



September 17, 2007

Jeffrey L. Quandt, Chief
Vehicle Control Division
Office of Defects Investigation
National Highway Traffic Safety Administration
1200 New Jersey Ave., S. E., Room W46-409
Washington, D.C. 20590

N070204

NVS-213swmc
PE07-037

Dear Mr. Quandt:

This letter is General Motors (GM) response to your information request (IR), dated July 27, 2007, regarding Preliminary Evaluation (PE07-037) for alleged rear differential failures that may cause loss of motive power and possibly loss of control in model year (MY) 2003 through 2006 Cadillac CTS, CTS-V, and STS vehicles manufactured by the General Motors Corporation.

Your questions and our corresponding replies are as follows:

1. **State, by model and model year, the number of subject vehicles GM has manufactured for sale or lease in the United States. Separately, for each subject vehicle manufactured to date by GM, state the following:**
 - a. **Vehicle identification number (VIN);**
 - b. **Model;**
 - c. **Model Year;**
 - d. **Date of manufacture;**
 - e. **Date warranty coverage commenced; and**
 - f. **The State in the United States where the vehicle was originally sold or leased (or delivered for sale or lease).**

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

General Motors is providing the number of subject vehicles in Table 1-1 produced for sale or lease in the United States by model and model year.

MAKE	MODEL GROUP	2003	2004	2005	2006	TOTAL
Cadillac	CTS	68,255	53,553	57,306	53,904	233,018
Cadillac	CTS-V	N/A	2,432	4,018	1,162	7,612
Cadillac	STS	N/A*	N/A*	37,229	31,372	68,601
Total		68,255	55,985	98,553	86,438	309,231

TABLE 1-1 SUBJECT VEHICLES

*THE 2003-2004 STS VEHICLES HAD A DIFFERENT ARCHITECTURE AND WERE FRONT WHEEL DRIVE ONLY.

The production information requested in 1a-1f is provided on the Disc in Attachment 1, in the folder labeled Response to Q1; refer to the Microsoft Access 2000 file labeled "PRODUCTION DATA." The GM database that contains Vehicle Identification Number (VIN) information does not include information on the state where an individual vehicle was sold. GM is providing the

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PE07-037_N070204 Response.doc



state where the vehicle was shipped in response to request 1f. For some of the subject vehicles, which have incomplete warranty files, the GM warranty system does not contain a warranty start date or state where the vehicle was shipped and therefore these fields are blank in the Microsoft Access 2000 file.

2. State the number of each of the following, received by GM, or of which GM is otherwise aware, which relate to, or may relate to, the alleged defect in the subject vehicles:
- a. Consumer complaints, including those from fleet operators;
 - b. Field reports, including dealer field reports;
 - c. Reports involving a crash, injury, or fatality, based on claims against the manufacturer involving a death or injury, notices received by the manufacturer alleging or proving that a death or injury was caused by a possible defect in a subject vehicle, property damage claims, consumer complaints, or field reports;
 - d. Property damage claims;
 - e. Third-party arbitration proceedings where GM is or was a party to the arbitration; and
 - f. Lawsuits, both pending and closed, in which GM is or was a defendant or codefendant.

For subparts "a" through "f" state the total number of each item (e.g., consumer complaints, field reports, etc.) separately. Multiple incidents involving the same vehicle are to be counted separately. Multiple reports of the same incident are also to be counted separately (i.e., a consumer complaint and a field report involving the same incident in which a crash occurred are to be counted as a crash report, a field report and a consumer complaint).

In addition, for items "c" through "f," provide a summary description of the alleged problem and causal and contributing factors and GM's assessment of the problem, with a summary of the significant underlying facts and evidence. For items "e and "f," identify the parties to the action, as well as the caption, court, docket number, and date on which the complaint or other document initiating the action was filed.

GM searched for reports of rear differential or half shaft failure that indicated a differential lock-up or a loss of motive power. Those results are shown in Table 2-1 and 2-2 respectively.

TYPE OF REPORT	GM REPORTS	SUBCATEGORIES			
		CORRESPONDING TO NHTSA REPORTS	NUMBER WITH PROPERTY DAMAGE	NUMBER WITH CRASH	NUMBER WITH INJURIES/FATALITIES*
Owner Reports	6	3	0	0	1
Field Reports	10	0	0	0	0
Not-In-Suit Claims	2	0	1	1	0
Subrogation Claims	1	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)	19	3	1	1	1
Total Vehicles with Reports (Unique VIN)	18	3	1	1	1

TABLE 2-1: DIFFERENTIAL LOCK-UP RELATED

* GM HAS NO FATALITY REPORTS

TYPE OF REPORT	GM REPORTS	SUBCATEGORIES			
		CORRESPONDING TO NHTSA REPORTS	NUMBER WITH PROPERTY DAMAGE	NUMBER WITH CRASH	NUMBER WITH INJURIES/FATALITIES
Owner Reports	0	0	0	0	0
Field Reports	24	0	0	0	0
Not-In-Suit Claims	0	0	0	0	0
Subrogation Claims	0	0	0	0	0
Third Party Arbitration Proceedings	0	0	0	0	0
Product Liability Lawsuits	1	0	0	0	0
Total Reports (Including Duplicates)	25	0	0	0	0
Total Vehicles with Reports (Unique VIN)	25	0	0	0	0

TABLE 2-2: LOSS OF MOTIVE POWER RELATED

To date, GM's investigation of the alleged defect has not included an assessment of the cause(s) of each incident responsive to Request No. 2. Some incident reports may not contain sufficient reliable information to accurately assess cause. Assessments of other incidents (from lawsuits and claims) may be attorney work product and/or privileged. Therefore, information and documents provided in this response, if any, consist only of non-attorney work product and/or non-privileged material for incidents that have been investigated and assessed.

The sources of the requested information and the last date the searches were conducted are tabulated in Table 2-3 below.

SOURCE SYSTEM	LAST DATE GATHERED
Customer Assistance Center	8/20/2007
Technical Assistance Center	8/28/2007
Field Information Network Database (FIND)	8/15/2007
Company Vehicle Evaluation Program (CVEP)	8/10/2007
Field Product Report Database (FPRD)	8/15/2007
Legal / Employee Self Insured Services (ESIS)	8/29/2007

TABLE 2-3: DATA SOURCES

3. Separately, for each item (complaint, report, claim, notice, or matter) within the scope of your response to Request No. 2, state the following information:
 - a. GM's file number or other identifier used;
 - b. The category of the item, as identified in Request No. 2 (i.e., consumer complaint, field report, etc.);
 - c. Vehicle owner or fleet name (and fleet contact person), address, and telephone number;
 - d. Vehicle's VIN;
 - e. Vehicle's model,
 - f. Vehicle's model year;
 - g. Vehicle's mileage at time of incident;

- h. Incident date;**
- i. Report or claim date;**
- j. Whether a crash is alleged;**
- k. Whether property damage is alleged;**
- l. Number of alleged injuries, if any; and**
- m. Number of alleged fatalities, if any.**

Provide this information in Microsoft Access 2000, or a compatible format, entitled "REQUEST NUMBER TWO DATA." See Enclosure 1, Data Collection Disc, for a preformatted table which provides further details regarding this submission.

The requested information is provided on the Disc in Attachment 1, in a folder labeled, "Response to Q3;" refer to the Microsoft Access 2000 file in the file labeled, "REQUEST NUMBER TWO DATA."

- 4. Produce copies of all documents related to each item within the scope of Request No. 2. Organize the documents separately by category (i.e., consumer complaints, field reports, etc.) and describe the method GM used for organizing the documents.**

Copies of the records identified in Item 2 are provided in the attachments listed in Table 2-1 and Table 2-2. GM has organized the records by the GM file number within each attachment.

- 5. 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 the subject components: 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. Concern stated by customer;**
- k. The cause and correction of the concern, and**
- l. Any additional comment, if any, by dealer/technician relating to claim and/or repair.**

For subparts "j" through "l" provide all text and information as available through any portion of the warranty reporting system (e.g., such as might be available to a General Motors Protection Plan warranty auditor when electronically reviewing claims prior to approval).

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.

GM searched regular and MIC extended warranty claims using labor codes related to replacement of the rear differential and rear half shafts. A list of the labor codes is provided in response to item No. 6. In order to identify claims that were more likely to be related to differential lock-up or loss of motive power, the regular warranty and MIC extended warranty claims were filtered for those that also had a GM Roadside Service towing claim (Labor Operations T2020 and Z2080) within three days of the rear differential or half shaft replacement. Cadillac customers are provided free towing during the new vehicle warranty period (48 months / 50,000 miles). There were no MIC extended warranty claims for differential or half shaft replacement that had an associated towing claim within three days of the replacement. The results of this search are summarized in Tables 5-1. A summary of the warranty claims, including the information requested in 5(a-1), is provided on the Attachment 1 Disc; refer to the folder labeled, "Response to Q5."

MAKE	MODEL GROUP	2003	2004	2005	2006	TOTAL
Cadillac	CTS	127	94	84	419	724
Cadillac	CTS-V	N/A	57	97	13	167
Cadillac	STS	N/A	N/A	38	92	130
Total		127	151	219	524	1021

TABLE 5-1 REGULAR WARRANTY CLAIMS FOR DIFFERENTIAL OR HALF SHAFT REPLACEMENT

GM found no claims paid for good will related to the subject condition and no Universal Warranty Corporation extended warranty claims related to the subject condition.

The sources of the requested information and the last date the searches were conducted are tabulated in Table 5-2 below.

Source System	Last Date Gathered
GM CARD – Regular Warranty	8/14/2007
Motors Insurance Corporation (MIC) – Extended Warranty	8/13/2007
Universal Warranty Corporation (UWC) – Extended Warranty	8/10/2007

TABLE 5-2 DATA SOURCE

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 MIC extended warranty system does not contain the following information: repairing dealer code, vehicle owner information, trouble code, trouble code description, part number, part description or verbatim text. The UWC extended warranty system does not use the GM labor code or labor code description, and it does not contain the repairing dealer code, trouble code or trouble code description.

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. Consequently, some of these warranty claims are not related to the alleged defect.

6. Describe in detail the search criteria used by GM to identify the claims identified in response to Request No. 5, including the labor operations, problem codes, part numbers and any other pertinent parameters used. Provide a list of all labor operations, labor operation descriptions, problem codes, and problem code descriptions applicable to the alleged defect in the subject vehicles. State, by make and model year, the terms of the new vehicle warranty coverage offered by GM on the subject vehicles (i.e., the number of months and mileage for which coverage is provided and the vehicle systems that are covered). Describe any extended warranty coverage option(s) that GM offered for the subject vehicles and state by option, model, and model year, the number of vehicles that are covered under each such extended warranty.

GM searched regular and MIC extended warranty claims using labor codes related to replacement of the rear differential and half shaft. The labor codes are listed in Table 6-1 below. The regular warranty and MIC extended warranty claims were filtered for those that also had a GM Roadside Service towing claim (Labor Operations T2020 and Z2080) within three days of the rear differential or half shaft replacement. The UWC extended warranty database does not contain labor codes.

LABOR CODE	DESCRIPTION:
F1513	HALF SHAFT, REAR DRIVE-REAR-RT-RPL
F1514	HALF SHAFT, REAR DRIVE-REAR-LEFT-RPL
F1515	HALF SHAFT, REAR DRIVE-REAR-BOTH-RPL
F1516	HALF SHAFT, REAR DRIVE-REAR-RT-R&R
F1517	HALF SHAFT, REAR DRIVE-REAR-LEFT-R&R
F1518	HALF SHAFT, REAR DRIVE-REAR-BOTH-R&R
Z1223	CARRIER ASSEMBLY-RR DIFF-R&R
Z1243	CARRIER ASSEMBLY (COMPLETE)-RR DIFF-R
Z1241	PERSONAL PROPERTY DAMAGE (GOOD WILL)
Z1242	RPR/REIMBURSEMENT-PRODUCT ALLEGATION (GOOD WILL)

TABLE 6-1 LABOR CODES USED IN WARRANTY SEARCH

The subject vehicles are covered by a bumper-to-bumper new vehicle warranty for 48 month or 50,000 miles, whichever occurs first. Many different extended warranty options are available through GM dealerships. They are offered at different prices and for varying lengths of time, based on customer's preference, up to 7 years from the date of purchase or up to a total of 100,000 vehicle miles. The GM's warranty system does not contain information on the number of vehicles that have extended warranty coverage. The number of extended warranty coverage contracts on the subject vehicles that have been sold by MIC regardless of status (in-force, expired, cancelled) as of August 13, 2007 is contained in Table 6-2. MIC does not break down contracts beyond the base level vehicle. If there are any CTS-V contracts, they are included in the total listed for the CTS. UWC has 989 extended warranty contracts as of August 10, 2007.

CADILLAC STS	N/A	N/A	3,775	2,127	5,902
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TABLE 6-2: MIC EXTENDED WARRANTY COVERAGE CONTRACTS SOLD

7. **Produce copies of all service, warranty, and other documents that relate to, or may relate to, the alleged defect in the subject vehicles, that GM has issued to any dealers, regional or zone offices, field offices, fleet purchasers, or other entities. This includes, but is not limited to, bulletins, advisories, informational documents, training documents, or other documents or communications, with the exception of standard shop manuals. Also include the latest draft copy of any communication that GM is planning to issue within the next 120 days.**

GM has issued the following preliminary information and service bulletins related to the rear differential or axle on the subject vehicles:

Preliminary Information #PIO1103A, 5/23/2003. Instructed dealers on how to identify and correct customer complaints related to left hand or right hand axle seal leaks. Emphasis was placed on the importance of using tool J44394 to protect the seal lip from damage during installation of the axles.

Service Information Bulletin #04-00-89-027, issued 07/20/2004. Informed dealers of some of the unique features and functions of the 2004-2005 Cadillac CTS-V. Included in the bulletin was a discussion on the vehicles potential for rear axle hop.

Preliminary Information #PIP3051C, 7/13/2006. Instructed dealers on how to identify and correct customer complaints related to howl or whine noise from the rear differential. The noise was most prevalent between 35-50 mph.

Service Information Bulletin #07-04-20-001, issued 2/2/2007. Instructed dealers on how to install a differential vent hose and metal vent for complaints related to seeping fluid.

Preliminary Information #PIP3152J, 2/9/2007. Instructed dealers on how to identify and correct customer complaints related to rear differential shudder or binding on low speed turns. Differential groan, growl, and moan noises were key search terms.

Preliminary Information #PIP3671E, 3/8/2007. Instructed dealers on how to identify and correct customer complaints related to pinion seal leaks. It also indicated that during the process of installing a new seal there could be trapped fluid that leaks and may present itself as a "false" leak.

General Motors currently has no drafts of any communications planned for the next 120 days to its dealers, regional offices, zone offices or other entities regarding the subject condition in the subject vehicles.

The bulletins are included on the ATT_1_GM Disc in the folder labeled Q_07; refer to the folder labeled, "Q_07_BULLETINS." The preceding information was collected from GM Service Operations. The data collection was completed on August 27, 2007

8. **Describe all assessments, analyses, tests, test results, studies, surveys, simulations, investigations, inquiries and/or evaluations (collectively, "actions") that relate to, or may relate to, the alleged defect in the subject vehicles that have been conducted, are being conducted, are planned, or are being planned by, or for, GM. For each such action, provide the following information:**

- a. Action title or identifier;
- b. The actual or planned start date;
- c. The actual or expected end date;
- d. Brief summary of the subject and objective of the action;
- e. Engineering group(s)/supplier(s) responsible for designing and for conducting the action; and
- f. A brief summary of the findings and/or conclusions resulting from the action.

For each action identified, provide copies of all documents related to the action, regardless of whether the documents are in interim, draft, or final form. Organize the documents chronologically by action.

The information listed in Table 8-1 below is a summary of actions performed by GM regarding the subject condition on the 2003-2006 MY subject vehicles. Documents and additional supporting information is included in the following Attachments: Attachment 1 Disc GM Data, Response to Q8 files. The data collection was completed on September 14, 2007.

<p>Action 8-1: Right and left hand axle seal leak analysis. Start Date: 08/2002 End Date: 05/23/2003 Engineering Group: GM and GETRAG Attachments: Document can be found on ATT_1_GM Disc in the folder labeled Q_07; refer to the folder labeled, "Q_07_BULLETINS." See Preliminary Information #PIO1103A Description: Analysis of leaking right and left hand axle seals Summary of Action: Contacts with dealers and the rear drive module sub assembly supplier. Bulletin issued and supplier process verified.</p>
<p>Action 8-2: CTS-V housing and half shaft fractures, and power hop analysis. 4 Problem Resolution Tracking System (PRTS)+ cases initiated. Start Date: 06/24/2004 End Date: 02/01/2006 Engineering Group: GM and GETRAG Attachments: Documents can be found on the ATT_1_GM, ATT_2_GM CONF, and ATT_3_SPLR folders labeled Q_08. Refer to the folder labeled, "Q_8.2." Description: All validation requirements met. Review of validation testing and reports, warranty reports, PRTS+ documents, and FEA simulations. Summary of Action: The CTS-V rear drive module meets all GM validation requirements.</p>
<p>Action 8-3: Pinion seal leak study. 2 Problem Resolution Tracking System (PRTS)+ cases initiated. Start Date: 12/5/2006 End Date: 5/15/2007 Engineering Group: GM, GETRAG, and Sabo Attachments: Documents can be found on the ATT_2_GM CONF and ATT_3_SPLR folders labeled Q_08. Refer to the folder labeled, "Q_8.3." Description: Analysis to understand increase in pinion seal leaks for the 2006 and 2007 model years. Summary of Action: Two Red-X Studies on pinion seal leaks completed, seal material analysis conducted, and third parties contracted to evaluate seal performance.</p>

<p>Action 8-4: Service Kit Release Start Date: May/2007 End Date: 8/2/2007 Engineering Group: GM, GETRAG Attachments: The document can be found on the ATT_2_GM CONF folder labeled Q_08. Refer to the folder labeled, "Q_8.4." Description: Develop Service kit to address 2006 and 2007 model year pinion seal leaks Summary of Action: Release of kit for 2006-2007 model years that can also be used for 2003-2005 model year vehicles.</p>
<p>Action 8-5: Warranty analysis of alleged lock-ups Start Date: August/2007 End Date: 9/4/2007 Engineering Group: GETRAG Attachments: Documents can be found on the ATT_3_Supp folder labeled Q_08. Refer to the folder labeled, "Q_8.5." Description: Analyze warranty claims where customer complaint was "lock-up." Summary of Action: Contacted dealers regarding 158 warranty claims where the customer complaint was "lock-up."</p>
<p>Action 8-6: Management Reviews of Differential Issue (3 meetings) Start Date: 5/31/2007 End Date: Ongoing Engineering Group: GM Attachments: Documents can be found on the ATT_2_GM CONF folder labeled Q_08, refer to the folder labeled, "Q8.6." Description: GM investigation into alleged issue regarding the 2003-2006 Cadillac CTS, CTS-V and STS. Summary of Action: Field reports, warranty analysis and engineering information regarding the subject vehicles was reviewed with GM management. Ongoing analysis of field returns is continuing.</p>

TABLE 8-1

9. Describe all modifications or changes made by, or on behalf of, GM in the design, material composition, manufacture, quality control, supply, or installation of the subject component, from the start of production to date, which relate to, or may relate to, the alleged defect in the subject vehicles. For each such modification or change, provide the following information:
- The date or approximate date on which the modification or change was incorporated into vehicle production;
 - A detailed description of the modification or change;
 - The reason(s) for the modification or change;
 - The part number(s) (service and engineering) of the original component;
 - The part number(s) (service and engineering) of the modified component;
 - Whether the original unmodified component was withdrawn from production and/or sale, and if so, when;
 - When the modified component was made available as a service component; and
 - Whether the modified component can be interchanged with earlier production components.

Also, provide the above information for any modification or change that GM is aware of which may be incorporated into vehicle production within the next 120 days.

For the Cadillac CTS-V, improvements to the rear differential carrier housing and half shafts were implemented during the 2005 and 2006 model years to improve the ability of the rear differential and half shafts to withstand snap clutch events that include power hop. Snap clutch engagement is when the foot is slipped off a fully depressed clutch pedal at high engine RPMs with the vehicle at rest. Snap clutch events apply significant torsional impact forces to the rear differential housing. The forces try to separate the gears within the differential, which results in tensile loads being imparted on the differential housing. Loads into the rear differential become even greater if the vehicle experiences power hop during the snap clutch event. The independent 5-link rear suspension on the CTS-V is designed to keep the tires and wheels in contact with the road. However, in extreme loss of drive wheel traction or with high applications of power a vehicle at rest, if the throttle is not reduced the effects of the suspension's design to keep the tire firmly against the road surface will result in a noticeable, abrupt wheel/axle hop (aka power hop). The addition of power hop can create forces of sufficient magnitude to overload and crack the rear differential housing or fracture the outboard stem of one of the half shafts. The differential housing may crack and separate in such a way that the engine propeller shaft is no longer engaged with the rear differential gears. In general it takes multiple snap clutch events with power hop to crack the differential housing or separate the half shaft.

The suspension mounts and the powertrain calibration for the CTS-V were also revised to reduce the potential for power hop.

A service seal kit is being developed and validated to incorporate the features of the seal that was put into production for the 2008 model year with a new seal supplier. This seal would be capable of servicing past model years. Validation of the service seal is scheduled to begin in late September 2007.

A summary document of the component modifications, engineering service notice information and process changes responsive to items 9 a-h is included on the Attachment 1 Disc GM; refer to the folder labeled "Q_09" and Attachment 2 Disc SPLR.

10. Furnish GM's assessment of the alleged defect in the subject vehicle, including:

- a. The causal or contributory factor(s);**
- b. The failure mechanism(s);**
- c. The failure mode(s), including the risk of both (1) loss of motive power; and (2) rear wheel lock-up resulting in loss of control;**
- d. The risk to motor vehicle safety that it poses;**
- e. What warnings, if any, the operator and the other persons both inside and outside the vehicle would have that the alleged defect was occurring or subject component was malfunctioning; and**
- f. The reports included with this inquiry.**

General Motors is responding to this IR regarding two separate issues. The first is rear differential or half shaft related incidents that could result in a loss of motive power. The second is rear differential seal leaks that could result in alleged rear differential lock up or a loss of motive power.

Loss of motive power:

The Cadillac CTS-V began production in the 2004 model year (February 2004). This vehicle is equipped with a standard six speed manual transmission and with significantly more horse

power (400hp vs. 210-220hp) and torque (395ft-lbs vs. 194-218ft-lbs) than the Cadillac CTS. These vehicles are sometimes used for extreme driving maneuvers.

GM's assessment of allegations of loss of motive power indicates that 90 percent of the complaints are for the CTS-V vehicles. Analysis of 16 warranty return rear differentials determined that the component breakage was a result of maneuvers such as snap clutch events from a stop which may cause power hop. Snap clutch engagement is when the foot is slipped off a fully depressed clutch pedal at high engine RPMs with the vehicle at rest. Snap clutch events apply significant torsional impact forces to the rear differential. The forces try to separate the gears within the differential, which results in tensile loads being imparted on the differential housing.

Loads into the rear differential become even greater if the vehicle experiences power hop during the snap clutch event. The independent 5-link rear suspension on the CTS-V is designed to keep the tires and wheels in contact with the road. If throttle application and clutch release occur that results in spinning the tires, noticeable abrupt power hop can occur until the throttle is reduced. The addition of power hop can create forces of sufficient magnitude to overload and crack the rear differential housing or fracture the outboard stem of one of the half shafts. The differential housing may crack and separate in such a way that the pinion gear loses contact with the ring gear. In general it takes multiple snap clutch events with power hop to crack the differential housing or separate the half shaft.

When GM conducted the CTS-V validation testing called Strength in Forward and Strength in Reverse Gears Testing, drivers were instructed to reduce the throttle if the vehicle experienced power hop. The CTS-V met the Strength in Forward and Strength in Reverse Gears Testing requirements with this test protocol.

GM made powertrain calibration changes and revisions to cross member isolators to reduce the potential for power hop, as a result of the cracks observed in the rear differential housing from 2004 model year warranty returns and to reduce damage associated with power hop. Structural enhancements to the differential housing were also made for the 2006 model year. The half shafts had the radius at the outboard stem increased from 1.25 mm to 2.25 mm for the 2006 model year to improve their strength.

During GM's review of the VOQs provided with the Information Request, it was determined that nearly 25 percent of the VOQs were from CTS-V customers who hadn't experienced a loss of motive power. The text of the VOQ indicated that their complaints were related either to the noise of the rear differential, that the vehicle was prone to power hop, or that they had had more than one differential replaced. None of the language in those VOQs indicated the vehicle had ever lost motive power.

GM believes the conditions described above do not result in an unreasonable risk to motor vehicle safety. The CTS-V is most likely to experience a loss of motive power at the start of high acceleration with the vehicle initially at rest rather than when driving at speed.

Alleged loss of motive power or rear differential lock-up related to axle or pinion seal leaks

Axle Seals:

Axle seals are located on the right hand and left hand side of the rear differential. The half shafts that are connected to the rear wheels are inserted through these seals. GM discovered that at the start of CTS vehicle production in the 2003 model year, the supplier that sub assembled the rear drive module was not using the protective tool when installing the half

shafts into the differential. The use of the tool is important because there are splines on the end of the half shaft that can nick or cut the seal when the half shaft is installed. A cut or nicked seal will allow differential fluid to leak out of the assembly. A leaking axle seal may result in a visible "puddle" of fluid where the vehicle has been parked. If enough fluid leaks, the driver may hear noise due to the reduction in rear pinion bearing lubrication. If the rear differential loses approximately 2/3 of its 1.3 L capacity, the bearings may no longer be lubricated, and start to overheat. Damage to the bearing and other differential components could then occur. Damaged bearings will create noise that may be heard by the vehicle occupants. In the few cases where vehicles continued to be driven with low fluid levels, three different outcomes were observed. The first is that the vehicle may continue to operate normally, but if it is stopped and then put in reverse, the pinion bearing cages may separate and allow the rollers to move out of position, potentially jam, and prevent vehicle motion. In the second case, the bearing cage may separate progressively and cause drag from the damaged bearing. In the third case, the pinion bearing rollers could jam and cause the rear differential to lock-up.

Including VOQs, there were nine unique reports for the 2003 model year that alleged a rear differential lock-up. One vehicle had a loss of motive power which is a possible outcome previously mentioned. One vehicle alleged a loss of control. The 2003 model year vehicle included with the VOQs had the differential replaced due to noise, and after a few miles of driving from the dealership the rear differential was alleged to lock-up. Rear differentials used for service are shipped without fluid. GM believes the dealership for the vehicle in question did not fill the rear differential as called out in the service procedure. Lack of fluid resulted in the rapid overheat and damage to the rear differential components. Of the remaining six reports, all are alleged to have had a rear differential lock-up, and the dealerships that serviced those vehicles confirmed that they had a left hand or right hand seal leak. Except for one, all of those vehicles were built before September 1, 2002 which is early in the 2003 model year. The highest mileage reported for any incident is 37,908 miles.

The subassembly supplier was informed that its process needed to ensure that the protective tool was being used. As listed in Question 7 above, on May 23, 2003 GM issued a preliminary information document to remind dealerships about the importance of using the protective seal cover tool if they replace a rear differential.

GM believes the rate and trend of side seal axle leaks that result in rear differential lock-ups does not present an unreasonable risk to motor vehicle safety. The issue of axle seals being cut was limited to early in the 2003 model year. The last known report of an alleged lock-up for a 2003 model year vehicle is January 3, 2006 with the odometer at 25,649 miles. That vehicle was built August 26, 2002. The highest mileage report was 37,908 miles for a 2003 model year vehicle with an incident date of April 16, 2004. GM has collected data on mileage accumulation of its cars and trucks. The early built 2003 model year CTS vehicles have had five years of exposure. The average car is driven 66,136 miles in five years. That is 75% more than the highest mileage of any known incident. This type of incident is self declaring, generally occurring early in the vehicle usage, and future occurrences are unlikely.

Pinion Seals:

The pinion seal is located on the front of the rear differential. It seals at the pinion flange to rear differential interface. The vehicle propeller shaft attaches to the pinion flange. GM discovered that in December 2004, the seal supplier made an unauthorized change to material used for the pinion seal. These seals were assembled into production vehicles beginning in approximately March 2005. GM noticed a significant increase in the warranty claims related to pinion seal leaks during the 2006 model year. A RED X study determined that the seals exhibited a condition known as high trimming. With high trimming, flash from the trimmed seal is in contact

with the flange instead of the designed sealing surface. This results in a seal that is more prone to leakage. The supplier was placed on controlled shipping to correct its trimming process.

Early in the 2007 model year it was discovered that while the pinion seal leak warranty rate had decreased, it was still several times higher than it had been for the 2003-2005 model years. A second RED X study and other laboratory evaluation determined that the seal material was not the same as what was used in the 2003-2005 model year. The supplier had made an unauthorized change to the seal material. It was only as a result of the RED X study completed on 4/25/07 that GM found the new material was responsible for premature seal wear and leaks. Even properly trimmed seals were exhibiting wear during vehicle use that could result in leaks at 6000 miles or less.

A leaking pinion seal will affect the rear differential in a manner similar to a leaking axle seal. A leaking axle seal may result in a visible "puddle" of fluid where the vehicle has been parked. If enough fluid leaks, the driver may hear noise due to the reduction in pinion bearing lubrication. If the rear differential loses approximately 2/3 of its 1.3 L capacity, the bearings may no longer be lubricated, and start to overheat. Damage to the bearing and other differential components could then occur. Damaged bearings will create noise that may be heard by the vehicle occupants. In the few cases where vehicles continued to be driven with low fluid levels, three different outcomes were observed. The first is that the vehicle may continue to operate normally, but if it is stopped and then put in reverse, the pinion bearing cages may separate and allow the rollers to move out of position, potentially jam, and prevent vehicle motion. In the second case, the bearing cage may separate progressively and cause drag from the damaged bearing. In the third case, the pinion bearing rollers could jam and cause the rear differential to lock-up.

There is significant warning to the customer that the differential is leaking fluid. Almost 0.9L (30oz) must be lost from rear differential before the bearings are no longer lubricated. That would result in a significant amount of fluid where the vehicle is parked. For the 2006 model year there have been nearly 20,000 claims for leaking rear differential pinion seals.

In GM's search for reports of alleged rear differential lock-up, there were three for 2004 model year vehicles. Two of the incidents were due to the dealer not filling the differential with fluid when it was replaced for a noise complaint. There was one report for a 2004 model year vehicle that had an alleged loss of motive power.

For the 2005 model year, GM found a report and a VOQ for one CTS and one STS of alleged rear differential lock-up.

For the 2006 model year GM found reports and VOQs on six CTS, one STS and one CTS-V of alleged rear differential lock-up.

The term "lock-up" isn't used consistently. For a sample of warranty claims, calls to dealers found that greater than 23% of customers who complained about a rear differential lock-up actually drove the vehicle to the dealership to have the part replaced.

GM is continuing its investigation to better understand the condition of rear differentials that have been reported to have locked up.

* * *

General Motors requested assistance and documents from suppliers in responding to items 8 and 9 and 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.

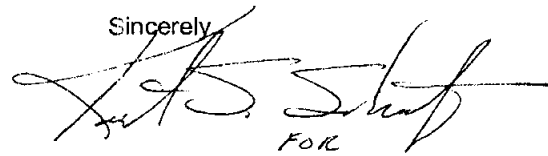
This response is based on searches of General Motors Corporation (GM) locations where documents determined to be responsive to your request would ordinarily be found. As a result, the scope of this search did not include, nor could it reasonably include, "all of its divisions, subsidiaries (whether or 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 January 1, 2000, were involved in any way with any of the following related to the alleged defect 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,



Gay P. Kent
Director

Product Investigations

Attachments