

**TOYOTA**  
**TOYOTA MOTOR NORTH AMERICA, INC.**

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May 31, 2006

Mr. Jeffrey Quandt  
Chief - Vehicle Controls Division  
Office of Defects Investigation  
National Highway Traffic Safety Administration  
400 Seventh St., SW  
Washington, DC 20590

Re: NVS-213car, PE06-010

Dear Mr. Quandt:

This letter is being sent in response to your March 9, 2006 letter regarding PE06-010. This submission is the final portion of our response. Attached you will find the updated response and a set of CD-ROM's with the attachments. Two copies of these materials are being provided for your convenience.

Please note that portions of Attachments 8 and 9 are confidential and are being sent to the Office of Chief Counsel under separate cover with a request for confidential treatment.

Should you have any questions about this response, please contact Mr. Chris Santucci at (202) 775-1707.

Sincerely,



Chris Tinto  
Vice President  
TOYOTA MOTOR NORTH AMERICA, INC.

CT:cs  
Attachment

As per our discussion with NHTSA Office of Defect Investigation, we define "Alleged Defect" as follows;

- a. Tire Pressure Warning System ("TPWS") failure, including malfunction and/or not provide the sufficient warning
- b. Tire failure, including low tire pressure, flat tire, puncture, blowout, wear, or tread separation

Also in this submission, we define "Failure Consequences" as follows;

- a1. TPWS warning light did not come on.
  - a2. TPWS warning light came on, including when the tire pressure was low.
  - a3. TPWS others
  - b1. Tire failure, including air leak, low pressure, flat, puncture, blowout, burst, tread separation
  - b2. Tire worn out, including uneven tire wear
  - O. Others
1. State, by model and model year, the number of subject and peer vehicles Toyota has manufactured for sale or lease in the United States. Separately, for each subject and peer vehicle manufactured to date by Toyota, state the following:
- a. Vehicle identification number (VIN);
  - b. Make;
  - c. Model;
  - d. Model Year;
  - e. Drive Type;
  - f. Size of tire fitted on the vehicle as original equipment;
  - g. Make of tire fitted on the vehicle as original equipment;
  - h. Line (model) of tire fitted on the vehicle as original equipment;
  - i. Run Flat or Non-Run Flat Tire;
  - j. Indirect or Direct TPWS;
  - k. Date of manufacture;
  - l. Date warranty coverage commenced; and
  - m. 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.

**Response 1**

The number of MY 2004-2006 (until March 20, 2006) Toyota Sienna vehicles Toyota has manufactured for sale or lease in the United States by model, model year is as follows.

Toyota Sienna Production Data		
Sienna	2004	216,015
	2005	170,784
	2006	89,233
Total		476,032

In addition, detailed information for each vehicle is provided electronically on CD-ROM, in Microsoft Access 2000 format entitled "PRODUCTION DATA(PE06-010).mdb" stored in the folder "Attachment-Response 1".

2. State, by model and model year, the number of each of the following, received by Toyota, or of which Toyota is otherwise aware, which relate to, or may relate to, the alleged defect in the subject and peer vehicles:
- Consumer complaints, including those from fleet operators;
  - Field reports, including dealer field reports;
  - 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;
  - Reports involving a fire, 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;
  - Property damage claims;
  - Third-party arbitration proceedings where Toyota is or was a party to the arbitration; and
  - Lawsuits, both pending and closed, in which Toyota is or was a defendant or codefendant.

For subparts "a" through "e," 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 "g," provide a summary description of the alleged problem and causal and contributing factors and Toyota's assessment of the problem, with a summary of the significant underlying facts and evidence. For items f and g, 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.

## **Response 2**

- a. Using the counting methodology described in Question 2, there are 3220 consumer complaints that may relate to the alleged defect. Please note that Toyota searched these consumer complaints from component categories of the TPWS, the tires, and the wheels. These consumer complaints were classified into failure consequences a1, a2, a3, b1, b2, O and each combination. The total count of each case is provided electronically on CD-ROM in Microsoft Excel 2000 format entitled "Total Number" stored in the folder "Attachment-Response 2".
- b. There is one field report that may relate to alleged defect "a", three reports that may relate to both alleged defect "a" and "b", and 19 reports that may relate to alleged defect "b". One of 23 field reports is duplicated with NHTSA's VOQ attached to the inquiry letter.
- c. In the consumer complaints, three incidents have been reported where a vehicle crash was alleged. One of these crash incidents alleged that an injury had occurred. This crash incident occurred on a slick highway and the complainant alleged that the run-flat tire did not have good winter performance. In the other two incidents, one occurred due to tire skid, and alleged all four tire pressure was low, and another case occurred due to tire blow out after tire replacement for uneven tire wear.  
The TPWS was not referred to in these three incidents as a related cause.  
There are no reports alleging that a fatality had occurred.
- d. In the consumer complaints, 3 incidents have been reported where a tire fire was alleged and 7 incidents have been reported with allegations of tire smoke.  
One of these 10 incidents alleged that the TPWS light came on. Even though we do not have enough information in the complaints, we believe that these incidents occurred as a result of continued vehicle operation while the tire had been punctured, gone flat, blown out, or burst. There were no fatalities or injuries reported with these incidents.
- e. Toyota has received no property damage claims that may relate to the alleged defect.
- f. There are no third party arbitration proceedings.
- g. There is one lawsuit that may relate to alleged defect "a" and two lawsuits that may relate to the alleged defect "b", in which Toyota is or was a defendant or codefendant. This includes one incident which was duplicated with NHTSA's VOQ attached to the inquiry letter.  
In addition, Toyota has 7 lawsuits (class action) that relate to the tire wear, in which Toyota is or was a defendant or codefendant.

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. Toyota'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. Alleged defect category (i.e. Alleged defect type a, b, or c)
  - d. Failure consequence (i.e., low tire pressure, flat tire, tire blowout, tread separation, etc.);
  - e. Vehicle owner or fleet name (and fleet contact person), address, and telephone number;
  - f. Vehicle's VIN;
  - g. Vehicle's make, model and model year;
  - h. Tire's size, make, and line;
  - i. Vehicle's mileage at time of incident;
  - j. Incident date;
  - k. Report or claim date;
  - l. Whether a crash is alleged;
  - m. Whether a fire is alleged;
  - n. Whether property damage is alleged;
  - o. Number of alleged injuries, if any; and
  - p. 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.

### **Response 3**

The information for the consumer complaints, field reports and lawsuits is provided electronically on CD-ROM, in Microsoft Access 2000 format entitled "REQUEST NUMBER TWO DATA(PE06010).mdb stored in the folder "Attachment-Response 3".

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 Toyota used for organizing the documents.

### **Response 4**

A list of the consumer complaints, copies of the field reports, and documents related to the lawsuits are all provided electronically on CD-ROM in Microsoft Excel 2000 and PDF format stored in the folder "Attachment-Response 4." (The list of the consumer complaints is stored in sub-folder "a. consumer complaint." Copies of the field reports are stored in sub-folder "b. Field Report" and the documents for the lawsuits are stored in the sub-folder "g. Lawsuit".)

5. State, by model and model year, a total count for all of the following categories of claims, collectively, that have been paid by Toyota 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. Toyota'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. Failure consequence (i.e., low tire pressure, flat tire, tire blowout, tread separation, etc.);
- h. Labor operation number;
- i. Problem code;
- j. Replacement part number(s) and description(s);
- 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 "WARRANTY DATA." See Enclosure 1, Data Collection Disc, for a pre-formatted table which provides further details regarding this submission.

#### **Response 4**

Total counts of warranty claims, extended warranty claims, and claims for good will services paid by Toyota for the subject vehicles that may relate to the "subject component" by model, model year and failure consequence are provided electronically on CD-ROM, in Microsoft Excel 2000 format entitled "Total Count for Claims.xls" stored in the folder "Attachment-Response 5".

The detailed information for each claim is provided electronically on CR-ROM, in Microsoft Access 2000 format entitled "WARRANTY DATA(PB06010).mdb" stored in the folder "Attachment-Response 5".

6. Describe in detail the search criteria used by Toyota 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 and peer vehicles. State, by model and model year, the terms of the new vehicle warranty coverage offered by Toyota 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). Describe any extended warranty coverage option(s) that Toyota offered for the subject and peer vehicles and state by option, model, and model year, the number of vehicles that are covered under each such extended warranty.

#### **Response 6**

The search criteria used by Toyota to identify the claims were the following:

Toyota searched the warranty database for those claims that replaced any of the parts identified in Microsoft Excel file entitled "Search Criteria, Operation & Problem Codes.xls" stored in the folder "Attachment-Response 6" on CD-ROM. Toyota submitted all extracted claims in Response 5 regardless of the reason for the replacement because failure of those parts may contribute to the malfunction or insufficient warning of the TPWS and it is difficult to discriminate by a review of the operation/problem code and claim comments which claims may actually relate to the alleged defect. In addition, a list of all labor operations, labor operation descriptions, problem codes and problem code descriptions found in these claims are also provided in Microsoft Excel file entitled "Search Criteria, Operation & Problem Codes.xls".

The terms that Toyota offers for new vehicle warranty coverage on the subject vehicles except tires is 36 months or 36,000 miles from the vehicle's date-of-first-use, whichever occurs first.

The terms and conditions of the tire warranty coverage are offered by each tire manufacturer. However recently Toyota has initiated a Customer Support Program to provide supplemental tire warranty coverage for certain 2004 through early 2006 model year all wheel drive Sienna vehicles equipped with run-flat tires. This Supplemental Tire Warranty Coverage is offered for a period of 36 months or 36,000 miles from the date-of-first-use, whichever occurs first, for uneven or premature tire wear under normal use.

There are some extended warranty coverage options that Toyota offered for purchase with the subject vehicles. Detailed information about these options is provided electronically on CD-ROM, in PDF format, entitled "Extended Warranty Option.pdf" stored in the folder "Attachment-Response 6". The number of vehicles that are covered under each such extended warranty option by option, model, and model year is as follows.

Model	MY	Gold	Platinum	Powertrain	Total
Sienna	2004	8,303	40,220	65	48,588
	2005	3,255	28,546	21	31,822
	2006	803	8,234	5	9,042
Total		12,361	77,000	91	89,452

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 Toyota 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 Toyota is planning to issue within the next 120 days.

#### **Response 7**

Toyota has issued 12 technical service bulletins pertaining to the "subject components". 10 of the 12 bulletins relate to the TPWS initialization, such as instructions on how and when to initialize the TPWS, including before delivery of the vehicle (Pre-Delivery Service). 2 of the 12 bulletins relate to the tire, including run-flat tire repair criteria.

In addition, Toyota is providing the documents related to the Customer Support Program mentioned in Response 6. The documents include a regional zone office/dealer notice, an owner letter, a brochure enclosed with the owner letter that explains the run-flat tire and the TPWS, and a warranty policy bulletin.

Copies of the technical service bulletins and documents related to the program are all provided electronically on CD-ROM in PDF format stored in the folder "Attachment-Response 7".

(Copies of the technical service bulletins are stored in the sub-folder "TSB" and the documents for the Customer Support Program are stored in the sub-folder "CSP".)

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, Toyota. 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.

### **Response 8**

Toyota provides a study summary report for using run-flat tires on the Sienna with the indirect TPWS. In addition, Toyota provides two reports regarding the detection performance of the TPWS. Copies of the reports and summary are provided electronically on CD-ROM in PDF and Microsoft Word 2000 format stored in the folder "Attachment-Response 8".

(Copies of the reports are entitled "Summary Report for Liaison Meeting[CONFIDENTIAL]", "MIS" and "Go & See Report" and the summary is entitled "Summary of the reports".)

9. Describe all modifications or changes made by, or on behalf of, Toyota in the design, material composition, manufacture, quality control, supply, or installation of the subject system, 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 vehicle production;
- b. A detailed description of the modification or change;
- c. The reason(s) for the modification or change;
- d. The part numbers (service and engineering) of the original component;
- e. The part number (service and engineering) of the modified component;
- f. Whether the original unmodified component was withdrawn from production and/or sale, and if so, when;
- g. When the modified component was made available as a service component; and
- h. Whether the modified component can be interchanged with earlier production components.

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

### **Response 9**

All modifications or changes made by Toyota, or on behalf of Toyota in the design, material composition, manufacture, quality control or installation, which relate to the subject components are provided electronically on CD-ROM, in Microsoft Excel 2000 format entitled "Modifications & changes" stored in the folder "Attachment-Response 9 [CONFIDENTIAL]".

10. Provide a description of how each subject and peer system functions within each of its respective subject and peer vehicles, by make, model, and model years. This includes, but is not limited to, the following for each subject and peer system:
- a. Identify whether the subject or peer system is indirect or direct;
  - b. Describe how the subject or peer system functions in all normal operating modes;
  - c. State the highest tire pressure at which the TPWS warning light will illuminate in the normal operating mode;
  - d. State how long after the tire pressure reaches the pressure defined in 10.c. it takes for the TPWS light to illuminate;
  - e. What warnings, if any, the operator would have that the subject or peer system was malfunctioning;
  - f. Describe the conditions or circumstances, other than components failing, under which each subject or peer system may not function properly (i.e. the low pressure warning light may not come on even if the tire pressure is low or the low pressure warning light may come on when the tire pressure is actually normal);
  - g. State why the conditions listed in 10.f. cause the subject or peer system to not function properly;
  - h. Describe the effect on vehicle braking distance and steering should the tire pressure in at least one of the tires fall to 25 percent or more below the vehicle manufacturer's recommended cold inflation pressure for the tires while the vehicle is moving;
  - i. Describe the effect on the subject or peer systems if the tread on one or more tires wears unevenly;
  - j. Describe the effect on the subject or peer systems if one or more of the tires is out of balance;
  - k. State all the TPWS diagnostic trouble codes associated with the subject vehicles;
  - l. Describe any differences in how the subject and peer systems function for subject and peer vehicles, respectively, which use run-flat tires and those that use non-run flat tires;
  - m. State whether non-run flat tires may be fitted on the same wheels as the run-flat tires without any modifications to the subject or peer system or subject or peer vehicle. (Note: This assumes that the consumer replaces all four tires with either all non-run flat or all run flat tires and that the tires are of comparable size.);
  - n. List any modifications required to make the conversion referenced in 10.m.;
  - o. Describe the conditions or circumstances under which the subject system needs to be reset, re-initialized, or re-calibrated;
  - p. Describe the procedure required to reset, re-initialize, or re-calibrate the subject system, including the length of time and the speed at which the vehicle must be driven after the TPWS has been reset, re-initialized, and/ or re-calibrated before the TPWS is capable of detecting a loss of tire pressure; and
  - q. Explain why the length of time and speed described in 10.p. are required before the TPWS will detect a loss of tire pressure.

### **Response 10**

- a. The Tire Pressure Warning System ("TPWS") installed on all 2004 through 2006 model year Sienna vehicles is an indirect system.
- b. There are two types of TPWS installed in the 2004 through 2006 model year Toyota Sienna vehicles. Vehicles equipped with Vehicle Stability Control (VSC) have a TPWS that uses two methods to detect low tire pressure:
- a resonance frequency method that determines low tire pressure by analyzing the signals from all four wheels; and;
  - a relative wheel speed difference method that determines low tire pressure according to the rotational speed of each wheel.

For vehicles equipped with the Anti-lock Brake System ("ABS") only (i.e., no VSC), the TPWS only uses the relative wheel speed difference method to detect low tire pressure.

We are including a section of the New Car Features for the 2004 model year Sienna, which explains the TPWS functionality in normal operating modes, as Attachment-Response 10-1(PE06-010) stored on CD-ROM.

- c. When the tire pressure is adjusted to the Toyota's recommended cold tire inflation pressure and the initialization is performed properly, the highest tire pressure at which the TPWS warning light will illuminate in the normal operating mode is:
- 200 kPa for the non run-flat tires; and;
  - 180 kPa for the run-flat tires.
- d. The length of time it takes for the TPWS light to illuminate after the tire pressure reaches the pressure defined in Response 10.c. varies with the road and/or driving conditions. However, if the initialization is performed properly and the vehicle is driven straight ahead on a flat surface with no turns at a vehicle speed above 30 km/h, it takes about 5 minutes for the TPWS to gather the necessary amount of data to detect the low pressure and illuminate the light. However, if the vehicle is operated in normal driving conditions, such as driving and turning the steering wheel, braking and/or accelerating, it may take approximately 20 to 30 minutes.
- e. When the TPWS is malfunctioning, the TPWS light in the combination meter illuminates or blinks to inform the driver as follows:

TPWS light condition	Malfunctions
Blinks once every second	Malfunction of speed sensor, stop light switch and TPWS ECU
Blinks twice every second	Failure to initialize during driving
Comes on	The tire pressure warning light circuit is open or shorted

- f. The conditions or circumstances, other than components failing, under which the TPWS may not function properly are provided in the table as Attachment-Response 10-2(PE06-010) stored on CD-ROM.
- g. The reasons that the conditions or circumstances listed in Response 10 f. cause the TPWS to not function properly are also provided in the table as Attachment-Response 10-2(PE06-010).
- h. Toyota has not specifically evaluated the effect on vehicle braking distance and steering should the tire pressure in at least one of the tires fall to 25 percent or more below the vehicle manufacturer's recommended cold inflation pressure for the tires while the vehicle is moving. However, we believe that the tires falling to about 25 percent below the vehicle manufacturer's recommended cold inflation pressure may not significantly affect vehicle operation/control, especially vehicles equipped with the run-flat tires.
- i. Please refer to Response 10 g.
- j. Please refer to Response 10.g.
- k. The TPWS diagnostic trouble codes (DTCs) associated with the subject vehicles are as follows:

DTC		Detection Item
2-digit	5-digit	
11	C2106	Stop light switch signal malfunction
13	-	ABS malfunction

- l. The difference of the TPWS between the vehicles that use run-flat tires and those that use non-run flat tires is as follows:
- Vehicles equipped with VSC that use non run-flat tires have the same TPWS as those vehicles equipped with run-flat tires
  - Vehicles equipped without VSC that use non run-flat tires have a TPWS that uses only the relative wheel speed method to detect low tire pressure

It is important to note that all vehicles equipped from the factory with run-flat tires are also equipped with VSC.

- m. The non-run flat tires can be fitted on the same wheels as the run-flat tires without any modifications to the TPWS and the vehicle, if the tire size is identical. This response applies only to the actual fitting of the tires onto the wheels. Some models of the 2WD Sienna have been equipped from the factory with non run-flat tires on the same wheels as the AWD model, which uses run-flat-tires.

In light of the differences in the TPWS explained above, it is important to note that Toyota only installs run-flat tires on those vehicles equipped with VSC. Non run-flat tires can be installed on a vehicle regardless of VSC.

- n. Not applicable.
- o. The tire pressure warning system needs to be initialized in the following conditions:
- When the low tire pressure warning light blinks two times every second.
  - After replacing or rotating tires or wheels.
- p. To initialize the TPWS, proceed as follows:
1. Turn the ignition switch to "OFF" position.
  2. Adjust the pressure of all the installed tires to the specified tire inflation pressure.
  3. Turn the ignition switch to "ON" position.
  4. On the vehicles with VSC, if the low tire pressure warning light comes on immediately, push the Tire Pressure Warning Initialization Switch for a few seconds and make sure the warning light goes off.
  5. Push and hold the Tire Pressure Warning Initialization Switch until the low tire pressure warning light blinks three times.

After the above initialization, the vehicle must be driven at speeds of 30 km/h or over for about 30 to 60 minutes before the TPWS is capable of detecting a loss of tire pressure. While the system is initialized at this point, it is still refining the calculation of the initial condition in order to increase the system accuracy. As such, 8 hours of driving may be necessary for the TPWS to obtain the most accurate initial condition.

- q. When the vehicle is driven less than 30 km/h, the data obtained from the wheel speed sensors is not accurate enough to properly initialize the system. Also, it takes about 30 to 60 minutes to store enough sampling data to obtain a calculation that approximates the properly inflated tire condition (initial condition). Afterwards, the TPWS continues to sample the data in order to refine the calculation of the initial condition. It takes about 8 hours to complete the refinement and obtain the most accurate initial condition.

11. Discuss Toyota's reasons for using an indirect instead of a direct TPWS in the subject vehicles. In addition, discuss Toyota's reasons for using run flat tires on the subject vehicles with all wheel drive rather than the same non-run flat tires used on the other subject vehicles.

#### **Response 11**

Toyota adopted the indirect TPWS in the subject vehicles because;

1. Toyota used the indirect TPWS (using the relative wheel speed difference method) on the first generation Sienna, which began production in August 1997. The system installed on the first generation Sienna had proven good performance at the time the current model Sienna (subject vehicles) was being developed.
2. Toyota designed the subject vehicle TPWS to include the resonance frequency low tire pressure detection method to improve the detection performance of the TPWS. Through evaluations conducted during the development stage, using tires intended to be installed on the subject vehicles, Toyota confirmed that the indirect TPWS could be used on the subject vehicles effectively.
3. During the development stage of the current model Sienna, a rulemaking for mandatory tire pressure monitoring systems was ongoing. Toyota, as well as most of the industry, believed that it was possible to implement an indirect system that would meet the requirements of the proposed rule. Toyota intended to expand the adoption of the indirect tire pressure monitoring system into the several Toyota models, except SUVs and trucks, in preparation for the anticipated final rule.

Toyota's decision to use the run flat tires on the subject vehicles with all wheel drive was based on customer safety and convenience. The run flat tires generally eliminate the need for a customer to stop and change a tire on a roadside. Run flat tires can be driven temporarily for up to 100 miles at speeds of 55 mph or less even if they lose all internal pressure, which allows customers to reach a safe place or a tire retailer for the repair or replacement of the tire.

In terms of effective utilization of vehicle space, there is space below the floor of the two-wheel-drive Sienna vehicles for a spare tire. However the Sienna vehicles equipped with all wheel drive have a driveshaft running through this same area. As such, using the same space for the spare tire is not possible. A spare tire would have to be placed in the cargo area if offered. Equipping the vehicle with run flat tires eliminates the need for a spare tire and the vehicle can have more cargo/utility space.

12. Describe all "actions," as defined in Request No. 8, that Toyota has conducted, are being conducted, are planned, or are being planned by, or for, Toyota that relate to, or may relate to, the impact of using an indirect versus a direct TPWS on vehicles that use run flat tires.

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;
- f. Test conditions and/ or criteria used during the action; and
- g. 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.

#### **Response 12**

As described in response 11, Toyota decided to use an indirect system and developed the Toyota Sienna to be used with run flat tires. We have not conducted, or are planning to conduct any activity that may relate to the impact of using an indirect versus a direct TPWS on vehicles that use run flat tires.

13. For each component part number of the subject system, including, but not limited to, the tires, wheels, and the TPWS, 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 Toyota is aware that contain the identical component, whether installed in production or in service, and state the applicable dates of production or service usage.

#### **Response 13**

The information on the supplier for each component part number of the subject system is provided electronically on CD-ROM in Microsoft Excel format entitled "Supplier Information.xls" stored in the folder "Attachment-Response 13".

The list of any other vehicles of which Toyota is aware that contain the identical components are also provided electronically on CD-ROM in Microsoft Excel format entitled "Other vehicles using identical component.xls" stored in the folder "Attachment- Response 13".

14. State whether the TPWS for MY 2000 Toyota Sienna vehicles contain the same subject system as the subject vehicles. If not, list the differences between the two TPWS systems, including the supplier's name, address, and appropriate point of contact (name, title, and telephone number).

#### **Response 14**

The 2000 model year Sienna vehicles are equipped with ABS only and a TPWS that uses the relative wheel speed difference method. This system has the same functionality as the TPWS for 2004 to 2006 model year Sienna vehicles equipped with ABS only (not the same as vehicles equipped with VSC). Information regarding the suppliers of components for the 2000 MY Toyota Sienna that differ from the subject vehicles is included as Attachment-Response 14(PE06-010), stored on CD-ROM.

15. Furnish Toyota'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);
- 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 system was malfunctioning;
- f. How long (in minutes or miles) a MY 2004-2005 Toyota Sienna vehicle with run flat tires can be driven at 70 mph when the tire pressure in at least one of the tires has fallen to 20 psi, 15 psi, 10 psi, and 0 psi; and
- g. The reports included with this inquiry.

#### **Response 15**

##### **Introduction**

After the TREAD Act was enacted in November of 2000, NHTSA began a rulemaking in order to require vehicle manufacturers to install a system in vehicles which can detect low internal pressure of the tire. As part of that rulemaking, and in order to proactively support NHTSA's activity, Toyota provided information on our tire pressure warning system to NHTSA and made an effort to implement the system into vehicle production at an early stage. An indirect tire pressure warning system was an optimal choice for Toyota to implement because an indirect system can detect low tire pressure by monitoring data from the Antilock Braking System (ABS). ABS was standard equipment on several models at the time and its availability had been increasing. Therefore Toyota (along with other manufacturers) was able to adopt the indirect TPWS on many models relatively quickly.

##### **System Design and Functionality**

As explained in Response 10, the indirect TPWS for the subject Sienna vehicles equipped with the VSC system uses two methods to detect low tire pressure. One is the relative wheel speed difference method and the other is the resonance frequency method. Therefore the TPWS for the Sienna vehicles equipped with the VSC system can detect low pressure not only when one of the tires is significantly under-inflated but also if the pressure in all four tires simultaneously becomes low over time. It is

important to note that Toyota does not rely on a change in tire radius only for detection of low pressure in the run-flat tires. While using the tire radius method alone can be appropriate for other types of tires, because of the characteristics of the run-flat tire, the resonance frequency method increases the detection performance for these tires.

However, regardless of the low tire pressure detection system, i.e. direct system or indirect system, Toyota believes that the tire pressure warning system is not a maintenance reminder, and it cannot absolve a driver from his/her responsibility for the regular maintenance of the tires, including the tire pressure. Toyota also believes that, when reviewing FMVSS 138 "Tire Pressure Monitoring System," which was published in April 2005, NHTSA has the same opinion as mentioned above. The final rule of FMVSS 138 requires that the owner's manual provide an image of the telltale symbol with the following statement;

"Each tire, including the spare, should be checked monthly when cold and inflated to the inflation pressure recommended by the vehicle manufacturer on the vehicle placard or tire inflation pressure label. .... Please note that the TPMS is not a substitute for proper tire maintenance, and it is the driver's responsibility to maintain correct tire pressure, even if under-inflation has not reached the level to trigger illumination of the TPMS low tire pressure telltale."

In particular, it is common that a tire will gradually lose air over time. Toyota believes that the low tire pressure condition caused by a gradual loss of air must be dealt with properly, through regular maintenance. By review of the FMVSS, we believe that the agency has the same opinion.

#### **Warning of TPWS Malfunction**

As detailed in our response, the TPWS installed on the subject vehicles uses the low tire pressure telltale to indicate a malfunction in the TPWS. The duration of low tire pressure telltale "lamp on" at vehicle startup identifies the TPWS initialization status. A blinking or steady low tire pressure telltale can indicate a failure to initialize or a system malfunction. These warnings would be obvious to the operator that a failure of the TPWS was occurring.

Both run-flat tires and non run-flat tires are available on the subject vehicles and, regardless of the type of equipped tire, all of the subject vehicles are equipped with a TPWS. As for non run-flat tires, low tire pressure can be detected by the TPWS because of the relatively large radius change of the tire when the internal pressure becomes significantly low. Also, a driver can readily notice a low pressure condition by the appearance of the non run-flat tire itself. On the other hand, in some conditions, the detection range of the TPWS for the run-flat tires is slightly lower than for the non run-flat tires. This is because the changes in the radius and in the resonance frequency of the run-flat tire when the internal pressure is low are smaller than those on the non run-flat tire. However, the TPWS has the capability to detect significantly low tire pressure if the initialization is performed properly. And, as mentioned in the owner's manual, the run-flat tire can be driven up to 100 miles at a speed below 55 mph after the tire goes flat and the TPWS light comes on.

### **Run-Flat Durability**

In the development stage, Toyota assessed the run-flat durability on one of the two OEM tire manufacturers under the assumed condition that the TPWS would not warn at the pressures lower than 100 kPa. According to one of the tire manufacturers, the tire's run-flat ability is not compromised when operated continuously at pressures 100 kPa or above. In order to prepare for situations where detection may not occur until after the tire has reached 100 kPa, an assessment of the tire run-flat durability was conducted on one of the two original equipment run-flat tires. The assessment evaluated two scenarios where the TPWS warns at pressures of less than 100 kPa:

- one tire with a nail puncture occurring at 100 kPa
- all four tires slowly leak air simultaneously past 100 kPa

As a result, we concluded that, although the run-flat durability at an internal pressure of 0 kPa could be compromised when driving at pressures lower than 100 kPa, the tire would still meet the design target in both situations. This means that the tire can still be driven up to 100 miles at a speed below 55 mph after the TPWS warns. More information is available in the response to Question 8, including the specific evaluations of slow and fast leak rates, the driving distances, and the associated safety factors.

### **Detection Time**

As described in our response, the indirect TPWS requires some amount of driving time to detect a low tire pressure condition. While some operators may experience no illumination of the low tire pressure telltale, it is possible that they may not have driven for enough time to allow the TPWS to detect the condition. In the case of a rapid loss of tire pressure, the driver may identify the problem faster (because of excessive noise or vibration) than the TPWS and stop the vehicle. This particular situation could be an important causal or contributory factor creating the appearance of a defect in the system when, in fact, the system is simply working as designed. An indirect system is not designed for the instantaneous detection of a loss of tire pressure. And while the specific detection pressure range or actual detection time may vary with the driving conditions, Toyota believes that the Sienna's indirect TPWS (properly initialized) works properly when the tire pressure becomes significantly low.

### **Existence of a Safety Related Defect**

Based on the above, Toyota assumes that the purpose of the agency's investigation is to assess whether or not there is any trend that indicates the existence of a defect in the TPWS for the subject vehicles when equipped with run-flat tires. After the agency opened its investigation, Toyota carefully reviewed the field reports, customer complaints and warranty claims that Toyota has received to date, as well as the thirteen NHTSA's VOQs. As a result of the analysis of all cases alleging the TPWS failure, Toyota has not identified any single issue with the design or manufacture of the TPWS that would indicate a safety defect trend.

The TPWS must initialize under the condition that all tires are inflated at the correct pressure recommended by the manufacturer. Also, the TPWS needs appropriate operating conditions in order to detect low tire pressure (see Response 10). As we explained in Response 10, there are several conditions where the TPWS may not warn properly. Toyota assumes that many of the claims alleging

the TPWS failure were attributed to those conditions, especially in cases where the tire pressure suddenly drops due to bursting/blowing out.

Toyota is also aware of many cases where the TPWS worked properly when the tire pressure was low and, therefore, believes that the TPWS can warn the driver of low tire pressure when properly initialized and operated under the appropriate conditions. However, in cases where the run-flat tire goes flat and the customer needs to replace the tire, many customers have registered complaints about the tire and/or the TPWS because of the high cost and limited availability of the replacement tire.

We have submitted three reports alleging that a crash occurred and wherein the tire is mentioned, but none of these reports identify a clear, specific TPWS failure. In addition, there are no reports of which we are aware that identify a loss of vehicle control or insufficient braking performance when the vehicle was operated with low tire pressure because of a lack of warning by the TPWS.

There are some reports that allege the TPWS light did not come on although the tire was flat, but this may have been caused by an inappropriate initialization or inappropriate detection conditions, including not enough time allotted for detection. As a result of our investigation of the relationship between the loss of the tire pressure in the run-flat tire and the illumination of the TPWS warning lamp, while the detection range and time may vary, we have confirmed that the TPWS warning light operates properly when the tire pressure becomes significantly low and that the tire's ability to be driven flat (0 psi) for 100 miles at speeds up to 55 mph is not compromised.

#### **Conclusion**

In conclusion, based on the findings mentioned above, Toyota believes that no specific trend indicates the existence of a safety related defect in the subject vehicles and the subject components. We hope that the agency better understands the functionality of the TPWS after review of this response. We understand that there are widely varied expectations for what a TPWS is and is not. We firmly believe that the TPWS is not a replacement for regular tire maintenance. We believe NHTSA has the same opinion. And while the detection threshold may appear low relative to the final rule for FMVSS 138, these vehicles were not developed to meet that standard. And while it is true that detection times are faster and accuracy is improved with a direct TPWS, when considering the existence of a safety-related defect, these factors become irrelevant when considering that overall, run-flat durability is not compromised at the limits of the system. Toyota firmly believes that when used properly, in combination with regular maintenance, the TPWS can identify a significantly under-inflated run-flat tire and warn the driver as needed.

**Customer Satisfaction**

As mentioned in Response 6, Toyota has initiated a Customer Support Program based on reports regarding uneven or premature tire wear on run-flat tires on certain 2004 through early 2006 model year Sienna all wheel drive vehicles. Although the tires are normally covered by the tire manufacturer's warranty, this program provides supplemental tire warranty coverage for uneven or premature tire wear under normal use. Through this program, Toyota has been carrying out an educational activity to give customers a better understanding of the TPWS as well as run-flat tires. Toyota has enclosed a brochure with the owner letter for this program which explains:

- what is a run-flat tire
- how a run-flat tire works
- the importance of regular tire pressure maintenance (every two weeks or at least monthly)
- what is the TPWS
- that the TPWS is not a maintenance indicator

Please refer to the copy of the brochure submitted as Attachment-Response 7.

In addition to the above, Toyota has also initiated the following since February, 2006:

- installed the same brochure in the glove box of all new Sienna vehicles equipped with run-flat tires
- installed a tag on the glove box door informing the purchaser that this vehicle is equipped with run-flat tires and advising to see the brochure in the glove box
- affixed a label on the right side front door window glass informing the purchaser that this vehicle is equipped with run-flat tires.

As mentioned in this response, Toyota believes that it is driver's responsibility to maintain the tire pressure regularly. Toyota did not develop the TPWS on the subject vehicles to be a replacement for proper tire maintenance. We also did not develop it for the instantaneous detection of catastrophic tire failure. However, in the interest of safe operation of our vehicles, Toyota has always been, and will always be proactive in our educational activity on tire and vehicle safety.

\* \* \*

Regarding privileged documents that may be responsive to this information request, Toyota understands that it is acceptable to the Agency at this stage for Toyota to identify categories of privileged documents rather than any specific document within those categories. These categories include (a) communications between outside counsel and employees of Toyota's Law Department, other Toyota employees, or employees of parties represented by Toyota in litigation or claims; (b) communications between employees of Toyota's Law Department and other Toyota employees or employees of parties represented by Toyota in litigation or claims; (c) notes and other work product of outside counsel or employees of Toyota's Law Department, including work product of employees or consultants done for or at the request of outside counsel or Toyota's Law Department. For any privileged documents that are not covered by these categories, if any, Toyota will provide a privilege log identifying any such documents under separate cover. Toyota is not claiming a legal privilege for any documents provided with this response; however, Toyota does not waive the legal privilege or work product protection with respect to other documents that may have been prepared in connection with a specific litigation or claim. In addition, Toyota may assert the attorney client privilege or claim protection under the work-product doctrine for analyses or other documents that may be prepared in connection with litigation or claims in the future.

Toyota understands that NHTSA will protect any private information about persons that is contained in the Attachments to this response, based on privacy policy considerations. Such private information includes data such as names, addresses, phone or fax numbers, email addresses, license plate numbers, driver's license numbers and last 4 digits of the vehicle's VIN.

Data provided in this document is current as of the following dates:

Response 1 : Production Data (March 20, 2006)  
Response 2 - 4 : Consumer complaint (April 12, 2006)  
Field Report (April 17, 2006)  
Lawsuit (April 7, 2006)  
Response 5 : Warranty claims (April 12, 2006)  
Goodwill & Extended warranty claims (April 18, 2006)  
Response 7 : Dealer communications (April 27, 2006)  
Response 8 : Investigation reports ( May 19, 2006)  
Response 9 : Modifications or changes (April 28, 2006)