GENERAL MOTORS NORTH AMERICA
Structure & Safety Integration

October 25, 2006

Richard Boyd, Chief
Medium & Heavy Duty Vehicle Division
Office of Defects Investigation
NHTSA Enforcement
Room #5326
400 Seventh Street, S.W.
Washington, D.C. 20590

GM-671B

NVS-214pk
EA05-017

Dear Mr. Boyd:

This letter is General Motors' (GM) response to your information request (IR) update, dated September 18, 2006, regarding allegations of steering knuckle fracture at the lower ball joint stud hole for MY 2003 through 2006 Hummer H2 SUV and H2 SUT vehicles.

Your questions and our corresponding replies are as follows:

1. **State the number and provide copies of all of the following information that relates or potentially relates to the subject condition in the subject vehicles. This should include all information in GM's possession or control or of which it is otherwise aware.**

   a. **owner complaints;**
   b. **repair shop claims;**
   c. **field reports;**
   d. **crash/injury incident reports;**
   e. **subrogation claims;**
   f. **lawsuits; and**
   g. **third-party arbitration proceedings where GM is a party to the arbitration.**

   List and collate your response separately for each category ("a" through "g") by date the incident was filed with GM. Provide for each item in this response the incident date, model, model year, wheel size, engine, owner name, owner address, owner phone number, zone, dealer code, problem code, vehicle identification number, build date, vehicle in-service date, repair date, repair mileage, repair order number, part numbers of subject components replaced, property damage, injuries, and the current status of GM's response to the incident.

   For "d," identify all crashes by date, location, and names of parties involved. For "f," identify all the lawsuits by caption, court, and docket number. Provide a separate analysis and description of each item "e" through "g" identifying the vehicle (by model year, build date, and VIN) and the vehicle owner (by name, address, and telephone number). Include all police reports that relate to the subject condition known to GM. Clearly describe the sequence of events leading up to any accident(s), the approximate vehicle speed, approximate vehicle mileage, and any personal injuries, vehicle damage, or property damage that may have occurred.

   Provide all related material and information that relate to the subject condition even if GM has not verified it. Indicate if no information exists for any category.

Table 1-1 below summarizes records for the subject vehicles that could relate to the subject condition.

Type of Report	GM Reports	Subcategories			
		Corresponding to NHTSA Reports	Number with Property Damage	Number with Crash	Number with Injuries/ Fatalities*
Owner Reports	2	0	2	2	0
Field Reports	0	0	0	0	0
Not-In-Suit Claims	1	0	1	1	0
Subrogation Claims	0	0	0	0	0
Third Party Arbitration Proceedings	0	0	0	0	0
Product Liability Lawsuits	0	0	0	0	0
Total Reports (Including Duplicates)	3	0	3	3	0
Total Vehicles with Reports (Unique VIN)	2	0	2	2	0

TABLE 1-1: SUBJECT H2 VEHICLE REPORT BREAKDOWN

GM is providing two unique VIN reports summarized in Table 1-1. Additional information on previously submitted reports is also being provided on the Attachment 1 CD; refer to the Microsoft Access 2000 file in the folder labeled "Response to Q1." GM has organized this summary by GM file number within each attachment.

2. **State, by model and model year, a total count for all of the following categories of claims, collectively, that have been paid by GM to date that relate to, or may relate to, the subject condition for the subject vehicles: warranty claims; extended warranty claims; claims for good will services that were provided; field, zone, or similar adjustments and reimbursements; and warranty claims or repairs made in accordance with a procedure specified in a technical service bulletin or customer satisfaction campaign.**

   Separately, for each such claim, state the following information:

   a. **GM's claim number;**
   b. **Vehicle owner or fleet name (and fleet contact person) and telephone number;**
   c. **VIN;**
   d. **Repair date;**
   e. **Vehicle mileage at time of repair;**
   f. **Repairing dealer's or facility's name, telephone number, city and state or ZIP code;**
   g. **Labor operation number;**
   h. **Problem code;**
   i. **Replacement part number(s) and description(s);**
   j. **Whether the vehicle was towed to the dealer for the repair (y/n);**
   k. **Secondary component damage (y/n) - Whether there were coincident repairs to secondary components that can be damaged when steering knuckle fracture occurs. For example, repairs to the following components at the same front wheel position as the subject component on or about the same date as the subject component**

repair (± 2 days): brake rotor, brake hose, axle (four-wheel drive), body damage, tie rod, etc. (state the specific criteria used by GM);

l. Concern stated by customer;

m. Comment, if any, by dealer/technician relating to claim and/or repair; and

n. If good will or any other GM good faith payment was received to the owner in an accordance to fix the subject vehicle.

Provide this information in Microsoft Access 2000, or a compatible format, entitled "WARRANTY DATA." See Enclosure 1, Data Collection Disc, for a pre-formatted table which provides further details regarding this submission.

For the subject vehicles, the regular warranty claim is summarized by model and model year in Table 2-1. The regular goodwill warranty claim is summarized by model and model year in Table 2-2. There were no MIC and UWC extended warranty claims for this update. A summary of these warranty claims are provided on the Attachment 1 Disc; refer to the folder labeled "Response to Q2."

GM is also providing the warranty history for this vehicle.

Make/ Model	2003 MY	2004 MY	2005 MY	2006 MY	Total
Hummer/H2 SUV	0	0	1	0	1
Hummer/H2 SUT	N/A	N/A	0	0	0
Total	0	0	1	0	1

Table 2-1: Subject Vehicle Regular Warranty Claims
N/A Not Applicable

Make/ Model	2003 MY	2004 MY	2005 MY	2006 MY	Total
Hummer/H2 SUV	1	0	0	0	1
Hummer/H2 SUT	N/A	N/A	0	0	0
Total	1	0	0	0	1

Table 2-2: Subject Vehicle Goodwill Warranty Claims
N/A Not Applicable

The regular warranty data was collected from the GM CARD database by searching for the labor operation codes listed in Table 2-3 and trouble codes listed in Table 2-4. The last two labor codes in Table 2-3 are goodwill labor codes. GM is providing the General Motors Service Policies and Procedures Manual Section describing guidelines for goodwill warranty repairs on the Attachment 1 Disc; refer to the folder labeled "Response to Q2."

LABOR CODE	DESCRIPTION
E2520	KNUCKLE ASSEMBLY, R-STEERING-REPLACE
E2521	KNUCKLE ASSEMBLY, L-STEERING-REPLACE
E2527	KNUCKLE ASSEMBLY, BOTH STEERING-RPL
E2720	SPINDLE – RIGHT – REPLACE
E2721	SPINDLE – LEFT – REPLACE
E2727	SPINDLE – BOTH – REPLACE
Z1241	PROD LIABILITY/INVESTIGATION REP PR
Z1242	PAR-REPAIRS/REIMBURSEMENT

TABLE 2-3: LABOR CODES USED IN CARD & MIC SEARCH

TROUBLE CODE	TROUBLE DESCRIPTION
1B	CASTING DEFECT
1D	BROKEN
1K	CRACKED
3Z	RUPTURED
4D	SHEARED
4H	TORN
4R	WELD BROKEN
4Q	WEAK
4X	WORN
6C	COMPONENT-INOPERATIVE

TABLE 2-4: REGULAR WARRANTY TROUBLE CODES

The MIC extended warranty data was also collected by searching for the E-labor codes listed in Table 2-3. No records were found. The UWC extended warranty data was collected by searching for the labor codes in Table 2-5. No records were found.

LABOR CODE	DESCRIPTION
0550	STEERING KNUCKLE

TABLE 2-5: LABOR CODES USED IN UWC SEARCH

The subject vehicles for 2003 MY are covered by a bumper-to-bumper new vehicle warranty for three years or 36,000 miles, whichever occurs first. The subject vehicles for 2004 MY through 2006 MY are covered by a bumper-to-bumper new vehicle warranty for four years or 50,000 miles, whichever occurs first.

GM searched the GM North America Claim Adjustment Retrieval Database (CARD-regular warranty), the Motors Insurance Corporation (MIC–extended warranty), and the Universal Warranty Corporation (UWC–extended warranty) databases to collect the warranty data for this response. The warranty data was last gathered on September 25, 2006.

GM's warranty database does not contain the vehicle owner's name or telephone number. Some of the replacement part numbers; part descriptions and customer concern code descriptions are not included in the GM warranty database. GM is providing a field labeled "Verbatim Text". The verbatim text is an optional field in the GM warranty system for the dealer to enter any additional comments that may be applicable to the warranty claim. The verbatim text field is not required to be completed for every warranty claim.

The warranty data provided has limited analytical value in analyzing the field performance of a motor vehicle component. The warranty records do not contain sufficient information to establish the condition of the part at the time of the warranty correction; and service personnel may not consistently use the appropriate labor and trouble codes. Warranty numbers represent claims by our dealers for reimbursement for parts and labor costs incurred in performing warranty service for our customers.

3. **The following concerns Question No. 4 in GM's March 31, 2006 EA-IR response. Police Accident Reports and EAA claims indicate that CDR data was collected. However, ODI was unable to obtain this information for the following consumers. Therefore, please provide CDR information that responds to Question No. 4 of the agency's IR of January 4, 2006 for incidents involving the following consumers that were not submitted in GM's March 31, 2006 EA-IR response.**

   a. 10/Baker;
   b. 12/Hayden;
   c. 24/Butrymowitz;
   d. 86/Border;
   e. 89/Essary;
   f. 90/Lane; and
   g. 93/O'Leary.

   GM has reviewed its March 31, 2006 IR response to NHTSA and the following is a summary of the above vehicle reports:

   Hummer H2: Baker Report
   GM has no CDR data for the Baker report since the EAA inspection was cancelled. GM submitted this report on March 31, 2006 EA-IR response, an electronic summary on the Attachment 1 CD; refer to the Microsoft Access 2000 file in the folder labeled "Response to Q3 – REQUEST NUMBER TWO DATA."

   Hummer H2: Hayden Report
   Dr. Hayden has made no complaint to General Motors and therefore GM does not have any additional information of the incident including CDR data.

   C/K: Butrymowitz, Border, Essary, Lane, and O'Leary Reports
   Copies of the C/K Truck Crash Data Retrieval (CDR) files (in response to c through g) are provided on the Attachment 1 Disc; refer to the folder labeled "Response to Q3."

4. **Also for Question No. 4 from GM's EA-IR response, please explain what, if any, final resolution was reached for each the 101 cases reported by GM (e.g. warranty, good will, settlement, or other -- if "other" explain). Did GM pay for the repairs? If so, how much did it pay for each repair? State whether each repair was subject to a confidential agreement or settlement and state and describe the terms of the agreement or settlement. The information may be provided in an excel spreadsheet.**

   Please see response to question 2 for GM's policies.

5. **Please provide ODI with complete sets of Police Accident Report photographs for the following incidents that GM reported in its March 31, 2006 IR response:**

a. 42/Roberts;
b. 76/Norris;
c. 81/Cignarale;
d. 89/Essray;
e. 96/Jones;
f. 97/Vogt; and
g. 30/Barksdale

Please provide with question "g" any additional buyback information where applicable.

Police Accident Report photographs for the above incidents are not available to General Motors.

6. **Provide detailed records from Grede, Eagle-Pitcher, Delphi, and GM on all non-conforming knuckles for the 2003 MY Hummer H2. Non-conforming refers to parts not meeting required specifications. This would include, but not necessarily be limited to, items such as the following:**

   a) Financial charges to any supplier from any of the supplied parties for non-conformance;
   b) Shipment records indicating return of non-conforming knuckles; and
   c) Quality Tracking records such as Problem Reporting and Resolution (PRR) documents and/or problem Resolution Tracking System (PRTS) or similar mechanism or procedure by which the nature of the non-conformance is documented, analyzed and/or resolved.

   a) GM, Delphi, Eagle-Picher, and Grede have no financial records that relate to non-conforming knuckles.

   b) GM, Delphi, Eagle-Picher, and Grede have submitted these records in response to March 31, 2006 EA-IR response on the Attachment 1 CD in the folder labeled "Response to Q35." Grede's shipment records indicating return of non-conforming knuckles in Parts Per Million (PPM) were also provided in GM's November 11, 2005 PE-IR Supplement 4 response on the Attachment 3 CD Grede Confidential in the file labeled "Resp to Q10 Knuckle scrap History.xls." GM is providing a Grede summary of those records on the Attachment 4 Disc Supplier Confidential; refer to the folder labeled "Response to Q6 Supplier Confidential." Delphi is providing Covisint Problem Reports for steering arm hole, O-ring assembly, and IB caliper pad on the Attachment 3 Disc Supplier; refer to the folder labeled "Response to Q6."

   c) GM has issued no PR&R documents to its suppliers for this issue. GM, Delphi, Eagle-Picher, and Grede have issued no PRTS documents for this issue.

7. **Describe the procedure and criteria for checking the surface finish and taper on the lower ball joint stud holes machined in the steering knuckles on the subject vehicles. Provide hard copies of the Job Instruction and Job Element Sheet (JES).**

   See Attachment Disc 3 Supplier in folder "Response to Q7" for the Instruction Sheets for "Taper Depth Gauge" and "Bluing Gage to check Tapered Holes."

8. **Describe the previous two-pass machining operation, tool life, tool type, speed and feeds and surface finish produced for the lower ball joint stud hole on the subject vehicle steering knuckles. Compare and contrast to the new, one-pass operation. What are the tolerances on the specifications? What was the date of this changeover? Provide photographs of the process.**

   Eagle-Picher has used the two-pass machining process since start of production of the subject component and is currently using the same two-pass machining process.

   Eagle Picher's machining control plan and process flow were provided in GM's February 28, 2005 PE-IR response on the Attachment 3 CD Supplier Confidential in the folder labeled "Response to Q9/9-3 Supplier Test Report/ Eagle Picher" with the file name "Eagle Picher Confidentiality Request Letter w attach.pdf." The control plan is on pages 28 through 48 and the process flow diagram is on pages 49 and 50. GM is providing Attachment Disc 3 Supplier in folder "Response to Q8" for the "Machining Station Layout" for Eagle Picher's machining station layout.

9. **Please describe any testing and/or assessments that GM has conducted (either on its own or on its behalf), regarding the interaction between the amount of torque applied to the ball joint nut and the occurrence of brinnelling on the steering knuckle and provide copies of those tests and assessments**

   GM is not aware of any testing where the torque applied to the ball joint nut has been varied and the occurrence of brinelling has been documented. However, in addition to the test results GM provided to NHTSA on March 31, 2006 EA-IR response, additional testing related to ball joint torque is described below.

   Laboratory testing has been performed where the torque applied to the ball joint nut has been varied, and the resulting torque to loosen the nut has been measured. Results of that testing are shown in Attachment Disc 1 in the folder labeled "Response to Q9." In these tests, a new (unused) Original Equipment (OE) knuckle, ball stud, and nut were used. The "ovalized" nut was first tightened to 70 Nm and the torque necessary to move the nut (loosen) was measured. Note that after tightening and before measuring the loosening torque, the axial load applied to the ball stud threads was not changed in any way. Therefore, the observed difference in torques is not a result of a reduction in load on the ball stud taper, but rather a consequence of the OE conical washer installed between the nut and the knuckle. The conical washer applies a reaction force on the nut that opposes tightening, so the torque to tighten and the torque needed to loosen the nut are expected to be different. The GM torque specification is in the tightening direction and torque measurements in the loosening direction will result in lower values.

   The process of tightening and loosening was then repeated except the tightening torque was increased to 80 Nm, 90 Nm, and 100 Nm in sequence. Those values are listed in the column Trial 1 for Test Set 1. Using the same hardware, the exact same process was repeated twice more, with the results shown in the columns labeled Trial 2 and Trial 3 for Test Set 1.

   The entire test procedure was repeated using a different, new and unused OE knuckle, ball stud and nut. Those results are shown in Test Set 2. For tightening torques of 80 Nm or higher, the loosening torque was typically about 60% of the torque used to tighten the nut.

A series of field tests were also conducted on a Hummer H2 vehicle. Each series of tests included driving maneuvers and curb impacts. In each field test series, measurements of loosening ball joint nut torque and torque to retighten were obtained before and after the driving events. Also, maximum compression and tensile loads were measured during the driving events. The measurement methods of torque-to-loosen verses torque-to-tighten yielded very different results. Any reduction in the loosening torque is attributable to additional ball joint draw-in caused by compression loads developed during harsh impacts.

GM provided load-to-failure test results in its March 31, 2006 IR response. This testing was performed in the laboratory where a ball stud nut was tightened to 100 Nm, and loaded transversely to different levels. Load levels were selected that caused permanent plastic deformation, and the knuckle was ultimately loaded to fracture. The results of that testing are shown in Attachment Disc 2 GM Confidential in folder labeled "Response to Q9 GM Confidential." Knuckle(s) subjected to multiple loadings sufficient to induce plastic deformation exhibited similar ultimate strength levels when compared with knuckles that fractured during only one loading event.

CONCLUSION

GM has found no facts indicating a manufacturing defect, engineering defect, field performance defect, and no safety defect trend. All of the available technical information demonstrates that H2 steering knuckle fractures are the consequence, not the cause, of vehicle crashes.

* * *

General Motors requested assistance and documents from suppliers in responding to items 6, 7, and 8. This response includes those documents received from suppliers.

GM claims that certain information, in documents that are part of lawsuit and claims files maintained by the GM Legal Staff, is attorney work product and/or privileged. That information includes notes, memos, reports, photographs, and evaluations by attorneys (and by consultants, claims analysts, investigators, and engineers working at the request of attorneys). GM is producing responsive documents from claims files that are neither attorney work product nor privileged, and withholding those that are attorney work product and/or privileged.

This response is based on searches of General Motors Corporation (GM) locations where documents determined to be responsive to your request would ordinarily be found. As a result, the scope of this search did not include, nor could it reasonably include, "all of its divisions, subsidiaries (whether or not incorporated) and affiliated enterprises and all of their headquarters, regional, zone and other offices and their employees, and all agents, contractors, consultants, attorneys and law firms and other persons engaged directly or indirectly (e.g., employee of a consultant) by or under the control of GM (including all business units and persons previously referred to), who are or, in or after 1993, were involved in any way with any of the following related to the subject condition in the subject vehicles:

(a) Design, engineering, analysis, modification or production (e.g. quality control);
(b) Testing, assessment or evaluation;
(c) Consideration, or recognition of potential or actual defects, reporting, record-keeping and information management, (e.g., complaints, field reports, warranty information, part sales), analysis, claims, or lawsuits; or
(d) Communication to, from or intended for zone representatives, fleets, dealers, or other field locations, including but not limited to people who have the capacity to obtain information from dealers."

This response was compiled and prepared by this office upon review of the documents produced by various GM locations, and does not include documents generated or received at those GM locations subsequent to their searches.

Please contact me if you require further information about this response or the nature or scope of our searches.

Sincerely,

FOR

Gay P. Kent
Director
Product Investigations

Attachments