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

400 Seventh St., S.W.
Washington, D.C. 20590

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Stephan J. Speth, Director
Vehicle Compliance and Safety Affairs
DaimlerChrysler Corporation
800 Chrysler Dr. – CIMS 482-00-91
Auburn Hills, MI 48326-2757

EA03-023
NVS-213

Dear Mr. Speth:

This letter is to inform you that the Office of Defects Investigation (ODI) of the National Highway Traffic Safety Administration (NHTSA) has completed its investigation of front suspension upper ball joint separations in model year (MY) 1998 through 2003 Dodge Durango sport utility vehicles and MY 1997 through 2004 Dodge Dakota pickup trucks and is requesting that DaimlerChrysler Corporation (DaimlerChrysler) conduct a safety recall to replace defective upper ball joints in some of those vehicles. ODI has identified what appears to be a safety-related defect in the upper ball joints used in approximately 600,000 MY 2000 through 2003 Dakota and Durango vehicles equipped with four-wheel drive and manufactured prior to January 2003.

Background

ODI began its investigation of the alleged defect in the subject vehicles when a Preliminary Evaluation (PE03-032) was opened on July 16, 2003. The investigation was upgraded to an Engineering Analysis (EA03-023) on November 19, 2003. During EA03-023 ODI collected and analyzed information regarding the alleged defect in approximately two million MY 1997 through 2004 Dakota pickup trucks and MY 1998 through 2003 Durango sport utility vehicles. The subject components are permanently sealed, maintenance-free upper ball joints that were initially supplied to DaimlerChrysler by TRW Automotive (TRW). The TRW ball joints were used in MY 1997 through 1999 Dakota and MY 1998 through 1999 Durango vehicles. DaimlerChrysler changed to an internal supplier, New Castle Machining and Forge (New Castle), beginning with the MY 2000 vehicles.[1] During PE03-032, ODI noted differences in the separation rates of the TRW and New Castle ball joints.

[1] In January 2004, DaimlerChrysler sold New Castle to Metaldyne Corporation.

Ball joint durability concern

According to DaimlerChrysler, subject vehicles manufactured prior to January 2003 were equipped with upper ball joints containing two-piece plastic bearings. DaimlerChrysler has identified concerns with upper crimp seal integrity in joints with the two-piece bearings. Ball joints with poor crimp seals were prone to early-life failures and have exhibited high warranty claim rates to address loose, noisy, or worn upper ball joints. DaimlerChrysler produced approximately 1.8 million subject vehicles with upper ball joints containing the seal integrity concerns. TRW ball joints were used in about 740,000 of these subject vehicles, which currently range in age from about 5 to 8 years in service. These vehicles include approximately 320,000 two-wheel drive and 420,000 four-wheel drive vehicles. New Castle ball joints were used in the remaining 1.06 million subject vehicles with joint durability concerns, which currently range in age from 2 to 5 years in service. These include approximately 460,000 two-wheel drive and 600,000 four-wheel drive vehicles.

To address concerns with joint durability, DaimlerChrysler introduced a running change to a one-piece bearing design during MY 2003 production.[2] During 2003, DaimlerChrysler implemented changes to improve boot sealing, durability and manufacturing. In August 2003, DaimlerChrysler issued a technical service bulletin to simplify and reduce the cost of upper ball joint replacement by revising the repair procedure to allow the ball joints to be serviced without replacing the upper control arm. In early-2004, additional changes were made to the ball joint design and manufacturing process to improve sealing integrity and durability.[3] In mid-2004, the supplier redesigned the ball joints used as service replacement parts to incorporate best design practices for joint sealing and ball retention (e.g., narrowing the housing throat opening). However, while acknowledging concerns with wear-related upper ball joint failures in these vehicles, DaimlerChrysler considers the problem to be a customer satisfaction issue and not related to motor vehicle safety.

DaimlerChrysler Position

DaimlerChrysler has contended that no safety defect exists with respect to the subject upper ball joints used in the subject vehicles. DaimlerChrysler believes that upper ball joint separation is only possible if lengthy and substantial warning is ignored and that the loads required for separating even severely worn ball joints are much greater than the maximum loads that the joints can experience in service. DaimlerChrysler's model of the failure progression projects that joint wear must progress to more than [redacted] inches of axial end-play before separation is possible from even infrequent high tensile load events and that the joint will still have some retention capability at more than [redacted] inches of end-play.

[2] Supplier documents indicate that the change to a one-piece plastic bearing occurred in October 2002. DaimlerChrysler has indicated to ODI that these parts were not fully implemented in vehicle production until January 2003.

[redacted]

In addition, DaimlerChrysler has stated that the subject upper ball joints are compression type joints that are substantially different from tension type ball joints that have been the subject of prior recall actions. In DaimlerChrysler's view, a compression ball joint design limits the possibility of separation to a low speed, high suspension articulation event in conjunction with a rebound condition. According to DaimlerChrysler, testing found that these types of maneuvers develop the highest measured tensile loads at the upper ball joint, but only for very short durations. DaimlerChrysler stated that the load at the upper ball joint is virtually zero in all other steady state driving conditions, making separation of even a worn joint virtually impossible. Finally, DaimlerChrysler contends that, even in joints with compromised sealing integrity, degradation of the ball to socket interface occurs over an extended period of time and that the number of joint separations are minimal and do not reveal a trend or pattern.

ODI Actions

To assess the alleged defect in the subject vehicles and DaimlerChrysler's position, ODI completed the following actions during EA03-023: (1) interviewed owners who alleged incidents of upper ball joint separation; (2) analyzed failure data relating to upper ball joint wear-out and separation; (3) conducted a survey of upper ball joint wear in Durango and peer sport utility vehicles; (4) sectioned and analyzed worn and separated ball joints collected from the field; (5) thoroughly reviewed test, survey and other technical data submitted by DaimlerChrysler; (6) reviewed upper ball joint design and manufacturing information provided by DaimlerChrysler; (7) conducted noise evaluations of a four-wheel drive Durango vehicle fitted with a loose upper ball joint and used by DaimlerChrysler to demonstrate the audible warning associated with the alleged defect; and (8) carefully assessed the assertions contained in DaimlerChrysler's analysis and position concerning the alleged defect in the subject vehicles.

Suspension System

ODI disagrees with DaimlerChrysler's assertion that the subject ball joints are compression type joints with the weight of the vehicle pressing the joint together during static (curb) and steady state driving conditions. In fact, the joints are properly classified as stabilizing type joints with relatively low service loads in comparison to the lower ball joints. Based on recent discussions with representatives of DaimlerChrysler's Vehicle Compliance and Safety Affairs office, ODI understands that DaimlerChrysler is no longer claiming that the subject ball joints are compression type joints, but continues to believe that they are not routinely subjected to service loads that are likely to cause separation of even badly worn joints.

Suspension Loads/Articulation (4x2 vs. 4x4)

The service loads and joint articulations in the subject vehicles are significantly greater in vehicles with four-wheel drive than in those with two-wheel drive. While the upper ball joint designs are the same, the upper control arm in the four-wheel drive vehicles is shorter by about two inches than in the two-wheel drive vehicles. This results in significantly greater amounts of

joint articulation per unit jounce or rebound of the front suspension in the four-wheel drive vehicles. The front suspension un-sprung mass is also greater in the four-wheel drive vehicles, which also contributes to the joint loads and separation forces.

Data submitted by DaimlerChrysler show that the tensile loads acting on the upper ball joint are [redacted] ODI believes that the greater tensile loads in the upper ball joints in four-wheel drive vehicles will tend to promote wear to the critical area of the housing throat opening that retains the ball in the joint as well as providing higher separation forces through a wider array of driving conditions.

Evidence of the greater joint wear in four-wheel drive vehicles is found in the results of a survey DaimlerChrysler conducted to evaluate the alleged defect in 78 subject vehicles. The average wear for original equipment upper ball joints was greater for the four-wheel drive vehicles than the two-wheel drive vehicles for every model year. The overall average for joint wear in the four-wheel drive original equipment joints was [redacted] inches compared with [redacted] inches in the original equipment joints in two-wheel drive vehicles. When limiting the comparison to vehicles with greater than 50,000 miles of service, the differences are even greater, averaging [redacted] inches for the four-wheel drive and [redacted] for the two-wheel drive vehicles.

Complaint Analysis

ODI does not agree with DaimlerChrysler's assertions that the numbers of joint separations are "minimal and do not reveal a trend or pattern." ODI believes there are clear patterns evident in the failure data. First, in ODI's view there is a non deminimis number of separation failures of ball joints in four-wheel drive vehicles with New Castle ball joints. Second, vehicles with New Castle ball joints have much higher rates of separation, particularly after adjusting for time in service or mileage, than vehicles with TRW ball joints. Third, four-wheel drive vehicles have much higher rates of separation than two-wheel drive vehicles. There are also differences, though not pronounced, based on region.

ODI reviewed 158 complaints to NHTSA[4] and 134 complaints submitted by DaimlerChrysler during PE03-032 and EA03-023 that were potentially related to the alleged defect in the subject vehicles. Twenty-four of the complaints submitted by DaimlerChrysler were duplicates of complaints to NHTSA, resulting in a total of 268 reports. After a thorough review of the information contained in the complaints and gathered in consumer interviews, ODI identified 149 incidents that appear to involve wear-related upper ball joint separation while driving.[5] While DaimlerChrysler asserts that the appropriate count is at least 37 percent lower, the patterns and

[4] These complaints were pulled from over 2,400 total complaints to ODI concerning the front suspension ball joints and control arms in the subject vehicles after a preliminary review identified allegations indicating that the incidents were potentially related to the alleged defect – upper ball joint separation while driving (e.g., the complaints used terms such as "separated," "broke," or "collapsed" while driving in describing a front suspension failure).

[5] ODI's complaint count does not include 15 potentially relevant incidents where a valid Vehicle Identification Number was not provided and the drive train is not specified.

trends that are discerned from the complaints it is counting are similar to the patterns and trends in the complaints counted by ODI.

DaimlerChrysler Complaint Analysis

DaimlerChrysler has indicated to ODI that it was able to confirm only 42 incidents of corrosive wear-related upper ball joint separation while driving in the subject vehicles.[6] DaimlerChrysler identified an additional 52 complaints whose allegations are consistent with the alleged defect condition, but which could not be confirmed. DaimlerChrysler has indicated to ODI that complaints in these two categories could reasonably be included in an analysis of the alleged defect. The remaining complaints were divided among the following categories: unconfirmed allegations of wheel separation; suspension failures caused by impact damage; inadequate retaining nut torque; insufficient information; and other/unrelated.

With regard to the incidents confirmed by DaimlerChrysler, ODI notes that all 42 involved vehicles equipped with New Castle ball joints and that 41 of those involved vehicles with four-wheel drive. Ninety-eight percent of the incidents confirmed by DaimlerChrysler have occurred in subject vehicles with four-wheel drive and New Castle ball joints, a population that accounts for only 33 percent of the 1.8 million subject vehicles with joint sealing integrity concerns. Thirty-one of the incidents confirmed by DaimlerChrysler involve MY 2000 vehicles with four-wheel drive, the oldest population with the New Castle ball joints.

When all 94 complaints in DaimlerChrysler's first two categories are considered, 88 involve vehicles equipped with New Castle ball joints and 76 of those involved vehicles with four-wheel drive. All but three of the 76 complaints involving the New Castle four-wheel drive population were received since June 2003. The resulting separation rate for the New Castle four-wheel drive vehicles is 12.7 incidents per hundred thousand vehicles compared with 2.6 for the New Castle two-wheel drive, 1.7 for the TRW four-wheel drive, and 0.0 for the TRW two-wheel drive. DaimlerChrysler's data show a clear pattern toward the New Castle four-wheel drive vehicles and shows a distinct rising trend with age and mileage accumulation.

ODI Complaint Analysis

ODI has identified 55 incidents as separations that were not counted as separations in DaimlerChrysler's analysis. ODI did not include any incidents that were categorized by DaimlerChrysler as relating to impact damage or retention nut torque. ODI also did not include any incidents alleging lower ball joint separation or other front suspension failures, unless subsequent investigation determined that a worn upper ball joint was the actual cause.[7] Nor did ODI include six complaints alleging that an upper ball joint separated while the vehicle was

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[6] DaimlerChrysler's criteria for confirmation involved confirmation from a reliable source that a corroded upper ball joint had separated from the socket.

[7] DaimlerChrysler has indicated to ODI that it has not confirmed any lower ball joint separations in the subject vehicles.

being lifted to perform service to the tire or suspension, though these events do provide additional evidence of the advanced wear that the subject joints can reach in service.
Of the 149 separations identified by ODI, 127 involve vehicles with New Castle ball joints and 107 of those involve vehicles with four-wheel drive. The resulting separation rate for the New Castle four-wheel drive vehicles is 17.9 incidents per hundred thousand vehicles compared with 4.4 for the New Castle two-wheel drive, 4.8 for the TRW four-wheel drive, and 0.6 for the TRW two-wheel drive. This data also shows a clear failure pattern in the New Castle four-wheel drive vehicles as well as a rising trend with age and mileage accumulation.

The differences in the separation rates between the TRW and New Castle-equipped vehicles in both the DaimlerChrysler and ODI analyses are even more remarkable when one considers the fact that the separation incidents don't begin to occur until about 30 months or 30,000 miles, service intervals that all of the TRW-equipped vehicles are well beyond and many of the New Castle-equipped vehicles have yet to reach. When the analysis is limited to the separation rate at 54 months in service, the separation rate of the four-wheel drive vehicles with New Castle ball joints is 15.8 incidents per hundred thousand vehicles.[8] This is more than an order of magnitude greater than the separation rates at that service interval for the two-wheel drive vehicles with New Castle ball joints (0.6), the four-wheel drive vehicles with TRW ball joints (1.0), and the two-wheel drive vehicles with TRW ball joints (0.0).

More significantly, the separation rate in the four-wheel drive New Castle population has shown an accelerating failure trend, rising from about 1 incident per hundred thousand vehicles after 30 months in service to almost 16 per hundred thousand vehicles after 54 months in service. The current separation rate in the MY 2000 vehicles with New Castle ball joints and four-wheel drive is 35.3 incidents per hundred thousand vehicles, with the oldest of those vehicles now just beyond 60 months in service. This trend of separation failures tracks with the larger pattern of joint wear-related failures in the subject vehicle population.

Ball Joint Design

The New Castle ball joints have a significantly larger throat opening than the TRW joints, resulting in lower separation forces when new and less material wear/erosion before retention capability is lost. The New Castle ball joints have a rectangular shaped throat opening that is approximately 22 millimeters wide, resulting in about 5 millimeters of retention interference with the stud ball, which is 27 millimeters in diameter. This represents a 35 percent reduction in retention interference from the TRW joint. Test data provided by DaimlerChrysler for new parts indicate that separation forces for the New Castle joints are about [redacted] percent lower than the TRW joints.

In addition, the New Castle parts have approximately [redacted] percent less contact area between the ball and socket in the throat area than the TRW joints when new, resulting in greater wear pressures on the material in the critical load bearing surface at the rim of the throat during tensile

[8] This analysis was limited to MY 2000 for the vehicles with New Castle ball joints.

load conditions. ODI's measurements of separated New Castle parts returned from the field has found that corrosive wear had caused increases in the throat opening averaging about 4 millimeters and decreases in the minimum ball diameter averaging about 2 millimeters, resulting in parts that can be separated with little or no force.

ODI believes that DaimlerChrysler has overstated the degree of joint wear necessary for separation to occur and the amount of warning available to the operator of a vehicle with worn joints. ODI's measurements of separated upper ball joints indicates that 0.500 inches of end-play is the best estimate for the upper limit of joint wear that can occur before the joint loses its retention capability (i.e., joint separation forces approach zero). When the joint has this amount of wear, separations can occur at loads well below the maximum values measured by DaimlerChrysler in its vehicle testing. With regard to DaimlerChrysler's projected limits of joint wear before separation can occur, ODI does not believe that such levels of end-play are physically possible given the dimensions of the joint and the known pattern of wear progression of the ball and socket.

Safety Consequences

Defect conditions that can result in front suspension collapse or wheel separation while driving have been commonly understood by ODI and the motor vehicle industry to be related to motor vehicle safety. DaimlerChrysler has conducted several safety recalls to correct defect conditions that could result in lower ball joint separation. The consequences of a separation event are at least as severe in the subject vehicles, where many of the separations have resulted in a wheel separating from the disabled vehicle and endangering surrounding traffic and pedestrians. The separation rate is greater than the rate recorded in about 460,000 MY 1994-96 Avenger, Sebring, and Talon passenger cars recalled by DaimlerChrysler in recalls 99V-066 and 00V-421 (ODI investigation PE99-008).

Contrary to DaimlerChrysler's assertions, ODI has found that separation incidents have not been limited to "low speed, high articulation events." Many of the separations have been reported at speeds greater than 30 mph, where the separation frequently results in a complete separation of the affected wheel, steel knuckle, brake components, and half-shaft. ODI has identified 43 wheel separation incidents, including 34 in the four-wheel drive vehicles with New Castle joints. In one incident, for example, the separated wheel struck a vehicle in the opposing lanes of traffic. In another incident, the separation incident occurred at more than 45 miles per hour while the vehicle was negotiating a curve in the road. After the separation occurred, the vehicle crossed the oncoming lanes of traffic and came to rest in a ditch.

Warning

To evaluate DaimlerChrysler's claim that a driver would receive an audible warning from a badly worn ball joint long before the joint could separate, engineers at NHTSA's Vehicle Research and Test Center (VRTC) in East Liberty, Ohio performed test drives to evaluate the audible warning

produced by a ball joint with over 0.200 inches end-play in a four-wheel drive Durango vehicle that was provided by DaimlerChrysler. The VRTC engineers found that the noise was intermittent and could potentially be masked by the radio or other noises that can occur during starts, stops, bumps, depressions, and other transient conditions that may cause relative motion between a loose ball and socket.

Further evidence that the noise produced by worn joints does not necessarily provide a warning of a potential failure is contained in DaimlerChrysler's survey results, where test engineers documented whether audible noise had been detected in a test drive sequence prior to removing the upper ball joints and measuring end-play. [redacted] percent of the four-wheel drive vehicles with greater than 50,000 miles of service had at least one ball joint with wear exceeding DaimlerChrysler's service replacement specification (0.060 inches). The DaimlerChrysler test engineers failed to detect audible noise in [redacted] percent of these vehicles.

The number of vehicles with out-of-specification end-play in DaimlerChrysler's survey is another indication that the available warning symptoms have not been effective in removing worn joints from service. As previously noted, the *average* end-play in the four-wheel drive vehicles surveyed by DaimlerChrysler with more than 50,000 miles of service was [redacted] inches, [redacted] percent greater than the service replacement specification for the parts. ODI understands that employees of DaimlerChrysler, a group that would presumably be more aware of such symptoms than the general public, owned many of the survey vehicles. The VRTC engineers also identified issues with excessive end-play in subject vehicles surveyed in the Columbus, Ohio area. The VRTC engineers recorded end-play in 15 MY 1998 through 2000 Durango vehicles and 20 peer sport utility vehicles of similar age. The survey results indicated that loose upper ball joints are common in the Durango vehicles and non-existent in peers with fewer than 100,000 miles.

Finally, ODI's interviews of owners who experienced upper ball joint separation incidents found that most reported that they had no prior warning. Thus, ODI does not believe that the noise produced by worn ball joints in these vehicles is sufficient to ensure that operators will always be alerted to the condition prior to separation. Moreover, even if they were, a manufacturer may not avoid making a safety-related defect determination by asserting that it is the operator's responsibility to detect and repair a defect condition that involves a progressive deterioration of a part that is critical to the safe operation of the vehicle.

ODI Position

On the basis of the available technical information and failure trend analysis, ODI believes that front suspension upper ball joint separations in the four-wheel drive vehicles with New Castle parts constitutes a defect related to motor vehicle safety. There have been a significant number of separations of these upper ball joints, and the rate of such failures appears to be increasing as the vehicles age and accumulate mileage. The current separation rate in these vehicles is high relative to other vehicles investigated by ODI for similar defect conditions and is very high relative to other subject vehicles analyzed in this investigation. Based on the rapidly increasing

separation rate and the projected rates of total wear-related failures in the subject parts, such separations are likely to increase in frequency as the subject vehicle population continues to accumulate time and mileage in service.

As DaimlerChrysler has acknowledged in prior cases, front suspension ball joint separation can lead to loss of control and result in crashes and injuries. This safety nexus is confirmed by the consistent practice of other vehicle manufacturers. Therefore, ODI requests that DaimlerChrysler initiate a safety recall, pursuant to 49 U.S.C. § 30118 and in accordance with 49 U.S.C. §§ 30119 and 30120, to notify all owners, purchasers, and dealers of the defect in the vehicles of concern, and to provide a free remedy for each of those vehicles.

If DaimlerChrysler decides not to conduct the requested recall, it must provide ODI, pursuant to 49 U.S.C. § 30166, with a full explanation for this decision, including any additional analysis of the problem beyond its past presentations. If DaimlerChrysler 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 DaimlerChrysler conduct a safety recall does not constitute an agency action 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.

DaimlerChrysler's written response to this letter, in duplicate, referencing the identification codes in the upper right hand corner of page one of this letter, must be submitted to this office no later than December 9, 2004. It is important that DaimlerChrysler respond to this letter on time. This letter is being sent in part 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 DaimlerChrysler 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. Jeffrey Quandt of my staff at (202) 366-5207.

Sincerely,

Richard Boyd for

Kathleen C. DeMeter, Director
Office of Defects Investigation
Enforcement