing at VRTC showed that the axial play on ball joints collected from the field only increased after the corrosion products, hardened grease, or other debris were flushed out from around the ball stud. For this testing VRTC collected 18 ball joints, measured the axial play, flushed the debris out of the joint, and re-measured the axial play in the joint. In all cases the amount of axial play increased after the joint was cleaned out. In most cases the axial play increased over 0.5mm. In three cases, the axial play increased by over 1mm. Based on this testing, the ODI believes that some amount of play can be masked and difficult to detect in a potentially failing joint due to a loss of grease, rust and contaminants.

This particular situation was brought to ODI's attention by a Volvo dealer who experienced a drag link separation. The dealer maintains that he was following Volvo's inspection requirements and would replace the ball joints "if any excessive up/down play was detected at the ball joint socket." After the separation, the dealer tested additional subject vehicles for play in the subject ball joints. In one vehicle, the dealer detected .020" (0.5mm) of play in the rear drag link ball joint. When he disassembled the ball joint on that vehicle, "we discovered this rear joint had no grease left, and rust had eroded the ball surface to the point it looked like the failed component." In effect, the dealer believed that this subject vehicle would fail even though the dealer conducted the appropriate inspections.

Peer Data

ODI determined that ball joint separations occurring on the subject vehicles are not occurring on peer vehicles at similar rates. Both the subject and peer vehicles would be maintained and inspected by similar, if not the same, group of maintenance facilities across the U.S. If, for some reason, these facilities were failing to maintain and inspect ball joints, then, arguably, the peer vehicles would also be experiencing ball joint failures. To this date ODI has only received one consumer complaint for a failed ball joint on a peer manufacturer's vehicle. The Agency received this complaint in 1995.

Furthermore, when comparing warranty claims rates, the drag links on the subject vehicles are being replaced at a rate 4.5 times greater than one of its peer manufacturers. The peer vehicles have a similar population as the subject vehicles and are equipped with a greaseable ball joint.

Similar Recalls

On August 4, 2000, TRW informed ODI that they were recalling 74,929 ball joints for a defect that allowed the joint to fail prior to the end of its design life. NHTSA designated this recall 00E-047. These joints were used on Class 8 trucks, and Volvo filed a subsequent notice of recall. NHTSA designated Volvo's recall 00V246. These TRW ball joints, which contained a grease fitting, were failing at approximately 120,000 miles. When they failed, a vehicle lost

steering in one wheel. In contrast, when the ball joints on the subject vehicles fail, there is a total loss of steering.

The following light vehicle manufacturers have conducted safety recalls for defects involving "maintenance-free" or sealed ball joints in steering and suspension systems: Chrysler Corporation (Safety Recalls 09V-119, 06V-288, 04V-596) and Toyota (Safety Recalls 07V-013, 05V-225). Although the vehicles affected by those recalls are light vehicles and not heavy trucks, the primary safety consequences of vehicles traveling on the road with a total or partial loss of steering are the same. With the subject vehicles, the loss of steering would occur on a heavy-duty truck weighing up to 80,000 pounds, and not on a light-duty vehicle weighing under 10,000 lbs.

Safety Risk

On the basis of the available information, ODI believes that the separation of the drag link in the subject vehicles constitutes a defect related to motor vehicle safety. The loss of steering control on any vehicle is a defect related to motor vehicle safety within the meaning of 49 U.S.C. § 30118. *See generally United States v. General Motors Corp.*, 518 F.2d 420 (D.C. Cir. 1975). Drag link separations on the subject vehicles have occurred and can occur when the vehicle is traveling at highway speeds. The result has been numerous crashes, property damage, and sometimes serious injuries. When a class 8 truck experiences a total loss of steering control, it poses a serious threat of injury to the driver and to the driver's of other vehicles.

Conclusion

The high number of complaints is indicative of a high rate of failure, and the drag link separations are continuing to occur. The failures could lead to safety problems involving injury or death. Therefore, ODI requests that Volvo initiate a safety recall, in accordance with 49 U.S.C. § 30118-30120, to notify all owners, purchasers, and dealers of the problem and to provide a free remedy for each of the subject vehicles.

If Volvo decides not to conduct the requested recall, it must provide ODI with a full explanation for this decision, including any additional analysis of the problem beyond its past presentations. If Volvo fails to initiate a recall, the agency may proceed to an Initial Decision that these vehicles contain a safety-related defect. An Initial Decision would be accompanied by a Federal Register notice describing the alleged defect and the ODI investigation, the scheduling of a public meeting, and the issuance of a press release to inform the public regarding this matter.

ODI's recommendation that Volvo conduct a safety recall does not constitute a formal conclusion by NHTSA with respect to the evidence in our investigative file. Also, this recommendation does not constitute an initial or final decision that the subject vehicles contain a safety-related defect pursuant to 49 U.S.C. § 30118, or an order to recall those vehicles.

Volvo's written response to this letter, in duplicate, referencing the identification codes in the upper right hand corner of page 1 of this letter, must be submitted to this office no later than May 28, 2010. It is important that Volvo respond to this letter on time. This letter is being sent pursuant to 49 U.S.C. § 30166, which authorizes this agency to conduct investigations and require the submission of reports that may be necessary to enforce Chapter 301 of Title 49.

Failure to respond promptly and fully to this letter may be construed as a violation of 49 U.S.C. § 30166, which could subject Volvo to civil penalties pursuant to 49 U.S.C. § 30165.

If you have any questions regarding recall procedures, please contact Mr. George Person of my staff at (202) 366-5210. If you have any technical questions, please contact Mr. Bruce York of my staff at (202) 366-6938.

Sincerely,

Richard Boyd

Richard Boyd, Acting Director
Office of Defects Investigation
Enforcement