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Annex B.2

C-ICAP

CHINA INTELLIGENT CONNECTED VEHICLE
TECHNICAL REGULATIONS (C-ICAP)

CICAP-B.2

Evaluation Rules for Valet Parking Assist (Version 1.0)

记忆泊车辅助测评细则

November 2022

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Evaluation Rules for Valet Parking Assist

This test technical regulation is applicable to valet parking assist system.

The valet parking assist system refers to a parking assist system that needs to set a route in advance and can complete cruise, park in or park out according to the route.

The vehicle under evaluation needs to declare whether it has one-button summoning capability for outdoor parking lot, one-button summoning capability for indoor parking lot, one-button parking capability for outdoor parking lot and one-button parking capability for indoor parking lot:

- 1) If it has one-button summoning capability for outdoor parking lot, then conduct the evaluations of items 1, 2, 3, 4, 5, 6, 7 in Table 1-1.
- 2) If it has one-button summoning capability for indoor parking lot, then conduct the evaluations of items 8, 9, 10, 11, 12 in Table 1-1.
- 3) If it has one-button parking capability for outdoor parking lot, then conduct the evaluations of items 13, 14, 15, 16, 17 in Table 1-1.
- 4) If it has one-button parking capability for indoor parking lot, then conduct the evaluations of items 18, 19, 20, 21 in Table 1-1.

Only when the score of B.1 Basic parking assist is ≥ 70 points can the test of this regulation be carried out.

1 Evaluation method

1.1 Indicator system

The indication system for valet parking assist is shown in Table 1-1.

Refer to subclause 1.3.4.17.1 for the score calculation instructions.

2 Test methods

2.1 Scope of application

This Specification applies to M₁ passenger cars.

2.2 Normative references

The provisions in the following documents become part of this Specification, through reference in this Specification. For dated references, their subsequent amendments (excluding corrigendum) or revisions do not apply to this Specification. For undated reference documents, the latest versions apply to this Specification.

ISO 15622-2018, *Intelligent transport systems - Adaptive Cruise Control systems - Performance requirements and test procedures*

ISO 22178-2009, *Intelligent transport systems - Low speed following (LSF) systems - Performance requirements and test procedures*

ISO 11270-2010, *Intelligent transport systems - Lane keeping assistance systems (LKAS) - Performance requirements and test procedures*

ECE R79, *Uniform provisions concerning the approval of vehicles with regard to steering equipment*

ECE R157, *Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems*

GB/T 20608-2006, *Intelligent transportation systems - Adaptive cruise control systems - Performance requirements and test procedures*

GB 5768.3, *Road traffic signs and markings - Part 3: Road traffic markings*

ISO 8855-1991, *Road vehicles - Vehicle dynamics and road-holding ability - Vocabulary*

ISO 16787, *Intelligent transport systems - Assisted parking systems (APS) - Performance requirements and test procedures*

JGJ 100, *Code for design of parking garage building*

05MR404 (GJBT-855), *City road - Curbs*

2.3 Terms and definitions

Vehicle Under Test

A vehicle that is capable of continuously controlling both lateral and longitudinal motion and is tested in accordance with this test procedure.

Vehicle Target

The vehicle target specified in this test technical regulation.

Time To Collision

The time it takes for the vehicle under test to collide with the vehicle target, mannequin target, bicycle target, or scooter target while maintaining the current state of motion.

Time Gap

The time required for the vehicle under test to travel at the current speed and reach the target position at the current moment.

Set Speed

The expected speed (displayed speed) of the vehicle when the driving assist system is activated.

Desired Speed

After setting the vehicle speed, the maximum stable vehicle speed that the system can achieve.

Number of parking

During the process of parking the vehicle, when the gear position is shifted to Gear R and the vehicle is moving, it is counted as the first parking. During the parking process, when the gear position is switched from R to D or from D to R, they should be counted as one parking respectively.

Average speed of cruising section

It refers to the average vehicle speed of the cruising section calculated based on the running time of the section of a 30m-long continuous road intercepted by the vehicle on the through-lane after it runs stably.

2.4 General

This part describes the test methods for valet parking.

2.5 Test conditions

2.5.1 Test site conditions

- 1) The test road needs to be dry. The surface is free of visible moisture. The surface is smooth and solid.
- 2) The test road surface requires compaction and no irregularities that may cause the sensor to work abnormally (such as large inclinations, cracks, manhole covers, or bolts with reflective capabilities).
- 3) Lane lines can be white solid lines, white dotted lines, yellow solid lines and yellow dotted lines, meeting the requirements of GB 5768.3.

Select the outdoor parking lot of China Automobile Center (or other closed outdoor parking area where the valet parking function can be activated), and the parking building of China Automobile Center (indoor parking lot) as the test site.

2.5.2 Test weather conditions

- 1) The weather is dry, without raining or snowing.
- 2) The visibility in the horizontal direction of the outdoor parking lot is not less than 1 km.
- 3) The wind speed is not greater than 10 m/s.
- 4) For tests conducted under natural light conditions, the lighting conditions should be consistent throughout the test area. The light intensity should not be lower than 2000 Lux. The test is not carried out towards or away from direct sunlight.
- 5) The illuminance of the indoor parking lot should not be less than 30 lux. There is no obvious shadow on the test road. Parking spaces are clearly marked.

2.5.3 Equipment requirements

2.5.3.1 The test equipment should satisfy the sampling and storage of dynamic data. The frequency of sampling and storage is at least 100 Hz. The DGPS time is used for data synchronization between the vehicle target and the vehicle under test.

2.5.3.2 Data acquisition and object control accuracy

The data acquisition accuracy of the target object and the vehicle under test during the test should at least meet the following requirements:

2.5.4.1.1 Confirmation of tire condition

Use new OEM tires consistent with the manufacturer's specified tire configuration (supplier, model, size, speed and load rating) to test. In the case of ensuring the same tire configuration (supplier, model, size, speed and load rating) as specified by the manufacturer, it is allowed to use the replacement tires provided by the manufacturer or the manufacturer's designated agent. Inflate the tire to the standard cold air pressure recommended by the manufacturer. This cold air pressure is at least suitable for normal load conditions.

2.5.4.1.2 Confirmation of vehicle condition

2.5.4.1.2.1 Make sure that the vehicle under test is loaded with a spare wheel (if equipped) and vehicle tools. There should be no other items in the vehicle.

2.5.4.1.2.2 Make sure that all tires are inflated to the manufacturer's recommended tire pressure for the current load.

2.5.4.1.2.3 Measure vehicle front and rear axle loads. Calculate the gross mass of the vehicle. Consider this weight as the curb weight of the vehicle and record it.

2.5.4.1.3 Equipment installation and stowage

2.5.4.1.3.1 Install test instruments and equipment.

2.5.4.1.3.2 Stow the vehicle according to the stowage mass requirements (200 kg deducting the mass of the test driver and test equipment). The installation should be reliable.

2.5.4.1.3.3 Measure the front and rear axle loads of the vehicle, including the driver.

2.5.4.1.3.4 Compare it to vehicle curb weight.

2.5.4.1.3.5 The difference between the measured gross vehicle mass and curb mass + 200 kg should be within $\pm 1\%$. The difference between the front and rear axle load distribution and the axle load distribution of a full-fuel and unloaded vehicle should be less than 5%. If the actual condition of the vehicle does not meet this requirement, adjust the load without affecting the performance of the vehicle. Make sure it is secure after adjustment.

2.5.4.1.3.6 Repeat 2.5.4.1.3.3 to 2.5.4.1.3.5 until the front and rear axle loads and total mass of the vehicle meet the requirements. Carefully adjust the stowage to be as close as possible to the original factory attributes of the vehicle. Record the final axle load.

2.5.4.2 Test preparation

2.5.4.2.1 Function setting

Make sure that the vehicle valet parking function can be activated normally.

2.5.4.2.2 Active hood system

When the failure of the active hood system of the vehicle does not affect the normal operation of the system, the system should be disabled before the test.

2.5.4.2.3 Airbag system

When the failure of the airbag system of the vehicle does not affect the normal operation of the system, the system should be disabled before the test.

2.5.5 Test items

2.5.5.1 Parking-out capacity for parallel parking space

2.5.5.1.1 Stationary vehicles on both sides

(1) Test scenario

Select the outdoor parking lot of China Automobile Center (or other outdoor enclosed parking areas where the valet parking function can be activated) to carry out the test. The test road contains at least one straight. There are no obstacles on the straight that affect the operation of the valet parking system (except test obstacles). There is a target parallel parking space on the side of the road. There are stationary vehicles on both sides of the parking space of the vehicle under test. The placement requirements for stationary vehicles are shown in Figure 2-4 (the longitudinal distance of the vehicle in the figure is the distance between the outermost edge of the vehicle and the inner edge of the parking space line; the lateral distance is the distance between the tire ground contact point and the inner edge of the parking space line). If the vehicle under test can be parked by relying on the valet parking system, the initial position of the vehicle under test is determined by the parking function of the valet parking system. Otherwise, the vehicle under test should be placed in the center of the parking space. The difference between the left and right sides of the vehicle body (calculated based on the tire ground point) and the inner edge of the parking space line is less than 10 cm. The difference between the front and rear sides of the vehicle body and the inner edge of the parking space line is less than 10 cm. As shown in Figure 2-4.

- 1) The vehicle under test activates the valet parking function and drives along the parking path.
 - 2) A dummy walking along the direction of the vehicle is set in front of the straight-line driving path of the vehicle under test. When the vehicle under test is at least THW=5s away from the dummy, the adult dummy accelerates to 5 km/h through 1 m and keeps moving at a constant speed. The trajectory of the dummy is located 0.5 m to the right of the middle of the road.
- (3) Exit conditions
- 1) The vehicle collides with other vehicles or obstacles while driving.
 - 2) The valet parking system issues an abnormal prompt.
 - 3) The vehicle under test arrives at the summoning location.

2.5.5.6 Encountering children crossing during summoning process

2.5.5.6.1 Encountering blocked children crossing in the direction of travel

(1) Test scenario

Select the outdoor parking lot of China Automobile Center (or other outdoor closed parking area where the valet parking function can be activated) to carry out the test. The test road contains at least two straights. There are no obstacles on the straights that affect the operation of the valet parking system (except test obstacles). There is perpendicular parking space on the right side of the driveway. The vehicle under test goes straight along the path in the lane. The target child dummy appears across the middle of the two parking spaces. Park an obstacle vehicle at least to the left of the child dummy. The distance between the front end of the obstacle vehicle and the edge of the road is 0.1 m. The target pedestrian (child) is 2 m away from the edge of the road (the longitudinal distance of the vehicle in the figure is the distance between the outermost edge of the vehicle and the inner edge of the parking space line; the lateral distance is the distance between the tire ground contact point and the inner edge of the parking space line). As shown in Figure 2-11.

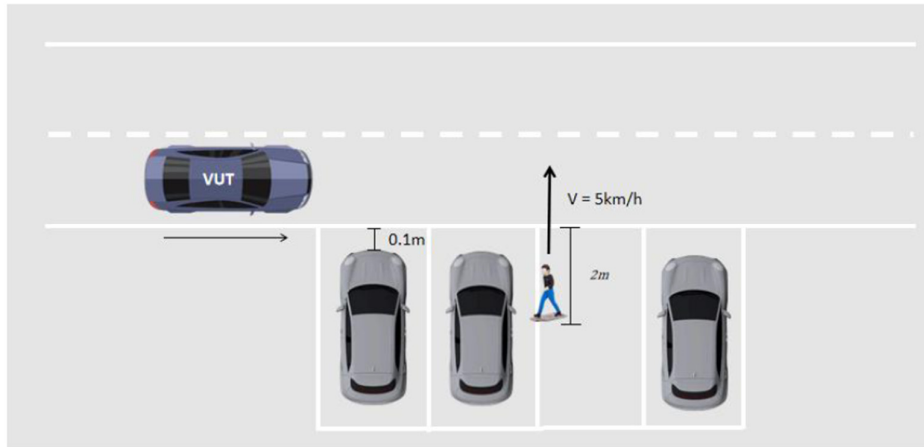


Figure 2-11: Schematic diagram for the scenario of encountering blocked children crossing in the direction of travel

(2) Test method

- 1) The vehicle under test activates the valet parking function and drives along the parking path.
- 2) The target child dummy accelerates from static to 5 km/h by 1 m and then passes through the test track at a constant speed of 5 km/h. The estimated collision location is 50% directly in front of the vehicle.

(3) Exit conditions

- 1) The vehicle collides with other vehicles or obstacles while driving.
- 2) The valet parking system issues an abnormal prompt.
- 3) The vehicle under test arrives at the summoning location.

2.5.5.7 Encountering temporary obstacles during summoning process

2.5.5.7.1 Encountering temporary traffic obstacles in the direction of travel

(1) Test scenario

Select the outdoor parking lot of China Automobile Center (or other outdoor enclosed parking areas where the valet parking function can be activated) to carry out the test. The test road is two straights containing dotted lines in the parking lot. Place 5 cone barrel-shaped traffic signs (recommended size: 50cm*35cm) at an angle of 45 degrees to the road direction in the middle of the lane as obstacles. As shown in Figure 2-12.

straight that affect the work of the valet parking system (except test obstacles). There is a target pillar parking space on the side of the road. There is a stationary child in front of the pillar parking space. There is a stationary vehicle on the side of the parking space where the vehicle under test is parked. There are pillars on the other side. Taking the left column parking space as an example, the placement requirements for stationary vehicles are shown in Figure 2-16 (the longitudinal distance of the vehicle in the figure is the distance between the outermost edge of the vehicle and the inner edge of the parking space line; the lateral distance is the distance between the tire ground contact point and the inner edge of the parking space line close to the target parking space). The child dummy is located on the perpendicular line of two points A and B and is 0.2 m away from the parking space line. If the vehicle under test can be parked by relying on the valet parking system, the initial position of the vehicle under test is determined by the parking function of the valet parking system. Otherwise, the vehicle under test should be placed in the center of the parking space. The difference between the left side and right side of the vehicle body (calculated based on the ground contact point of the tire) and the inner edge of the parking space line is less than 10 cm. The difference between the front side and rear side of the vehicle body and the inner edge of the parking space line is less than 10 cm. As shown in Figure 2-14.

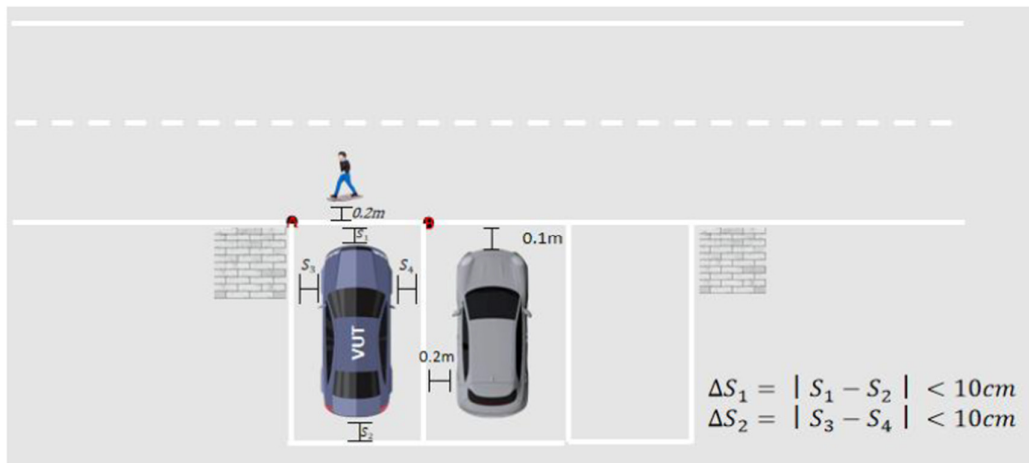


Figure 2-14: Schematic diagram for the scenario of stationary vehicles on one side and stationary upright children during parking out

(2) Test method

Randomly select the left or right pillar parking space. The driver activates the valet parking system of the vehicle under test. The vehicle under test is parked out.

(3) Exit conditions

- 1) The vehicle is not parked out of the parking space or collides with border vehicles, child dummies, and pillars.

- 2) The system sends a takeover request before the parking-out completion prompt.
- 3) The vehicle under test is parked out of the parking space.

2.5.5.9 Parking-out capacity for wall parking space

2.5.5.9.1 Stationary vehicles on one side

(1) Test scenario

Select the indoor parking lot of China Automobile Center to carry out the test. The test road includes at least one straight in the parking lot. There are no obstacles on the straight that affect the valet parking system (except test obstacles). There is a target wall parking space on the side of the road. If there is a parking space next to the parking space for the vehicle under test, a stationary vehicle should be parked. The other side is the wall. The placement requirements for stationary vehicles are shown in Figure 2-17 (the longitudinal distance of the vehicle in the figure is the distance between the outermost edge of the vehicle and the inner edge of the parking space line; the lateral distance is the distance between the tire ground contact point and the inner edge of the parking space line close to the target parking space). If the vehicle under test can be parked by relying on the valet parking system, the initial position of the vehicle under test is determined by the parking function of the valet parking system. Otherwise, the vehicle under test should be placed in the center of the parking space. The difference between the left side and right side of the vehicle body (calculated based on the ground contact point of the tire) and the inner edge of the parking space line is less than 10 cm. The difference between the front side and rear side of the vehicle body and the inner edge of the parking space line is less than 10 cm. As shown in Figure 2-15.

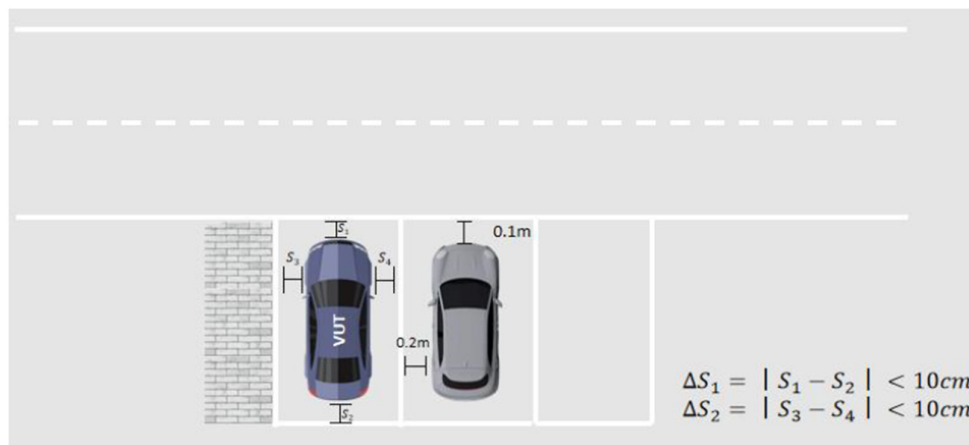


Figure 2-15: Schematic diagram for the scenario of stationary vehicles on one side

(2) Test method

The driver activates the valet parking system of the vehicle under test. The vehicle under

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