BRAKING PERFORMANCE TEST PROCEDURE

1. Scope
   This test procedure applies to the “Braking performance test during full braking” of passenger vehicles with 9 occupants or less and commercial vehicles with a gross vehicle mass of 2.8 tons or less which are equipped with an antilock brake system (ABS) among the tests to be conducted by the National Agency for Automotive Safety and Victims’ Aid (NASVA) in the new car assessment program information supply services.

2. Definition of Terms
   The terms used in the test procedure are defined as follows:
   (1) “Stopping distance” means the distance to be traveled by the vehicle from the point when the brake pedal starts to actuate by application of pressure by the driver to the point at which the motor vehicle reaches a complete stop.
   (2) “Initial braking speed” means the speed of the motor vehicle at the moment when the brake pedal starts to actuate by application of pressure by the driver.
   (3) “Brake temperature prior to braking” means the higher the mean temperatures of the brake linings or pads on the right and left wheels of each axle measured according to the method prescribed in JIS D 0210 immediately before starting each braking test while the motor vehicle is in park.
   (4) “Pedal application force” means the brake pedal operation force of the test vehicle.
   (5) “Designated vehicle speed” means the designated value of the vehicle speed when initial braking is applied in the test.
   (6) “Vehicle’s mass at the time of delivery” means the mass of the test vehicle with the motor and fuel systems filled with fuel, lubricating oil and cooling water, including tools, spare tires, and standard portable goods.
   (7) “Vehicle speed measuring device” means a device to measure the speed of test vehicles.
   (8) “Stopping distance device” means a device to measure the stopping distance of test vehicles.
   (9) “Brake temperature confirmation device” means a device to confirm the brake temperature of test vehicles by a thermocouple.
   (10) “Pedal application force measurement device” means a device to measure the brake pedal force of test vehicles, such as a pedal force meter.

3. Testing Conditions
   3.1 Conditions of Test Vehicle
   The test vehicle shall be tested under the following conditions:
(1) Loading conditions

The mass of the test vehicle shall be recorded under the condition where two persons are sitting in the front seats of the vehicle at the time of delivery, provided that the test vehicle mass shall be the mass at the time of delivery +110 +20/-0 kg with one driver including measuring equipment.

(2) Tires

The tires that are fitted at the time of purchasing the test vehicle shall be used. The operation for running in the tires shall be conducted at the same time as the test vehicle is driven so that the bedding of the braking system may be conducted, as described in Paragraph 3.1 (3). Furthermore, prior to running (at normal temperature), the air inflation pressure of the tires shall be adjusted on a horizontal level to the value for normal operation, as described in the Specification Table provided by the manufacturer.

(3) Brake system

The discs, drums and friction materials that were installed when the test vehicle was purchased shall be used after bedding them in according to the procedure prescribed in Paragraph 4.1. The braking system shall be adjusted normally as specified. Furthermore, the braking system shall be free from adverse effects such as abnormal heat gain or wetting.

(4) Drive axle

For motor vehicles where it is possible to select the drive axle, drive axle that is normally used shall be selected.

3.2 Proving Ground

The proving ground shall meet the following requirements:

(1) The proving ground shall be flat, with no fallen leaves or sand on it, and the surface shall be clean asphalt. The test shall be conducted under dry and wet conditions.

(2) The friction coefficient of the proving ground shall be around 1.0 under dry conditions and around 0.80 under wet conditions. The measurement method shall be in accordance with ASTM E1337, the test tires shall meet the requirements of ASTM E1136, the test load shall be 4586 ± 67 N, the tire pressure shall be 241 ± 3 kPa, and the velocity shall be 64 ± 0.8 km/h.

3.3 Meteorological Conditions

(1) The mean wind velocity during the test shall be 5 m/s or less.

(2) The temperature of the road surface of the proving ground shall be within the range given below. Ideally, this condition shall be maintained, however, if the temperature is lower than the requirement but the schedule cannot be changed because subsequent test schedules are fixed, the brake test may be performed provided that the published
results are accompanied by a note explaining that the braking distance may be slightly shorter than the required condition.

<table>
<thead>
<tr>
<th>Road surface temperature of the proving ground under dry conditions</th>
<th>35.0 ± 10.0°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road surface temperature of the proving ground under wet conditions</td>
<td>27.0 ± 5.0°C</td>
</tr>
</tbody>
</table>

3.4 Measurement Items
The following items shall be measured and confirmed in the test:
(1) Brake temperature prior to braking
(2) Initial braking speed
(3) Pedal application force
(4) Stopping distance
(5) Deviation from the lane

3.5 Measuring equipment
The following measuring equipment to be used in the test shall be capable of smoothly handling the data of the measurement items prescribed in Paragraph 3.4:
(1) The vehicle speed measurement device shall measure the test speed with a margin of error of ±1%.
(2) The stopping distance measurement device shall measure the stopping distance with a margin of error of ±1%.
(3) The brake temperature confirmation device shall measure the temperature with a margin of error of ±3%.
(4) The pedal pressure measurement device shall measure the pedal application force with a margin of error of ±1%.

4. Testing Method
4.1 Burnish Running
Burnish the brakes (disk brakes or drum brakes) by making 200 stops from 64 km/h at deceleration of 3.7 m/s². The interval from the start of one service brake application to the start of the next shall be either the time necessary to reduce the initial brake temperature to 110–132°C, or the distance of 1.6 km, whichever occurs first. Accelerate to 64 km/h after each stop and maintain that speed until making the next stop (same as FMVSS105, S7.4.1.1).

4.2 Testing Preparation
(1) Measurement preparation
Install the vehicle speed measuring device, stopping distance measurement device,
brake temperature confirmation device and pedal application force measurement device in the test vehicle.

(2) Re-burnishing

Before the test is started, the burnishing shall be conducted at least 35 times according to the procedure prescribed in Paragraph 4.1. It is permissible to carry out this re-burnishing up to 50 times depending on the conditions of the braking system of the test vehicle.

(3) Warm-up operation

Perform a warm-up operation for the tires and braking system immediately before making the test run. With regard to the warm-up operation for the braking system, repeat the braking operation, as required, in the same way as the re-burnishing, until the brake temperature reaches the specified range. However, in cases where the test is conducted subsequent to the re-burnishing in Paragraph 4.2 (2), the test may be started immediately after the braking system cools down and the brake temperature prior to braking reaches the specified range.

(4) Setting up the proving ground

The width of the braking proving ground shall be 3.5 m. Signposts shall be installed on the proving ground. In order to provide wet conditions, water shall be sprinkled over the test road surface with a sprinkler truck to maintain slick water of around 2 mm thickness prior to each braking.

4.3 Testing

(1) Test sequence

The test shall be conducted under wet conditions and under dry conditions in that order. No braking other than the braking for the tests is allowed during the test, except braking for re-adjusting the measurement equipment and the trial run before the test.

(2) Designated speed

The designated speed shall be 100 km/h.

(3) Brake temperature before braking

The brake temperature before braking shall be 65–100°C.

(4) Braking method

The test vehicle shall be braked quickly on a braking proving ground as specified in Paragraph 4.2 (4) from the initial braking speed of the designated vehicle speed ±3 km/h specified in Paragraph 4.3 (2) with a pedal application force of 50 ± 3 daN. Measure the stopping distance at this time. The gear position of the transmission during braking shall be neutral. It is permissible to manipulate the steering wheel during braking so that the test vehicle remains within the braking proving ground.

(5) Number of tests
The number of tests shall be five for each condition. If any provisions concerning the initial braking speed, gear position of the transmission during braking and the pedal application force deviate, or if braking falls under the conditions in the following paragraphs, the braking shall be regarded as invalid and shall not be included in the number of tests:

(a) Cases where the required test results could not be obtained because of malfunctioning of measurement equipment or other malfunctions, or cases where the test results are judged explicitly as wrong

(b) Cases where there was apparent wrong operation by the driver, such as extremely slow application of the brake pedal

4.4 Measurement Data and Recording

(1) Brake temperature before braking
The brake temperature prior to braking shall be read and confirmed for each braking to the nearest 1°C.

(2) Initial braking speed
The initial braking speed shall be read for each braking to the nearest 0.1 km/h. Enter the initial braking speed in the relevant column of Appendix Table 2.

(3) Corrected value of stopping distance
The stopping distance shall be corrected for the designated speed, using the following formula. As for the second decimal place, fractions of 5 and over shall be counted as 10 and smaller fractions shall be discarded. Enter the thus-corrected value of the stopping distance to the first decimal place in the relevant column of Appendix Table 2.

\[ S_s = 0.1V_s + (S_a - 0.1V_a) \left( \frac{V_s}{V_a} \right)^2 \]

where:
- \( S_s \): Corrected value of stopping distance of test (unit: m)
- \( V_s \): Designated speed of test (unit: km/h)
- \( V_a \): Measured value of initial braking speed of test (unit: km/h)
- \( S_a \): Measured value of stopping distance of test (unit: m)

(4) Pedal application force
The pedal application force at a stable portion, except for momentary values, shall be read for each braking to the nearest 1 daN. Enter the thus-read pedal application force in the relevant column of Appendix Table 2.

(5) Deviation from vehicle lane
Confirmation shall be made for each braking to ascertain whether or not the test

- 5 -
vehicle deviated from the 3.5 m-wide braking proving ground during the braking, and entered in the relevant column of Appendix Table 2. If the vehicle deviated from the vehicle lane when the vehicle stopped, measure the maximum deviation from the vehicle lane and enter the amount in the relevant column of Appendix Table 2. Make an additional entry in the measurement section for the vehicle body.

5. Arrangement of Test Results

5.1 Record

Record the test conditions, specifications of the test vehicle, test date, meteorological conditions at the time of the test and so forth in Appendix Table 1.

5.2 Test Results

(1) Stopping distance

Exclude the maximum and minimum values from the corrected values of stopping distance of the results of the five valid tests recorded in Appendix Table 2. Then, calculate the mean value of the results of the three tests. As for the second decimal place, fractions of 5 and over shall be counted as 10 and smaller fractions shall be discarded, and the value entered to the first decimal place. Enter the stopping distance in the test results column of Appendix Table 2. However, if the number of tests could not reach five because of tire damage and so forth in the Braking Performance Test during Full Braking, if the number of tests is four, determine the mean value of the test results of the three tests excluding the minimum value. If the number of tests is three, determine the mean value of all the test results. Enter the thus-calculated stopping distance.

(2) Deviation from the vehicle lane

If the test vehicle deviated from the vehicle lane even once in the three test results that were used in calculating the stopping distance in Paragraph 5.2 (1), the deviation from vehicle lane shall be recorded as “deviated” in the test results column of Appendix Table 2.

6. Process of Dissent and Arbitration

(1) The vehicle manufacturer and importer may submit their own test results, which shall be specified in this test method to use the same model of test vehicle (optional equipment shall be the same as the test vehicle) prior to the test.

If the vehicle manufacturer and importer do not submit its own test results specified in this test method prior to the test, it may not object to the test results.

(2) The test institute shall submit the data of the test results, which are the stopping distance, deviation from the test lane, wind velocity, initial braking speed and pedal application force, to NASVA immediately after the test.
(3) After receiving the above-mentioned test data from the test institute, NASVA shall inform the manufacturer or the importer thereof.

(4) If the vehicle manufacturer and importer has some objection to the test results, they may submit a comparison of their own data and NCAP test results and also a reasoned objection with written technical evidence after receiving the above-mentioned test data. (It is allowed to dissent orally first, then submit a written dissent later.) If necessary, the vehicle manufacturer and importer may consult with NASVA before submitting an official dissent.

In this case, NASVA will request an investigation to the test institute based on the discussion results with the vehicle manufacturer and importer, and NASVA will inform the results of the investigation from the test institute to the vehicle manufacturer or importer.

(5) NASVA will decide whether to conduct a re-test or not after consulting with the test institute when necessary.

If test results are not proper due to mechanical trouble or functional failure of the vehicle, if necessary, NASVA may confirm with the vehicle manufacturer and importer. If possible, a re-test will be conducted on the same day, but the braking system, ABS, etc. of the test vehicle may need to be repaired and it may be impossible to re-test on the same day, in which case a re-test will be conducted at a later date.

(6) If NASVA decides to conduct a re-test, they will order the re-test to the test institute immediately after making such a decision. The cost of the re-test shall be paid by the test institute in case the cause is attributable to the operation of the test, but otherwise the vehicle manufacturer and importer shall cover all costs of the re-test.

(7) NASVA shall confirm the results of the re-test after receiving them, and inform the results to the vehicle manufacturer and importer.

(8) If NASVA decides it is not necessary to conduct a re-test, the test results will be finalized and informed to the vehicle manufacturer and importer.
Appendix Table 1
Test Conditions of Brake Performance Test and Specifications of Test Vehicle

Test Date: Y. M. D. Test Site: _____ Tested by:

1. Meteorological Conditions
   Weather: ___________ Ambient temperature: __________ °C
   Wind direction: ______________ Mean wind velocity: __________ m/s

2. Test Vehicle
   (1) Vehicle model name, Type:

   (2) Tires Installed at Time of Test

<table>
<thead>
<tr>
<th></th>
<th>Front wheel</th>
<th>Rear wheel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brand name, Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rim size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air inflation pressure (kPa)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3) Braking System

<table>
<thead>
<tr>
<th></th>
<th>Front wheel</th>
<th>Rear wheel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of braking system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braking system and Braking wheel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braking booster</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braking force control device</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(4) Weight distribution of the test vehicle

<table>
<thead>
<tr>
<th>Equivalent to riding of two people</th>
<th>Weight distribution(daN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Front wheel</td>
</tr>
<tr>
<td>Left wheel</td>
<td></td>
</tr>
<tr>
<td>Right wheel</td>
<td></td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

(Note) 1 daN = 1 kgf
# Appendix Table 2. Braking Performance Test Data Record Form

## 1. Wet conditions

<table>
<thead>
<tr>
<th>Test records</th>
<th>Test results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature of road surface (°C)</td>
<td></td>
</tr>
<tr>
<td>Initial braking speed (km/h)</td>
<td></td>
</tr>
<tr>
<td>Stopping distance</td>
<td></td>
</tr>
<tr>
<td>Measured value (m)</td>
<td>Corrected value (m)</td>
</tr>
<tr>
<td>100 km/h</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Deviated • Not deviated</td>
</tr>
<tr>
<td>2</td>
<td>Deviated • Not deviated</td>
</tr>
<tr>
<td>3</td>
<td>Deviated • Not deviated</td>
</tr>
<tr>
<td>4</td>
<td>Deviated • Not deviated</td>
</tr>
<tr>
<td>5</td>
<td>Deviated • Not deviated</td>
</tr>
</tbody>
</table>

## 2. Dry conditions

<table>
<thead>
<tr>
<th>Test records</th>
<th>Test results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature of road surface (°C)</td>
<td></td>
</tr>
<tr>
<td>Initial braking speed (km/h)</td>
<td></td>
</tr>
<tr>
<td>Stopping distance</td>
<td></td>
</tr>
<tr>
<td>Measured value (m)</td>
<td>Corrected value (m)</td>
</tr>
<tr>
<td>100 km/h</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Deviated • Not deviated</td>
</tr>
<tr>
<td>2</td>
<td>Deviated • Not deviated</td>
</tr>
<tr>
<td>3</td>
<td>Deviated • Not deviated</td>
</tr>
<tr>
<td>4</td>
<td>Deviated • Not deviated</td>
</tr>
<tr>
<td>5</td>
<td>Deviated • Not deviated</td>
</tr>
</tbody>
</table>