

# IVISTA

## China Intelligent Vehicle Index

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### Intelligent Parking Index Memory Parking System Rating Protocol

(Version 2023)

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# Intelligent Parking Index Memory Parking System Rating Protocol

## 1 Scope

This document specifies the evaluation method for IVISTA China Intelligent Vehicle Index -Intelligent Parking Index - Memory Parking System.

## 2 Normative References

The following normative documents contain provisions which, through reference in this text, constitute indispensable provisions of this document. For dated references, only the dated edition applies to this document. For undated references, the latest edition (including all amendments) applies to this document.

GB 34660 Road Vehicles - Requirements and Test Methods of Electromagnetic Compatibility

GB 5768.3 Road Traffic Signs and Markings - Part 3: Road Traffic Markings

GB/T 18385-2005 Electric Vehicles - Power Performance - Test Method

GB/T 34590 (All Parts) Road Vehicles - Functional Safety

GB/T 39263-2020 Road Vehicles - Advanced Driver Assistance Systems (ADAS) - Terms and Definitions

GB/T 40429-2021 Taxonomy of Driving Automation for Vehicles

GB/T 41630-2022 Performance Requirements and Test Methods for Intelligent Parking Assist System

JGJ 100 Code for Design of Parking Garage Building

ISO 16787 Intelligent Transport Systems-Assisted Parking Systems (APS)-Performance Requirements and Test Procedures

## 3 Evaluation Method

### 3.1 Overview

The evaluation of memory parking test results consists of the evaluation of closed field test results and open parking lot test results, with a full score of 100 points. The final score of the VUT in the above two parts is calculated according to the evaluation methods given in 3.2 and 3.3, and rounded to 1 decimal place.

### 3.2 Closed field evaluation

3.2.1 The full score of closed field evaluation is 60 points, and the overall evaluation is carried out based on the test route as the minimal unit. The full scores of Route I and Route II are both 60 points. The full score weights of learning and mapping, and parking application for each test route are 20% and 80% respectively. The lower value of the overall actual score

of the VUT on the two test routes is taken as the final score of the closed field evaluation of the VUT.

3.2.2 If the memory parking function of the VUT is only applicable to outdoor parking lots, that is, if an outdoor parking lot test is carried out, the final score of the closed field test and evaluation shall be gained by multiplying the score from the test by a coefficient of 0.9

**Table 1 Score Distribution of Closed Field Evaluation**

Test Item	Score	Contents to Be Investigated	Score	Evaluation Index	Score
Learning and mapping	12 points	Success rate of learning and mapping	12 points	Success rate of test route learning and mapping	12 points
Parking application (Group A and Group B)	24 points/group	Response to test scenarios	15 points	Response to test scenario A	5 points
				Response to test scenario B	5 points
				Response to test scenario C	5 points
		Performance on test route	9 points	Average speed	6 points
				Absolute maximum longitudinal acceleration	3 points

3.2.3 For the evaluation of closed field learning and mapping, the scoring is based on the "success rate of learning and mapping" of VUT. For the same test route, the more times a VUT learns, the lower its scoring rate of learning and mapping on this route will be. See Table 2 for specific scoring rules.

**Table 2 Scoring Rules for Evaluation of Closed Field Learning and Mapping**

Number of Tests	Success Rate of Learning and Mapping	Score
1st test	100%	12 points
2nd test	50%	9.6 points
3rd test	33%	7.2 points
4th test	25%	4.8 points
5th test	20%	2.4 points

**Note:** If the VUT performs meaningless stopping and reversing actions at the original position in the test scenario during the verification of the learned and mapped path, the final score for learning and mapping evaluation shall be gained by multiplying the test score by a coefficient of 0.9.

3.2.4 The evaluation of the closed field parking application is determined by the sum of the scores of Group A and Group B tests of the VUT on test routes. The final scores of Group A and Group B tests are the average of 3 test scores of the VUT in the corresponding test scenarios. For each test, a comprehensive evaluation shall be carried out on the overall performance of the VUT on the test route, including the evaluation of "response to test scenario", with a full score of 15 points, and "performance on test route", with a full score of 9 points.

3.2.5 For the evaluation of "response to test scenario", different scores are given according to the actual performance of the VUT in the response to test scenarios on the test route. The full score weight distribution of 3 test scenarios on the test route is 1:1:1, and the scoring rules for different performances of the VUT in the response to the test scenario are shown in Table 3.

3.2.6 The evaluation of "performance on test route" is determined based on the traffic

efficiency index "average speed" and the driving and riding comfort index "absolute maximum longitudinal acceleration" of the VUT on the test route. The scoring rules for different interval ranges of the above two indexes are shown in Table 4.

**Table 3 Scoring Rules for Response to Test Scenarios**

Response	Score
Safe and collision-free passage	5 points
Takeover with safety reminder	3 points
Stopping in front of the scenario for a long time	(1 point)
Collision or active emergency takeover by test personnel to avoid collision	0 points

**Note 1:** "Stopping in front of the scenario for a long time" means that the vehicle stops in front of the scenario for more than 30 seconds when passage is allowed.

**Note 2:** During the evaluation of test scenarios "passing in narrow space" and "encountering crouched child during a right turn", if the VUT response is "takeover with safety reminder", 5 points will be scored.

**Note 3:** The driver's control of the buttons, screen and lever (excluding lever shifting) of the VUT is not considered "takeover".

**Table 4 Scoring Rules for Performance on Test Route**

Evaluation Index	Score	Range of Index	Score
Average speed (V)	6 points	$V > 8\text{km/h}$	6 points
		$8\text{km/h} \geq V > 5\text{km/h}$	3 points
		$5\text{km/h} \geq V > 0\text{km/h}$	1.5 points
Absolute maximum longitudinal acceleration (a)	3 points	$0.1g > a$	3 points
		$0.2g \geq a > 0.1g$	1.5 points
		$a > 0.2g$	0 points

**Note:** When the VUT passes through 5 scenarios, i.e. "making way on a straight road", "interference from front vehicle exiting from perpendicular parking spot", "interference in parking by following rear vehicle", "interference from nearside crossing pedestrian" and "emergency braking by front vehicle", its absolute longitudinal acceleration is not used to evaluate the index "absolute maximum longitudinal acceleration" indicating the performance on the test route.

The calculation method of the traffic efficiency index "average speed" is as follows:

$$V = \frac{S}{T}$$

Where,

V - average speed of the VUT on the test road;

S - distance from the "function activation area" to the "parking completion area" of the test route;

T - time for the VUT to travel from the "function activation area" to the "parking completion area".

**Table 5 Determination Moment of Timing Interruption**

Response	Timing Pause Moment	Timing Restart Moment
Safe and collision-free passage (a scenario through which the vehicle cannot pass in the initial state of the scenario)	Moment when the VUT stops in front of the scenario	Moment when the scenario conditions allow passage
Takeover with safety reminder	Moment when the VUT gives a takeover reminder	Moment when the VUT resumes the parking application function
Stopping in front of the scenario for a long time	30 seconds after parking	
Collision or active emergency takeover by test personnel to avoid collision	Moment when the driver takes over the VUT or a collision occurs	

3.2.7 If the test personnel is required to remove the test scenario because the VUT cannot pass through it smoothly in the initial state of the test scenario, or if there are "takeover with safety reminder", "stopping in front of the scenario for a long time" and "collision or active emergency takeover by the test personnel to avoid collision" when the VUT passes through the test scenario, the timing on the test route shall be temporarily stopped. The specific "timing pause moment" and "timing restart moment" are shown in Table 5.

### 3.3 Open parking lot evaluation

3.3.1 The full score of the open parking lot evaluation is 40 points, and the full scores for evaluation of the performance in the parking lots with three difficulty levels (easy, medium and challenging) are 5 points, 15 points and 20 points respectively. The overall evaluation is carried out based on the actual performance of the VUT on the test routes of the parking lots with three difficulty levels. For each test route, both the evaluations of learning and mapping and of parking application shall be carried out, with a full score weight of 20% and 80% respectively. The final score of the open parking lot evaluation is the sum of the actual scores of the VUT on the test routes of the parking lots with three difficulty levels.

3.3.2 If the memory parking function of the VUT is only applicable to outdoor parking lots, that is, if an outdoor parking lot test is carried out, the final score of the open parking lot test and evaluation shall be gained by multiplying a coefficient of 0.9.

**Table 6 Score Distribution of Open Parking Lot Evaluation**

Difficulty Level of Parking Lot	Score	Evaluation Item	Weight
Easy	5 points*K	Learning and mapping	20%
		Parking application	80%
Medium	15 points*K	Learning and mapping	20%
		Parking application	80%
Challenging	20 points*K	Learning and mapping	20%
		Parking application	80%

**Table 7 Relationship between Cruise Distance (D) and Coefficient (K) of VUT with Memory Parking Function**

Cruise Distance (D)	Coefficient (K)
D > 2500m	1
2000m < D ≤ 2500m	0.9
1500m < D ≤ 2000m	0.8
1000m < D ≤ 1500m	0.7
500m < D ≤ 1000m	0.6
200m < D ≤ 500m	0.5
D ≤ 200m	0.4

**Table 8 Scoring Rules for Learning and Mapping Evaluation**

Number of Tests	Success Rate	Scoring Rate		
		Easy	Medium	Challenging
1 <sup>st</sup> test	100%	100%	100%	100%
2 <sup>nd</sup> test	50%	0%	50%	50%
3 <sup>rd</sup> test	33%	0%	0%	25%
4 <sup>th</sup> test	25%	0%	0%	0%
5 <sup>th</sup> test	20%	0%	0%	0%

3.3.3 The evaluation of learning and mapping in the open parking lot is scored based on the "success rate of learning and mapping" of VUT on the test route. For the same test route, the more times VUT learns, the lower its scoring rate of learning and mapping on this route will be. See Table 8 for specific scoring rules.

3.3.4 The evaluation of parking applications in open parking lots is scored based on the takeover of parking applications by the VUT on the test route. Three tests shall be carried out for each test route, and the final score of the VUT on a specific test route is the average of the scores of the three tests. The calculation method for the "scoring rate of parking application" in a single test is as follows.

$$P = \frac{100 - (X + Y)}{100} \times 100\%$$

Where,

P - reference index for scoring rate of parking application;

X - deduction weight determined by the "number of takeovers with reminders", as shown in Table 9;

Y - deduction weight determined by the "number of takeovers without reminders", as shown in Table 9.

**Table 9 Query Form of Scoring Rules for Different Takeover Conditions**

Takeover Condition		Easy	Medium	Challenging
Number of takeovers with reminders (M)	X	50*(M-1)	50*(M-2)	25*(M-3)
Number of takeovers without reminder (N)	Y	100*N	50*N	50*N

**Note 1:** In the process of the open parking lot test, if other movable traffic participants appear in front

of the VUT abnormally in an emergency, causing the test personnel to take over the vehicle's driving urgently (for example, in case of a sudden object or pedestrian falling), this takeover will not be counted into the "number of takeovers with reminders" and "number of takeovers without reminders" counts.

**Note 2:** If the VUT fails to pass before a certain scenario, causing the parking application function of memory parking to exit automatically, accompanied by a signal prompt indicating the exit of the function, this situation is considered "takeovers with reminders";

**Note 3:** The driver's control of the buttons, screen and lever (excluding lever shifting) of the VUT is not considered "takeover".

**Table 10 Calculation Rules for Scoring Rate of Parking Application**

Calculated P Range	$P < 0\%$	$0\% \leq P \leq 100\%$	$P > 100\%$
Scoring rate of parking application	0%	P	100%

3.3.5 In the evaluation process of parking application in the open parking lot, if the memory parking function of the VUT successfully completes any one of the following investigation items, bonus points can be awarded. The proportion of each investigation item to the full score of parking application evaluation on the test route is shown in Table 11. The sum of the bonus points of the VUT shall not exceed 20% of the full score of the test route.

**Table 11 Investigation Items for Bonus Points in the Evaluation of Parking Application in Open Parking Lots**

S/N	Investigation Item for Bonus Points	Bonus Points Proportion
1	Cruise from the target parking space to the garage entrance and exit	10%
2	In-vehicle interactive prompts, such as display of target object detection results, display of path learning and mapping completion, next action prompt, and driving distance prompt during learning and mapping process.	5%
3	Exterior interactive prompts, such as turning on the turn signal for turns, automatically turning on the headlamp in dark environments, flashing lights when passing through intersections, and providing external reminders of actions.	5%
4	Global optimization of learning and mapping path based on driving tasks during parking application	5%
5	Ability to use parking application function by obtaining paths learned and mapped by other vehicles	1%
6	Ability to select any parking spot within the map for memory parking before the parking application function is activated	1%

**Note:** The VUT can be awarded bonus points corresponding to an investigation item above only when the VUT meets the bonus point requirements for all the similar investigation items encountered in the same test route.