TOYOTA MOTOR CORPORATION

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August 7, 1986

Mr. Philip Davis, Director
Office of Defects Investigation, Enforcement
National Highway Traffic Safety Administration
400 Seventh Street, S. W.
Washington, D. C. 20590

RE: NEF-12qdc, EA85-045

Dear Mr. Davis:

In response to your letter of May 6, 1986, in which you requested information concerning alleged sudden acceleration of certain 1981-1984 Toyota Cressida vehicles, we hereby submit, in duplicate, the data you requested. We also enclose our inspection report of the failed cruise control computer.

Please note that the information claimed to be confidential is deleted and is being sent to the Chief Counsel's office under separate cover in accordance with the directions in your letter above.

If you have any technical questions concerning this matter, please contact our Washington branch office at (202) 775-1707.

Sincerely,

TOYOTA MOTOR CORPORATION

K. Kato

Kenichi Kato
General Manager
U.S. Office

KK:cc
Enclosure

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TOYOTA'S RESPONSE TO NEF-12gdc, EA85-045

OF MAY 6, 1986

Q.1. Has Toyota conducted any electromagnetic field surveys in the U.S. and/or Japan to identify certain locations, frequencies, and durations of electromagnetic occurrence and its source and modulation such as police or amateur radio, AM or FM broadcast, radar, etc? If so, provide a copy of the survey summary and results, and describe the application of this survey. If not, explain why such a survey is not necessary.

Response 1:

The summary of the electromagnetic field survey conducted in the U.S. and its results are being provided as Attachment I (confidential). Toyota has also conducted actual vehicle tests at the time of these field surveys.

Q.2. Has Toyota established an in-house EMC standard applicable to design and testing of electrical and electronic devices in the subject vehicles? If so, provide a copy of the standard and describe the basis and background information regarding its development. If not, explain why such a standard is not deemed necessary.

Response 2:

There are various types of electrical and electronic devices other than the cruise control computer indicated in your letter, such as the EFI computer, the ESC (Electronic Skid Control) computer, the ECT (Electronic Controlled Transmission) computer, etc. Each such device has its own unique standard.

Thus the following is for the in-house EMC standard as applicable only to the subject cruise control computer.

The EMC can be categorized by its characteristics as follows:

1) Compatibility with electrical noise generated within the vehicle itself.

   The compatibility with electrical noise generated by the electrical and electronic components equipped on the vehicle.

2) Compatibility to electromagnetic environment from the outside source.

a) Compatibility to electromagnetic waves generated from on-board radio transmitter.

b) Compatibility to electromagnetic environment from broadcast radio waves.

There are other electromagnetic waves generated by the vehicle which may cause interference to outside radio receiver/transmitter electromagnetic force, but will be omitted herein as it is not related. The EMC standard summary as related to the cruise control computer is provided as Attachment II (confidential).

Q.3. Has Toyota conducted EMC road-testing of subject or prototype vehicles at key locations in U.S. or Japan chosen on the basis of field strengths observed and frequencies to which vehicular electronic systems are particularly susceptible? If so, provide a copy of documents related to test procedures, conditions, instrumentation, test results, test evaluation, and analysis.

Response 3:

The summary of the road test results on the subject vehicle is provided as Attachment III (confidential).

Q.4. Has Toyota performed EMC testing of the subject or prototype vehicles in test chambers? If so, provide a copy of documents related to test procedures, conditions, instrumentation, test results, test evaluation and analysis, including correlation of performance in the field to chamber testing.

Response 4:

Please refer to our response letter of December 6, 1985, Attachment VIII, items (b), (1) and (3), which is applicable to this item.

Q.5. Has Toyota performed subject vehicular component testing as a means of determining relative component immunity to EMI? If so, furnish the name of each tested component and provide a copy of documents pertaining to test procedures, conditions, instrumentations, test results, test evaluation and analysis, including correlation of performance in the field to component testing.

Response 5:

Please refer to our response letter of December 6, 1985, Attachment VII-1, Reliability Test Report Nos. 8, 9, 10, 11, 13, 14 and 17, which is applicable to this item. For test details. please refer to Response 2.

Q.6. Explain how each of the tests described above associate with (1) transient immunity, (2) electronics immunity to on-board transmitters, (3) radiated emissions from electronics potentially resulting in communication receiver interference, and (4) immunity to external narrow band radiation.

Response 6:

Please see Response 2.

Q.7. Describe all obvious EMI reduction techniques incorporated in the subject vehicles such as shielding and filtering; avoidance of resonances; adjustment of component size, location, and orientation; etc. Also, furnish the date, model, and model year of the subject vehicles in which the techniques were introduced.

Response 7:

Please see Attachment IV.

Q.8. Furnish Toyota's opinion of the likelihood of the alleged problem occurring due to EMI in the subject vehicles. Please include an assessment of the following:

a. the potential EMI causal or contributing factors which may result in the alleged problem;

b. the failure mode; and

c. any warning of EMI and what that warning might be.

Response 8:

We have not experienced any problem with EMI as a failure source during development or from the field.

Thus we do not believe that EMI is the probable source of the subject problem.

Q.9. In reference to Attachment X, item 5, of your letter of December 6, 1985, you indicated in October 1983 that Toyota added some resistances and capacitors to the speed control computer assembly for improvement of electromagnetic interference resistance. Based on the above, please respond to the following:

a. Provide a circuit diagram showing locations and capacity of added resistances and capacitors.

b. Furnish a copy of the documents related to tests and analysis which show different effects on the speed control computer due to EMI before and after the resistances and capacitors were added.

Response 9:

a) Please refer to Attachment V.

b) We do not have any quantitative analysis data. However, as shown in the reliability test reports (see Attachment VII-1 to our December 6, 1985 response), we confirmed that the modified computer also met our criteria.

However, theoretically these added devices could improve it as indicated in Attachment IV.

Q.10. ference to item 1 of Mr. Iida's letter dated ıry 21, 1986, describe in detail some "unknown" re. ns or some possible causes which can lead the computer ground circuit "A" and the two earth points which are connected to "A" becoming open or partially open.

Response 10:

These three points of ground circuit are bolted on three different locations of the vehicle. Thus, the possibility of the earth point becoming open exists if the three affixing bolts were to become loose or dislodge altogether.

However, we have not experienced any incident where these three earth point bolts became loose or dislodged altogether during development and/or in the field.

Q.11. In reference to item 2 of Mr. Iida's letter dated February 21, 1986, describe in detail some "unknown" reasons or some possible causes which can result in the voltage at "OUT-B" of the IC having a continuously low level output.

Response 11:

When an unexpected change of input or abnormal input occurs to the IC and the micro-processor, it was considered as a possible cause. In reality, it is hard to believe that such a phenomenon would occur.

Q.12. Item 3 of Mr. Iida's letter dated February 21, 1986, states in part "When the brake pedal is depressed, 'Switch A' of the stop lamp switch assembly is engaged, sending a signal to the computer assembly to shut off the actuator circuit". Based on the above statement, is it possible that the computer may fail or malfunction and not shut off the actuator circuit? If so, describe the possible causes of such failure or malfunction. If not, explain the reason for adding Switch B in the stop lamp switch assembly.

Response 12:

Because it is possible that a computer could fail or malfunction from unknown causes and not shut off the actuator circuit, the "back-up" circuit was incorporated as a design improvement.

Q.13. Reference to item 3 of your letter dated March 28, 1986, states in part: "We can assure you that the product improvements made in our cruise control systems were not made as a result of discovery of design or manufacturing defects, but were incorporated to minimize the likelihood of danger should any kind of failures occur in the cruise control system". Please describe the kind of possible failure mode of the cruise control system which would likely cause "danger". Also, explain what is the likelihood of danger.

Response 13:

Our response was not made to imply that the improvements were based on the likelihood that danger may occur, but as part of Toyota's continuous reliability improvement program. Such reliability improvements are constantly incorporated into vehicle design because they represent advancements in the "state-of-the-art".

ATTACHMENT IV

Toyota introduced the following EMI reduction techniques incorporated in the subject computer.

1. Arrangement of Resistance Elements' Location (1982 model)

   (1) Purpose : To protect a micro-processor from high frequency energy coming through a connector.

   (2) Method : Arrange resistance elements' location around a connector.

2. Surge absorber (1984 model)

   (1) Purpose : To improve immunity to surge, such as load dump.

   (2) Method : Add a zener diode to power supply circuit.

3. Addition of resistance and condenser (Oct. 1983)

   (1) Purpose : To improve FMC.

   (2) Method : Add a condenser to absorb surge voltage from the input circuit such as the power supply or sensor.

   Add resistance into the cancellation circuit to improve immunity to EMI.