

**Ministry of Transportation and  
Communications**

**Taiwan New Car Assessment Program  
(TNCAP)**

**Second Version**

**3.14 Blind Spot Assist Systems Testing  
Protocol**

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## TABLE OF CONTENTS

3.14.1 Definitions.....	3
3.14.2 Reference System.....	3
3.14.3 Measuring Equipment.....	4
3.14.4 Test Conditions .....	5
3.14.5 Blind Spot Detection System Test Procedure .....	5
3.14.6 Illustration .....	10
3.14.7 Blind Spot Visualization System Test Procedure.....	13
3.14.8 Illustration .....	16

### 3.14.1 Definitions

3.14.1.1 Subject vehicle (SV) – Vehicle equipped with the system in question and related to the topic of discussion.

3.14.1.2 Target vehicle (TV) – Motorcycle that is closing in on the subject vehicle from behind, or any vehicle that is located in one of the adjacent zones.

3.14.1.3 Coverage zone – The entire area to be monitored by a BSS. A system's coverage zone comprises a specific subset of the following zones: left adjacent zone, right adjacent zone, left rear zone and right rear zone.

3.14.1.4 Adjacent zones – Zones to the left and right of the subject vehicle.

3.14.1.5 Closing speed – (of a target vehicle) the difference between the target vehicle's speed and the subject vehicle's speed.

Note: This definition applies to target vehicles in the rear zones only. A positive closing speed indicates that the target vehicle is closing in on the subject vehicle from the rear.

3.14.1.6 Overtaking speed – (of the subject vehicle) the difference between the subject vehicle's speed and the target vehicle's speed when the subject vehicle is overtaking the target vehicle.

3.14.1.7 Blind spot warning function – Function that detects the presence of target vehicles in one or more of the adjacent zones and warns the subject vehicle driver in accordance with the requirements given in section 3.14.2.1.

Note: A target vehicle located within the coverage zone will thus be detected by the system.

3.14.1.8 Visual function – As for non-detection type, the system shall be able to provide a live visual of the vehicles moving in the same direction, and on the side and/or rear of the subject vehicle which can be activated manually or via turn signal action.

Note: A target vehicle located within the coverage zone will thus be visualized by the system.

### 3.14.2 Reference System

The International Standard specifies system requirements and test methods for Lane Change Decision Aid Systems (LCDAS). LCDAS is fundamentally intended to warn the driver of the subject vehicle against potential collision with vehicles to the side and/or to the rear of the subject vehicle, and moving in the same direction as the subject vehicle during lane change maneuvers.

#### 3.14.2.1 Type I Systems

Provide the blind spot warning function only. These systems are intended to warn the subject vehicle driver of target vehicles in the adjacent zones. These systems are not required to provide warnings of target vehicles that are approaching the

subject vehicle from the rear. If the installed system does not warn of the approaching target vehicles, the subject vehicle driver shall be made aware of the limitations of this type of system, at least in the owner’s manual. In particular, the owner’s manual shall include the following statement: “This system provides support only within a limited area beside the vehicle. The system may not provide adequate warning for vehicles approaching from the rear.”

### 3.14.3 Measuring Equipment

The basic measurements include vehicle speed (using GPS-based vehicle speed sensors), video logger and performance meter for event recording, and BSS alert signal lamp indicators.

#### 3.14.3.1 Zone Instrumentation

##### 3.14.3.1.1 Blind Spot Assist Systems (BSS) assessment jig

The setup process includes preliminary plotting of blind spot zone, fitment angle of video logger and performance meter camera and onboard equipment. Precise and accurate measurement is essential to ensure superior and reliable output from the assessment.

Referring to Figure 1, BSS jig setup is divided into two parts; part A and B.

Part A is a video logger jig frame for outside camera and is located on the top side of main windshield.

Part B is a jig for pre-setup of blind spot zone level 3 which views live-feed video recording taken by video logger and performance meter.

The assessment will be based on video recording system using video logger and performance meter applications which require pre-setup of zone area level 3 in the live-feed view. These two parts are designed to be used in any passenger car and are removable with static measurement at any flat surface.



Figure 1: Blind spot zone setup

As shown in Figure 2, the main components to complete the jig structure are:

- (1) Component A- Black metal connector pipe C1-24 (Length 130mm x diameter 33mm x hollow 38mm) x 5 pcs.

- (2) Component B- Black metal connector pipe C2-5 (Length 130mm x diameter 33mm x hollow 33mm) x 4 pcs.
- (3) Component C- Black metal connector pipe C3-11 (Length 84mm x diameter 33mm x hollow 36mm) x 4 pcs and the last component is a standard steel pipe (diameter 28mm) with 2 different length 1465mm (10 pcs) and 1965mm (2 pcs).

Tools required for setup process: Allen-key size 3mm to tighten the connector and aluminum hollow pipe.

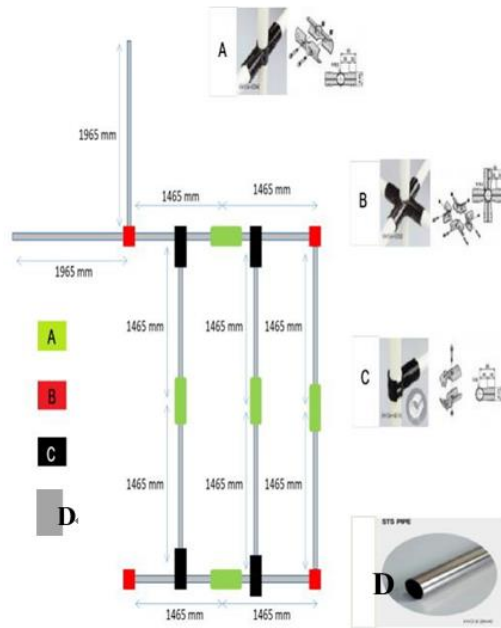


Figure 2: Blind spot coverage zone jig

### 3.14.4 Test Conditions

3.14.4.1 The test location shall be on a flat, dry asphalt or concrete surface. The ambient temperature during testing shall be within the range of 5°C - 40°C. The horizontal visibility range shall be greater than 1 km (ISO17387 Sec. 5.2). The test shall be conducted during the day.

#### 3.14.4.2 Test Track

3.14.4.2.1 The tests are done on a dry (no visible moisture on the surface), uniform, solid-paved surface with a consistent slope between level and 1%.

3.14.4.2.2 The surface must be paved and may not contain any irregularities (e.g. large dips or cracks, manhole covers or reflective studs) that may give rise to abnormal sensor measurements within a lateral distance of 3.0m to either side of the test path and with a longitudinal distance of 10m ahead of the VUT when the test ends.

### 3.14.5 Blind Spot Detection System Test Procedure

#### 3.14.5.1 Conditioning

#### 3.14.5.1.1 Vehicle Preparation

Prepare the on-board test equipment and instrumentation in the vehicle. Also fit any associated cables, cabling boxes and power sources.

#### 3.14.5.1.2 Test Target Vehicle

The primary objective of BSS testing is to detect motorcycles.

Thus, the dimension of target vehicle used in this protocol will be as follows:

Table 1: Target vehicle dimension

	Dimensions (m)
Length	1.8 - 2.0
Width	0.6 - 0.8
Height	1.0 - 1.4

#### 3.14.5.2 Test Scenarios

The assessment is to evaluate that the blind spot warning system gives warnings when required as the target vehicle overtakes the subject vehicle. Referring to Figure 3 and the line definitions in 4, the test shall be conducted as follows.

On a straight and flat test course, the test Subject Vehicle (SV) shall be driven in a straight line at a maximum steady speed of 40 km/h $\pm$ 2 km/h. The test Target Vehicle (TV) shall be ridden in a straight line as shown in Figure 3 so that its closing speed is 10 km/h $\pm$ 2 km/h.

Both vehicles shall be driven/ridden such that the lateral distance between the outermost edge of the subject vehicle's body (excluding the exterior mirror) and the centreline of the TV is between 2.0 to 3.0 meter for true warning test and at 6.5 meter for false warning test.

The assessment will start when both vehicles reach a steady speed of 40 km/h $\pm$ 2 km/h and the TV shall be completely behind line A (> 30-meter distance).

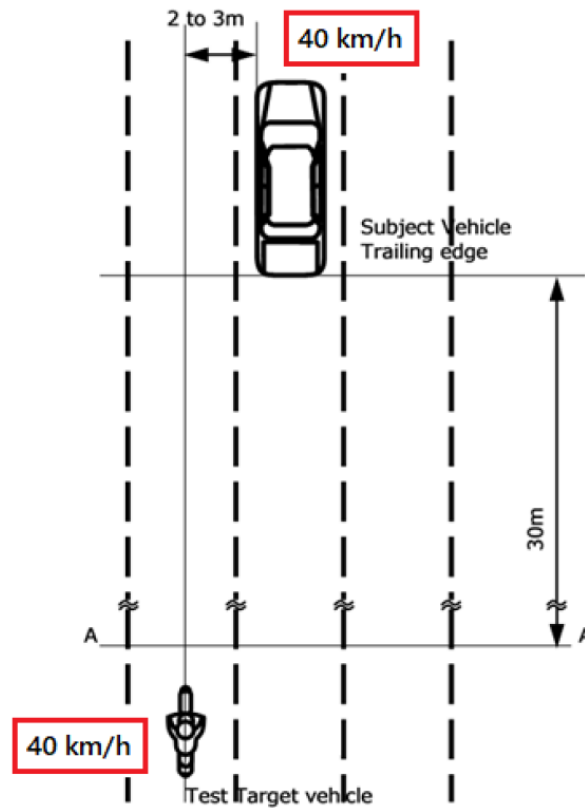


Figure 3: Target Vehicle entering 30-meter zone with steady speed

### 3.14.5.3 Test Conduct

#### 3.14.5.3.1 Straight-Lane Tests

The test SV is subjected to one type of performance test: the straight-lane test. In the straight-lane test series, both SV and TV are driven and ridden in separate but parallel, lanes with the target vehicle riding longitudinally past the subject vehicle. TV is ridden on the lane next to the SV either on the driver's or passenger's side as depicted in Figure 4.

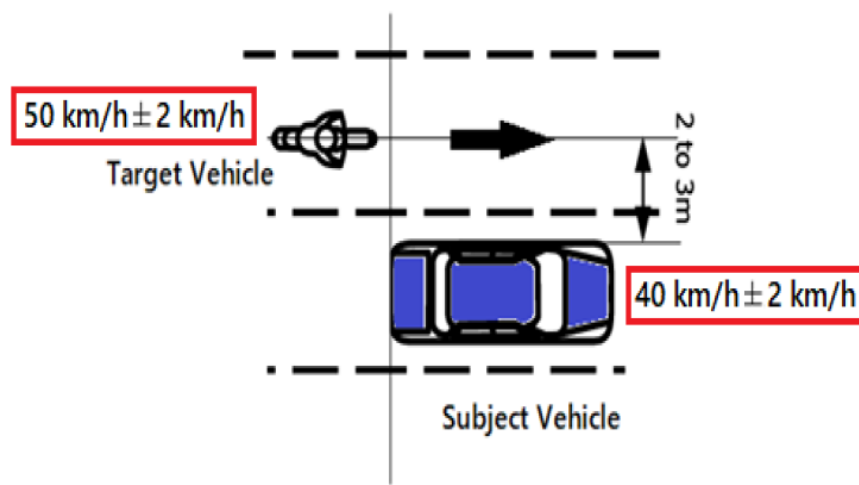


Figure 4: Target Vehicle overtaking Subject Vehicle speed

The straight-lane tests are performed on a controlled straightaway test facility

containing equal or more than three parallel lanes of concrete surface roadway. All tests are performed during the day.

Once these measurements are completed for the passenger’s side, the entire test is repeated for the driver’s side sensor.

### 3.14.5.3.2 Functionality Check and Scoring

Check the functionality whether the BSS system gives warnings when test is performed according to the test procedure with test conditions and the target vehicle described in sections 3.14.4 and 3.14.5.1.2.

### 3.14.5.3.3 True Warning Test

In the true warning test, target vehicle overtaking subject vehicle in between 2 to 3 meters adjacent as described in section 3.14.5.3.

BSS warning requirements are divided into three sections; must give warning, might give warning and must not give warning. The result shall be based on Table 2. The subject vehicle must be in fully prepared condition while running at 40 km/h $\pm$ 2 km/h. The target vehicle speed is 50 km/h $\pm$ 2 km/h to overtake the subject vehicle. All tests cover both driver and passenger sides of subject vehicle.

Table 2: BSS warning requirements

BSS indicator/audible/visual warning	Must not on	Might be on	Must be on
Distance	Beyond 30 meter behind car	In 30 meter zone behind car	In 3 meter zone behind car to 95 <sup>th</sup> percentile eyellipse

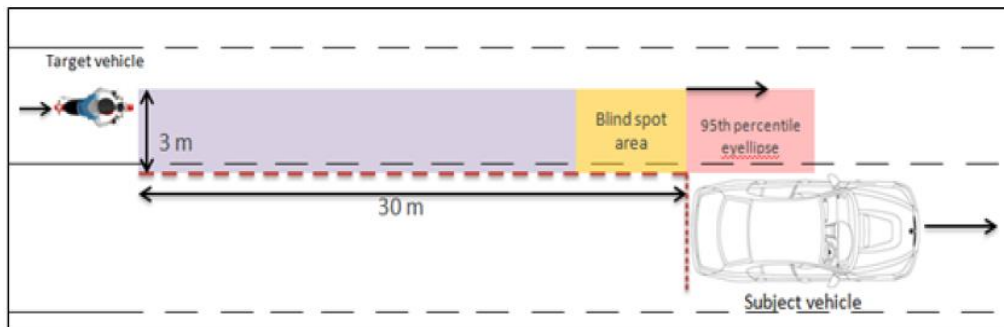


Figure 5: Must not give blind spot warning to the driver

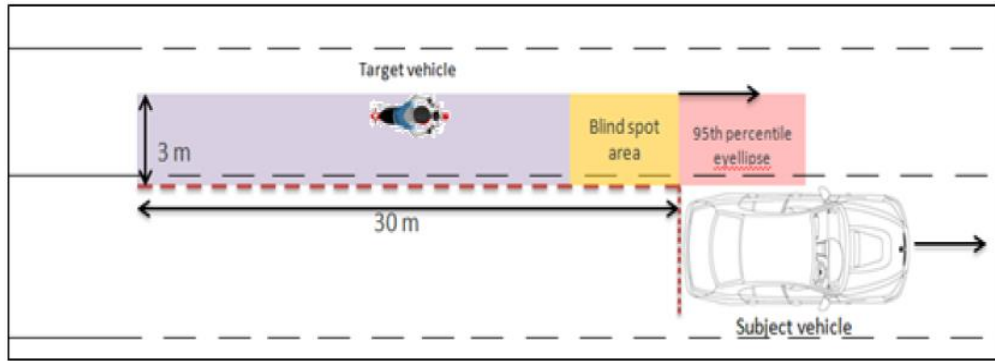


Figure 6: Might give blind spot warning to the driver

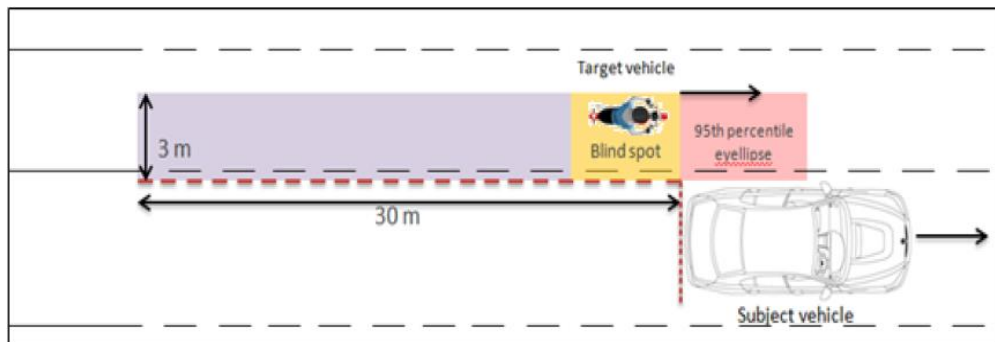


Figure 7: Must give blind spot warning to the driver

Three (3) repeated runs of each side sequence are completed to determine sensitivity and repeatability.

If subject vehicle does not meet the requirements for all 3 runs as described in Table 2, no point will be rewarded.

#### 3.14.5.3.4 False Warning Test

The purpose of this test is to determine that the lane change warning system gives no warning when the target vehicle is in the lane beyond the adjacent lane. In each test, the lateral distance between the outermost edge of the subject vehicle's body (excluding the exterior mirror) and the centerline of the test target vehicle shall be maintained at 6.5 meters.

The system shall give no warning signal during these trials. All tests cover both the left and right side of subject vehicle. Single test run is adequate to complete the assessment.

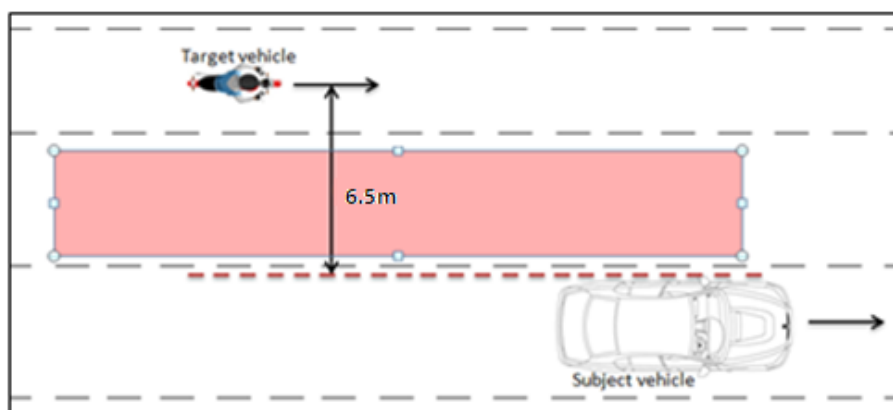


Figure 8: Target vehicle shall be maintained at 6.5 meters during test

### 3.14.5.3.5 Test Facility Layout

Based on Figure 9, it shows the layout of BSS test facility. This layout area includes length (minimum) of 700-meter and 11-meter wide; sufficient for the testing. This layout is divided into three zone A, B and C.

- (1) A is the starting area for the test vehicle.
- (2) B is the bypass area where the target vehicle needs to overtake the subject vehicle.
- (3) C is for braking area and U-turn.

Subject and target vehicle start moving at the same time laterally and achieve constant/steady speed at  $40 \text{ km/h} \pm 2 \text{ km/h}$ , before entering Zone B.

In Zone B, the target vehicle needs to accelerate to  $50 \text{ km/h} \pm 2 \text{ km/h}$  to overtake the subject vehicle within 500-meter range. Zone B is a critical area for the test where the blind spot assist systems needs to function and give warning to driver. Both vehicles need to slow down and make a U-turn when entering Zone C and return to the starting line for the next run. Minimum repetition is four (4) runs for each side.

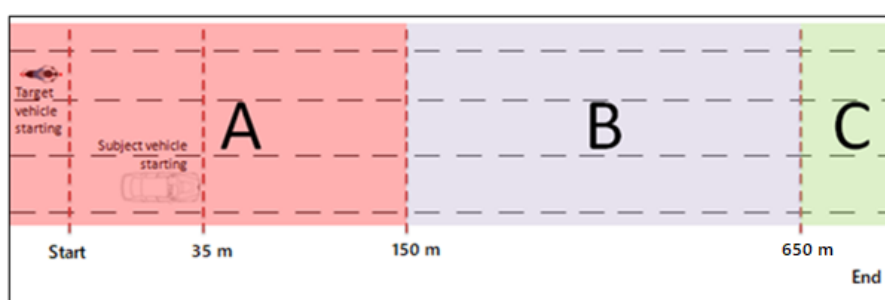
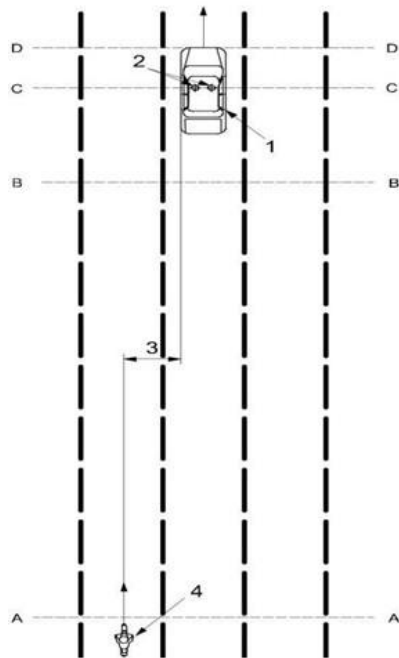


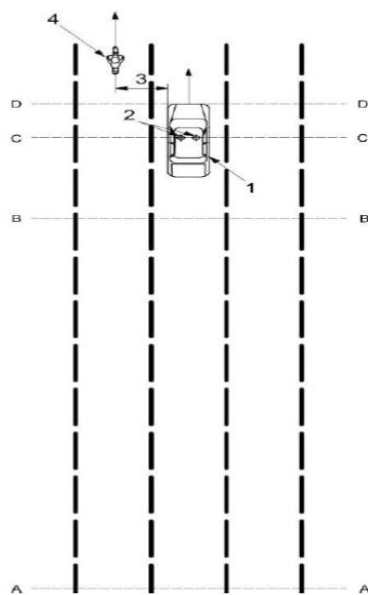
Figure 9: Test facility layout

### 3.14.6 Illustration



- (1) Subject vehicle
- (2) Centre of the 95<sup>th</sup> percentile eyellipse
- (3) Lateral distance
- (4) Target vehicle

Figure 10: Target and subject vehicle starting point



- (1) Subject vehicle



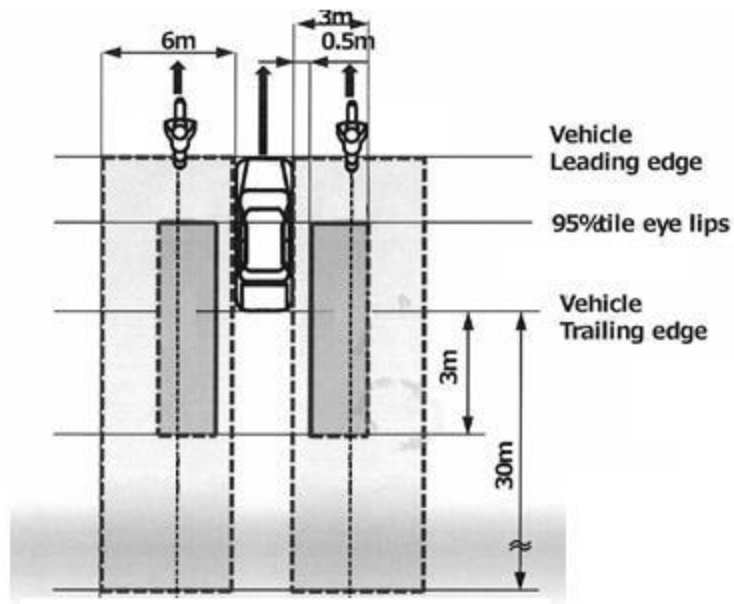


Figure 14: Blind Spot Zone

### 3.14.7 Blind Spot Visualization System Test Procedure

#### 3.14.7.1 Conditioning

##### 3.14.7.1.1 Vehicle Preparation

Setup the on-board test equipment and instrumentation in the vehicle. Also fit any associated cables, cabling boxes and power sources.

##### 3.14.7.1.2 Test Target Vehicle

The primary objective of the BSV System test is to display motorcycle images. Thus, the dimension of target vehicle used in this protocol will be as follows:

Table 3: Target vehicle dimension

	Dimensions (m)
Length	1.8to 2.0
Width	0.6 to 0.8
Height	1.0 to 1.4

#### 3.14.7.2 Test Conduct

##### 3.14.7.2.1 Static Straight-Lane Tests

The test SV is subjected to one type of performance tests namely static straight-lane tests.

In the static straight-lane test series, both SV and TV are placed on separate but parallel lanes with the target vehicle positioned in the lane next to the SV either on the driver or passenger side as depicted in Figure 15.

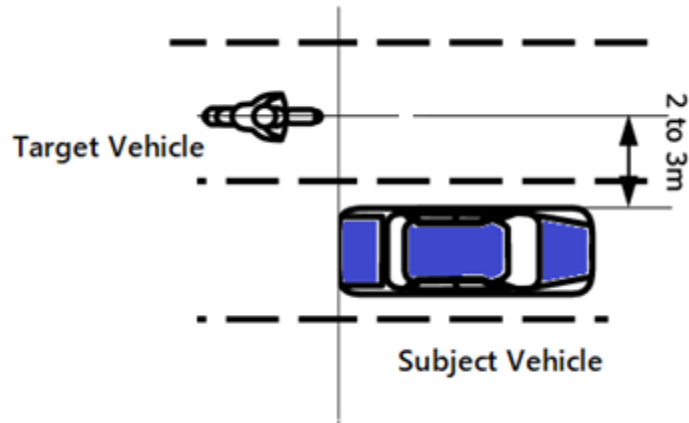


Figure 15: Target Vehicle and Subject Vehicle position

The static straight-lane tests are performed on a controlled straightaway test facility containing equal or more than three parallel lanes of concrete surface roadway. All tests are performed during the day or/and at night.

Once these measurements are completed for the passenger-side, the entire test is repeated for the driver-side sensor.

\* In order to identify the system's interaction with the application of the SV's turn signals, the test series are repeated with the turn signal activated.

Note: Manufacturer is required to provide information for specific model.

#### 3.14.7.2.2 Functionality Check and Scoring

Check the functionality whether the BSV system provides adequate live visual of static vehicle when test is performed according to the test procedure with the target vehicle described in the 3.14.7.2.2.1.

##### 3.14.7.2.2.1 Static Test

In the static test, the target vehicle will be positioned at 5 different locations in the lane next to the subject vehicle in between 2 to 3 meters adjacent as described in Figure 16. Confirm that the target vehicle is visible at each place and distance.

The locations of target vehicle must be as follows (in respect to subject vehicle rear);

- (1) 30m zone
- (2) 20m zone
- (3) 10m zone
- (4) 3m zone, and
- (5) Blind spot zone

For BSV type system, the system must be able to provide a live visual of the static vehicle in the same direction, and on the adjacent side of the subject vehicle. The result shall be based on the following Table 4.

Table 4: BSS Visualization type requirements

Live visual video	Must be clearly visible
Distance	In 30-meter zone from SV trailing edge to blind spot zone

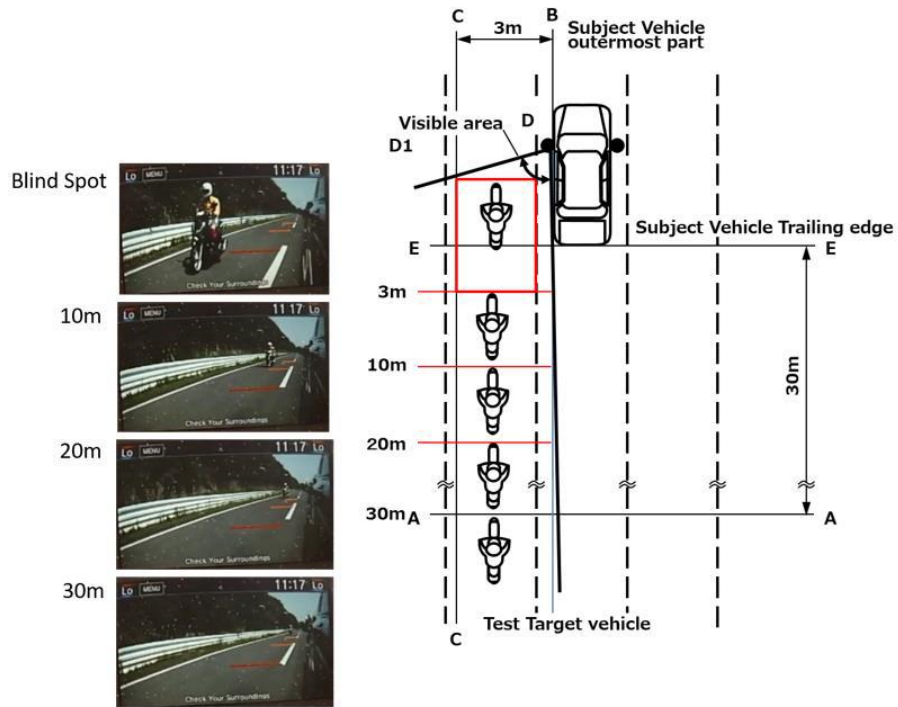


Figure 16: Functionality check and score

If the subject vehicle does not meet all the requirements as described in Table 4, no point will be rewarded.

The subject vehicle shall be able to visualize other vehicles in the blind spot zones, especially smaller ones such as motorcycles (target vehicle) and provide adequate visibility as described in Figure17.

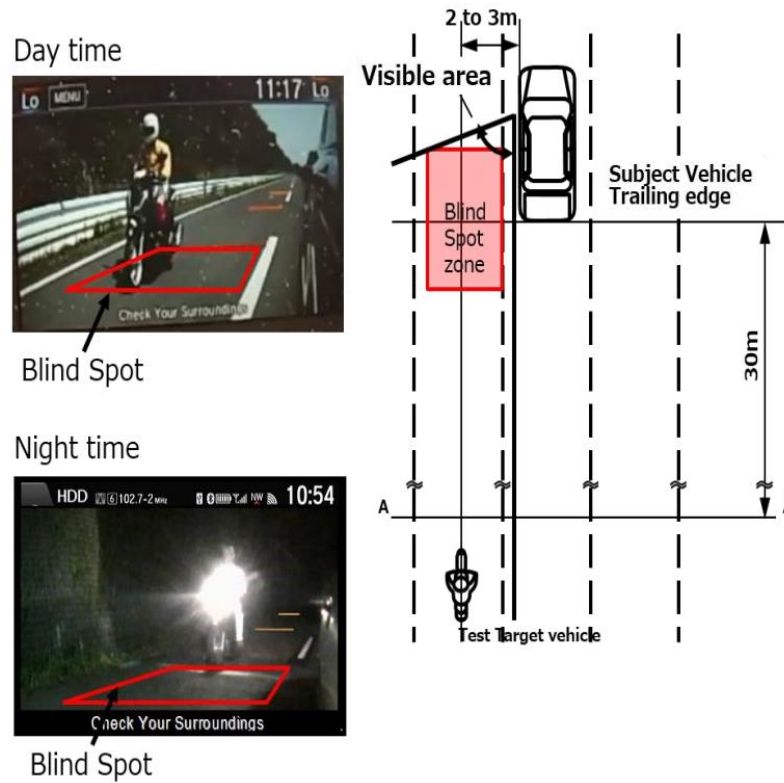


Figure 17: Zone requirements for BSV system live visual

\* For assessment at night, the test needs to be conducted with a motorcycle with the head-light turned on.

### 3.14.8 Illustration



Figure 18: Video logger image of BSV test

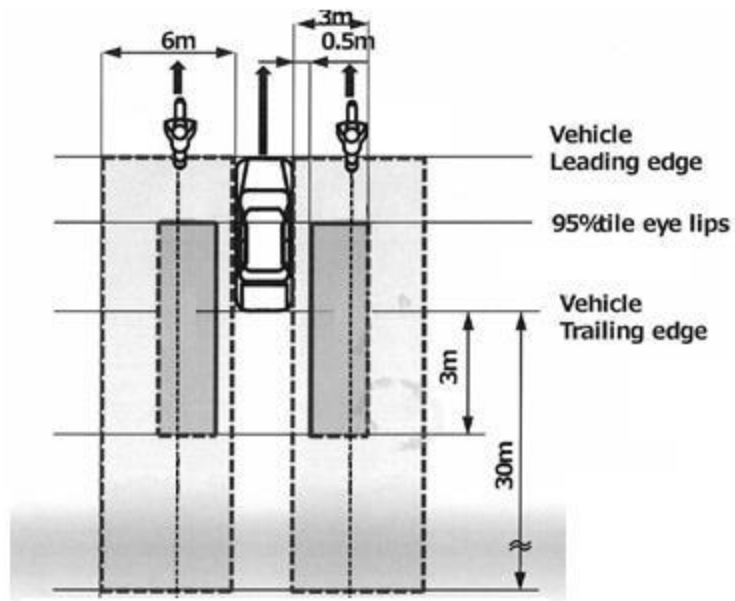


Figure 19: Blind Spot Zone