June 18, 2010

Mr. Richard P. Boyd, Chief
Medium and Heavy Duty Vehicle Division
Office of Defects Investigation
U.S. Department of Transportation
National Highway Traffic Safety Administration
1200 New Jersey SE
Washington, D.C. 20590

Re: **EA09-003, Ltr dated June 3, 2010**
NVS- 214bby

Dear Mr. Boyd:

Volvo Trucks North America ("Volvo") has reviewed your letter of June 3, 2010. We respectfully disagree with your opinion of a safety related defect and take exception to certain information contained in NHTSA's letter. Volvo would appreciate your consideration of the information contained in this response.

Sincerely,

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Discussion of NHTSA letter dated June 3, 2010

Volvo respectfully disagrees with NHTSA's contention that a safety related defect exists. NHTSA has not provided an explanation on what the actual defect is. Volvo agrees that a ball socket separation is a safety concern, and that the consequence can be severe. However, regardless of whether the drag link ball socket is of a sealed or greasable design, the joint is nevertheless subject to wear, has a finite life, and requires periodic inspection and maintenance.

The primary contributor to separation is either damage to the sealing mechanism or lack of lubrication over an extended period of time that results in corrosion and accelerated wear to the ball and socket. TRW has supplied information that shows that the process of degradation of the ball socket to a point of separation is approximately seven calendar quarters, which Volvo believes provides ample time to identify and replace the drag link before a complete separation occurs.

Whether sealed or greasable, ball sockets are subject to wear and separation and therefore require the same inspections. A recent review of the Volvo warranty claims yield the basic statistics below.

Ball Socket Type	Production Years	Population Size	# of warranty claims	Average Time to failure (yrs)	Average Mileage to failure	# of reported separations
TRW Sealed	1997-2005	134,699	964	2.24	256,194	30
TRW Greasable	2005-2008	23,212	131	1.65	191,680	2

As discussed above, Volvo disagrees with certain information contained in NHTSA's letter. The statements that Volvo takes specific exception to are as follows:

1. On page one, the statement is made 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." This statement is not correct; there is at least one additional major manufacturer of class 8 trucks that used a drag link with a sealed ball socket. This has been confirmed by TRW.

2. On page one, the last paragraph discusses the mechanism required for separation. One common factor in all separations investigated by Volvo and TRW was the presence of significant corrosion due to prior damage to the sealing boot. This factor was not discussed or even identified in the NHTSA's letter.

3. On the bottom of page one and top of page two, the statement is made that "ODI's investigation revealed that drag link separations can occur at any point when the vehicle is in motion. Nearly half (48%) of the separations reported to ODI resulted in a crash." The highest loading to the ball socket occurs at low speed maneuvers or when the steering wheel is being turned while the vehicle is not in motion (i.e. dry steer). This may explain why less than half of the reports to NHTSA involved a crash.

According to Volvo's records, there have been thirteen reports of accidents involving the suspect component, two of which were determined to be separations that were caused by the impact when the accident occurred. This was confirmed by a thorough examination of the physical evidence (e.g. drag link, steering gear etc.). Physical examination of the drag link, steering gear and other components at time of accident is required in order to determine if the drag link separation contributed to, or was caused by, the accident. Volvo was hampered in conducting a full investigation of other accidents as notification was received well after the accidents occurred and parts were no longer available. Volvo expects this is the same problem with which NHTSA was confronted; it received reports of accidents, but could not make a full investigation due to the absence of parts to review.

4. In paragraph one under the *ODI's Investigation* on page two, reference is made to 49 reports of ball socket separations in the subject vehicles. Volvo has record of only 30 reports of separation on the subject sealed drag links. Information has not been provided as to those reports of which Volvo has received no notification. Questions also arise as to whether the 49 claimed reports relate to trucks all owned/operated by different owners, or whether some of the reports may be relate to trucks owned by the same owner/operator. If the latter, an inference could be drawn of improper maintenance/inspection affecting an entire fleet.

5. In paragraph two under *ODI's Investigation* section on page two, it states "detailed information on 14 of these reports from fleet operators, owners, and drivers" was collected and "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." It goes on to state "in at least five instances, the inspection or maintenance work had been done within 5,000 miles of separation." Volvo was not given an opportunity to review the information or evidence showing how NHTSA determined that the inspection was done. We refer to TRW's presentation dated May 27th 2009, which provides empirical evidence that looseness would be felt and opportunity of replacement given well in advance of a complete separation.

Volvo has no information concerning the qualifications of the entities that performed the periodic inspections, annual DOT inspection or alignment. NHTSA has provided no information concerning its investigation into the qualifications of those purported to have done this work. Recognizing such work is often not done by the truck owner but rather by third parties, NHTSA may have had to rely upon the statements of the owner of the truck.

It is Volvo's position that if a drag link separated within 25,000 miles of having a periodic maintenance inspection, annual DOT inspection, or wheel alignment performed; this constitutes *per se* negligence on the part of the entity that performed such work. If the drag link is within acceptable wear limits at the time of any of these enumerated services, the ball socket will not wear to the point of separation within 25,000 miles and is not likely to separate at mileages well beyond that point.

6. In paragraph three on page two under *ODI's Investigation* section, the statement is made that "According to Volvo, the drag link has a design life of 625,000 miles." This information was supplied to NHTSA in the presentation by TRW on May 27, 2009. The life is actually a function of the number of maneuvers per kilometer. This was explained in information supplied to NHTSA in Volvo's November 7, 2009 submission. Specifically, for urban use,

five maneuvers per kilometer, a life of 500,000 kilometers or 310,866 miles is expected. For long range use, there are two values, 800,000 kilometers or 497,097 miles based on 4 maneuvers per kilometer and 1,000,000 kilometers or 621,371 miles based on 1 maneuver per kilometer.

As tractors age and accumulate mileage, they may be taken out of over-the-road service and placed into regional service. Here the maneuvers per kilometer increase. Alternatively, the trucks may be sold and placed into the secondary market where they may continue in line haul operation or be used in regional or urban environments where the maneuvers per mile increases again. They may even be converted to vocational applications or into applications for which they were never intended. The initial transition normally occurs as the result of increasing maintenance costs, reduced reliability and the need for driver retention. As the trucks age and mileage accumulates, maintenance becomes an increasing large part of the overall costs of operation.

Volvo is not aware of any data that could be used to accurately predict the design life of the drag link as the application for which the tractor was intended changes. While 1,000,000 kilometer is the anticipated design life of the drag link when used in an application where usage is one maneuver per kilometer, this rarely occurs, if at all, with a line haul tractor as at some point in time, the tractor will be taken out of that service.

It is not appropriate to use these anticipated life values when the application for the vehicle has changed, or more specifically when the maneuvers per kilometer changes.

7. In paragraph four on page two under *ODI's Investigation* section, a comparison is made on the rate of replacement of sealed ball socket drag links to greasable ball socket drag links. The numbers presented are 1% and 0.24% respectfully. According to Volvo's latest data collection that was done in May 2010, the rate of replacement of the sealed ball socket drag link is 0.72% and the greasable ball socket drag link is 0.56%. The difference has been reduced to 0.16% between the two. This can be explained by examination of the production years in the table on page two of this document. The TRW sealed ball socket drag link was used during the years of 1997 through 2005, a population which has mileages that currently range from approximately 601,825 to 1,564,745 miles based on 120,365 miles per year in service. On the other hand, the TRW greasable drag link was used from 2005 through 2008, a population which has mileages that range from approximately 240,735 through 601,825 based on 120,365 miles per year in service. The statistical data for the greasable drag link is not as mature as the sealed drag link. The same would apply to the Lemforder and USK drag links which were not introduced until 2005 and 2008 respectfully. An accurate comparison of the replacement rates cannot be achieved based solely on the current number of claims that exist today. The maturity of the vehicle populations must be considered with the understanding that the TRW greasable, Lemforder, and USK parts were introduced at a later date and therefore the data is not as mature as the TRW drag links with sealed ball sockets.

8. In paragraph one on page three under the *Volvo's Position* section, the statement is made that "Volvo stated that the drag link separations do not pose an unreasonable risk to safety" and "Volvo has not produced any evidence indicating that the owners and drivers are failing to properly maintain their vehicles". We disagree with these statements and therefore will clarify our position and what has been shared that supports this position.

Obviously a drag link separation resulting in loss of steering poses a serious safety risk. The steering mechanism has components that wear due to the dynamics of the system. A similar example would be a tire which contacts the road and wears over time or brake pads that wear as they contact the brake drum. The point is that ball socket assemblies do wear and therefore require periodic maintenance and inspection. Like tires and brakes, continuous inspection and replacement is necessary. Periodic inspection of the steering system and ball sockets is required by the Federal Motor Carrier Safety regulations, supported by industry standards such as the Commercial Vehicle Safety Alliance and requirements specified by motor vehicle and equipment manufacturers. The product reports provided in Volvo's November 7, 2009 submission provides evidence involving cases where separation occurred because of lack of inspection and replacement.

9. In paragraph three on page three under the *ODI's Response* section, reference is made to Volvo's inspection procedure and the February 22, 2010 letter that was sent to owners. Some examples were provided suggesting the Volvo requirement is more comprehensive than the regulations and standard inspections prescribed by FMCSA and CVSA.

Regarding the examples, the first example states "the person inspecting could push and pull on the drag link on the non-adjustable end" which implies that they may not inspect the adjustable end. The regulation and standard is focused on ball socket assemblies in general. The drag link, like the tie rod assembly has two ball sockets. Both ball sockets must be inspected to comply with the requirements.

The second example states that "a person inspecting could push and pull on the drag link in a manner that is parallel to the ground." This may be possible; however, the chance of inspection as is being suggested is remote at best. The common means of inspection as recommended by the industry for many years has been to check using hand force for looseness in the axial direction. Additionally, the FMCSA or CVSA requirement does not limit the inspection to any one direction. Specifically, Appendix G to Subchapter B of the Federal Motor Carrier requirements state, "any motion, other than rotational, between any linkage member and its attachment point of more than $^{1}/_{4}$ inch." Also unlike light-duty vehicles, the operation and maintenance of Commercial Motor Vehicles is highly regulated.

Additionally, it is important to note that NHTSA was afforded an opportunity to review the February 22, 2010 inspection procedure in advance of its release and did provide input, which was incorporated into the document.

10. The second paragraph on page four, speaks of how Volvo supplies literature to dealers and repair facilities automatically, and states that others outside the Volvo network must take affirmative action to obtain the documents by contacting Volvo or a Volvo dealer. This statement implies that those outside the Volvo network have to take extraordinary steps to obtain the service information and that the required inspection instruction is not commonly known by North America technicians. This is an extraordinary statement. It suggests Volvo should send repair, maintenance and inspection information to entities Volvo may not even know exist! Entities outside the Volvo service network can go to Volvo Truck's website and order the needed information or go to an authorized Volvo Truck dealer and request the same information. This is consistent with other vehicle manufacturers.

The paragraph goes on to state that 'this discrepancy was highlighted by internal emails, where a Volvo employee wrote "there is no inspection procedure in place for the typical North American technician to use."' The reference made to the Volvo employee's statement has been taken out of context. The very next sentence written by the employee is " Using the current industry standard inspection method , a new drag link can be condemned and removed under truck stop inspection removal criteria." Therefore, the actual intended meaning is that a drag link that is operable can be condemned under the industry standard method of inspection.

11. The third paragraph on page four also misrepresents a statement made by a Volvo employee. The statement used is '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 a larger travel."' NHTSA goes on to state that "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." The sealed drag link design used by Volvo is actually the European style design with the softer spring and larger travel and not the stiffer spring shorter travel design as stated by NHTSA.

Furthermore, these statements are associated with an investigation where Volvo noticed an increased drag link replacement rate and found after a thorough investigation involving the supplier, TRW, that operable drag links were being replaced inadvertently because the European design has a softer spring and therefore normal spring travel was interpreted as looseness or free play. To service technicians and others familiar with the North American approach to drag link ball socket design, the soft spring and long travel was interpreted as a worn out ball socket calling for replacement.

This factor skewed much of the warranty claims data. Many claims were filed for worn out drag links when, in fact, they were not. Full reliance upon such warranty claims data as indicative of worn out drag links ball sockets can be problematic.

12. On the bottom of page four and top of page five, NHTSA speaks of testing that was performed. The testing involved measurement of play in ball sockets and rocking the steering wheel back and forth to measure free play at the steering wheel. Two drag links with play of 4.0 and 4.8 and a new drag link were used. NHTSA goes on to state that there was not a discernible difference between the three drag links when checking free play at the steering wheel. Additionally, statements are made to support the theory that the condition may not be detectable prior to separation. NHTSA's analysis and assessment fails to include important considerations:

1. Daily visual inspection for damaged or loose components as required by the Federal Motor Carrier Safety requirements; no reference is made to the condition of the boot or ball socket seal on the drag links used by NHTSA/ VRTC for the testing.

2. Periodic inspection with hand force at the ball socket, the common and preferred method, is required in addition to the steering free play test. Looseness of 4 mm and 4.8 mm as detected by VRTC exceeds the CVSA Out-of-Service criteria, and Volvo's and TRW's replacement criteria; therefore, the ball sockets or drag links should be replaced.

It is important to note that the measurements of 4 mm and 4.8 mm even when adding the additional 1 mm, which is suggested, still yields a value well below the 8 mm where separation may occur.

The evaluation performed by VRTC was done with ball sockets that were beyond the acceptable wear limit. VRTC determined that no movement could be detected with the steering wheel free play test. However, separation does not occur until the wear approaches 8 mm. No information was provided indicating to what extent, if any, steering wheel play would indicate a wear condition, regardless of the ball socket type, that a ball socket was nearing separation.

13. On paragraph three on page five, reference is made to a Volvo dealer who allegedly had a separation, conducted an assessment by testing additional vehicles, found 0.5 mm of play in one ball socket and by disassembly of said ball socket determined that "rust had eroded the ball surface to the point it looked like the failed component." Volvo questions the credence of these statements and what is being implied. It appears that this information is hearsay without empirical research to support the statements and inclusion. Also, there are approximately two hundred fifty eight Volvo dealers in the US and there is no mention of NHTSA visiting other dealers or service facilities to qualify these statements.

14. On page five, there is also a discussion and comparison made regarding the difference in peer data. To reiterate, an accurate comparison of the replacement rates cannot be made based solely on the current number of claims that exist today. Consideration must be give to the maturity of the vehicle populations and recognition that the TRW greasable, Lemforder, and USK parts were introduced later. Data regarding these components is not as mature as the TRW sealed drag link data. Volvo has been advised by TRW that separations have occurred involving greaseable ball sockets and have received reports as indicated in the chart on page two. Separation is not limited to non-greaseable ball sockets.

15. Page five references "Similar Recalls". Recall 00V246 related to tie rod ball sockets and was initiated by TRW which advised Volvo of manufacturing defects. The subject Engineering Analysis has not indicated what type of defect may exist, if any, much less a manufacturing defect. The relevance of Recall 00V246 is questioned.

Reference is also made to various light vehicle recalls using sealed ball sockets in either double wishbone or MacPherson strut front suspensions. One of the recalls involved a seal which could be damaged allowing contaminants to enter the socket and accelerate wear. All recalls site either corrosion as leading to excessive wear or a manufacturing defect leading to excessive wear. The latter is not an apparent issue in the subject Engineering Analysis.

It must be noted the components in the cited recalls are front suspension components and not steering system components. As such they are subject to very different loading conditions. In fact, the comparable components in a Volvo Truck front suspension is not a ball socket at all, but rather a bushing which is greasable.

Other than corrosion being the most significant factor, the relevancy of these recalls is questioned.

16. On page six under the safety risk section, NHTSA speaks of "numerous crashes, property damage, and sometimes serious injuries." This statement is subjective and does not quantify the actual number and therefore can be easily misinterpreted. According to Volvo's records, there have been 30 reported separations over a population of approximately 135,000 vehicles, which involved 13 reported accidents with no fatalities and two injuries. One of the injuries involved a personal injury lawsuit, where it was determined that the drag link separation occurred on impact and therefore, did not cause the accident. In another claim, the drag link separation occurred on impact and therefore did not cause the accident.

Volvo does not consider a failure rate of 0.02% indicative of a high failure rate as described by NHTSA. Additionally, the circumstances associated with each of the cases and contributing factors such as detectable looseness and visible damage to components must be considered.

In summary, Volvo agrees that a ball socket separation is a serious safety concern but disagrees that a safety related defect exists. NHTSA has not provided a clear description of the defect or provided substantial evidence in support of their opinion. Also, one major contributing factor, boot damage leading to contamination and corrosion, is not at all mentioned in NHTSA's assessment but remains a factor common to all separations investigated by Volvo and TRW. The only explanation for this is unrepaired damage to the boot. Regardless of whether the ball socket is greasable or sealed, damage to the boot will lead to corrosion and accelerated wear, and if left untreated can result in a ball socket separation.

The design of a greasable ball joint includes a boot that has provisions to allow grease to be purged from the joint. If the joint is not regularly lubricated, contaminants can enter the openings and cause the same result as that found on a sealed joint with a damaged boot. One design is not superior to the other. The absence of proper inspection and maintenance and allowing the joint to wear well beyond the recommended replacement limit will ultimately result in separation.

Volvo Trucks has elected to move forward with a safety campaign as requested by NHTSA of the TRW 35 mm sealed drag links even though we feel that this is not a defect. The Campaign will involve replacement of TRW 35 mm sealed drag links with a comparable drag link or ball socket with a grease fitting. The notification mechanism used will be the same as that used for safety related recalls to ensure the greatest possible coverage.

New production will use greaseable ball sockets. Non-greaseable drag links will continue to be offered as optional for those customers who have a preference for low maintenance components.