

IVASA

ASEAN NCAP Intelligent Vehicle Advanced Safety Assessment Program

Evaluation Protocol for Intelligent Driving Assistance

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IVASA Evaluation Protocol for Intelligent Driving Assistance

1 Scope

This document specifies the assessment methods for the intelligent driving assistance component of IVASA under the ASEAN NCAP Intelligent Vehicle Advanced Safety Assessment Program.

2 Assessment Methods

2.1 Overview

The intelligent driving assistance assessment carries a maximum of 100 points and is conducted through a public road test. The public road test comprises a highway test and an urban road test, each with a maximum score of 100 points and a minimum score of 0 points. Based on the vehicle system configuration, either the highway test or the urban road test shall be selected. The final intelligent driving assistance score shall be the score for the selected test.

2.2 Public Road Test Scoring

2.2.1 The public road test has a maximum score of 100 points and assesses functional completion in the specified test scenarios. The detailed scoring methods for the highway and urban road tests are specified in Tables 1 and 2, respectively.

2.2.2 Final public road test score = sum of the scores for the applicable test cases – penalty points.

Table 1 Highway Scenario Completion Scoring Matrix

	Test Scenario		Maximum Score
Highway	Stop-and-go in congested traffic	Stop-and-go in congested traffic	16
	Exiting a highway via an exit ramp	No interfering surrounding vehicle	17
		Interfering surrounding vehicle	17
	Merging onto a highway via an entry ramp	No interfering surrounding vehicle	17
		Interfering surrounding vehicle	17
	Route selection on a ramp	Route selection on a ramp	16

Table 2 Urban Road Scenario Completion Scoring Matrix

	Test Scenario			Maximum Score
Urban Road	Roundabout Negotiation	When entering the roundabout	No interfering surrounding vehicle	8
			Interfering surrounding vehicle	8
		When travelling within the roundabout	No interfering surrounding vehicle	9
			Interfering surrounding vehicle	9
		When exiting the roundabout	No interfering surrounding vehicle	8
			Interfering surrounding vehicle	8
	Intersection Negotiation	VUT approaching an intersection	No interfering surrounding vehicle	8
			Interfering surrounding vehicle	8
		VUT stopped at an intersection	No interfering vehicle ahead	8
			Interfering vehicle ahead	8
		VUT passing through an intersection	No interfering surrounding vehicle	9
			Interfering surrounding vehicle	9

2.2.3 For scenario completion assessment, the VUT shall be scored under each test condition based on the level of driving automation achieved during the completion of the assigned driving task. The scoring is divided into three tiers, with detailed criteria provided in Annex A and B.

- Tier 1: The VUT completes all driving tasks using a Level 2 driver control assistance system (DCAS) without issuing a takeover request or degradation warning during the process. The percentage score for the corresponding test condition is 100%;
- Tier 2: The VUT completes the driving task with either a Level 2 or Level 1 system and prompts the driver to take control of the vehicle or issues a degradation warning. The percentage score for the corresponding test condition is 60%;

- c) Tier 3: The VUT fails to complete the driving task and does not issue a takeover request or degradation warning. The percentage score for the corresponding test condition is 0%.

Note 1: If the VUT completes the Tier 1 driving task using a driver-confirmed lane-change function, such as gaze-activated lane change, 95% of the maximum score shall be awarded for the corresponding test scenario. If the VUT completes the Tier 1 driving task using any other driver-initiated lane-change function, 90% of the maximum score shall be awarded for the corresponding test scenario.

Note 2: If the VUT stops for more than 20 s on a single occasion because of complex traffic conditions while the DCAS remains activated, or cannot complete the scenario within 180 s under congested conditions, the test personnel shall take control of the vehicle and continue the test. The score for that scenario shall be determined with reference to Tier 2, based on the extent to which the driving task was completed.

Note 3: If the VUT is involved in a collision, the percentage score for that test condition is 0%.

2.2.4 If a specific test condition is encountered multiple times during the public road test, each result shall be scored separately. The lowest 10% of the results shall be removed, and the average of the remaining scores, rounded to two decimal places, shall be taken as the final score for that test condition.

Note: If 10% of the number of test runs for the test condition is not an integer, it shall be rounded to the nearest integer; if the result is less than 1, it shall be taken as 1.

2.2.5 During the entire public road test, if any of the following situations occurs, the corresponding points shall be deducted from the public road test score as penalties. The maximum total penalty is 12 points, as shown in Table 3.

Table 3 Penalty Items

Penalty Item			Points Deducted
Highway/ Urban Road	All road sections	Exceeding the posted speed limit	0.5
		Changing lanes without using the turn signal	0.5
		Crossing a solid lane line	0.5
		Continuously straddling a dashed lane line for more than 8 s (except in cases of force majeure)	0.5
		Braking or steering unexpectedly from the driver's perspective	1
		Crossing two or more traffic lanes in one continuous manoeuvre	1
		Entering an incorrect route	0.5
		Entering an incorrect lane	0.5

	Road sections Without specified scenarios	Total number of interventions (highway: 1 – 2; urban road: 2 – 4)	0.5
		Total number of interventions (highway: 3 – 4; urban road: 5 – 7)	1
		Total number of interventions (highway: more than 4; urban road: more than 7)	1.5
Highway	Within a road section	When traffic is free-flowing, the VUT travels below the posted minimum speed for more than 30 s	0.5
Urban Road	At an intersection	Running a red light	1

Note 1: If the VUT triggers the same penalty item multiple times on the same public road section or at the same location, the penalty shall be applied only once.

Note 2: A maximum of 3 points may be deducted for each penalty item.

Note 3: If force majeure makes it necessary to cross a solid lane line, the system shall not automatically change lanes across the solid line; otherwise, a penalty shall be applied. In other force majeure situations where a lane change across a solid line is unavoidable, the system shall prompt the test personnel to take control. The test personnel shall make the lane change after determining that the surrounding traffic environment is safe. No points shall be deducted in such cases.

Note 4: Where Note 3 cannot be satisfied because an urgent collision risk must be avoided, the road traffic rules shall be followed.

Note 5: On test road sections not designated for a specified scenario, the test personnel shall take control of the vehicle promptly to ensure safety when there is a collision risk or a risk of violating traffic regulations. The total number of interventions means the total number of times the test personnel take control of the vehicle throughout the entire public road test.

2.3 Overall Assessment

2.3.1 The overall intelligent driving assistance assessment comprises five ratings: Good (G), Adequate (A), Marginal (M), Weak (W), and Poor (P). The assessment criteria are specified in Table 4.

- Overall rating Good (G): percentage score $\geq 80\%$;
- Overall rating Adequate (A): $70\% \leq \text{percentage score} < 80\%$;
- Overall rating Marginal (M): $65\% \leq \text{percentage score} < 70\%$;
- Overall rating Weak (W): $50\% \leq \text{percentage score} < 65\%$;
- Overall rating Poor (P): percentage score $< 50\%$.

The percentage score is calculated by dividing the test score by the total available points and is rounded to one decimal place.

Table 4 Overall Intelligent Driving Assistance Rating

Rating	Percentage Score
Good (G)	percentage score $\geq 80\%$
Adequate (A)	$70\% \leq \text{percentage score} < 80\%$

Marginal (M)	$65\% \leq \text{percentage score} < 70\%$
Weak (W)	$50\% \leq \text{percentage score} < 65\%$
Poor (P)	$\text{percentage score} < 50\%$

Annex A
(Normative)
Scoring Criteria for Public Road Highway Tests

A.1 Stop-and-Go in Congested Traffic

- a) Tier 1 (percentage score 100%): On a congested road section, the VUT automatically follows the vehicle ahead in the same lane in stop-and-go traffic and completes passage through the specified congested section without functional degradation or a takeover request;
- b) Tier 2 (percentage score 60%): On a congested road section, the VUT cannot automatically follow the vehicle ahead in the same lane throughout the stop-and-go condition and requires driver confirmation (by button press or light accelerator-pedal input), or the system prompts the driver to follow;
- c) Tier 3 (percentage score 0%): On a congested road section, the VUT cannot automatically follow the vehicle ahead in the same lane in stop-and-go traffic, and the system does not prompt the driver to follow.

A.2 Exiting a Highway via an Exit Ramp

- a) Tier 1 (percentage score 100%): The VUT can detect vehicles in its own lane and adjacent lanes and complete the lane change from the highway mainline onto the exit ramp without functional degradation or a takeover request. When the VUT starts the lane change or the system prompts the driver to confirm the lane change, the wheels do not cross a solid line or enter the painted gore area, and the THW from the front of the VUT to the exit-ramp diverge point is not less than 5 s;
- b) Tier 2 (percentage score 60%): The VUT can detect vehicles in its own lane and adjacent lanes. When the THW from the front of the VUT to the exit-ramp diverge point is not less than 5 s, the system issues a takeover request and the driver completes the lane change;
- c) Tier 3 (percentage score 0%): The requirements for this tier are met if any one of the following conditions occurs:
 - When the VUT starts the lane change or the system prompts the driver to confirm the lane change, the THW from the front of the VUT to the exit-ramp diverge point is less than 5 s;
 - The system issues a takeover request when the THW from the front of the VUT to the exit-ramp diverge point is less than 5 s;
 - The VUT fails to detect a vehicle in the adjacent lane, creating a collision risk during the lane change and requiring emergency driver intervention;
 - The VUT does not change lanes onto the ramp and the system does not issue a lane-change confirmation request or takeover request, causing the wheels to cross a solid line or requiring emergency driver intervention;
 - Any wheel of the VUT enters the painted gore area;

——The VUT successfully changes lanes at the exit-ramp diverge point but does not enter the ramp.

A.3 Merging onto a Highway via an Entry Ramp

- a) Tier 1 (percentage score 100%): The VUT can detect vehicles in its own lane and adjacent lanes and fully merge from the entry ramp onto the highway mainline without functional degradation or a takeover request. When the VUT starts the lane change or the system prompts the driver to confirm the lane change, the wheels do not cross a solid line or enter the painted gore area, and the THW from the front of the VUT to the end of the acceleration lane is not less than 5 s;
- b) Tier 2 (percentage score 60%): The VUT can detect vehicles in its own lane and adjacent lanes. When the THW from the front of the VUT to the end of the acceleration lane is not less than 5 s, the system issues a takeover request and the driver completes the lane change;
- c) Tier 3 (percentage score 0%): The requirements for this tier are met if any one of the following conditions occurs:

——When the VUT starts the lane change or the system prompts the driver to confirm the lane change, the THW from the front of the VUT to the end of the acceleration lane is less than 5 s;

——The system issues a takeover request when the THW from the front of the VUT to the end of the acceleration lane is less than 5 s;

——The VUT fails to detect a vehicle in its own or an adjacent lane, creating a collision risk during the lane change and requiring emergency driver intervention;

——The VUT does not change lanes onto the highway mainline and the system does not issue a lane-change confirmation request or takeover request, causing the wheels to cross a solid line, requiring forced driver intervention, or causing the vehicle to enter the emergency lane.

A.4 Route Selection on a Ramp

- a) Tier 1 (percentage score 100%): The VUT follows the correct route within the ramp without functional degradation or a takeover request. When the VUT starts the lane change or the system prompts the driver to confirm the lane change, the THW from the front of the VUT to the start of the painted gore area is not less than 5 s;
- b) Tier 2 (percentage score 60%): When the THW from the front of the VUT to the start of the painted gore area is not less than 5 s, the system issues a takeover request and the driver enters the correct ramp corresponding to the test route;
- c) Tier 3 (percentage score 0%): The requirements for this tier are met if any one of the following conditions occurs:

——When the VUT starts the lane change or the system prompts the driver to confirm the lane change, the THW from the front of the VUT to the start of the painted gore area is less than 5 s;

- The system issues a takeover request when the THW from the front of the VUT to the start of the painted gore area is less than 5 s;
- The VUT does not change lanes onto the correct route corresponding to the test route within the ramp, and the system does not issue a lane-change confirmation request or takeover request, causing the wheels to cross a solid line or requiring emergency driver intervention;
- Any wheel of the VUT enters the painted gore area.

Annex B
(Normative)
Scoring Criteria for Public Road Urban Tests

B.1 Roundabout Negotiation

The roundabout negotiation scenario comprises three sub-scenarios: VUT entering a roundabout, VUT travelling within a roundabout, and VUT exiting a roundabout.

B.1.1 VUT Entering a Roundabout

- a) Tier 1 (percentage score 100%): The VUT completes the driving task with the Level 2 DCAS activated. The VUT can detect vehicles in its own lane and adjacent lanes and enter the roundabout correctly in accordance with traffic-signal indications (if any), without issuing a degradation warning or takeover request during the process;
- b) Tier 2 (percentage score 60%): The VUT successfully completes the driving task with either a Level 2 or Level 1 system activated. The VUT can detect vehicles in its own lane and adjacent lanes but cannot accurately detect and respond to traffic-signal indications (if any). While entering the roundabout, the VUT issues a takeover request or degradation warning and is driven into the roundabout under driver control without a collision;
- c) Tier 3 (percentage score 0%): The requirements for this tier are met if any one of the following conditions occurs:
 - The VUT cannot detect surrounding vehicles, creating a collision risk before entering the roundabout and requiring emergency driver intervention;
 - The VUT cannot accurately detect and respond to traffic-signal indications (if any) and does not issue a takeover request or degradation warning, resulting in driver control of the vehicle;
 - The VUT cannot enter the roundabout and does not issue a takeover request or degradation warning, resulting in the driver controlling the vehicle into the roundabout.

B.1.2 VUT Travelling within a Roundabout

- a) Tier 1 (percentage score 100%): The VUT completes the driving task with the Level 2 DCAS activated. The VUT can detect vehicles in its own lane and adjacent lanes and travel within the roundabout in accordance with traffic rules, without issuing a degradation warning or takeover request during the process;
- b) Tier 2 (percentage score 60%): The VUT successfully completes the driving task with either a Level 2 or Level 1 system activated. The VUT can detect vehicles in its own lane and adjacent lanes but cannot accurately detect and respond to traffic-signal indications (if any). While travelling within the roundabout, it issues a takeover request or degradation warning and is driven under driver control without a collision;

- c) Tier 3 (percentage score 0%): The requirements for this tier are met if any one of the following conditions occurs:
 - The VUT cannot detect surrounding vehicles, creating a collision risk while travelling within the roundabout and requiring emergency driver intervention;
 - The VUT cannot accurately detect and respond to traffic-signal indications (if any) and does not issue a takeover request or degradation warning, resulting in driver control of the vehicle;
 - The VUT cannot travel within the roundabout and does not issue a takeover request or degradation warning, resulting in driver control of the vehicle.

B.1.3 VUT Exiting a Roundabout

- a) Tier 1 (percentage score 100%): The VUT completes the driving task with the Level 2 DCAS activated. The VUT can detect vehicles in its own lane and adjacent lanes, correctly follow traffic-signal indications (if any), and exit through the roundabout exit corresponding to the test route, without issuing a degradation warning or takeover request during the process;
- b) Tier 2 (percentage score 60%): The VUT successfully completes the driving task with either a Level 2 or Level 1 system activated. The VUT can detect vehicles in its own lane and adjacent lanes but cannot correctly detect and respond to traffic signals (if any). As the VUT approaches the roundabout exit corresponding to the test route, it issues a takeover request or degradation warning and is driven out of the roundabout under driver control;
- c) Tier 3 (percentage score 0%): The requirements for this tier are met if any one of the following conditions occurs:
 - The VUT cannot detect surrounding vehicles, creating a collision risk while exiting the roundabout and requiring emergency driver intervention;
 - The VUT cannot correctly detect and respond to traffic signals (if any) and does not issue a takeover request or degradation warning, resulting in driver control of the vehicle;
 - The VUT cannot select the corresponding roundabout exit according to the navigation instructions and does not issue a takeover request or degradation warning, resulting in driver control of the vehicle.

B.2 Intersection Negotiation

The intersection negotiation scenario comprises three sub-scenarios: VUT approaching an intersection, VUT stopped at an intersection, and VUT passing through an intersection.

B.2.1 VUT Approaching an Intersection

- a) Tier 1 (percentage score 100%): The VUT completes the driving task with the Level 2 DCAS activated. The VUT can detect vehicles in its own lane and adjacent lanes and change to the lane indicated by

navigation before reaching the solid lane line at the intersection, without issuing a takeover request or degradation warning or being involved in a collision;

- b) Tier 2 (percentage score 60%): The VUT successfully completes the driving task with either a Level 2 or Level 1 system activated. The VUT can detect vehicles in its own lane and adjacent lanes but cannot change to the lane corresponding to the test route before reaching the solid lane line at the intersection. During the process, the VUT issues a takeover request or degradation warning and is driven under driver control into the lane indicated by navigation;
- c) Tier 3 (percentage score 0%): The requirements for this tier are met if any one of the following conditions occurs:
 - The VUT cannot detect surrounding vehicles, creating a collision risk before reaching the solid lane line at the intersection and requiring emergency driver intervention;
 - Before reaching the solid lane line at the intersection, the VUT cannot change to the lane corresponding to the test route and does not issue a lane-change confirmation request, takeover request, or degradation warning, requiring emergency driver intervention to enter the lane corresponding to the test route;
 - When the VUT issues a lane-change confirmation request, takeover request, or degradation warning, it has already entered an intersection lane that does not correspond to the navigation instructions.

B.2.2 VUT Stopped at an Intersection

- a) Tier 1 (percentage score 100%): The VUT completes the driving task with the Level 2 DCAS activated. The VUT can detect vehicles in its own lane and adjacent lanes, accurately detect the red traffic signal for the direction of travel, and stop automatically. After the VUT comes to rest, the outer edge of the vehicle body does not extend beyond the stop line. During the process, the VUT does not issue a takeover request or degradation warning and is not involved in a collision;
- b) Tier 2 (percentage score 60%): The VUT successfully completes the driving task with either a Level 2 or Level 1 system activated. The VUT can detect vehicles in its own lane and adjacent lanes but cannot detect the red traffic signal for the direction of travel and stop automatically (when there is no interfering vehicle ahead). During the process, the VUT issues a takeover request or degradation warning, and the driver stops the VUT at the intersection stop line without the outer edge of the vehicle body extending beyond the stop line;
- c) Tier 3 (percentage score 0%): The requirements for this tier are met if any one of the following conditions occurs:
 - The VUT cannot detect surrounding vehicles, creating a collision risk and requiring emergency driver intervention;

- The VUT cannot accurately detect the red traffic signal for the direction of travel and does not issue a takeover request or degradation warning, requiring emergency driver intervention;
- After the VUT stops, the outer edge of the vehicle body extends beyond the stop line.

B.2.3 VUT Passing through an Intersection

- a) Tier 1 (percentage score 100%): The VUT completes the driving task with the Level 2 DCAS activated. The VUT can detect vehicles in its own lane and adjacent lanes and pass through the intersection without issuing a takeover request or degradation warning or becoming involved in a collision. This includes:

Case 1: Straight ahead/left turn/right turn — no dedicated right-turn lane

- The VUT can accurately detect the green traffic signal for the direction of travel and start moving promptly;
- The VUT can complete passage through the intersection in accordance with traffic regulations while ensuring safety.

Case 2: Right turn — dedicated right-turn lane

- If there is no traffic signal for the dedicated right-turn lane, the VUT can safely pass through the right-turn lane in accordance with traffic rules;
- If there is a traffic signal for the dedicated right-turn lane, the VUT can accurately detect the green traffic signal for the direction of travel and start moving promptly.

- b) Tier 2 (percentage score 60%): The VUT successfully completes the driving task with either a Level 2 or Level 1 system activated. The VUT can detect vehicles in its own lane and adjacent lanes; however, it issues a takeover request or degradation warning while passing through the intersection, which is then completed under driver control.

- c) Tier 3 (percentage score 0%): The requirements for this tier are met if any one of the following conditions occurs:

- The VUT can accurately detect the green signal for straight-ahead travel but cannot start moving promptly and does not issue a takeover request or degradation warning;
- The VUT cannot detect surrounding vehicles, creating a collision risk and requiring emergency driver intervention.

Note 1: When the VUT is the first vehicle in the queue with the Level 2 DCAS activated, accurately detects the green traffic signal, and starts moving within 3 s, it receives the Tier 1 score;

Note 2: When the VUT is not the first vehicle in the queue and the Level 2 DCAS is activated, if it follows the preceding vehicle and starts moving within 3 s after that vehicle starts, it receives the Tier 1 score;

Note 3: When the VUT is the first vehicle in the queue with the Level 2 DCAS activated and accurately detects the green traffic signal, but starts moving after more than 3 s, it receives the Tier 3 score;

Note 4: When the VUT is not the first vehicle in the queue and the Level 2 DCAS is activated, if it follows the preceding vehicle and starts moving more than 3 s after that vehicle starts, it receives the Tier 3 score.