HYUNDAI-KIA
AMERICA TECHNICAL CENTER, INC.

September 24, 2008

Mr. Jeffrey L. Quandt
Chief, Vehicle Control Division
Office of Defects Investigation
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, D.C. 20590

RE: NVS-213dlr, PE08-040

Dear Mr. Quandt:

This letter provides supplemental information in response to your above referenced request for information, dated July 16, 2008. Complete responses were previously provided with a letter dated September 11, 2008 for Requests 1, 2, 3, 4, 5, 6, 7, 10, and 12. NHTSA has granted an extension until September 26, 2008 to provide responses to Requests 8, 9, 11, and 13. Although Hyundai believes that the definition of "document" is overly broad, the company has searched in good faith for materials responsive to each request in the time frame provided.

This response includes additional documents responsive to NHTSA's information request. Hyundai continues to evaluate the data and will provide further analysis to the agency as it becomes available.

Request 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, Hyundai. 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.

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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 to Request 8.

See Attachment C - Santa Fe Rear Trailing Arm Analysis provided by Donghee Industry Co., Ltd.

See the attached Quality Information Report QASM-C-070101.pdf relating to a vehicle produced in September 2000.

Source: Hyundai Motor Company
Information as of September 22, 2008

Request 9.

Describe all modifications or changes made by, or on behalf of, Hyundai in the design, material composition, manufacture, quality control, supply, or installation of the subject component, from the start of production to date, which relate to, or may relate to, the alleged defect in the subject vehicles. For each such modification or change, provide the following information:

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 number(s) (service and engineering) of the original component;
e. The part number(s) (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 Hyundai is aware of which may be incorporated into vehicle production within the next 120 days.

Response to Request 9.

a. The date or approximate date on which the modification or change was incorporated into vehicle production;

   January 27, 2003

b. A detailed description of the modification or change;

See Attachment D for requested information. Attachment D has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.

c. The reason(s) for the modification or change;

See Attachment D for requested information. Attachment D has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.

d. The part number(s) (service and engineering) of the original component;

55100-26000, 55101-26000, 55100-26600, 55101-26600, 55100-26700, and 55101-26700

e. The part number(s) (service and engineering) of the modified component;

No part number changes.

f. Whether the original unmodified component was withdrawn from production and/or sale, and if so, when;

The modified components were introduced into production on January 27, 2003, replacing the original configurations.

g. When the modified component was made available as a service component; and

The modified components were introduced as service components shortly after the production incorporation date of January 27, 2003, replacing the original configurations.

h. Whether the modified component can be interchanged with earlier production components.

Yes.

Hyundai has no plan for any modification or change which may be incorporated into vehicle production within the next 120 days.

Source: Hyundai Motor Company
Information as of September 22, 2008

Request 11.

Provide the following information regarding the subject components:

a. Provide top, side and front view diagrams of the subject components and the rear suspension including the wheels and tires;
b Provide all design FMEAs (Failure Mode Effects Analysis) related to the subject components including any FMEAs related to corrosion failures;

c. Describe all potential paths for water and other foreign material entering the subject component and state where the water would collect (e.g., the low point of the assembly);
d. Describe the corrosion protection system for the subject component (internal and external), including all minimum thickness specifications for anti-corrosion protection systems and drainage features designed in the subject component;
e. Describe the stress distribution in the subject components in the following conditions, including all finite element analyses conducted by or for Hyundai in both curb weight and GVWR conditions: (1) static condition; (2) steady-state driving; (3) while cornering (inner and outer trailing arm); and (4) full jounce;
f. Describe the conditions of vehicle loading and driving dynamics that produce the greatest loads/stresses in the subject components and state the approximate locations and magnitudes of the loads/stresses;
g. Using a diagram or photograph of the subject component, identify the areas Hyundai believes are: (1) experiencing the most severe corrosion in vehicles where rear trailing arm corrosion damage has been observed; and (2) most likely to fail (e.g., fracture, bend, buckle, etc.) in service from corrosion damage;
h. State the capacity, or yield strength, of the subject component for the load condition identified in 11.g for a new rear trailing arm with no corrosion damage;
i. Provide Hyundai's assessment of the amount of corrosion damage required to reduce the strength of the subject component enough that it may lose the capacity to carry the full range of in-service loads/stresses and the approximate time in service required for that damage to occur in the most severe corrosion areas of the United States;
j. Give Hyundai's assessment of the geographic distribution of failure risk based on failure rates and trend, field surveys or other data used by Hyundai to measure corrosion patterns in the United States in suspension components;
k. Describe all requirements for salt-spray and other durability tests related to corrosion resistance; and
l. Provide copies of all documents related to 11.a – 11.k

Response to Request 11.

a. Provide top, side and front view diagrams of the subject components and the rear suspension including the wheels and tires;

   See Attachment E for requested information. Attachment E has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.

b. Provide all design FMEAs (Failure Mode Effects Analysis) related to the subject components including any FMEAs related to corrosion failures;

   No such analyses have been identified.

c. Describe all potential paths for water and other foreign material entering the subject component and state where the water would collect (e.g., the low point of the assembly);

   See Attachment C, page 3. Attachment C has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.

d. Describe the corrosion protection system for the subject component (internal and external), including all minimum thickness specifications for anti-corrosion protection systems and drainage features designed in the subject component;

See Attachment D, page 3. Attachment D has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.

e. Describe the stress distribution in the subject components in the following conditions, including all finite element analyses conducted by or for Hyundai in both curb weight and GVWR conditions: (1) static condition; (2) steady-state driving; (3) while cornering (inner and outer trailing arm); and (4) full jounce;

See Attachment F and the discussion in response to Question 13(b). Attachment F has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.

f. Describe the conditions of vehicle loading and driving dynamics that produce the greatest loads/stresses in the subject components and state the approximate locations and magnitudes of the loads/stresses;

See Attachment F and the discussion in response to Question 13(b). Attachment F has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.

g. Using a diagram or photograph of the subject component, identify the areas Hyundai believes are: (1) experiencing the most severe corrosion in vehicles where rear trailing arm corrosion damage has been observed; and (2) most likely to fail (e.g., fracture, bend, buckle, etc.) in service from corrosion damage;

See Attachment I.

h. State the capacity, or yield strength, of the subject component for the load condition identified in 11.g for a new rear trailing arm with no corrosion damage;

No such analyses have been identified.

i. Provide Hyundai's assessment of the amount of corrosion damage required to reduce the strength of the subject component enough that it may lose the capacity to carry the full range of in-service loads/stresses and the approximate time in service required for that damage to occur in the most severe corrosion areas of the United States;

See response to Request 13.

j. Give Hyundai's assessment of the geographic distribution of failure risk based on failure rates and trend, field surveys or other data used by Hyundai to measure corrosion patterns in the United States in suspension components;

The geographical occurrence of trailing arm corrosion is in the "Salt Belt" area of the northeast and north central United States.

k. Describe all requirements for salt-spray and other durability tests related to corrosion resistance; and

See Attachment G for the Material Specification governing painting metal products for the purpose of rust prevention. Attachment G has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.

l. Provide copies of all documents related to 11.a – 11.k

See Attachments C, D, E, F, G and I.

Source: Hyundai Motor Company
Information as of September 22, 2008

Request 13.

Furnish Hyundai'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. The effect on vehicle control while driving at highway speeds (e.g. speeds ≥55mph) and while turning at speeds above and below 55 mph;
f. What warnings, if any, the operator and the other persons both inside and outside the vehicle would have that the alleged defect was occurring or subject component was malfunctioning; and
g. The reports included with this inquiry.

Response to Request 13.

a. The causal or contributory factor(s);

Road salt contamination of the left or right trailing arm complete assembly, which may be referred to as trailing arms, can result from vehicle operation over roads that have been coated with salt to promote deicing during the winter months. Water and road salt contamination may enter the trailing arms through holes or joints between metal components. The water and road salt contamination may be forced to the back portion of the trailing arms and may collect in that area because of insufficient drainage. The contamination causes corrosion of the inner surfaces of the trailing arms and prolonged exposure to the road salt contamination may result in corrosive damage to the trailing arms.

b. The failure mechanism(s);

Repeated exposure to water-born road salt results in gradual and progressive corrosion of the inner surfaces of the trailing arm. Over time, the corrosion will result in perforations and holes that are clearly visible on the outside of the trailing arm. These holes manifest well before there is any failure or deformation of the trailing arm because the corrosion tends to be concentrated in localized areas of the arm. Specifically, there are two areas where the corrosion tends to manifest first, one area on the top panel, and one area on the lower panel.

On the top panel of the trailing arm, corrosion develops more quickly around the spring seats due to the continuous stress exerted on the upper panel by the spring. The stress distribution illustrations provided in Attachment F illustrate the stress state of the upper panel. Specifically, the illustrations of "Steady State Driving Stress Distribution" and "Cornering Stress Distribution" illustrate the stress state of the upper panel generally and in the area of the spring seat in particular. The continuous stress applied by the spring, along with associated impact and vibration from the spring, frequently results in the spring seat rusting through first. Localized failure in the spring seat area results in the metal-on-metal noises that are frequently reported by customers but there is no impact on drivability.

On the lower panel of the trailing arm, corrosive damage is also localized and concentrated. The lower panel corrosion develops initially on the lower trailing portion of the arm where water tends to collect. The illustrations at Attachment D depict the path of water flow and its collection in the un-drained lower portion of the trailing arm. The collection of water in this area results in holes in this portion of the arm that can clearly be seen before the arm reaches the point of failure or deformation.

c. The failure mode(s);

Each rear tire and wheel assembly is positioned by the trailing arm, an upper and a lower control arm and a shock absorber assembly. In advanced cases, trailing arm corrosion can result in failure of the trailing arm such that the trailing arm no longer supports the wheel along the longitudinal axis. In the event of such failure, the wheel remains connected to the vehicle by the upper control arm, the lower control arm, the shock absorber and the axle. Since the trailing arm is primarily responsible for maintaining the orientation of the wheel along the longitudinal axis, loss of the control arm affects the alignment of the rear wheel that is located by that trailing arm. Complete failure of the trailing arm can significantly impact rear wheel alignment and drivability by affecting the toe-in/toe-out alignment of the wheel.

d. The risk to motor vehicle safety that it poses;

Hyundai does not believe that the alleged defect poses an unreasonable risk to motor vehicle safety. In the vast majority of cases, corrosion on customer vehicles is identified well before there is complete failure of the trailing arm, and well before there is any impact on drivability. Because the failure mechanism results in concentrated and localized corrosion that creates readily identified holes before there is a complete failure, any impact on drivability in the field is very rare.

The data submitted on September 11, 2008 confirms this. Part sales data indicates that approximately 6,241 trailing arms have been sold as replacement parts, but yet Hyundai has only received a total of 15 complaints from customers about this condition. Seven of these complaints do not reference any sort of failure-while-driving and are focused primarily on the cost of repair. Of the remaining eight complaints which indicate a failure of the arm while driving, only three alleged an impact on vehicle control. Thus, the vast majority (99.9%) of the 6,241 trailing arms that have required replacement in the field have apparently been identified and replaced prior to failure.

In addition, the progressive nature of the corrosion also provides drivers clear warnings in the most advanced cases, where there is potential for complete failure. For example, where the spring seat rusts through, customers report hearing certain metal-on-metal creaking and clunking noises associated with movement between the spring and spring seat on the upper panel of the arm. Similarly, in advanced cases, customers may experience an unusual feeling during turning or braking associated with flexing of a weakened or bent trailing arm prior to complete failure. Although complete failures of the Santa Fe trailing arm are very rare, the data available to Hyundai confirms the prevalence of warnings in those cases.

As of this date, of the nine VOQs that have been received by NHTSA, five referenced some form of advanced warning prior to failure. Similarly, of the eight owner complaints alleging a failure while driving, two reported hearing some type of noise or warning prior to failure. Hyundai has received no allegations of any accidents or injuries and has received no property damage claims in connection with this component.

e. The effect on vehicle control while driving at highway speeds (e.g. speeds ≥55mph) and while turning at speeds above and below 55 mph;

A fractured rear trailing arm would affect the alignment of the rear tire and wheel that are located by that trailing arm. The misaligned rear tire and wheel assembly may adversely affect the handling of the vehicle and drivability.

f. What warnings, if any, the operator and the other persons both inside and outside the vehicle would have that the alleged defect was occurring or subject component was malfunctioning; and

The driver and occupants may become aware of an unusual noise in the rear of the vehicle. The noise may be described in various ways, such as creaking, snapping or thumping. Drivers may also notice a change in turning or braking, which indicates the need to seek service.

g. The reports included with this inquiry.

NHTSA provided 6 Vehicle Owner Questionnaires with this inquiry. None of the 6 VOQs claim that an accident or crash occurred. None of the 6 VOQs alleges that any injury occurred.

One owner described hearing a loud snapping noise after turning into her development after driving on a highway. Another described the car would not brake steadily for a few days and then a thump was heard at the rear of the car. The owner drove for a few miles while hearing significant noise in the rear. He finally took the vehicle to a dealer. Another owner reports that the driver side rear rusted through, while the other three owners report that a trailing arm failed during driving on a highway or secondary road.

The reports provided directly to Hyundai and supplied in response to this inquiry are similar in that the vast majority of reports are from the salt belt.

Please do not hesitate to call me with any questions relating to this response.

Sincerely,

Robert Babcock

Robert Babcock
Senior Manager, Regulation and Certification Department

Attachments:

Two CDs, each containing:
ATTACHMENT C Santa Fe Trailing ArmReport.ppt (Attachment C has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.)
ATTACHMENT D Santa Fe Trailing Arm Design Change.ppt (Attachment D has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.)
ATTACHMENT E Santa Fe Trailing Arm Drawings.xls (Attachment E has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.)
ATTACHMENT F Santa Fe Trailing Arm Stress Distribution.ppt (Attachment F has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.)
ATTACHMENT G Rust Prevention MS 630-01 (Attachment G has been provided to the Office of Chief Counsel with a request for treatment as Confidential Business Information.)
ATTACHMENT I.jpg
Quality Information Report Attachment QASM-C-070101.pdf