

This is a translation to English for reference purpose of JNCAP test method which is originally prescribed in Japanese language.

Please be sure to refer to the Japanese test method if you need to be precisely correct.

## **AUTONOMOUS EMERGENCY BRAKING SYSTEM [CAR-TO-CAR] PERFORMANCE TEST METHOD**

Created: April 1, 2014  
Revised: April 25, 2023  
March 23, 2022  
March 31, 2020

### **1. Effective Dates:**

This testing method will be put into operation starting April 1, 2014. However, the new regulations set on April 25, 2023 will go into effect starting April 25, 2023.

### **2. Scope of Application:**

This test procedure applies exclusively to the "Autonomous Emergency Brake System [car-to-car] Performance Test" of passenger vehicles with 9 occupants or less and commercial vehicles with a gross vehicle mass of 2.8 tons or less conducted by the National Agency for Automotive Safety and Victims' Aid (hereinafter referred to as "NASVA") in the new car assessment program information supply project.

### **3. Definition of Terms:**

The terms used in this testing method are defined as follows.

- (1) "**AEBS (Autonomous Emergency Braking System)**": Automatically manipulates the brakes to help avoid frontal collisions and to reduce collision speed.
- (2) "**FCWS (Forward Collision Warning System)**": A warning system that assesses frontal collision risk and prompts the driver to use the brakes either with audible/visual warning or audible/haptic warning.
- (3) "**T<sub>AEBS</sub>**": The time at which deceleration via AEBS first crosses  $0.3\text{m/s}^2$ .
- (4) "**T<sub>FCWS</sub>**": The time at which the warning system of the FCWS first gives off an audible warning.
- (5) "**Vehicle Target (VT)**": A test device that simulates the vehicle in front as shown in Appendix A.
- (6) "**CCRs**": Test scenarios in which the test target is held stationary.
- (7) "**CCRm**": A test scenario in which the test target is towed at a constant speed.
- (8) "**Reference runway**": A target course established for the test vehicle and the test target to travel on the same straight line.
- (9) "**Time to collision (TTC)**": The time remaining before collision when the test vehicle and the

test target maintain their current speed.

(10) **"Collision"**: The state at which the distance between the test vehicle and the VT becomes 0.

(11) **"Vimpact"**: The speed at which the test vehicle collides with the VT.

(12) **"Vrel\_impact"**: The relative speed at which the test vehicle collides with the VT.

(13) **"Initial Velocity Difference"**: The relative velocity of the test vehicle and the VT at  $T_{AEBS}$  for the AEBS test, and at  $T_{AEBS}$  or at  $T_{FCWS}$  whichever the earlier point in time for the FCW test

(14) **"Velocity Reduction Amount"**: Subtracts the speed at the time of collision from the initial speed.

(15) **"Velocity Reduction Rate"**: The Deceleration Rate divided by the Initial Speed Difference.

(16) **"Lateral position"**: The lateral distance between the center-front of the test vehicle and the center-rear of the Standard Track. (Fig. 1)

(17) **"Lateral Offset"**: The difference between the test vehicle's Lateral Errors and the VT. (Fig. 1)

(18) **"Brake Pedal Stroke"**: The amount of depression applied on the test vehicle's brake.

(19) **"Accelerator Stroke"**: The amount of depression applied on the test vehicle's accelerator.

(20) **"Mass at Vehicle Delivery "**: The test vehicle's condition when fully loaded with fuel, lubricants, coolants, etc. in the engine and fueling system, and equipped with onboard tools, spare tire, and standard accessories.

(21) **"Pre-Braking Brake Temperature"**: The higher of the average temperatures of left and right wheels of each axle pursuant to the procedures of JIS D 0210 when the temperature of the brake lining or pad of each wheel is measured immediately before the start of each running for braking with the vehicle in fixed position.

(22) **"Brake Temperature Check Unit"**: A device to check the brake temperature by thermocouple measurement before the test vehicle's brakes is used.

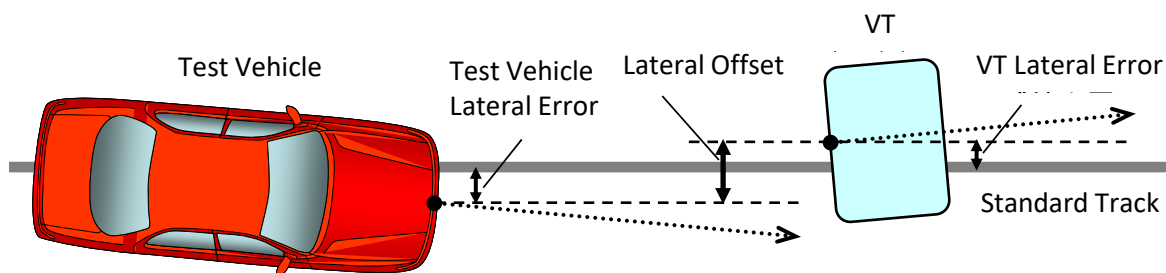


Figure 1: Lateral Error and Lateral Offset

## 4. Test Conditions

### 4.1 Provision of Data from Vehicle Manufacturer

The vehicle manufacturer is to provide NASVA with the data necessary for test preparation (Appendix 1) and, if the test vehicle complies with UN-R152, documents certifying that the approval of UNR152 has been granted for the vehicle (e.g., specification sheet, certificate of approval issued based on the "Agreement concerning the Adoption of Harmonized Technical United Nations

Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations (1958 agreement)").

#### 4.2 Test Vehicle's Condition

The test vehicle's condition shall be as follows:

- (1) **Load Condition:** The mass of the test vehicle with one driver (including the measurement equipment) shall be the Mass at Vehicle Delivery + 200kg ( $\pm 1\%$ ). Front axle/rear axle weight distribution (%) shall be on a par ( $\pm 5\%$ ) with that of the Mass at Vehicle Delivery.

If the preceding requirement is not met, parts may be removed or installed as long as the performance is not adversely affected. Weight-increasing parts should be securely fitted.

- (2) **Tires:** The tires installed at the time of purchase of the test vehicle shall be used. The breaking-in of the tires shall be done in conjunction with the brake conditioning of the following items. Additionally, the tire air pressure shall be set before running (normal temperature) on a level surface, at the value for ordinary run defined in Section 5.1.
- (3) **Brake system:** The brake discs, drums and linings that are installed at the time of the purchase of the test vehicle shall be used. The brake system shall be adjusted properly without any impact of abnormal heat history, getting wet, etc.
- (4) **Drive axis:** When the drive axis may be selected, choose the default.
- (5) **AEBS and FCWS setup:** If the driver can set up the activation timing of AEBS and/or FCW, use the median of the allowed scope. If there is no median (when the setup options are an even number), choose the value closest to the median on the side on which the timing of activation start will be later.
- (6) **Protection devices:** If passenger or pedestrian protection devices are installed, set such devices not to be activated.

#### 4.3 Test Track

The test track shall meet the following requirements:

- (1) The test track shall be a flat, dry, and clean paved road surface without any leaves, dirt, etc.
- (2) The test track shall have a friction coefficient of about 0.9 under dry conditions. The measurement procedure shall comply with ASTM E1337. The test tires: ASTM E1136, the test load:  $4586 \pm 67\text{N}$ , the tire air pressure:  $241 \pm 3\text{kPa}$ , and the speed:  $64 \pm 0.8\text{km/h}$ .
- (3) During testing, there shall be no obstacles within a lateral distance of 3.0m to either side of the Standard Track and with a longitudinal distance of 30m ahead of the test vehicle when the test ends. Additionally, at the points where AEBS activation or deceleration by post-FCWS braking is expected to take place, there shall no road paint or markings.

#### 4.4 Weather Conditions

- (1) The temperature during testing shall be  $-5^{\circ}\text{C} \sim 40^{\circ}\text{C}$ .
- (2) The average wind speed during testing shall be 5m/s or less.
- (3) Visibility during testing shall be at least 1km.
- (4) A declaration by a vehicle manufacturer might allow the following tests under sunlight

conditions to be avoided:

- ① Illumination during testing is 2000 lx or less
- ② A dark shadow from a source other than the test vehicle or VT near the Standard Track
- ③ Direct sunlight on the test vehicle from the front or the rear
- ④ The temperature during testing is under 5°C

#### **4.5 Measurement Items**

The items of the test shall be measured as described below and the sampling frequency shall be 100Hz or more. Furthermore, for yaw rate and longitudinal acceleration, the high-frequency component shall be eliminated at a cutoff frequency of 10Hz.

- (1)  $T_{AEBS}$
- (2)  $T_{FCWS}$
- (3) Collision time
- (4) Test vehicle and VT positions
- (5) Test vehicle and VT speeds
- (6) Test vehicle and VT yaw rate
- (7) Test vehicle and VT longitudinal acceleration
- (8) Test vehicle steering velocity
- (9) Brake Pedal Stroke
- (10) Accelerator Stroke
- (11) Pre-Braking Brake Temperature

#### **4.6 Measurement Equipment**

The following measuring equipment for testing shall be capable of smoothly handling the data of the measurement items covered in Section 4.5. Additionally, before conducting the test, the test vehicle position shall be verified. As for the other measurement equipment, accuracy shall be checked based on the results of calibration by the measurement equipment manufacturer.

- (1) Test vehicle position measurement device: Accuracy of test vehicle position for each test shall be  $\pm 0.03\text{m}$ .
- (2) Test vehicle speed measurement device: Accuracy of test vehicle speed for each test shall be  $\pm 0.1\text{km/h}$ .
- (3) Yaw rate measurement device: Accuracy of yaw rate for each test shall be  $\pm 0.1^\circ/\text{s}$ .
- (4) Longitudinal acceleration measurement device: Accuracy of longitudinal acceleration for each test shall be  $\pm 0.1\text{m/s}^2$ .
- (5) Steering wheel velocity measurement device: Accuracy of steering wheel velocity for each test shall be  $\pm 1^\circ/\text{s}$ .
- (6) Brake pedal stroke measurement device: Accuracy of brake pedal stroke for each test shall be  $\pm 1\text{mm}$ .
- (7) Accelerator stroke measurement device: Accuracy of accelerator stroke for each test shall be  $\pm 1\%$ .
- (8) Brake Temperature Check Unit: Accuracy of temperature of each test shall be  $\pm 3\%$ .

## **5. Pre-test run**

### **5.1 Brake Conditioning**

To condition the brake discs, drums and linings of the test vehicle, (excluding the conditioning of that was carried out in other tests), the process of accelerating to 64km/h and braking to the result in deceleration of  $3.7\text{m/s}^2$  and vehicle stop shall be repeated 200 times. The interval between the initial and second braking shall be either the time required to reduce the brake temperature to  $110^\circ\text{C}\sim 132^\circ\text{C}$  or the distance of 1.6km, whichever occurs earlier. After every stop, the vehicle shall be accelerated to 64km/h and keep that speed until the next braking. (Brake Conditioning is equivalent to that provided in FMVSS105 S7.4.1.1.)

Furthermore, if the vehicle manufacturer requests it, the test vehicle is allowed to run up to 100km on ordinary roads to initialize sensor units. As long as the conditions required for initialization are met, the initialization work may be performed in conjunction with the above conditioning run.

### **5.2 Re-brake conditioning**

In the case of the first braking system test for the test car (generic term of the test carrying out brake conditioning of section 5.1), before starting the test, repeat the process of section 5.1 at least 35 times in principle for re-conditioning. Further, when the period from the conditioning run of section 5.1 to the test exceeded two weeks, the process may be repeated up to 50 times depending on the condition of the brake system in the test vehicle.

In the case of second or more braking system test (same when it takes multiple days in the same test), 35times if one week or more has passed since the previous test data, and 50 times at most if two weeks or more have passed, it is possible to carry our re-brake conditioning.

If re-brake conditioning test is not carried out on the day of test, warm up run should be carried out until the brake temperature exceed  $100^\circ\text{C}$  by the procedure of the section 5.1.

## **6 Test Method**

### **6.1 Testing**

- (1) Test scenario: Two types of tests shall be conducted for each of the AEBS and FCWS evaluation tests: CCRs and CCRm with VT towed at speed of 20km/h. (See Figure 2)

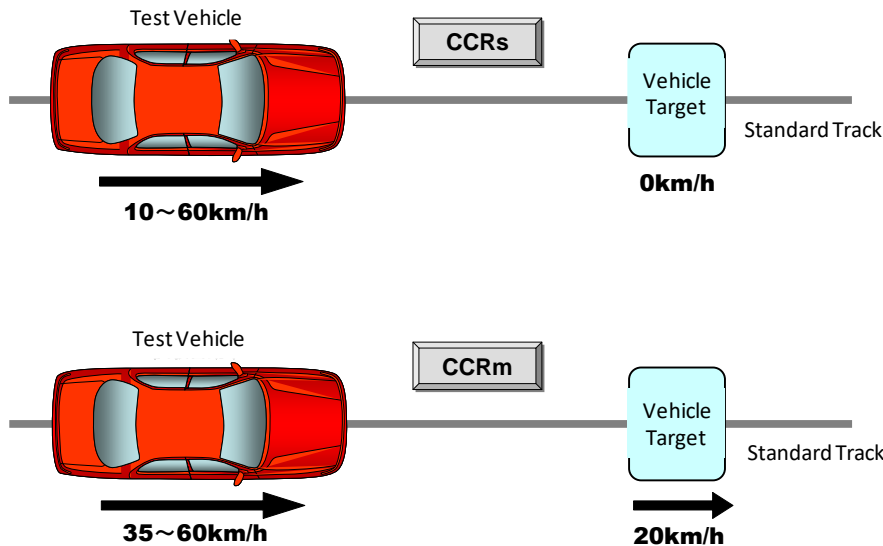


Figure 2: Test Scenario

(2) Test Vehicle Speed: The test vehicle's speed shall be within the parameters as described in Table 1, and the test will be performed by starting at the lowest speed and increasing it in increments of 5km/h or 10km/h. Furthermore, the vehicle's starting speed may be increased or decreased upon declaration of a vehicle manufacturer. However, AEBS test for CCRs at speed condition of 55km/h and 60km/h shall be performed when  $V_{rel}$  impact at those speed conditions becomes less than 50km/h as per the result of the pre-data, etc. In either case, test results for speed conditions unperformed shall be treated in the same manner as when the device is not activated.

Table 1: Test Vehicle Speed

	AEBS Test	FCWS Test
<b>CCRs Scenario</b>	<b>10~60km/h</b>	<b>10~60km/h</b>
<b>CCRm Scenario</b>	<b>35~60km/h</b>	<b>35~60km/h</b>

- (3) Transmission: For test vehicles with automatic transmissions, use the D-range. For vehicles with manual transmissions, use the highest gear where the engine's RPM will be at least 1500 at the test speed, and do not disengage the clutch during testing.
- (4) Test Measurement Sections: Measurements shall start when the test vehicle approaches the VT and the TTC reaches 4.0 sec. Measurements shall finish when any of the following conditions are reached:
- ① The test vehicle is stopped
  - ② The test vehicle's speed becomes lower than the VT speed
  - ③ The test vehicle collides with the VT
- (5) Requirements for Successful Completion of Test: In the time between the initial measurement and the moment when the initial speed gap is obtained, if the prescribed measurement items

deviate from the permissible error shown in Table 2, and when the test video of Section 6.3 is not acquired (except when the driving status of the test car, the operating status of the test target and the collision / avoidance status can be confirmed by the in-vehicle video or the outside video), the attempted test shall be deemed invalid (foul) and shall not be counted in the number of tests. In addition, the measured value etc. shall round off the value less than the unit in each item. (Same in case in below test method)

If any abnormality is observed in the operation of the test target, the recorded test video shall be checked and if the abnormality is evident, it shall be considered as a foul and shall not be included in the test count.

Table 2: Permissible Errors in Test Conditions

Test Condition	Permissible Range
Test Vehicle Speed	Test Speed + 1.0 km/h or less
VT Speed	20.0 ± 1.0 km/h or less
Lateral Offset	± 0.20 m or less
Yaw Rate	± 1.0°/s or less
Steering Wheel Velocity	± 15.0°/s or less
Brake Temperature before braking	65-100°C

(6) Number of Tests: The tests shall be performed once for each test speed. However, if the vehicle manufacturer provides pre-data that shows a deviation of more than 5km/h in the descending speed between median value of pre-data and official test result, the test shall be conducted three times.

Additionally, the third test can be omitted if the following conditions occur:

- ① A collision is avoided twice in a row
- ② The velocity reduction rate is same twice in a row

Furthermore, the number of pre-data tests is once in case collision avoided in each test speed. (or three times if it's not avoided) if it falls under the above ② conditions. The third test can be omitted.

(7) Test Implementation Procedures: For both the CCRs and the CCRm, the tests shall be started at the lowest speed condition or the speed condition declared by the vehicle manufacturer. In addition, those vehicles that have been confirmed to comply with UN-R152 by the documents provided in Section 4.1 shall be treated as having avoided a collision under the speed conditions of CCRs 10 to 40 km/h and CCRm 35 to 60 km/h. The test vehicle's speed shall be increased in increments of 5km/h; however, when collisions are avoided more than 2 times out of 3 tests, the test vehicle speed may be raised by 10km/h (the 5km/h increment will be passed). When

collisions are avoided under a condition of 10km/h higher as well, collisions are deemed to be avoided for passed 5km/h increment. However, when collisions could not be avoided 2 times or more out of 3 tests, the test vehicle speed shall lowered by 5km/h and the test for passed 5km/h increment must also be performed.

Subsequently, take the same procedures to conduct tests up to the highest speed condition or the one declared by the vehicle manufacturer, etc. However, notwithstanding the above, the test will be ended when either of the following 1 or 2 is met.

1. The Velocity Reduction Amount is less than 5km/h in one test in the case that the Velocity Reduction Amount is measured by one test or in two out of three tests in the case that the Velocity Reduction Amount is measured by two or three tests due to deviation from the prior data during the same speed condition test.

2. The Vrel impact is 50km/h or more two times.

Also, in CCRs at speed condition of 55km/h and 60km/h, if FCWS is not activated when TTC becomes less 1.2 seconds at FCWS test and if FCWS or AEBS is not activated when TTC becomes less than 1.2 seconds at AEBS test, the driver shall be able to avoid a collision or to reduce a collision impact by braking. In such cases, FCWS and AEBS are regarded as not activated and no activation shall be the test result.

(8) Accelerator Operation during the AEBS Test: During the measurement section, the accelerator stroke shall be held constant so as not to cause any impact on the activation of AEBS. Further, for those test vehicles on which the accelerator is controlled when AEBS is activated, upon consultation with the vehicle manufacturer, the accelerator stroke during AEBS activation may be adjusted.

(9) Accelerator/Brake Operation during the FCWS Test: The test vehicle accelerator shall be released 1.0 seconds after  $T_{FCWS}$ . The brake pedal shall be pressed down 1.2 seconds after  $T_{FCWS}$ , taking 0.2 seconds to reach the point where deceleration under non-threat situation of  $4.0 (+0.25)m/s^2$  is generated (however, maximum pedal application rate is at 400mm/s), and prescribed pedal force shall be maintained. For these brake operation setup values (Brake Pedal Stroke, application rate and pedal force), the value declared by the vehicle manufacturer shall be used. When the vehicle manufacturer submits no setup values or when the deceleration under non-threat situation exceeds the permissible range ( $4.00\sim4.25m/s^2$ ), the setup shall be performed by NASVA in accordance with the steps described in Appendix B.

(10) When it is obvious that the same results with the AEBS test will be obtained from the FCWS test, the results of the AEBS test may be deemed the result of the test.

## **6.2 Measurement Data and Recording**

(1) Confirmed Completion of Testing: For each test, confirm whether the test conditions meet the permissible error of Table 2.

(2) Collision Avoided Yes/No: For each test, confirm whether collisions were avoided, and record the presence or absence of a collision and the measurement data for the next and subsequent items in Attached Table 2.



- (3) Initial Velocity Difference: Record the Initial Velocity Difference in units of 0.1km/h.
- (4) Velocity Reduction Amount: Record the Velocity Reduction Amount in units of 0.1km/h.
- (5) Velocity Reduction Rate: Rounding off to two decimal places, and record the Velocity Reduction Rate obtained.

### **6.3 Recording Footage of the Tests**

- (1) Images inside the vehicle: Images of front of the test vehicle, near the driver's seats and FCWS activation status shall be recorded by a video camera installed in the test vehicle interior.  
(Filming can be canceled in consultation with the vehicle manufacturer if poor lighting conditions hinder the quality of these images.)
- (2) Images outside the vehicle: A video camera installed on the side of the test track at the point where a collision between the test vehicle and the test target is expected to occur will be used to record the driving conditions of the test vehicle and the collision/avoidance conditions with the test target.

## **7. Organizing Test Results**

Record test results, etc. in Attached Table 2.

The Velocity Reduction Rate of each test speed shall be either the obtained value by one valid test, or the median of 3 valid test results conducted 3 times due to deviation in the Velocity Reduction from pre-data based on Section 6.1 (6). The Velocity Reduction Rate of the condition when collisions are avoided shall be 1.00.

Furthermore, if only 2 tests are conducted in accordance with the Sections in 6.1 (6) and (7), The Velocity Reduction Rate shall be the obtained value by two valid tests in the case that Section 6.1 (6) is applied, and The Velocity Reduction Rate shall be the lower value of the two valid test results in that case that Section 6.1 (7) is applied.

## ATTACHMENT A: VT SPECIFICATIONS

For the VT, those having specifications equivalent to those of the Euro-NCAP (Test Protocol - AEBS systems Version1.0 July 2013 ATTACHMENT A EVT SPECIFICATIONS) shall be used.

Attached Diagram 1 shows external appearance of the VT.

The VT is designed to be detected by such sensors as laser radars, millimeter-wave radars and cameras in an equivalent manner to Segment C vehicles in the EU.

A "JNCAP" logo made of fabric shall be placed in the license plate position of the VT. VT air pressure shall be set to 25kPa, which will be maintained during testing.



Attached Diagram 1: External appearance of VT

## ATTACHMENT B: HOW TO SET UP BRAKE OPERATIONS FOR FCWS TEST

### B.1 Definitions

- (1)  $T_{\text{BRAKE}}$ : When the brake pedal stroke exceeded 5mm
- (2)  $T_{2\text{m/s}^2}$ : When the filtered deceleration data exceeded  $2\text{m/s}^2$  for the first time
- (3)  $T_{6\text{m/s}^2}$ : When the filtered deceleration data exceeded  $6\text{m/s}^2$  for the first time

### B.2 Measurement Method

Apply the measurement method and filtering described in Chapter 3.

### B.3 Test Procedure for Brake Input Characteristics

#### B.3.1 Test Preparation

Perform the warm-up operation of brakes and tires defined in the remarks to Section 5.2 first.

Check brake input characteristics right before conducting the FCWS test.

#### B.3.2 Brake Input Characteristics Test

- (1) Accelerate the test vehicle to be  $85\text{km/h}$  or more. For test vehicles with automatic transmissions, select D-gear. For vehicles with manual transmissions, select the highest gear where the RPM will be at least 1500 at the test speed.
- (2) Release the accelerator and when the speed becomes slower than  $80 (\pm 1) \text{ km/h}$ , start applying brakes at the pedal application rate of  $20 (\pm 5) \text{ mm/s}$  until deceleration becomes  $7\text{m/s}^2$ . For manual transmissions, throw out the clutch at the earliest timing possible before the RPM will be 1500rpm or less. When the deceleration becomes  $7\text{m/s}^2$ , end the test and measure the Brake Pedal Stroke and pedal force in operation.
- (3) Perform the above test 3 times in a row. The interval between tests shall be between 90 seconds and 10 minutes, and when 10 minutes is passed, perform the warm-up operation again before resuming the test.
- (4) Based on the deceleration data from the Brake Pedal Stroke between  $T_{2\text{m/s}^2}$  and  $T_{6\text{m/s}^2}$ , apply quadratic curve approximation using least square, and calculate the Brake Pedal Stroke corresponding to deceleration  $4\text{m/s}^2$  (which shall be "D4" in unit of m. For the pedal force as well, use the same method to obtain the pedal force value corresponding to deceleration  $4\text{m/s}^2$  (which shall be "F4" in unit of N).

#### B.3.3 How to Set Up Brake Pedal Force and Repeating the Procedure

- (1) Run the test vehicle constantly at  $80(+1) \text{ km/h}$ . The test vehicle gear position shall be the same as B.3.2.
- (2) By manual trigger, not in response to FCWS, apply the brakes in accordance with the steps described in B.4. Based on the measured deceleration data, obtain average deceleration of the sections from  $T_{\text{BRAKE}}+1 \text{ sec}$  to  $T_{\text{BRAKE}}+3 \text{ sec}$ . If the average deceleration deviates from 4 (+0.25)  $\text{m/s}^2$ , use the correction formula below to correct the F4 value.

$$F4_{\text{new}} = F4_{\text{original}} * (4 / \text{average deceleration})$$

(e.g., when average deceleration is  $5\text{m/s}^2$ ,  $F_{4\text{new}} = F_{4\text{original}} * 4 / 5$ )

Use the corrected  $F_4$  and repeat brake operations of B.4 so that the average deceleration will be within a scope of  $4 (+0.25)\text{m/s}^2$ .

#### **B.4 Brake Operations during FCWS Test**

- (1) Detect the activation of FCWS, time of which shall be  $T_{\text{FCW}}$ .
- (2) Release the accelerator at  $T_{\text{FCW}}+1$  sec.
- (3) Brake pedal stroke control shall start at  $T_{\text{FCW}}+1.2$  sec, and the application rate shall be either  $D4 \times 5$  mm/s or  $400\text{mm/s}$ , whichever is smaller. (In other words, it shall be the speed at which the stroke reaches  $D4$  in  $200\text{ms}$ , and the upper limit value shall be  $400\text{mm/s}$ .)
- (4) Monitor the pedal force values processed by second-order filtering with a cutoff frequency  $20\text{Hz}$  or moving average at  $50\text{ms}$ , and upon reaching either of the following, switch to the pedal force control with target value of  $F_4$ . The time of the switch shall be recorded as  $T_{\text{switch}}$ .

- ① When the stroke  $D4$  defined in B.3 is exceeded for the first time.
- ② When the pedal force value  $F_4$  defined in B.3 is exceeded for the first time.

Furthermore, when it is shifted to pedal force control before reaching enough pedal stroke after performing filtering, etc., upon consultation with the vehicle manufacturer,  $T_{\text{switch}}$  timing may be adjusted. (For example, take a measure not to switch to pedal force control until reaching certain pedal stroke.)

- (5) At  $T_{\text{switch}}$  onward, control the brake pedal in such a way that the pedal force will be  $F_4 \pm 25\%$ .  
Stable pedal force control should be realized within  $200\text{ms}$  from  $T_{\text{switch}}$ ; however, even when the pedal force value exceeds  $F_4 \pm 25\%$  due to intervention by AEBS, it shall be acceptable when duration is  $200\text{ms}$  or less.
- (6) It is desirable that the pedal force average value will be in the range of  $F_4 \pm 10\text{N}$  from  $T_{\text{FCW}}+1.4$  sec to the end of the test.

## APPENDIX 1: COLLISION DAMAGE MITIGATION PERFORMANCE [CAR-TO-CAR] TEST CONDITIONS AND TEST VEHICLE SPECIFICATION

[To be filled in by Vehicle Manufacturer]

### 1. Test Vehicle Specification

(1) Model/Type (Model Name): \_\_\_\_\_ / \_\_\_\_\_ (\_\_\_\_\_)

(2) Sensor System: \_\_\_\_\_

(3) Installed Tires

	Front	Rear
Size		
Brand/Type		
Air Pressure (kPa)		

### 2. Declarations by Vehicle Manufacturer

(1) AEBS Test Start Vehicle Speed CCRs: \_\_\_\_\_ km/h CCRm: \_\_\_\_\_ km/h

(2) AEBS Test End Vehicle Speed CCRs: \_\_\_\_\_ km/h CCRm: \_\_\_\_\_ km/h

(3) FCWS Available or Not: Available / Not available

(4) FCWS Test Start Vehicle Speed CCRs: \_\_\_\_\_ km/h CCRm: \_\_\_\_\_ km/h

(5) FCWS Test End Vehicle Speed CCRs: \_\_\_\_\_ km/h CCRm: \_\_\_\_\_ km/h

(6) FCWS Function Specification: "Auditory and visual information" and "auditory and haptic information"

Frequency of auditory information: \_\_\_\_\_ Hz \_\_\_\_\_ Hz

Attach a document stating the location of the provision of such information (speaker location, display location, etc.).

(7) FCWS Test Brake Operation Setup Values

Brake Pedal Stroke: \_\_\_\_\_ mm Application rate: \_\_\_\_\_ mm/s Pedal force: \_\_\_\_\_ N

(8) Timing Manual Setup at Activation Start?: Yes ( \_\_\_\_\_ ) / No

(9) Limitations of sunlight conditions during testing: Applicable / NA (no need to consider daytime/nighttime, shadows, backlight, etc)

(10) Limit on number of AEBS activations: Applicable (up to \_\_\_\_\_ times per run) / NA

(11) Protection device: Document describing how to deactivate the passenger protection device and pedestrian protection device, or document describing brief overview of the modification for deactivation

(12) Pre-data submission: Yes (Attached Table 3 or equivalent) / No

(13) UN-R152 Conformance Status: Conform / Incompatible

(14) Notes

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3. Functions, Cautions, etc. of Systems to Support Users

Documents shall be attached relating to the idea of the subjects and conditions of activation, and functions of systems, as determined by the vehicle manufacturer.

## APPENDIX 2: COLLISION DAMAGE REDUCTION SYSTEM [CAR-TO-CAR] PERFORMANCE TEST RESULTS

[To be filled in by Testing Institute]

Test date (YYYY/MM/DD): \_\_\_\_\_ Place : \_\_\_\_\_

### 1. Test Vehicle Specifications

(1) Model/Type (Model Name): \_\_\_\_\_ / \_\_\_\_\_ ( \_\_\_\_\_ )

(2) Frame number: \_\_\_\_\_

(3) Sensor system: \_\_\_\_\_

(4) Installed tires

	Front	Rear
Size		
Brand/Type		
Air pressure (kPa)		

(5) Test Vehicle Load Allocation

		Left Wheel	Right Wheel	Subtotal	Grand Total	Front-rear Distribution
Load Distribution at Vehicle Delivery (daN)	Front Axle					%
	Rear Axle					%
Load Distribution at Testing (daN)	Front Axle					%
	Rear Axle					%

(Note) Indicate as 1daN = 1kgf

### 2. Declarations by Vehicle Manufacturer

(1) AEBS Test Start Speed CCRs: \_\_\_\_\_ km/h CCRm: \_\_\_\_\_ km/h

(2) AEBS Test End Speed CCRs: \_\_\_\_\_ km/h CCRm: \_\_\_\_\_ km/h

(3) FCWS Available or Not: Available / Not available

(4) FCWS Test Start Speed CCRs: \_\_\_\_\_ km/h CCRm: \_\_\_\_\_ km/h

(5) FCWS Test End Speed CCRs: \_\_\_\_\_ km/h CCRm: \_\_\_\_\_ km/h

(6) FCWS specifications: audible/visual information / audible/haptic information

(7) FCWS Test Brake Operation Setup Values

Test implemented or not: Yes/ No

Brake Pedal Stroke: \_\_\_\_\_ mm Application rate: \_\_\_\_\_ mm/s Pedal force: \_\_\_\_\_ N

(8) Timing Manual Setup at start: Set up ( \_\_\_\_\_ ) / NA

### 3. Environmental Conditions

Day 1 Test date (YYYY/MM/DD):\_\_\_\_\_ Place:\_\_\_\_\_

Start Time:\_\_\_\_\_ Weather:\_\_\_\_\_ Temp.:\_\_\_\_\_ Wind Speed:\_\_\_\_\_

End Time: \_\_\_\_\_ Weather:\_\_\_\_\_ Temp.:\_\_\_\_\_ Wind Speed:\_\_\_\_\_

Remarks:\_\_\_\_\_

Day 2 Test date (YYYY/MM/DD):\_\_\_\_\_ Place:\_\_\_\_\_

Start Time:\_\_\_\_\_ Weather:\_\_\_\_\_ Temp.:\_\_\_\_\_ Wind Speed:\_\_\_\_\_

End Time: \_\_\_\_\_ Weather:\_\_\_\_\_ Temp.:\_\_\_\_\_ Wind Speed:\_\_\_\_\_

Remarks:\_\_\_\_\_

Day 3 Test date (YYYY/MM/DD):\_\_\_\_\_ Place:\_\_\_\_\_

Start Time:\_\_\_\_\_ Weather:\_\_\_\_\_ Temp.:\_\_\_\_\_ Wind Speed:\_\_\_\_\_

End Time: \_\_\_\_\_ Weather:\_\_\_\_\_ Temp.:\_\_\_\_\_ Wind Speed:\_\_\_\_\_

Remarks:\_\_\_\_\_



#### 4. Test Results

##### (1) AEBS test for CCRs

			(a)	(b)	(c) = (a)-(b)	(d) =(c)/ (a)	
Velocity Conditions	Number of Tests	Avoided or Not (*)	Initial Velocity	Speed at Collision	Velocity Reduction Amount	Velocity Reduction Rate	Velocity Reduction Rate Median
10km/h	1st						
	2nd						
	3rd						
15km/h	1st						
	2nd						
	3rd						
20km/h	1st						
	2nd						
	3rd						
25km/h	1st						
	2nd						
	3rd						
30km/h	1st						
	2nd						
	3rd						
35km/h	1st						
	2nd						
	3rd						
40km/h	1st						
	2nd						
	3rd						
45km/h	1st						
	2nd						
	3rd						
50km/h	1st						
	2nd						
	3rd						
55km/h	1st						
	2nd						
	3rd						
60km/h	1st						
	2nd						
	3rd						

(\*) ○: Collision avoided, P: Passed (deemed avoided), △: Speed reduced, x: No activation, —: Not implemented

(2) FCWS test for CCRs			(a)	(b)	(c) = (a)-(b)	(d) =(c)/ (a)	
Velocity Conditions	Number of Tests	Avoided or Not (*)	Initial Velocity	Speed at Collision	Velocity Reduction Amount	Velocity Reduction Rate	Velocity Reduction Rate Median
10km/h	1st						
	2nd						
	3rd						
15km/h	1st						
	2nd						
	3rd						
20km/h	1st						
	2nd						
	3rd						
25km/h	1st						
	2nd						
	3rd						
30km/h	1st						
	2nd						
	3rd						
35km/h	1st						
	2nd						
	3rd						
40km/h	1st						
	2nd						
	3rd						
45km/h	1st						
	2nd						
	3rd						
50km/h	1st						
	2nd						
	3rd						
55km/h	1st						
	2nd						
	3rd						
60km/h	1st						
	2nd						
	3rd						

(\*) ○: Collision avoided, P: Passed (deemed avoided), △: Speed reduced, x: No activation, —: Not implemented

(3) AEBS test for CCRm			(a)	(b)	(c) = (a)-(b)	(d) =(c)/ (a)	
Velocity Conditions	Number of Tests	Avoided or Not (*)	Initial Velocity Difference	Relative Speed at Collision	Velocity Reduction Amount	Velocity Reduction Rate	Velocity Reduction Rate Median
35km/h	1st						
	2nd						
	3rd						
40km/h	1st						
	2nd						
	3rd						
45km/h	1st						
	2nd						
	3rd						
50km/h	1st						
	2nd						
	3rd						
55km/h	1st						
	2nd						
	3rd						
60km/h	1st						
	2nd						
	3rd						

(\*) ○: Collision avoided, P: Passed (deemed avoided), △: Speed reduced, x: No activation, —: Not implemented

(4) FCWS test for CCRm			(a)	(b)	(c) = (a)-(b)	(d) =(c)/ (a)	
Velocity Conditions	Number of Tests	Avoided or Not (*)	Initial Velocity Difference	Relative Speed at Collision	Velocity Reduction Amount	Velocity Reduction Rate	Velocity Reduction Rate Median
35km/h	1st						
	2nd						
	3rd						
40km/h	1st						
	2nd						
	3rd						
45km/h	1st						
	2nd						
	3rd						
50km/h	1st						
	2nd						
	3rd						
55km/h	1st						
	2nd						
	3rd						
60km/h	1st						
	2nd						
	3rd						

(\*) ○: Collision avoided, P: Passed (deemed avoided), △: Speed reduced, x: No activation, —: Not implemented

**Attached Table 3: COLLISION DAMAGE REDUCTION SYSTEM [CAR-TO-CAR]  
PERFORMANCE TEST RESULTS**

**[For advance data as defined in the detailed regulations of the New Car, etc. Assessment  
Information Provision Project]**

\*Only the results of tests conducted on the same type of vehicle as the assessment test vehicle (with optional equipment similar to that of the test vehicle) using the test methods specified by NASVA may be submitted.

Test date (YYYY/MM/DD): \_\_\_\_\_ Place : \_\_\_\_\_

**1. Test Vehicle Specifications**

(1) Model/Type (Model Name): \_\_\_\_\_ / \_\_\_\_\_ ( \_\_\_\_\_ )

(2) Sensor system: \_\_\_\_\_

(3) Installed tires

	Front	Rear
Size		
Brand/Type		
Air pressure (kPa)		

(4) Test Vehicle Load Allocation

		Left Wheel	Right Wheel	Subtotal	Grand Total	Front-rear Distribution
Load Distribution at Vehicle Delivery (daN)	Front Axle					%
	Rear Axle					%
Load Distribution at Testing (daN)	Front Axle					%
	Rear Axle					%

(Note) Describe 1daN as 1kgf

**2. Testing Conditions:**

(1) AEBS Test Start Speed      CCRs: \_\_\_\_\_ km/h      CCRm: \_\_\_\_\_ km/h  
 (2) AEBS Test End Speed      CCRs: \_\_\_\_\_ km/h      CCRm: \_\_\_\_\_ km/h  
 (3) FCWS Available or Not: Available / Not available  
 (4) FCWS Test Start Speed      CCRs: \_\_\_\_\_ km/h      CCRm: \_\_\_\_\_ km/h  
 (5) FCWS Test End Speed      CCRs: \_\_\_\_\_ km/h      CCRm: \_\_\_\_\_ km/h



#### 4. Test Results

##### (1) AEBS test for CCRs

			(a)	(b)	(c) = (a)-(b)	(d) =(c)/ (a)	
Velocity Conditions	Number of Tests	Avoided or Not (*)	Initial Velocity	Speed at Collision	Velocity Reduction Amount	Velocity Reduction Rate	Velocity Reduction Rate Median
10km/h	1st						
	2nd						
	3rd						
15km/h	1st						
	2nd						
	3rd						
20km/h	1st						
	2nd						
	3rd						
25km/h	1st						
	2nd						
	3rd						
30km/h	1st						
	2nd						
	3rd						
35km/h	1st						
	2nd						
	3rd						
40km/h	1st						
	2nd						
	3rd						
45km/h	1st						
	2nd						
	3rd						
50km/h	1st						
	2nd						
	3rd						
55km/h	1st						
	2nd						
	3rd						
60km/h	1st						
	2nd						
	3rd						

(\*) ○: Collision avoided, P: Passed (deemed avoided), △: Speed reduced, x: No activation, —: Not implemented

(2) FCWS test for CCRs			(a)	(b)	(c) = (a)-(b)	(d) =(c)/ (a)	
Velocity Conditions	Number of Tests	Avoided or Not (*)	Initial Velocity	Speed at Collision	Velocity Reduction Amount	Velocity Reduction Rate	Velocity Reduction Rate Median
10km/h	1st						
	2nd						
	3rd						
15km/h	1st						
	2nd						
	3rd						
20km/h	1st						
	2nd						
	3rd						
25km/h	1st						
	2nd						
	3rd						
30km/h	1st						
	2nd						
	3rd						
35km/h	1st						
	2nd						
	3rd						
40km/h	1st						
	2nd						
	3rd						
45km/h	1st						
	2nd						
	3rd						
50km/h	1st						
	2nd						
	3rd						
55km/h	1st						
	2nd						
	3rd						
60km/h	1st						
	2nd						
	3rd						

(\*) ○: Collision avoided, P: Passed (deemed avoided), △: Speed reduced, x: No activation, —: Not implemented



(3) AEBS test for CCRm			(a)	(b)	(c) = (a)-(b)	(d) =(c)/ (a)	
Velocity Conditions	Number of Tests	Avoided or Not (*)	Initial Velocity Difference	Relative Speed at Collision	Velocity Reduction Amount	Velocity Reduction Rate	Velocity Reduction Rate Median
35km/h	1st						
	2nd						
	3rd						
40km/h	1st						
	2nd						
	3rd						
45km/h	1st						
	2nd						
	3rd						
50km/h	1st						
	2nd						
	3rd						
55km/h	1st						
	2nd						
	3rd						
60km/h	1st						
	2nd						
	3rd						

(\*) ○: Collision avoided, P: Passed (deemed avoided), △: Speed reduced, x: No activation, —: Not implemented

(4) FCWS test for CCRm			(a)	(b)	(c) = (a)-(b)	(d) =(c)/ (a)	
Velocity Conditions	Number of Tests	Avoided or Not (*)	Initial Velocity Difference	Relative Speed at Collision	Velocity Reduction Amount	Velocity Reduction Rate	Velocity Reduction Rate Median
35km/h	1st						
	2nd						
	3rd						
40km/h	1st						
	2nd						
	3rd						
45km/h	1st						
	2nd						
	3rd						
50km/h	1st						
	2nd						
	3rd						
55km/h	1st						
	2nd						
	3rd						
60km/h	1st						
	2nd						
	3rd						

(\*) ○: Collision avoided, P: Passed (deemed avoided), △: Speed reduced, x: No activation, —: Not implemented