

Ford Motor Company

James P. Vendale, Director
Automotive Safety Office
Environmental & Safety Engineering

June 1, 2005

Ms. Kathleen C. DeMeter, Director
Office of Defects Investigation Safety Assurance
National Highway Traffic Safety Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Dear Ms. DeMeter:

Subject: EA04-034:NVS-213day

The Ford Motor Company (Ford) response to the agency's April 19, 2005 information request concerning steel wheels used on model year 2003 and later Crown Victoria police and taxi vehicles is attached.

Ford and the supplier of the subject steel wheels have expended considerable effort and resources investigating the causal and contributory factors leading to cracks in the subject wheels. As the agency is aware, Ford identified a higher than expected rate of wheel crack allegations in wheels produced for 2003 model year police and taxi vehicles that were manufactured before September, 2002, and accordingly conducted safety recall 03S05 that replaced affected wheels with an improved design wheel. Ford also extended the warranty coverage for wheels used in police and commercial applications built prior to November 19, 2004, including wheels used to remedy vehicles involved in 03S05.

Warranty parts return analysis of the wheels that are the subject of this Engineering Analysis reveals that only 54% of wheels returned to Ford with an associated crack allegation were actually found to exhibit some type of crack. Additionally, 74% of wheels that were returned under the extended warranty program (which applied only to cracked wheels) were found, upon close inspection, in fact to have no crack.

Although Ford is aware of a small number of reports alleging rapid air loss, based upon our investigation, we do not believe there are any incidents of rapid air loss due to a cracked wheel. For each allegation of rapid air loss our investigation has found the incidents to be actually slow air loss events, typically occurring over a span of hours or days, which is similar to findings in our investigation of several reports received prior to August 2004 that were addressed in our September 23, 2004 response to RQ04-007.

Ford also believes, based on our vehicle testing, analysis of parts and an accident scene, that none of the alleged steel wheel cracks have caused an accident or injury. High speed vehicle



evaluations conducted by Ford, that included aggressive driving maneuvers, demonstrated that the CVPI maintains excellent handling characteristics, even when negotiating an aggressive curve with front outer tire pressure reduced by 20 psi.

Based on Ford's extensive vehicle evaluations, our review and analysis of the wheels returned from the field, our discussions with fleet personnel regarding their experience, and our survey of targeted fleets, Ford continues to believe that the actions already in place appropriately address any concerns that may arise related to this subject, and that no further action is warranted.

If you have any questions concerning this response, please feel free to contact me.

Sincerely,



James P. Vondale

Attachment

FORD MOTOR COMPANY (FORD) RESPONSE TO EA04-034

Ford's response to this Engineering Analysis information request was prepared pursuant to a diligent search for the information requested. While we have employed our best efforts to provide responsive information, the breadth of the agency's request and the requirement that information be provided on an expedited basis make this a difficult task. We nevertheless have made substantial effort to provide thorough and accurate information, and we would be pleased to meet with agency personnel to discuss any aspect of this Engineering Analysis.

The scope of Ford's investigation conducted to locate responsive information focused on Ford employees most likely to be knowledgeable about the subject matter of this inquiry and on review of Ford files in which responsive information ordinarily would be expected to be found and to which Ford ordinarily would refer, as more fully described in this response. Ford notes that although electronic information was included within the scope of its search, Ford has not attempted to retrieve from computer storage electronic files that were overwritten or deleted. As the agency is aware, such files generally are unavailable to the computer user even if they still exist and are retrievable through expert means. To the extent that the agency's definition of Ford includes suppliers, contractors and affiliated enterprises for which Ford does not exercise day-to-day operational control, we note that information belonging to such entities ordinarily is not in Ford's possession, custody or control.

Ford has construed this request as pertaining to vehicles manufactured for sale in the United States, its protectorates and territories.

Answers to your specific questions are set forth below. As requested, after each numeric designation, we have set forth verbatim the request for information, followed by our response. Unless otherwise stated, Ford has undertaken to provide responsive documents dated up to and including April 19, 2005, the date of your inquiry. Ford has searched within the following offices for responsive documents: Environmental and Safety Engineering, Ford Customer Service Division, Quality, Office of the General Counsel and North American Car Product Development.

Request 1

State, by model and model year, the number of **subject vehicles** Ford has manufactured for sale or lease in the United States. Separately, for each **subject vehicle** manufactured to date by Ford, state the following:

- a. Vehicle identification number (VIN);
- b. Date of manufacture;
- c. Part number suffix (CC, CD, CF, AA, etc) of the original equipment (OE) wheel;
- d. If the purchaser was a police or law enforcement agency;
- 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 "SubjectProductionData." See the enclosed CD-ROM titled "EA04034 IR Attachments" for a pre-formatted table which provides further details regarding this submission.

Answer

Ford records indicate that the approximate total number of subject vehicles sold in the United States (the 50 states and the District of Columbia) and its protectorates and territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and Virgin Islands) through April 19, 2005 is 145,603.

The number of subject vehicles sold in the United States by model and model year is shown below:

Model	2003 MY	2004 MY	2005 MY
Crown Victoria Commercial	70,629	45,098	29,876

Ford does not routinely record whether a fleet vehicle purchaser is a police, other law enforcement agency, or commercial (taxi) use. For purposes of responding to this request, we have separately classified Crown Victoria Commercial vehicles into general usage categories based on the Body Code designation of the VIN (characters 5, 6 and 7).

- P71 Body Code - Police and other law enforcement agencies typically purchase Crown Victoria Police Interceptor (CVPI) models denoted by a P71 Body Code.
- P70 or P72 Body Code - Taxi and fleet customers typically purchase Crown Victoria Long Wheelbase models denoted by a P70 Body Code, or Crown Victoria Regular Wheelbase models with a P72 Body Code.

P71 models are sold only to police and other law enforcement agencies. The P70 and P72 models may be sold to any fleet organization including those involved with police and other law enforcement, though the annual sales of P70 or P72 models to police or law enforcement agencies is very low.

The design change table provided in Appendix F in response to Request 13 specifies the part number (including suffix level) of the original equipment wheel released for vehicle production and the corresponding vehicle production dates.

The requested data, where available, for each subject vehicle is provided electronically in Appendix A1 (filename: 2005-06-01_Appendix_A1) on the enclosed CD.

Request 2

State, by model and model year, the number of *peer vehicles* Ford has manufactured for sale or lease in the United States. Separately, for each *peer vehicle* manufactured to date by Ford, state the following:

- a. Vehicle identification number (VIN);
- b. Date of manufacture;
- c. Date warranty coverage commenced; and
- d. 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 "PeerProductionData." See the enclosed CD-ROM titled "EA04034 IR Attachments" for a pre-formatted table which provides further details regarding this submission.

Answer

Ford records indicate that the approximate total number of peer vehicles sold in the United States (the 50 states and the District of Columbia) and its protectorates and territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and Virgin Islands) is 29,478.

The requested data, where available, is provided electronically in Appendix A2 (filename: 2005-06-01_Appendix_A2) on the enclosed CD.

Request 3

State the number of each of the following, received by Ford, or of which Ford is otherwise aware, that relate to, or may relate to, the alleged defect in the *subject and peer 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 or peer vehicle*, property damage claims, consumer complaints, or field reports;
- d. Property damage claims;
- e. Third-party arbitration proceedings where Ford is or was a party to the arbitration; and
- f. Lawsuits, both pending and closed, in which Ford is or was a defendant or codefendant.

For subparts "a" through "d," 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 Ford'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.

Answer

For purposes of identifying reports of incidents potentially involving the alleged defect and any related documents, Ford has gathered "owner reports" and "field reports" maintained by Ford Customer Service Division (FCSD), fleet reports maintained in a Fleet Test Database, and claim and lawsuit information maintained by Ford's Office of the General Counsel (OGC).

Ford's search for records responsive to Request 3 pertaining to the subject vehicles was limited to records created after the search cut-off date for RQ04-007 (August 4, 2004) through the date this request was received (April 19, 2005). A search for such records pertaining to the peer vehicles includes those created from January 1, 2001 through April 19, 2005.

Descriptions of the FCSD owner and field report systems, and the Fleet Test Database systems, and the criteria used to search each of these are provided electronically in Appendix B (filename: 2005-06-01_Appendix_B) on the enclosed CD.

The following categorizations were used in the review of reports located in each of these searches:

Category	Allegation
A1	Alleged steel wheel crack or split with reported loss of inflation pressure
A2	Alleged steel wheel crack or split with no reported loss of inflation pressure
03S05	Wheel(s) replaced under 03S05 field service action
58B01	One-Time Inspection of All Five (5) Wheels for Engineering Part No. and Build Code – No wheels require replacement
M	Wheel(s) replaced under 03M03/04M05 extended warranty with no allegation or symptom
B	Ambiguous

We are providing electronic copies of reports categorized as "B" as "non-specific allegations" for your review because of the broad scope of the request. Based on our engineering judgment, the information in these reports is insufficient to support a determination that they pertain to the alleged defect.

Owner Reports: Records identified in a search of the Master Owner Relations Systems (MORS) database, as described in Appendix B, were reviewed for relevance and categorized in accordance with the categories described above. The number of relevant owner reports identified in this search and review is provided in Appendix C1 (filename: 2005-06-01_Appendix_C1) and in Appendix C2 (filename: 2005-06-01_Appendix_C2) on the enclosed CD for subject and peer vehicles respectively. Copies of these categorized owner reports are provided in the MORS III portions of the electronic databases also contained in Appendices C1 and C2. The categorization of each report is identified in the "Category" field.

When we were able to identify that responsive (i.e., not ambiguous) duplicate owner reports for an alleged incident were received, each of these duplicate reports was marked accordingly, and the group counted as one report. In other cases, certain vehicles may have experienced more than one incident and have more than one report associated with their VINs. These reports have been counted separately.

Legal Contacts: Ford is providing in Appendix B a description of Legal Contacts and the activity that is responsible for this information, Litigation Prevention. Because there were no Legal Contacts, there are no Litigation Prevention files to produce to the agency.

Fleet Reports: In addition to fleet reports that may be contained in the owner reports or field reports identified in this response, Ford conducted a search of its internal Fleet Test Database, as described in Appendix B, for reports that may relate to the alleged defect in the subject and peer vehicles. No internal fleet reports were identified that relate to the subject defect.

Field Reports: Records identified in a search of the Common Quality Indicator System (CQIS) database, as described in Appendix B, were reviewed for relevance and categorized in accordance with the categories described above. The number of relevant field reports identified in this search and review is provided in Appendices C1 and C2. Copies of these categorized

field reports are provided in the CQIS portion of the electronic database also contained in Appendices C1 and C2. The categorization of each report is identified in the "Category" field.

When we were able to identify that responsive duplicate field reports for an alleged incident were received, each of these duplicate reports was marked accordingly, and the group counted as one report. In other cases, certain vehicles may have experienced more than one incident and have more than one report associated with their VINs. These reports have been counted separately. In addition, field reports that are duplicative of owner reports are provided in Appendices C1 and C2 but are not included in the report count provided in those appendices.

Unified Database: The Unified Database (UDB) was created to facilitate parts availability by tracking part sales and is not intended as a problem reporting system. However, because a small percentage of the records may contain verbatim comments that could potentially relate to the agency's inquiry, we searched UDB for reports responsive to Request 2 as described in Appendix B. No potentially relevant reports were identified.

VOQ Data: This information request had an attachment that included 37 Vehicle Owner's Questionnaires (VOQs). Ford made inquiries of its MORS database for customer contacts, and its CQIS database for field reports regarding the vehicles identified in the VOQs. Ford notes that in some instances, where the VOQ does not contain the VIN, or the owner's last name and zip code, it is not possible to query the databases for owner and field reports specifically corresponding to the VOQs. Any reports which relate to the alleged defect located on a subject vehicle identified in the VOQs are included in the MORS and CQIS portions of the electronic database provided in Appendix C1 and have been identified by a "Y" in the "VOQ Dup" field.

Ford notes that 37 VOQ's included with this information request involve 32 vehicles and 30 of these reports are from a single agency. Two reports from that source allege a loud sound preceding partial deflation of a tire and one report alleges a rapid deflation. All of the other reports describe the expected obvious symptoms of slow air loss and/or steering wheel vibration.

Crash/Injury Incident Claims: For purposes of identifying allegations of accidents or injuries that may have resulted from the alleged defect, Ford has reviewed responsive owner and field reports, and lawsuits and claims. Based on a reasonable and diligent search, Ford located no owner (MORS) reports, no field (CQIS) reports, no warranty claims, and no lawsuits or claims, alleging an accident that may be related to the alleged defect. Ford received the accident allegation that occurred near New Stanton, Pennsylvania prior to the RQ04-007 response. This incident is discussed in detail in response to Request 19.

Claims, Lawsuits, and Arbitrations: For purposes of identifying incidents that may relate to the alleged defect, Ford has gathered claim and lawsuit information maintained by Ford's OGC. Ford's OGC is responsible for handling product liability lawsuits, claims, and consumer breach of warranty lawsuits and arbitrations against the Company.

Based on a reasonable and diligent search, Ford located no lawsuits, claims, consumer breach of warranty lawsuits, or arbitrations that appear to relate to the alleged defect in the subject and peer vehicles. Further, Ford located no lawsuits, claims, consumer breach of warranty lawsuits, or arbitrations against the Company which are ambiguous as to whether they meet the alleged defect criteria.

Request 4

Separately, for each item (complaint, report, claim, notice, or matter) within the scope of your response to Request No. 3, state the following information:

- a. Ford's file number or other identifier used;
- b. The category of the item, as identified in Request No. 3 (i.e., consumer complaint, field report, etc.);
- c. The company source (company-owned vehicle survey, service technician, field service and quality engineer, technical hot line, fleet or police operator, etc.) which submitted the field report/complaint if it was taken from Ford's CQIS database, or alternatively, provide information that allows ODI to discern the source on its own (can any fields be decoded/interpreted to identify the source, particularly for EDSR's);
- d. Vehicle owner or fleet name (and fleet contact person), address, and telephone number;
- e. Vehicle's VIN;
- f. Vehicle's make, model and 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 "ComplaintData." See the enclosed CD-ROM titled "EA04034 IR Attachments" for a pre-formatted table that provides further details regarding this submission.

Answer

Ford is providing owner and field reports in the electronic databases contained in Appendices C1 and C2 on the enclosed CD in response to Request 3. To the extent information sought in Request 4 is available for owner and field reports, it is provided in the database. A source code for each responsive field report is provided in Appendices C1 and C2, the definition of each code is provided in Appendix B.

Request 5

Produce copies of all documents related to items 'c' through 'f' within the scope of Request No. 3. Organize the documents separately by category (i.e., consumer complaints, field reports, etc.) and describe the method Ford used for further organizing the documents.

Answer

Ford is providing owner and field reports in the electronic databases contained in Appendices C1 and C2 in response to Request 3. To the extent information sought in Request 5 is available, it is provided in the referenced appendices.

Request 6

State, by model and model year, a total count for all of the following categories of claims, collectively, that have been paid by Ford to date that relate to, or may relate to, the alleged defect in the **subject and peer 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. Ford'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 claim was related to a Ford recall or field service action (03S05, 03M03, 04M05, etc.);
- k. Concern stated by customer; and
- l. Comment, if any, by dealer/technician relating to claim and/or repair.

Provide this information in Microsoft Access 2000, or a compatible format, entitled "WarrantyData." See the enclosed CD-ROM titled "EA04034 IR Attachments" for a pre-formatted table that provides further details regarding this submission.

Answer

Records identified in a search and review of Ford's Analytical Warranty System (AWS) database records, as described in Appendix B, were reviewed for relevance and categorized in accordance with the categories described in the response to Request 3. The number of relevant warranty claims identified in this search and review is provided in Appendices C1 and C2. Copies of these categorized warranty claims are provided in the AWS portion of the electronic databases also contained in Appendices C1 and C2. The categorization of each report is identified in the "Category" field.

Ford's search for records responsive to Request 6 pertaining to the subject vehicles was limited to records created after the search cut-off date for RQ04-007 (August 4, 2004) through the date this request was received (April 19, 2005). A search for such records pertaining to the peer vehicles includes those created from January 1, 2001 through April 19, 2005.

When we were able to identify that duplicate claims for an alleged incident were received, each of these duplicate claims is marked accordingly and the group is counted as one report. In other cases, certain vehicles may have experienced more than one incident and have more than one claim associated with their VINs. These claims have been counted separately. Warranty claims that are duplicative of owner and field reports are provided in Appendices C1 and C2 but are not included in the report count in those appendices.

Requests for "goodwill, field or zone adjustments" received by Ford to date that relate to the alleged defect that were not honored, if any, would be indicated in the MORS reports identified above in response to Request 3; requests that were honored by Ford to date, if any, are identified as warranty claims and are included in Appendices C1 and C2. Claims associated with Field Service Actions 03S05, 03M03 or 04M05 can be identified by the Transaction Codes specified in Appendix B in response to Request 7.

Request 7

Answer the following questions related to Request 6, the warranty claims data Ford is providing, and Ford's warranty policies:

- a. Describe in detail the search criteria and any subsequent record reviewed used by Ford to identify the claims identified in response to Request No. 6, including the labor operations, problem codes, part numbers and any other pertinent parameters used;
- b. Provide a list of all warranty component classifications, warranty component classification descriptions, customer concern codes, customer concern code descriptions, condition codes, and condition code descriptions applicable to the alleged defect in the *subject and peer vehicles*;
- c. Provide an explanation of the source and meaning of the data stored in the fields titled "TXN_CD" and "VFG_CD" in Ford's AWS data file and provide a list of codes and meanings for the data provided in response to Request 6;
- d. State, by make and model year, the terms of the new vehicle warranty coverage offered by Ford on the *subject and peer vehicles* (i.e., the number of months and mileage for which coverage is provided and the vehicle systems that are covered);
- e. State the warranty terms Ford offers (i.e., the number of months and mileage for which coverage is provided) for *subject vehicle* wheels that were replaced:
 - i) under NHTSA recall 03V279 (Ford 03S05);
 - ii) under Ford service campaigns 03M03 and 04M05;
 - iii) under new vehicle warranty (non-campaign) coverage;
 - iv) as a service replacement part (non-warranty);
- f. State the warranty terms offered for subject wheels sold by Ford retailers over-the-counter (as a component not installed by the retailer); and
- g. Describe Ford's goodwill policy as its administration as it applies to subject wheel replacement on the *subject vehicles*.

Answer

The search criteria used by Ford to identify responsive warranty claims, as well as warranty component classifications, warranty component classification descriptions, customer concern codes, customer concern code descriptions, condition codes, and condition code descriptions is described in the AWS section in Appendix B. An explanation of Transaction Code (TXN_CD) and Vehicle Function Group Code (VFG_CD) is also provided in Appendix B.

All 2002 - 2005 model year Ford passenger cars include the following warranty coverage:

- 36 month/36,000 mile bumper-to-bumper
- 60 month/50,000 mile safety restraint system
- 60 month/unlimited corrosion (perforation only)

Ford implemented extended warranty programs (03M03 and 04M05) on 2003 through 2005 model year Crown Victoria Police and commercial fleet vehicles to address allegations of cracked steel wheels manufactured from August 18, 2001 through November 19, 2004 for five

years or 150,000 miles from the vehicle original warranty start date. All replacement wheels (except those manufactured between the preceding dates), including non-warranty and over-the-counter sales, include the standard service replacement part warranty of twelve months or 12,000 miles.

Ford's After Warranty Assistance (AWA) program includes payments made on a case-by-case basis for repairs not covered by the vehicle warranty, service part warranty, Ford ESP, or non-Ford service contract. Dealership, Zone and District Operations Managers, Commercial Area Fleet Manager (Fleet Service Representatives), Regional Managers, Modified Vehicle Specialists and Fleet Service Hotline Analysts make AWA decisions based on the customer's loyalty to the dealership and proper vehicle use and maintenance. AWA is used to build or maintain long-term relationships with customers.

Request 8

Produce copies of all service, warranty, and other documents that relate to, or may relate to, the alleged defect in the *subject and peer vehicles*, that Ford 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, recall and campaign notifications, 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 Ford is planning to issue within the next 120 days.

Answer

For purposes of identifying communications to dealers, zone office, or field offices pertaining, at least in part, to steel wheel cracking or fracture in the subject and peer vehicles, Ford has reviewed the following FCSD databases and files: On-Line Automotive Service Information System (OASIS) containing Technical Service Bulletins (TSBs) and Special Service Messages (SSMs); Internal Service Messages (ISMs) contained in CQIS; and Field Review Committee (FRC) files. We assume this request does not seek information related to electronic communications between Ford and its dealers regarding the order, delivery, or payment for replacement parts, accordingly we have not included these kinds of information in our answer.

Ford's search for records responsive to Request 8 pertaining to the subject vehicles was limited to records created after the search cut-off date for RQ04-007 (August 4, 2004) through the date this request was received (April 19, 2005).

A description of Ford's OASIS messages, Internal Service Messages, and the Field Review Committee files and the search criteria used are provided in Appendix B.

OASIS Messages: Ford has identified no SSMs and no TSBs that may relate to the alleged defect in the subject or peer vehicles.

Internal Service Messages: Ford has identified no ISMs that may relate to the alleged defect in the subject or peer vehicles.

Field Review Committee: One dealer bulletin relating to extended warranty action 04M05, including four attachments, and three owner letters, are provided electronically in Appendix D (directory: 2005-06-01_Appendix_D) on the enclosed CD.

Request 9

Discuss in detail and provide in-depth information describing the process and explaining the effects of the specialized manufacturing process involving shot peening of the subject wheel that Ford discussed during a September 23, 2004 meeting with ODI. Answer the following questions:

- a. State the date Ford's wheel supplier incorporated the process into wheel manufacture;
- b. State the date Ford introduced shot peened wheels into **subject vehicle** manufacture;
- c. State the date that Ford last used non-shot peened wheels in **subject vehicle** manufacture;
- d. Provide the company name, address and point of contact (name, title, and phone number) for the supplier that provides the shot peening process to Ford or its wheel supplier;
- e. Identify the area of the wheel that receives the shot peening treatment;
- f. Identify the specific parameters of the shot peening process, including the dimensions of the shot material, the volume rate and velocities of the material utilized, the duration of treatment, etc.;
- g. State the part number of the shot peened wheel;
- h. Identify each way shot peened wheels can be distinguished from non-shot peened wheels;
- i. Provide the results of any testing that Ford has conducted showing the effects of the shot peening process on the durability of the wheel and how it compares to other wheels similarly tested (reference the chart provide at the November 3, 2004 Quarterly meeting);
- j. Describe in detail how the testing in item 'i' was performed
- k. State Ford's analysis of the testing performed in 'i';
- l. Discuss/describe any correlation Ford has determined between the test results of item 'i' and real world service usage of the subject wheel; and
- m. State what effect severe service usage (pot hole strikes, driving over curbs and other obstacles) will have on the durability effects of shot peening a wheel.

Answer

Ford and Hayes-Lemmerz implemented a shot peen treatment on the subject wheels to improve fatigue properties of the wheel assembly. Shot peening introduces residual compressive stress in the heat-affected zone (HAZ) adjacent to the weld. For information concerning residual tensile and compressive stresses, their affect on fatigue life, and the use of shot peening to modify residual stress and increase fatigue life, refer to SAE Technical Paper 2000-01-2564, Evaluation of Welding Residual Stress Levels Through Shot Peening and Heat Treating, or a website maintained by Metal Improvement Company (www.metallimprovement.com).

Information regarding part numbers and vehicle implementation dates of shot peened wheels is included in the design change table in Appendix F provided in response to Request 13. The shot peening process is out-sourced to Metal Improvement Company; contact information is provided in Appendix F. The shot peening process specifications including coverage area, dimensions, volume rate, velocity and duration of treatment are being submitted under separate cover with a request for confidentiality to the agency's Office of Chief Counsel in Appendix G (filename: 2005-06-01_Appendix_G) in response to Request 16. The part number stamped on the face of the wheel distinguishes shot peened wheels from non-shot peened wheels.

Radial fatigue tests were conducted in accordance with Ford Tire and Wheel Assembly System Design Specification requirement TY-0039, Road Wheel – Lab and Vehicle Durability. Ford requirement TY-0039 specifies testing similar to SAE J328, section 5, but requires two and one half times more cycles than specified in the SAE recommended practice. Ford notes that the Weibull distribution plots from test results comparing radial fatigue performance for each of the subject wheel designs used on the peer and subject vehicles, including the current production shot peened wheel, are being submitted under separate cover with a request for confidentiality to the agency's Office of Chief Counsel in Appendix E (filename: 2005-06-01_Appendix_E).

Test results demonstrate that the shot peen process increases the performance on the radial fatigue durability test substantially when compared to a similar wheel without the shot peen process. None of the shot peened wheels experienced cracks when tested, and testing was suspended after wheels attained eight times the number of cycles required by Ford, or 20 times the number of cycles specified in the SAE recommended practice. Weibull distribution plots of the shot peened wheel tests provided in Appendix E are conservative approximations based on a statistical analysis that assumes that a wheel crack was imminent when testing was suspended, even though none of the shot peened wheels actually cracked during this test.

Radial Fatigue testing is an industry recognized standard procedure for evaluating long term wheel durability. Ford and Hayes-Lemmerz have found Radial Fatigue tests to be an effective method for duplicating fatigue cracks in the subject wheel. Weibull distribution plots of Radial Fatigue test results provided in Appendix E clearly show an improvement in wheel durability corresponding to each of the design and process improvements implemented between June 2002 and December 2004. These improvements in test results correlate directly with reductions in the quantity of the typical slow air loss and wheel vibration allegations that may be associated with a cracked wheel. Likewise, the dramatic improvement in radial fatigue test performance exhibited by the Weibull distribution for the shot peened wheel testing is expected to correlate to a further reduction in the number of allegations received for those wheels.

The subject vehicles involved in this information request constitute some of the most severe service usage of all Ford vehicles. While we cannot anticipate or test for every potential instance of impact events that wheels fitted to these vehicles may experience during their life, the subject wheels have been tested and meet Ford requirements for pot hole and curb impact included in the Tire/Wheel System Design Specification included in Appendix G. Although shot peen treatment of the HAZ adjacent to the circumferential weld is effective in eliminating the residual tensile surface stress resulting from the weld process and creating a compressive residual surface stress that is resistant to initiation of fatigue cracks, a severe wheel impact can potentially cause a permanent deformation of the wheel and could reintroduce tensile stress in the HAZ. Wheel impacts of a magnitude sufficient to cause permanent wheel deformation in the subject wheels would typically result in vibration conditions that are obvious to the driver.

Request 10

Further to the discussion held during the September 23, 2004 meeting between ODI and Ford, state whether Ford has any information demonstrating the effects of front outer (FO) and rear outer (RO) tire pressure loss on limit handling capabilities (vehicle handling and dynamics) during *subject vehicle* turns, and if so, describe how the information was obtained and provide a copy of it. If no such data exists, state whether Ford is willing to conduct vehicle test and/or computer simulation work to demonstrate such effects; describe

the information Ford would produce. Potential examples include:¹ 1) steering wheel angle versus lateral acceleration for a constant radius turn at varying FO and RO tire inflations, or 2) responsiveness (steering wheel angle and YAW rate correlation to time) during vehicle lane change maneuvers at varying FO or RO tire inflations.

Answer

In April 2005, Ford conducted a vehicle evaluation to determine the affect of front outer tire pressure loss on high speed handling in a subject vehicle, and to attempt to re-create the tire marks resulting from the New Stanton, Pennsylvania incident alleged in VOQ 10082282. Evaluations were conducted at Ford Michigan Proving Grounds (MPG) using a 2003 model year Crown Victoria Police Interceptor (CVPI) vehicle. A 1,250 foot constant radius curve was established on a large skid pad, and the CVPI was driven at speeds of 102 to 105 mph negotiating a right turn starting with the recommended 35 psi cold inflation pressure in all four tires. The vehicle involved in the New Stanton, Pennsylvania incident was also a 2003 CVPI, reportedly traveling at approximately 110 mph around a 2,500 foot constant radius curve. A more aggressive radius curve was used in Ford's evaluation in order to accentuate any affects on handling performance and to increase the lateral acceleration of the vehicle. The front outer tire pressure was reduced in successive increments until the tire pressure was ultimately reduced by 20 psi. The Ford driver conducting the evaluation was able to identify noticeable symptoms of low tire pressure with a reduction of five psi, and expected that any driver familiar with the CVPI would notice low pressure symptoms well before pressure in a front tire is reduced by ten psi.

Evaluations included steady state negotiation of the curve, braking during the curve and an obstacle avoidance maneuver, with and without braking, during the curve. Vehicle handling throughout the evaluation was judged to be predictable and controllable in all maneuvers and at all front outer tire pressures tested, in conditions that produced a substantially higher lateral acceleration than that experienced in the New Stanton reported incident. The driver observed that at the recommended tire pressure (35 psi cold), the vehicle exhibited a slight steady state understeer handling characteristic. With successive reductions in front outer tire pressure, the car predictably required slightly more steering wheel input to maintain the turn into the radius. Reduction in front outer tire pressure did not notably affect the handling characteristics of the vehicle. Wheel strike-through to the pavement was not experienced in any of the tests, nor was it experienced at the New Stanton, Pennsylvania site based on inspection of the wheel and pavement. Ford's vehicle evaluation was terminated at the driver's discretion because he felt that reducing the pressure beyond 20 psi under the more aggressive set of test parameters used at the MPG test could result in a tire de-bead during the maneuver, which would damage the testing surface.

In May 2005, Ford engineers repeated the above evaluations to document the test and set-up with video. The video record is provided electronically in Appendix H (filename: 2005-06-01_Appendix_H) on the enclosed CD. Overall test observations and conclusions are provided electronically in Appendix I (filename: 2005-06-01_Appendix_I) on the enclosed CD. Information regarding tire marks resulting from this evaluation and a comparison to tire marks photographed at the New Stanton, Pennsylvania site is provided in response to Request 19.

¹ These examples were derived from information provided by Ford during EA00-023 and presented in a March 28, 2001 presentation to ODI. An Adobe file (EA00023Presentation.pdf) is attached for information and review.

Request 11

In reference to biaxial wheel testing methods such as those discussed in SAE recommended practice J2582 or in various other SAE technical papers (20004-01-1578, 1999-01-0781, 851833), state whether Ford or its wheel supplier(s) utilized biaxial testing methods for the design, development, and/or validation of any of the design levels of the subject wheels used on the *subject and/or peer vehicles*, and if so, state the specific design levels tested, the type of machine the test was performed on, and provide a copy of the test results. Additionally, state whether Ford has a biaxial test load file for the *subject vehicle* wheel, and if so, provide a copy of the load file data.

Answer

Ford requires all wheels released for use on passenger cars intended for special use (police, taxi, fleet, etc.) to pass a rigorous series of vehicle durability tests. Vehicle tests are typically conducted at Ford's Michigan or Arizona Proving Ground facilities and are very time consuming and labor intensive. Alternatively, at the test requester's option, certain portions of the wheel durability requirements can be verified using biaxial wheel testing as a surrogate to full vehicle tests, depending on the nature and the specific characteristics under review and objective of the particular evaluation. Biaxial wheel testing is not specifically used in the design or development of wheels, but can be used for a portion of design verification.

Certain design iterations of the steel wheel used in the subject vehicle were subjected to biaxial testing. Information relating to design levels tested, test results and a biaxial test load file recorded for subject wheel verification is being submitted under separate cover with a request for confidentiality to the agency's Office of Chief Counsel in Appendix J (directory: 2005-06-01_Appendix_J). The performance of the shot peen treated wheels was verified using Radial Fatigue testing as explained in response to Request 9. Biaxial testing was not used for the design verification of the wheels used on the peer vehicle.

Biaxial wheel testing for passenger cars, when specified by Ford, is conducted in accordance with Ford Corporate Engineering Test Procedure 04.01-L-307, provided in Appendix G in response to Request 16. Ford does not use standardized load files, but develops specific load files recorded from actual vehicle durability tests.

Request 12

In addition to the information provided in response to Request 9, 10 and 11, describe all other 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, Ford. 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/supplier responsible for designing and/or 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.

Answer

Ford is construing this request broadly and is providing not only studies, surveys, and investigations related to the alleged defect, but also notes, correspondence, and other communications that were located pursuant to a diligent search for the requested information. Ford is providing the responsive non-confidential Ford documentation in Appendix K1 and electronically in Appendix K2 (filename: 2005-06-01_Appendix_K2) on the enclosed CD.

Ford's search for records responsive to Request 12 pertaining to the subject vehicles was limited to records created after the search cut-off date for RQ04-007 (August 4, 2004) through the date this request was received (April 19, 2005).

To the extent that the information requested is available, it is included in the documents provided. If the agency should have questions concerning any of the documents, please advise.

Ford is submitting additional responsive documentation electronically in Appendix L (filename: 2005-06-01_Appendix_L) with a request for confidentiality under separate cover to the agency's Office of the Chief Counsel pursuant to 49 CFR, Part 512.

Request 13

In addition to the information provided in response to Request 9, describe all other modifications or changes made by, or on behalf of, Ford in the design, material composition, manufacture, quality control, supply, or installation of the subject wheel, 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:

- a. The date or approximate date on which the modification or change was incorporated into the wheel supplier's production;
- b. The date or approximate date on which the modification or change was incorporated into vehicle production;
- c. A detailed description of the modification or change;
- d. The reason(s) for the modification or change;
- e. The part numbers (service and engineering) of the original component;
- f. The part number (service and engineering) of the modified component;
- g. Whether the original unmodified component was withdrawn from production and/or sale, and if so, when; and
- h. When the modified component was made available as a service component.

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

Answer

A table of the requested changes along with the requested information is provided electronically in Appendix F (filename: 2005-06-01_Appendix_F) on the enclosed CD. As part of its ongoing product improvement process, Ford continues to evaluate design and process modifications to

further enhance the robustness of wheels used on vehicles subjected to severe customer usage. The agency will be notified if any changes are implemented.

Request 14

State the number of subject wheels that Ford has sold that may be used in the **subject vehicles** by component part number (both service and engineering/production), model and model year of the vehicle in which it is used and month and year of sale (*including the cut-off date for sales, if applicable*). For each component part number, provide the supplier's name, address, and appropriate point of contact (name, title, and telephone number). Also identify by make, model and model year, any other vehicles of which Ford is aware that contain the identical component, whether installed in production or in service, and state the applicable dates of production or service usage. For each month and year of sale identified, state whether Ford can discern the purchaser's intended use of the components sold (e.g., to complete a recall action, service campaign, or other warranty replacement repair, for non-warranty repairs such as collision damage, or for resale to other non end-user entities), and if so, provide this information. If no such information exists, state so.

Answer

As the agency is aware, Ford service parts are sold in the U.S. to authorized Ford and Lincoln-Mercury dealers. Ford has no means by which to determine how many of the parts were actually installed on vehicles, the vehicle model or model year on which a particular part was installed, the reason for any given installation, or the purchaser's intended use of the components sold.

Ford is providing the total number of Ford service replacement steel wheels by part number (both service and engineering) and calendar month and year of sale, where available, in electronic form in Appendix M (file: 2005-06-01_Appendix_M) on the enclosed CD. Information pertaining to production and service usage for each part number, and supplier point of contact information, is included in Appendix F provided in response to Request 13.

Request 15

State the number of subject wheels that Ford has sold that may be used in the **peer vehicles** by component part number (both service and engineering/production) and month/year of sale (*including the cut-off date for sales, if applicable*). For each component part number, provide the supplier's name, address, and appropriate point of contact (name, title, and telephone number).

Answer

As the agency is aware, Ford service parts are sold in the U.S. to authorized Ford and Lincoln-Mercury dealers. Ford has no means by which to determine how many of the parts were actually installed on vehicles, the vehicle model or model year on which a particular part was installed, the reason for any given installation, or the purchaser's intended use of the components sold.

The number of subject wheels that Ford has sold for service that may be used for the peer vehicles is included in Appendix M provided in response to Request 14. The wheels used to service peer vehicles (service part number F8AZ-1007-EA) are also released for service on other Ford models and model years.

Request 16

Provide a copy of (or reference to) all engineering specifications and standards (including internal specifications, SAE/ISO standards, etc) that Ford utilizes in the design, modification, testing, and validation of the subject wheels manufactured for the **subject and peer vehicles**. Provide an engineering drawing for each design level of the subject wheel manufactured for the **subject and peer vehicles**. Ensure the drawings reflect the current production level wheel design (including the shot peen operation).

Answer

Ford is submitting, under separate cover with a request for confidentiality to the agency's Office of Chief Counsel, the engineering drawing of each of the subject wheels specified for use on the subject and peer vehicles in electronic form in Appendix G. Electronic copies of internal engineering specifications and test procedures that are judged to be pertinent to the subject of this inquiry are also included in Appendix G. Ford is not providing copies of non-Ford (e.g. SAE) specifications, or internal specifications that are not pertinent to this investigation (e.g. specifications relating to paint, corrosion, etc.). Any supplier specifications noted on engineering drawings are available from that supplier, and are not being provided in this response.

The table below is an index of the individual electronic files of documents provided in Appendix G.

File Name	Description
F8AC-1007-EA.tif	Engineering Drawing F8AC-1007-EA
3W73-1007-CD.tif	Engineering Drawing 3W73-1007-CD
3W73-1007-CF.tif	Engineering Drawing 3W73-1007-CF
3W73-1007-CG.tif	Engineering Drawing 3W73-1007-CG
4W73-1007-AA.tif	Engineering Drawing 4W73-1007-AA
5W73-1007-AA.tif	Engineering Drawing 5W73-1007-AA
ESF2DC-1007-AA-1.tif through ESF2DC-1007-AA-20.tif	Engineering Specification, Steel Wheel Assembly, page 1 through page 20
SDS-TIREWHL.21.0.LIB.pdf	Tire/Wheel Assembly System Design Specification
CETP 0401-L-307.pdf	Durability Test Procedure for Passenger Car Wheels

Request 17

State by make, model, MY, wheel dimension (diameter and width), and approximate production volume (number of vehicles) all **non-subject and non-peer vehicles** Ford manufacturers that utilize steel wheels of the full face design type. State the names of the suppliers who manufacture the wheels for Ford.

Answer

The requested information is provided in Appendix N (filename: 2005-06-01_Appendix_N).

Request 16

As discussed during Ford's September 23, 2004 meeting with ODI, provide a copy of the Ford Central Lab report(s) involving the components (two subject wheels and at least one tire) related to the VOQs with ODI numbers 10082262 (vehicle crash) and 10080703 (noise with rapid deflation). State the current disposition of the components Ford analyzed.

Answer

Ford Central Lab report 41850 relating to the wheels from the referenced VOQs is being submitted under separate cover with a request for confidentiality to the agency's Office of Chief Counsel in Appendix O (filename: 2005-06-01_Appendix_O). The test report concludes that both wheels cracked along the weld joining the rim to the disk by multiple origin rotational bending fatigue. The analyzed components have been retained and are available for review at the agency's request.

The wheel related to VOQ 10082262 (Wheel A) had a crack visible around approximately 230 degrees of the circumference. The crack surfaces were covered with dirt and oxidation and show evidence of pounding in some areas, suggesting that some portion of the crack existed for some time before the reported incident occurred. The wheel has an inward dent in the inboard rim, which resulted from severe impact to the inboard portion of the rim. The wheel also has a large gouge on the inside of the rim, likely caused by contact with the lower ball joint bolt. The gouge location is consistent with the crack, indicating that the two occurred at the same instant. Metal filings at the end of the gouge were oriented in a direction that shows the wheel was rotating in a reverse direction when the gouge occurred. The rim has no evidence of contact with the road surface, which indicates that the tire maintained adequate pressure to prevent de-banding and wheel strike-through during the event.

The test report also includes analysis by Ford and Goodyear personnel of the tire that was mounted on Wheel A. Ford and Goodyear concluded that the tire showed no evidence of extended operation in an over-deflected (under inflated or overloaded) condition. The tire was mounted and re-inflated on a different wheel and a bulge was observed on the inside sidewall, located in alignment with the observed wheel deformation on the inboard rim. The sidewall bulge is indicative of a severe impact while the tire was inflated. Photographs of the outboard tire sidewall included in the test report also demonstrate an absence of scuffing, which would have been present if the tire was significantly under-inflated while the vehicle was negotiating a right hand turn. However, photographs of the inboard sidewall, also included in the test report, show some evidence of scuffing, which indicates that the tire may have been under-inflated while the tire was turned to the left. The response to Request 19 includes more analysis and observations relating to under-inflated sidewall scuffing during high speed cornering maneuvers.

The wheel associated with VOQ 10080703 (Wheel B) contains a visible crack around approximately 145 degrees of the circumference. Similar to Wheel A, the crack faces were covered with dirt and corrosion and show evidence of pounding, indicating that some portion of the crack likely existed for some time prior to wheel service. The crack faces exhibit two fatigue zones separated by an overload region of approximately 6.3 cm. There was no evidence that the rim contacted the pavement, and no other signs of damage to the wheel.

Request 19

Provide Ford's assessment and interpretation of the photographs and police report related to the incident described in VOQ ODI number 10062262, especially as concerns the tire markings allegedly made by the vehicle during the crash (see photograph file "DSC00929.JPG"). A copy of the photographs (20) and image of the police report are included on the enclosed CD-ROM for your review. Also provide copies of any crash reconstruction or crash analysis work related to this incident that Ford has conducted or had conducted on its behalf.

Answer

Ford has expended considerable time evaluating the circumstances associated with this incident, including investigating the incident site, conducting a detailed analysis of the tire and wheel, reviewing accident scene photographs and conducting extensive vehicle evaluations in an effort to ascertain the sequence of events that ultimately lead to impact with the guard rail. Ford's conclusions, as described in detail below, are consistent both with the evidence reviewed and the results of vehicle evaluations.

During the incident described in the subject VOQ, the driver reports that the vehicle was traveling at a high rate of speed while negotiating a gradual right hand turn. During the turn the driver reports that the left front wheel dropped and "he did all he could to keep it [the vehicle] going straight...." as quoted in the accident report. Consistent with this statement, and based on Ford's analysis of the marks from the scene, Ford believes the driver imparted a left turn input to the steering wheel. Ford concludes that when the driver imparted this left turn to straighten the vehicle path, the vehicle began a slight counterclockwise yaw as it left the highway. The car continued in a straight path (as the driver intended) until it ultimately struck the guard rail. Subsequent analysis of the front left tire and wheel found no evidence of rim strike-through, indicating that at least partial tire pressure was maintained throughout this course of events. Ford's vehicle evaluations suggest that there was more than sufficient tire pressure to maintain vehicle control. The incident appears to be a result of intentional driver input due to a perceived need to keep the vehicle going straight as opposed to a loss of tire pressure resulting in loss of vehicle control.

Ford Design Analysis engineers conducted an engineering inspection of the accident site in July 2004. The report resulting from that inspection was provided to the agency in Appendix M of the Ford response to RQ04-007, and concluded that the left front wheel cracked due to severe impact, and that none of the tires were totally deflated before the vehicle impacted the guardrail. Ford engineers visited the accident site a second time in December, 2004 to measure the radius of curvature and road surface coefficient of friction that were later used in Ford's vehicle evaluations.

Ford conducted extensive vehicle testing at Ford's Michigan Proving Grounds (MPG) in March 2005 to evaluate the effect of front outer tire pressure on high speed handling in the subject vehicle, and to attempt to re-create the tire marks found at the site of the New Stanton, Pennsylvania incident reported in VOQ 10062262. A description of these vehicle tests and analysis of vehicle handling under varying conditions is provided in response to Request 10. The radius of the curve measured at the New Stanton, Pennsylvania site was 2,500 feet; the testing conducted at MPG included a more severe 1,250-foot radius right hand curve. The more severe radius was used in the MPG testing to accentuate any affects on handling performance and to increase the lateral acceleration on the vehicle through the wheels. Appendices H and I contain video of the test and a presentation of results and observations.

The MPG testing included an attempt to re-create the tire markings depicted in file DSC00929.JPG, and to determine how they may have been created. Observations of the accident scene and the tire marks are as follows:

- The New Stanton scene is a down hill section of highway, 2,500 foot radius right hand curve. The shoulder of the road has a higher coefficient of friction than the road surface, and is sloped slightly away from the road (crowned). See Figure 1, below.

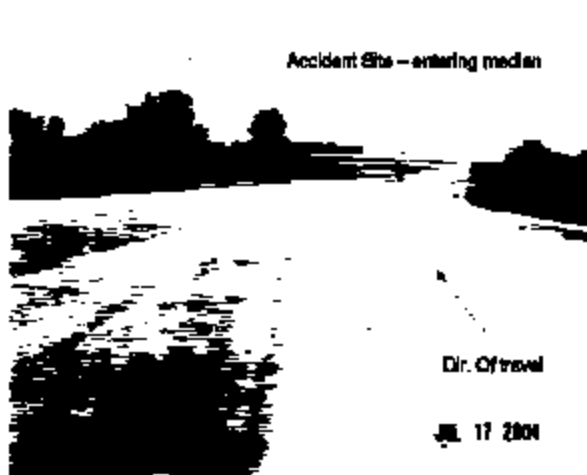


Figure 1

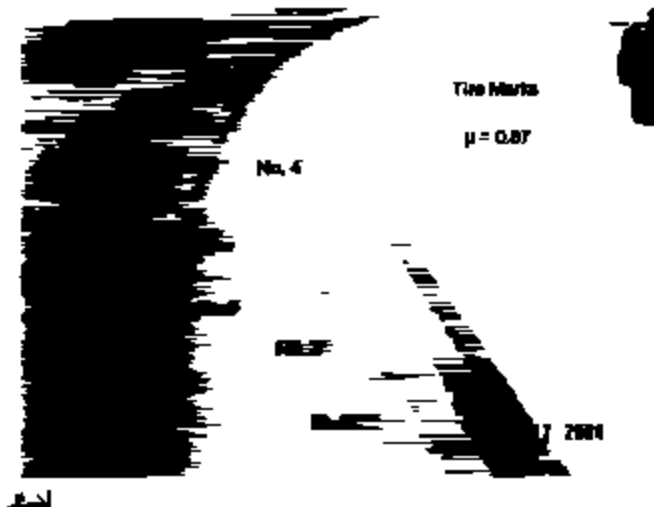


Figure 2

- Four distinct tire marks are visible in file DSC00929.JPG. The file included in Appendix I includes several copies of the photo, with each tire mark identified as No. 1 through 4. See Figure 2, above.
- Tire marks No. 1 and No. 2 are faint, parallel and approximately two inches apart. Tire mark No. 1 is very faint, intermittent and not visible across the entire length of the shoulder of the road. A close-up of Figure 2 is provided in Figure 3 below.
- Tire mark No. 3 is darker, wider and appears to be caused by a cyclic tire input.
- Tire mark No. 4 is dark and solid, and appears to be straight. No. 4 is farthest from the camera when the photograph was taken and is not as clear in the photo as No. 1 - 3.

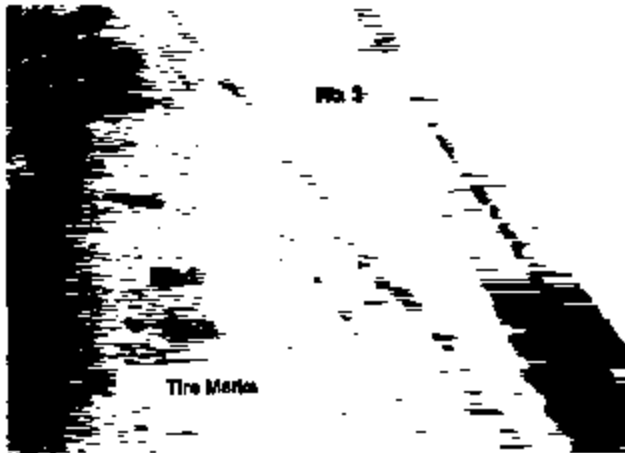


Figure 3

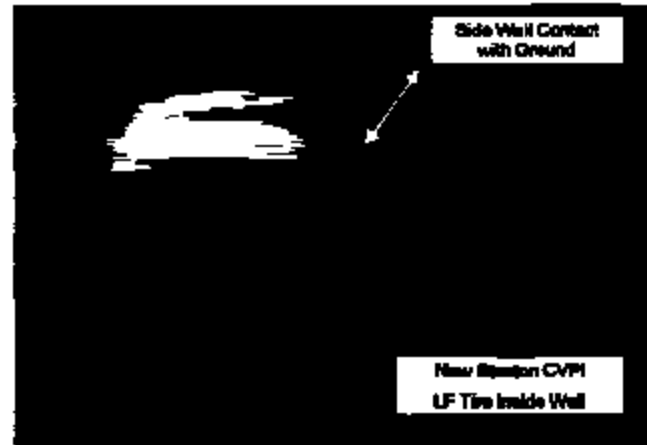


Figure 4

Observations relating to tire marks from the MPG testing were as follows:

- Two parallel tire marks, No. 1 and No.2, approximately 16 inches apart, caused by the left front and left rear tire could be duplicated without braking. The marks from the front outer tire are always inboard of the rear outer tire marks – i.e. the rear tire always follows a slightly wider turn than the front.
- Three parallel tire marks could be duplicated during iterations with braking applied, at all left front tire pressures tested. Figure 5 shows the three tire marks and numbers them No. 1 through No. 3. The left rear tire caused tire mark No. 1, No. 2 was caused by the left front tire, and No. 3 was from the right front tire, indicating a clockwise yaw.

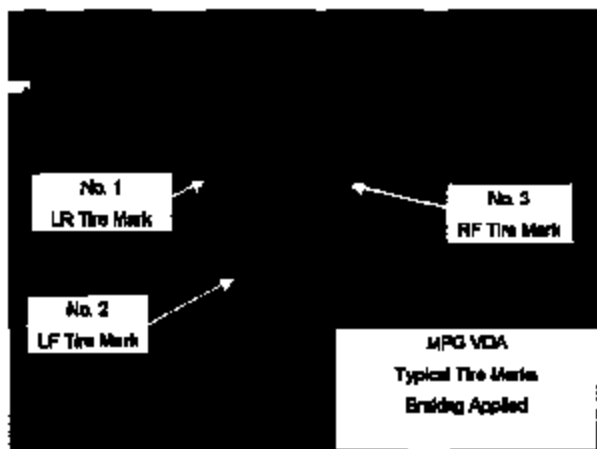


Figure 5

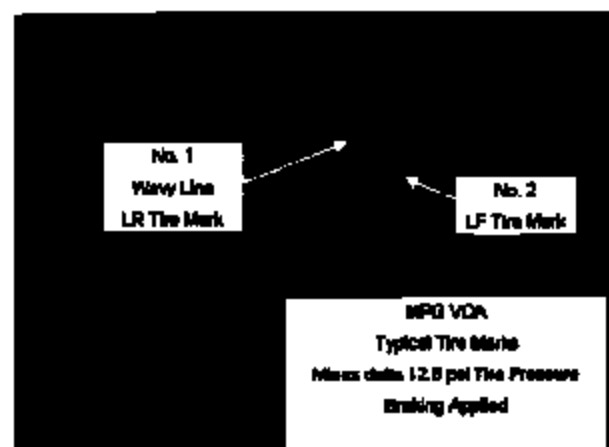


Figure 6

- The two outer tire marks are darker than the mark left by the inboard tire, indicating higher loading on the outer tires, as expected during a turn.
- A cyclic tire mark similar to the tire mark shown in file DSC00929.JPG was duplicated by the left rear tire. See Figures 6 and 7. The driver indicated that he felt the ABS begin to activate and opined that the ABS brake pulse caused the cyclic mark. The cyclic mark resulted from a test iteration with the left front tire reduced by 12.5 psi.

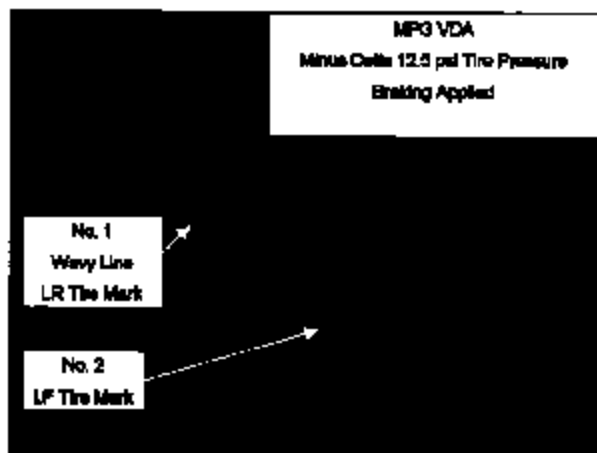


Figure 7

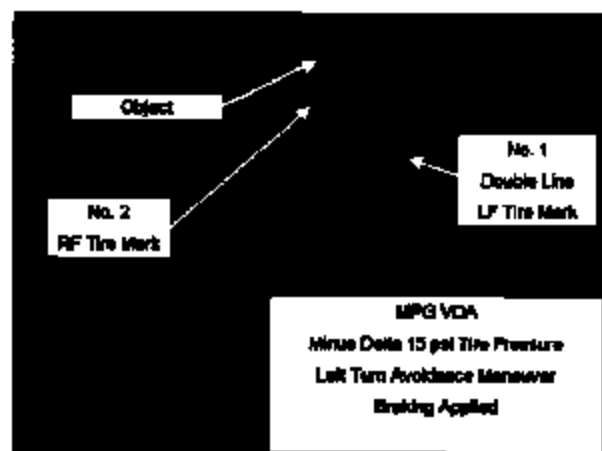


Figure 8

- The left front tire reproduced a double tire mark, shown in Figure 8, similar to tire mark Nos. 1 and 2 shown in Figure 3 from the New Stanton scene, when pressure was reduced by 15 psi. The double marks were caused by the outboard edge of the tread (tire mark No. 2, Figure 3) and the outboard sidewall of the tire (tire mark No. 1, Figure 3).
- Testing with low left front tire pressure resulted in outboard sidewall scuffing of the underinflated tire when turning right, as shown in Figures 9 and 10. As expected, the sidewall scuffing increased further into the sidewall of the tire as the pressure was reduced, until at a reduction of 20 psi the scuffing extended through approximately half of the sidewall under these specific test parameters.



Figure 9

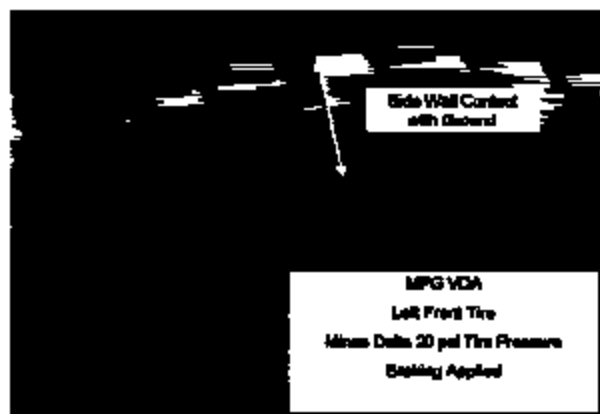


Figure 10

- A fourth tire mark from the right rear tire resulted when the left front tire pressure was reduced by 20 psi.
- Tire marks resulting from an obstacle avoidance maneuver, which consisted of swerving around a marker while negotiating the turn, were similar to other tests, and resulted in no unexpected handling characteristics or significantly different tire marks.
- Testing was terminated when tire pressure was reduced by 20 psi because the driver felt that the tire might debond from the wheel at further pressure reductions under these exaggerated test conditions and result in damage to the skid pad surface.

The following conclusions relating to the incident described in VOQ 10082282 are based on the MPG testing, review of the New Stanton scene photographs, and analysis of the wheel and tire:

- The left front tire caused tire mark Nos. 1 and 2 shown in Figures 2 and 3 from the New Stanton scene. The left front tire may have had reduced tire pressure. If the left front tire had reduced pressure, the double tire marks were likely caused by the inboard edge of the tread and the inboard sidewall of the tire. The scuffing on the inboard sidewall of the New Stanton tire supports this conclusion. The scuffing appears to extend less into the sidewall, compared to the sidewall scuffing from the MPG tire, though we note that the MPG evaluations were conducted at a more severe radius of curvature than the New Stanton roadway at nearly equivalent speeds, resulting in substantially higher lateral acceleration.
- The left rear tire caused tire mark No. 3 shown in Figures 2 and 3. MPG testing was able to reproduce a cyclic tire mark only from a rear tire during an ABS activation. The slope of the shoulder away from the road surface may reduce the road force sufficiently to cause the cyclic markings. The effects of road crowning were not evaluated at MPG.
- The right front tire caused tire mark No. 4 shown in Figure 2. This tire mark is relatively dark, suggesting heavier vehicle load on the right side of the vehicle. This would occur on a right front tire when the vehicle is in a left hand yaw condition.

Based on these conclusions, we believe the vehicle left the highway with a slight counterclockwise yaw resulting from a left turn input to the steering wheel. This is consistent with the driver comments that he attempted to straighten the vehicle from its right hand turn.

Request 20

State by MY and any other pertinent variable (engine/transmission configuration, tire specification, etc.) the design intent maximum vehicle speed for the *subject and peer vehicles* and identify the driving conditions (roadway conditions, wind speed, etc) that the speeds are quoted for. For each speed quoted, state whether the maximum speed is regulated by engine power limitation or by the intervention of a particular vehicle or engine system. If the speed is limited by intervention, describe how the system operates and how Ford established and set the threshold/cutoff speed.

Answer

"Maximum design intent speed" is an engineering term used to describe a speed at which certain mechanical design constraints of a vehicle system are reached, when tested in a controlled laboratory environment. They are not intended to imply a safe operating speed, or even that a particular vehicle can achieve those speeds in real world driving conditions due to constraints that are not considered, such as aerodynamic drag. Ford does not typically quote or advertise a maximum vehicle speed.

Ford evaluates powertrain bending characteristics, powertrain cooling capability and tire rating constraints when determining the design intent maximum speed of a vehicle. The subject and peer vehicle's design intent maximum speed is constrained either by powertrain bending or tire rating, depending on the driveshaft design, axle ratio and tire rating of a specific subject vehicle.

The subject and peer vehicles maximum design intent speeds are controlled by the Powertrain Control Module (PCM), which limits fuel supplied to the engine. Each PCM is calibrated to limit the speed of a specific vehicle based on original vehicle content. Maximum design intent speeds are being submitted under separate cover with a request for confidentiality to the agency's Office of Chief Counsel in Appendix P (filename: 2005-06-01_Appendix_P).

Request 21

Regarding the in-service **subject vehicle** wheel failure survey and inspection program Ford is conducting in conjunction with ODI:

- a. Provide a copy of the survey form that Ford mailed to certain fleet operators;
- b. Provide the fleet name, approximate size, and point of contact details (name, title and telephone number) for each operator selected;
- c. State the date the form was mailed out;
- d. State where the failed wheels are to be returned to;
- e. At ODI's request, provide copies of each form returned;
- f. State how the fleets operators were identified and selected by Ford;
- g. Describe the testing, analysis and data collection Ford plans to conduct on each failed wheel returned; and
- h. State the number of wheel returns that Ford expects to collect.

Answer

A copy of the survey form that was mailed to certain fleet operators on March 7, 2005 is being provided electronically in Appendix Q (filename: 2005-06-01_Appendix_Q) on the enclosed CD. The surveys were sent to fleet contacts that participate in the Ford Police Fleet Advisory Board because those fleets have, in the past, demonstrated a willingness to voluntarily respond to information requests. Despite the fact that these surveys were electronically mailed in March to fleets likely to provide timely and candid information, and despite a follow-up reminder communication that was sent to the fleets on May 17, 2005, Ford has only received five survey responses as of May 31, 2005. Copies of these surveys are provided in Appendix Q. Ford notes that two survey responses each describe a tire on the same vehicle that reportedly experienced simultaneous pressure loss "instantly," as well as symptoms of steering wheel shake. Discussion with the repair technician on May 25, 2005, clarified that both tires went flat during the course of one eight hour shift, which Ford does not consider rapid air loss that would result in an unexpected change in vehicle handling characteristics. The three other survey responses each describe typical, continuous slow air loss symptoms. Though requested as part of the survey process, wheels from vehicles involved in the five surveys have not been received at the Ford Warranty Parts Return Center (WPRC) as of May 25, 2005. Consequently, we have not been able to analyze those wheels.

Fleet contact information and their approximate size is also included in Appendix Q. As part of Ford's investigation into this matter, fleets and dealers have been instructed to return all subject wheels to the WPRC in Dearborn, Michigan, where Ford and supplier engineers determine if they were serviced for reported leaks or cracks, or for other issues. Through this process we have found both a significant number of parts incorrectly identified on warranty

claims in addition to inaccurate concern descriptions. For example, 97 wheels have been returned with an associated warranty claim relating to wheel part number 3W73-1007-CF. Upon inspection, we found that 43 of these 97 wheels were not a "CF" wheel but were actually a prior design level "CD" wheel. As a consequence, analysis of warranty claims data alone would be misleading and would likely result in erroneous conclusions.

Additionally, inaccurate concern descriptions make an accurate analysis of concern rates very difficult. Our extended warranty program was intended to address wheels with cracks as evidenced by leaks or vibration. Our parts return analysis found that, of the 32 "CF" wheels returned to Ford with no accompanying concern description, 74% were found upon inspection to have no crack or leak. Of the 94 wheels returned with claims that specifically describe a crack or leak, 28% were found to have no crack or leak, 54% were found to have a crack, and 15% had a pinhole leak without a crack. We expect that the percentage of wheels returned to WPRC containing actual cracks compared to wheels alleged to have cracks would be similar in the overall population of wheel claims. We again note that, without visually observing a wheel associated with a warranty claim, there is uncertainty as to the design level of the actual affected wheel. Our analysis in support of this investigation has found that warranty claims have accurately identified the design of the wheel less than 25% of the time.

For those wheels returned to the WPRC as part of this investigation, all part number 3W73-1007-CF or 4W73-1007-AA wheels (the replacement wheels for Ford's 03S05 safety recall and 03M03 and 04M05 service programs) that allege an air loss, crack, or include 03S05, 03M03 or 04M05 warranty Transaction Codes in the claim were shipped to the Hayes-Lemmerz facility in Northville, Michigan. Hayes-Lemmerz conducted a leak test on wheels by submerging the pressurized wheel into a water tank.

As of May 13, 2005, 422 wheels from the subject vehicles have been returned to and reviewed at the WPRC. Of those wheels, 143 are 3W73-1007-CF parts, 94 of which were returned for alleged leaks or cracks. Of the 94 wheels returned for alleged cracks or leaks, we have identified 27 with visible cracks. An additional 24 did not have visible cracks, but a crack was detected during the leak test. Fourteen wheels exhibited a pinhole type leak that is not necessarily indicative of a crack, but is more likely related to a weld void that results in very slow air loss. Three wheels were damaged by service personnel to preclude their re-use and could not be leak tested. The remaining 26 wheels had no leak or crack. In summary, of the 94 wheels in this sub-set of the subject wheel population that were returned to the WPRC with leak allegations, 51 actually exhibited a leak due to a crack, whether visibly cracked or not, and 26 exhibited no crack or leak. None of the wheels in this subset of the population of subject wheels contained more than one crack.

The wheels examined at the WPRC also include 32 3W73-1007-CF wheels that were replaced without a symptom or reason provided in the warranty claim other than "recall" or "replace wheels per 04M05" or a similar comment. Even though the extended warranty program specifies coverage only for wheels that are cracked, we found only four wheels that had a visible crack, three that had a non-visible crack, and 23 that had no crack and did not leak. Two wheels were damaged by service personnel and could not be leak tested.

Ford has contacted several service technicians that have alleged rapid air loss in a claim or report, or have returned wheels to Ford that have larger cracks (between 90 and 180 degrees). These technicians typically describe slow air loss, not a rapid air loss condition, such as the reports summarized below.

VIN	Allegation	Detail Description*
2FAFP71W14X	Survey comments: Instantly lost tire pressure in 2 wheels (survey response)	Not a "blowout" type event, was a gradual loss of air pressure within an eight hour shift.
2FAFP71W13X	Heavy vibration; rapid loss of tire pressure (field report)	Vibration got progressively worse, unable to balance, loss of pressure over a few days
2FAFP71WX3X	Steering felt loose, vibration quickly increased in intensity followed by rapid air loss (field report)	Vibration got progressively worse, unable to balance, loss of pressure over a few days
2FAFP71W53X	Extreme vibration followed by rapid air loss (field report)	Vibration got progressively worse, unable to balance, loss of pressure over a few days

*Based on telephone conversation comments.

Wheel return collection data is provided electronically in Appendix R (filename: 2005-08-01_Appendix_R) on the enclosed CD. Ford and Hayes-Lemmerz are tentatively planning to continue wheel collection and analysis through June 1, 2005. All wheels that were forwarded to Hayes-Lemmerz for leak testing have been retained at that facility and are available for review at the agency's request.

Request 22

Furnish Ford's assessment of the alleged defect in the *subject vehicles*, including:

- a. The causal or contributory factor(s);
- b. The failure mechanism(s);
- c. The failure mode(s);
- d. The risk to motor vehicle safety that it poses;
- e. Ford's assessment of the effectiveness of the shot peening operation as a solution to the alleged defect in the *subject vehicles*;
- f. Ford's projections for warranty, campaign, and overall failure rate versus time for the subject wheel on the subject vehicles over the coming 5 to 10 years;
- g. The number (or portion) of future subject vehicle wheel failures that will result in sudden tire deflation incidents such as those described in VOQs ODI 10080703, 10082262, and 10102520;
- h. The possible cause of the noise reported in VOQs ODI 10080703 and 10102520;
- i. 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 wheel was malfunctioning; and
- j. The reports included with this inquiry.

Answer

Ford and Hayes-Lemmerz have expended considerable effort and resources investigating the causal and contributory factors leading to cracks in the subject wheels. As the agency is aware, Ford identified a higher than expected rate of wheel crack allegations in wheels produced for 2003 model year police and taxi vehicles that were manufactured before September, 2002, and accordingly conducted safety recall 03S05, which replaced affected wheels with an

Improved design wheel. Ford also extended the warranty coverage for wheels built between August 18, 2001 and November 19, 2004, including wheels used to remedy vehicles affected by 03S05.

Ford has found through testing and analysis of warranty return parts that some of the wheels in this investigation, when subjected to severe police and taxi usage, have experienced a significant wheel impact that permanently deformed the rim. Under such conditions, a fatigue crack may initiate in the HAZ adjacent to the circumferential weld. Our analysis of test results, owner reports, field reports and warranty claims determined that the cracks are progressive and result in easily detectable, slow, repeated air loss and vibration. Vehicle evaluations discussed in response to Request 10 conclude that if air loss and vibration symptoms are ignored or not detected, the subject vehicle handles predictably at high speeds, even with low front outer tire pressure. Our analysis of wheels returned to Ford demonstrates that most wheels are incorrectly identified in the associated warranty claims. Only 54% with an associated crack allegation were actually found to exhibit some type of crack. Additionally, 74% of wheels returned under the extended warranty program that had no crack allegation were confirmed, upon close inspection, in fact, to have no crack.

Although Ford is aware of a small number of reports alleging rapid air loss and some alleging noise immediately preceding air loss, based upon our investigation, we do not believe there are any incidents of rapid air loss due to a cracked wheel. For each allegation of rapid air loss, our investigation has found the incidents to be actually slow air loss events, similar to our investigation of several reports received prior to August 2004 that were addressed in our September 23, 2004 response to RQ04-007. Some service technicians have reported rapid or even "instant" air loss; however, upon further investigation it is apparent that the air loss actually occurred over the course of several hours or days (reference customer surveys provided in Appendix Q and CQIS reports 4JRAH037, 4JNBL114 and 4JNBL121 provided in Appendix C1). One other rapid air loss allegation provided in Appendix C1 (CQIS report 4IUAC850) is still under investigation, although the dealership service technician did not recall the air loss to be rapid when he was questioned. Ford is continuing to investigate this incident to more fully understand the circumstances involved. The alleged "noise" described in a few reports immediately preceding air loss has not been duplicated in any Ford testing and we are unaware as to the source of the noise.

The welding process used to join the wheel rim to the face of the subject wheels introduces a typical residual tensile surface stress in the HAZ near the weld. Residual stress near the weld is an expected condition resulting from a weld process. Ford believes that typical customers will never experience an issue with the wheel. However, under very severe police and taxi usage conditions, including aggressive wheel impacts that may permanently deform the wheel, a fatigue crack may initiate. In the event that a crack initiates, the customer should observe symptoms of vibration and slow repeated air loss. Returned parts analysis has confirmed that customers are successfully identifying wheels with very small cracks due to these symptoms. If vibration and slow air loss symptoms are ignored or not noticed, the fatigue crack typically propagates slowly, which eventually causes an increase in the rate of air loss and magnitude of vibration.

Ford expects that drivers familiar with these fleet vehicles, such as a law enforcement officers familiar with the CVPI, or with high speed driving experience in any vehicle, would recognize the slow air loss and vibration symptoms and immediately have the vehicle serviced. High speed vehicle evaluations (detailed in response to Request 19) conducted by Ford which included aggressive maneuvers with the subject vehicle, demonstrated that the CVPI maintains excellent handling characteristics, even when negotiating an aggressive curve with the front outer tire

pressure reduced by 20 psi. While conducting the Ford handling evaluations, the test driver commented that he would expect a typical driver familiar with the CVPI to notice air loss in a front tire when pressure was reduced by five to ten psi when driving at typical highway speed.

Ford has reviewed the VOQ reports included with this inquiry, and notes that only the New Stanton, Pennsylvania incident discussed in our meeting with the agency on September 23, 2004 and discussed in detail in response to Request 19 alleges a rapid air loss. The other 36 VOQ reports describe the typical slow air loss and vibration symptoms that were obvious indications to those drivers that service was required. Other than the New Stanton incident, Ford is aware of no reports or claims involving allegations of an accident, injury, or property damage.

Based on Ford's extensive vehicle evaluations, our review and analysis of the wheels returned from the field, our discussions with fleet personnel regarding their experience, and our survey of targeted fleets, Ford continues to believe that the actions already in place for its customers of these vehicles appropriately addresses any concerns that may arise related to this subject, and that no further action is warranted.

As discussed in response to Request 9, the shot peen process results in a dramatic increase in radial fatigue performance of the subject wheel. Ford expects the improved test performance to correlate to significantly higher actual wheel assembly durability even when subjected to such severe usage conditions.
