Annex A

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China Intelligent Vehicle Index

Test and Evaluation Protocol for Intelligent Safety Index

(Version 2026)

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Published by **China Automotive Engineering Research Institute Co., Ltd.**

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Foreword

At present, the intelligence and connectivity technologies of automobiles are developed at a rapid speed, and all-round protection of vehicle safety has become a focus of concern for consumers. The number of vehicles installed with combined driver assistance systems continues to rise, the L2 advanced combined driver assistance system function on new vehicles is gradually popularized to more models, and many models are equipped with this function. However, the performance of each solution varies greatly, and there are still many safety risks in the actual application of driver assistance functions. At the same time, cybersecurity issues have become increasingly complex and diverse. In recent years, malicious attacks against automobile enterprises, Internet of Vehicles（IoV） information service providers and other enterprises have occurred frequently, posing a severe challenge to the safety of intelligent and connected vehicles (ICVs).

To scientifically evaluate the comprehensive performance of intelligent safety of ICVs and promote the safety improvement and function update of systems, China Automotive Engineering Research Institute Co., Ltd.(CAERI) has comprehensively analyzed the safety risk timeline during vehicle driving, built a test and evaluation system integrating four dimensions: "complex scenario safety, driving interaction safety, cybersecurity and privacy security and active and passive safety" and officially launched the IVISTA China Intelligent Vehicle Index (Version 2026) - Test and Evaluation Protocol for Intelligent Safety Index.

Among them, the complex scenario safety test sets up city roads, highway and expressway typical test scenarios and simulation tests in closed proving grounds, focusing on evaluating the real vehicle performance and simulation generalization scenario performance of vehicles in complex scenarios, which is of great significance for recognizing the system's risk response capabilities and improving reliability in complex scenarios. Driving interaction safety testing primarily covers driver interaction safety and intelligent lighting safety. Driver interaction safety mainly evaluates driver status monitoring, driving visual assistance, and voice interaction safety, providing effective alerts for safety risks during driving to ensure overall driving safety. Intelligent lighting safety, on the other hand, focuses primarily on testing adaptive driving beams and auxiliary projection lights to ensure the safety of vehicle lighting interactions. Cybersecurity and privacy testing focuses on two key areas—cybersecurity and privacy—to ensure the stable operation of in-vehicle networks and the protection of data privacy, thereby effectively defending against various attacks targeting in-vehicle information and eliminating the risk of sensitive data leaks.

The purpose of this protocol is to provide consumers with an objective and reliable basis for car purchases and clear guidance for technological breakthroughs in the industry, thereby driving upgrades across the industrial chain and continuously empowering the high-quality development of the intelligent vehicle industry.

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Test and Evaluation Protocol for Intelligent Safety Index

1 Scope

This document specifies the test and evaluation methods of IVISTA China Intelligent Vehicle Index (Version 2026) - Intelligent Safety Index.

2 Normative References

The following normative documents contain provisions which, through reference in this text, constitute indispensable provisions of this document. Among them, for dated references, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies to this document.

GB 4599-2024 Road Illumination Devices and Systems for Motor Vehicles

GB 5768.2-2022 Road Traffic Signs and Markings - Part 2: Road Traffic Signs

GB 5768.3-2009 Road Traffic Signs and Markings - Part 3: Road Traffic Markings

GB 5768.5-2017 Road Traffic Signs and Markings - Part 5: Speed Limit

GB 23826-2009 Light-emitting Diode Changeable Speed Limit Signs of Expressway

GB/T 15089 Classification of Power-driven Vehicles and Trailers

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

GB/T 20608-2006 Intelligent Transportation Systems - Adaptive Cruise Control Systems - Performance Requirements and Test Procedures

GB/T 37036.5-2023 Information technology - Biometric Identification of Mobile Devices - Part 5: Voiceprint

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

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

GB/T 41797-2022 Performance Requirements and Test Methods for Driver Attention Monitoring System

GB/T 44433-2024 Performance Requirements and Testing Methods for Intelligent Speed Limit System of Vehicles

GB/T 39901-2025 Technical requirements and testing methods for advanced emergency braking system of light-duty vehicles

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

ISO 15622 Intelligent transport systems - Adaptive cruise control systems - Performance requirements and test procedures

ISO NP 21717 Intelligent transport systems - Partially automated in lane driving systems (PADS) - Performance requirements and test procedures

ISO 22179 Intelligent transport systems - Full speed range adaptive cruise control (FSRA) systems - Performance requirements and test procedures

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Headlight Test and Rating Protocol (Version III)

Federal Motor Vehicle Safety Standards; Lamps, Reflective Devices, and Associated Equipment, Adaptive Driving Beam Headlamps

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1

combined driver assistance system

a system composed of hardware and software that continuously performs lateral and longitudinal vehicle motion control as part of the dynamic driving task under its designed operating conditions and that is capable of performing part of the object and event detection and response task appropriate to such motion control

3.2

subject vehicle; SV

vehicle under test, equipped with a combined driver assistance system

3.3

target vehicle, TV

a vehicle that can interfere with the functions of combined driver assistance systems of the SV when running ahead of or near the SV

3.4

express tricycle target vehicle

an express tricycle test equipment designed for the test of combined driver assistance system

3.5

truck target vehicle

a truck test equipment designed for the test of combined driver assistance systems

3.6

light truck target vehicle

a light truck test equipment designed for the test of combined driver assistance systems

3.7

child pedestrian target; CPT

a child pedestrian test equipment designed for the test of combined driver assistance systems

3.8

adult pedestrian target; APT

an adult pedestrian test equipment designed for the test of combined driver assistance systems

3.9

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scooter target adult; STA

an electric scooter target with an adult driver test equipment designed for the test of combined driver assistance systems

3.10

clearance

distance between the rear of the TV and the front of the SV, expressed by $X_0(t)$

3.11

time gap

time interval required for the SV to pass through the clearance between consecutive vehicles, as shown in Fig. 1, with the calculation formula of Formula (1):

$$\tau = \frac{x_0(t)}{v_{sv}(t)} \quad (1)$$

Where, τ – time gap, in s

$V_{SV}(t)$ – current speed, in m/s

$X_0(t)$ – clearance, in m

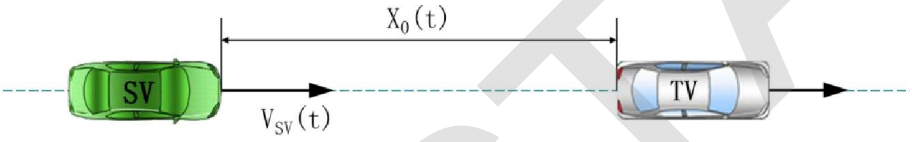


Fig. 1 Clearance

3.12

set speed

expected GPS speed of the vehicle under DA control

3.13

direct control alert; DCA

a warning signal used to prompt the driver to immediately resume performing vehicle lateral motion control

3.14

pre-impact point

the theoretical point at which the SV first has a pre-impact event with the object target (including passenger car target vehicle, truck target vehicle, express tricycle target vehicle, pedestrian target, adult bicyclist target, scooter target adult and special shape object target)

3.15

time to collision; TTC

the remaining time before a collision between two vehicles traveling on the same path, assuming that the relative velocity remains unchanged, calculated as per the following formula, provided that the relative velocity is not zero

The value may be estimated through dividing the clearance between the SV and TV by

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the relative velocity, as indicated in Formula (2). If the calculation condition is not met or the calculated TTC is negative, the collision is impossible under the above-mentioned assumed conditions.

$$TTC=\frac{X_0(t)}{V_r(t)} \quad (2)$$

Where, TTC – time to collision, in s

$V_r(t)$ – relative velocity, in m/s

$X_0(t)$ – clearance, in m

3.16

longitudinal offset

distance from the center point of the SV's front to the TV on the planned path of the SV, as shown in Fig. 2



Fig. 2 Longitudinal Offset

3.17

lateral overlap

a percentage of the width overlap between the TV and the SV to the SV's width, as shown in Fig. 3

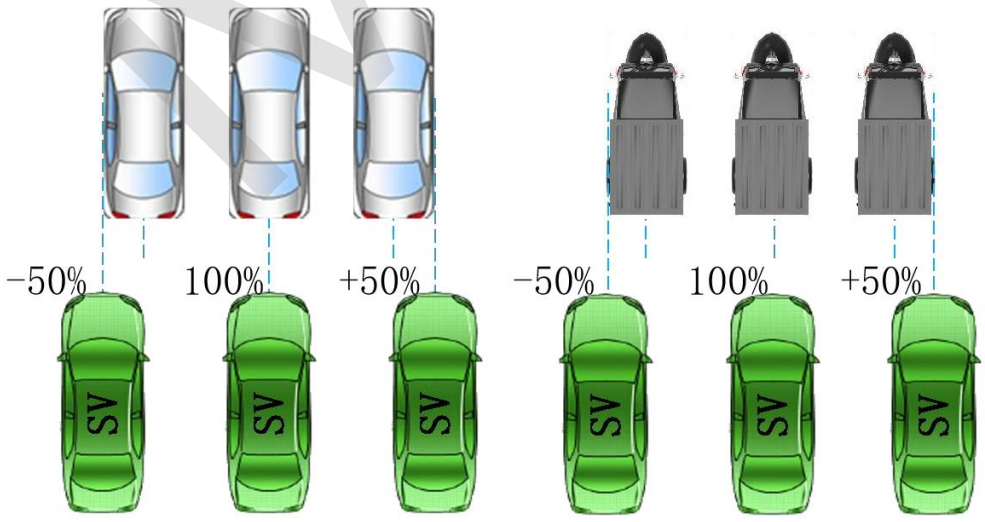


Fig. 3 Lateral Overlap

3.18

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driver state monitoring

a driver state monitoring system capable of determining whether the driver is in a state of distraction or fatigue

3.19

distraction

any behavior that distracts the driver from the primary task of driving/controlling the vehicle

3.20

inertial frame

the inertial frame specified in ISO 8855:2011 used in this protocol, in which the x axis points towards the front of the vehicle, the y axis towards the left side of the driver and the z axis upwards (right-hand coordinate system)

Viewed from the origin to the positive directions of the x, y, and z axes, a clockwise rotation around the x, y, and z axes corresponds to roll, pitch, and yaw angles, respectively. This frame is used for both left-hand and right-hand drive vehicles.

3.21

headlamp

a lamp that provides low beam, high beam or both, illuminating the road ahead of a vehicle

3.22

low beam

short-range illumination beam used without dazzling or causing discomfort to other road users in front of the vehicle

3.23

high beam

long-range illumination beam used when there are no other road users in front of the vehicle

3.24

adaptive driving beam; ADB

a driving beam that can automatically adjust its projection range to reduce glare disturbance to drivers of other vehicles ahead or in opposite directions

3.25

aiming

positioning of the light beam on the photometric screen during the photometric characteristics test

3.26

axis of reference; reference axis

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the lamp characteristic axis specified by the manufacturer serves as the reference direction (H=0°, V=0°) for field of view during photometric measurements and lamp installation

3.27

centre of reference

intersection of the reference axis and the outer surface of the lens, specified by the lamp manufacturer

The mark of the centre of reference (with a graphic size of at least 2 x 2 mm) shall be indicated on the technical drawings submitted to the testing organization or marked on the lamp.

3.28

ADB masking precision and accuracy

ADB masking precision and accuracy includes two indicators: masking precision and masking accuracy.

For the ADB masking precision and accuracy, the masking precision is used to evaluate the masking range. The smaller the range, the higher the masking precision. The evaluation index is the ratio ρ of the masking area S of the ADB on the screen projection to the initial projection area S_0 of the object target on the screen when the ADB is turned on.

Masking accuracy is used to evaluate the position of masking. The closer the masking position is to the target vehicle, the higher the masking accuracy. The evaluation index requires that the object target can be properly masked.

3.29

assistance projection function

a projection function that assists the driver in assisted driving by adjusting the light distribution

Examples: slippery road warning projection function, lane keeping assist (LKA) signal projection function and rear-end collision alert signal (RECAS) projection function.

3.30

global system for mobile communications; GSM

a digital mobile communication standard

3.31

vehicle control application

a mobile application that communicates with the vehicle by using wireless communication technologies (such as Bluetooth and mobile network) to achieve remote control and management of various functions of the vehicle, such as starting or stopping the engine, opening and closing doors, monitoring vehicle position and status, adjusting the interior temperature

3.32

deauthentication (DE-AUTH) attack

an attack mode in which an attacker forces the target device to disconnect from the Wi-Fi

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network by sending a forged deauthentication frame to the Wi-Fi access point or client

3.33

phishing attack

a network attack mode in which an attacker deceives users to obtain their sensitive information by disguising themselves as a trusted entity

3.34

fuzz testing

an automated testing technique designed to uncover vulnerabilities, errors or security problems in software or systems

3.35

false acceptance rate; FAR

a proportion of unauthorized users (i.e., heterogeneous samples) that are incorrectly recognized as authorized users (i.e., homogeneous samples) in a biometric or security verification system

[SOURCE: GB/T 37036.5-2023]

4 Test Requirements

4.1 Requirements for test track and environment

4.1.1 Requirements for the test field

4.1.1.1 The closed test site shall meet the following requirements:

a) The test field shall be a dry pavement, without visible moisture, obvious pits, cracks and other defects.

b) Except for the ramp, the ground slope shall be less than 1%;

c) The test field shall be concrete or asphalt pavement.

d) The lane width of the test road shall be between 3.5 m and 3.75 m;

e) The lane lines can be white solid lines, white dotted lines, yellow solid lines and yellow dotted lines, which meet the requirements of GB 5768.3.

Note: Under test conditions such as rainfall or fog, the test road may not meet the requirements specified in a).

4.1.1.2 Test field for cybersecurity and privacy security

a) A spacious, flat and open test field or a vehicle shielded room shall be selected for the test;

b) For relevant tests involving wireless communication, the vehicle shielded enclosure shall be selected as the test site to avoid interference and reflection of wireless signals;

c) Within 30 m ahead of stationary target vehicles and on both sides of the open test ground, no vehicles, obstacles or other test-interfering objects shall be present.

4.1.2 Requirements for test environment

4.1.2.1 The closed test site environment shall meet the following requirements:

a) Weather conditions are favorable, with wind speeds not exceeding 5 m/s; barring

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exceptional circumstances, there is no adverse weather such as rain, snow, or dust storms;

b) Except for nighttime, rainy, or foggy conditions, tests shall be conducted under uniform natural lighting conditions, with an average wind speed not exceeding 5 m/s, a maximum instantaneous wind speed not exceeding 10 m/s, and no rain, snow, fog, or dust;

c) The illumination intensity for the daytime test shall not be less than 2000 lx, and the background illumination intensity for the nighttime test shall not be higher than 5 lx;

d) The temperature shall be 0°C ~ 45°C;

4.1.2.2 Intelligent lighting test environment:

a) The temperature shall be 5°C ~ 42°C;

b) The test shall be carried out at least 30 min after sunset when the illuminance is not greater than 0.3 lx;

c) The test lane is 3.5 to 3.75 meters wide, with no standing water or obstructions on the lane.

4.1.2.3 Cybersecurity and privacy test environment:

a) During the test, avoid interference from other wireless devices and ensure the purity of the test environment;

b) In the shielded room, testers need to place external communication devices such as mobile phones and tablets outside the shielded room.

4.1.3 Vehicle lighting laboratory:

a) The standard temperature range of the laboratory is 21°C ~ 25°C, and the relative humidity is 70% RH;

b) The illumination of the laboratory shall be strictly controlled, and the value displayed on the photometer shall be less than 0.001 lx;

c) The distance between the white screen for testing in the vehicle lighting laboratory and the headlamp shall be at least 25 m;

d) Angle measurement resolution: 0.01°;

e) Test angle range (illumination range of high beam and low beam): horizontal: -60° ~ +60°, vertical: -7° ~ +6°;

f) Glare measurement: ≤ ± 1% at 0.01 lx; visibility measurement: ≤ ± 0.5% at 5 lx;

g) Illumination error: ≤ ± 3%.

4.2 Requirements for test equipment

4.2.1 Object target

a) Adult pedestrian targets (APT) and standing child pedestrian targets (CPT) (as shown in Fig. 4); the surface feature parameters of the targets shall be representative of the aforementioned adults and standing children, and the targets must be soft objects capable of swinging their legs to accommodate the sensor system. Specific requirements are outlined in ISO 19206-2.

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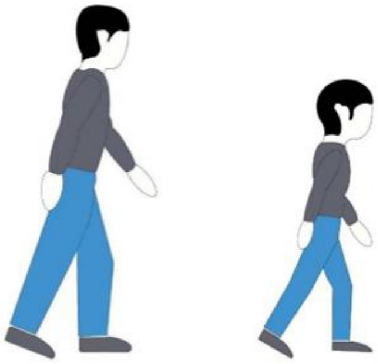


Fig. 4 Adult Dummy (Left) and Standing Child Dummy (Right)

Note 1: For soft targets, the requirements of applicable national standards shall prevail after they are published.

Note 2: If the manufacturer of the SV believes that the soft target does not meet the requirements of the SV sensor for the target, please contact the IVISTA Management Center.

b) The passenger vehicle TV shall be a mass-produced M1 passenger vehicle, or a soft target that has surface characteristic parameters representative of M_1 passenger vehicles and can adapt to the sensor system. See ISO 19206-3 for specific requirements and Fig. 5 for the appearance of soft passenger vehicle target.



Fig. 5 Appearance of Soft Passenger Vehicle Target (3D Vehicle Target (Left), without Lighting System (Middle) or with Lighting System (Right))

c) The express tricycle target vehicle shall be a mass-produced express tricycle, or a soft target that has surface characteristic parameters representative of express tricycles and can adapt to the sensor system. See Table 1 for the current main dimensions and Fig. 6 for the appearance of soft express tricycle target.



Fig. 6 Appearance of Soft Express Tricycle Target

Table 1 Main Dimensions of Soft Express Tricycle Target

Dimensions	Value (mm)
Total length	2900±30
Wheelbase	1950±25

Total height (including base plate and vehicle front)	1750±50
Total vehicle height (by compartment)	1500±25
Total width	1000±25
Compartment height	1150±20

Note 1: For soft targets, the requirements of applicable national standards shall prevail after they are published.

Note 2: If the manufacturer of the SV believes that the soft target does not meet the requirements of the SV sensor for the target, please contact the IVISTA Management Center.

d) The truck target vehicle shall be a mass-produced N3 vehicle for the carriage of goods, or a soft target that has surface characteristic parameters representative of N3 vehicles for the carriage of goods and can adapt to the sensor system. The current main dimensional requirements are given in Table 2.



Fig. 7 Appearance of Soft Truck Target

Table 2 Main Dimensions of Soft Truck Target

Dimensions	Value (mm)
Total height	3900±50
Compartment width	2500±50
Compartment height	2700±50
Bumper height above the ground	440±10
Bumper length	2340±30
Bumper width	120±5

e) The STA shall be a soft target that has surface characteristic parameters representative of a scooter and can adapt to the sensor system. The current main dimensional requirements are given in Table 3.



Fig. 8 Appearance of STA

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Table 3 Main Dimensions of STA

Dimensions	Value (mm)
Length	1720±10
Width	630±10
High	1000±10
Seat height	730±10
Total height	1570±20

f) For rainy weather scenarios, an umbrella is fixed to the adult dummy target APT through a soft bracket and set as an adult dummy target holding an umbrella. The umbrella is a black three-folded umbrella, and the umbrella cloth is made of pongee fabric or black coating, with a radius of 55 cm. See Fig. 9 for the appearance of APT with an umbrella.



Fig. 9 Appearance of Pedestrian Target Holding an Umbrella

g) The light truck target vehicle shall be a mass-produced N2 vehicle for the carriage of goods, or a soft target that has surface characteristic parameters representative of N2 vehicles for the carriage of goods and can adapt to the sensor system. The current main dimensional requirements are given in Table 4.



Fig. 10 Appearance of Soft Light Truck Target

Table 4 Main Dimensions of Soft Light Truck Target

Dimensions	Value (mm)
Total vehicle length	6000±50
Total vehicle height	3140±50
Total vehicle width	2210±50
Compartment width	2060±50

Compartment length	4210±50
Compartment height	2200±50
Head height	2680±50
Head length	1690±30
Head width	1860±30
Wheelbase	3360±50
Tail board height	1600±20
Tail above the ground	400±20

h) The adult bicyclist target and the pedestrian target pushing a bicycle (as shown in Fig. 11) shall be soft targets whose surface feature parameters are representative of the adult bicyclist above and can adapt to the sensor system. Refer to ISO 19206-4 for specific requirements.

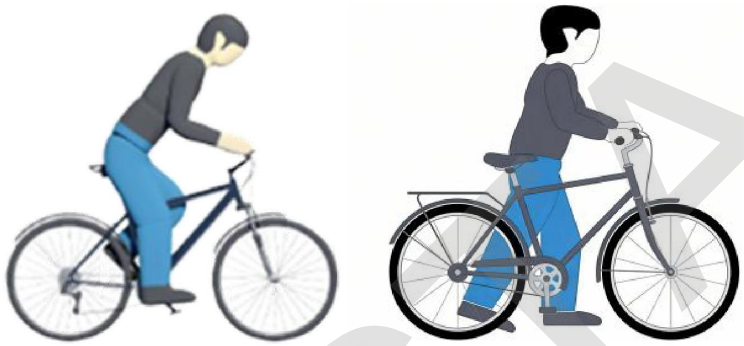


Fig. 11 Appearances of ABT and Pedestrian Target Pushing a Bicycle

4.2.2 Simulation toolchain

Requirements for simulation test toolchain:

a) The simulation test toolchain shall not be changed during the simulation test.

b) The simulation test toolchain shall have the ability to run concrete test scenarios (including but not limited to road network and object targets).

c) The simulation test toolchain shall have the ability to access the automated driving system model, algorithm or hardware under test.

d) The simulation test toolchain should have the ability to run the raw signal-level data from sensors or access the sensor hardware, such as cameras and radars.

e) The simulation test toolchain shall have the ability to run the vehicle dynamics model or access the vehicle execution system.

f) The simulation test toolchain shall support the judgment of simulation test results and ensure the traceability of simulation test results, and shall at least support the recording and saving of the test data required in 4.4.

4.2.3 Driving interaction test tool

4.2.3.1 Eye tracker

a) The sampling rate of the eye tracker for recording the driver's line of sight shall not be less than 60 Hz;

b) Gaze tracking error: ±0.5°;

c) Head turning angle tracking error: ±0.5°;

d) Eyelid closure recognition error: ±0.1 cm.

Fix the eye tracker cameras below the front windshield in the vehicle with the mounting fixture. Install cameras 1 and 3 on the central console near the left and right A-pillars, and camera 2 on the central console directly below the rearview mirror (the specific installation positions may be adjusted based on the type of the central console of the model). Align the plane of the camera lens with the face of the driver, and ensure that the driver's face is within the field of view of the eye tracker camera. The schematic diagram of the installation position of the eye tracker is shown in Fig. 12.

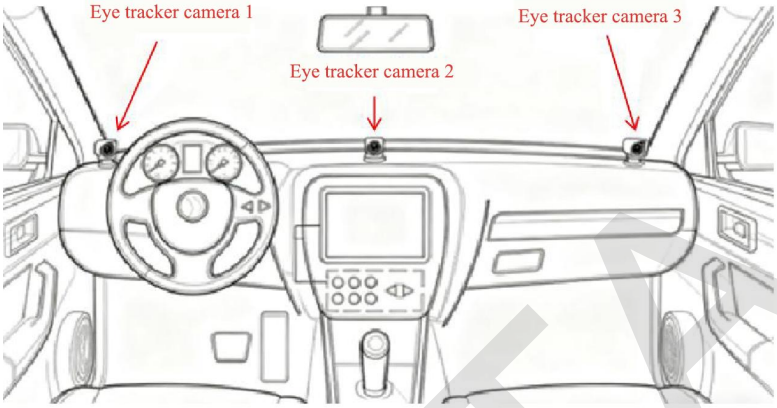


Fig. 12 Installation Position of Eye Tracker

4.2.3.2 Camera and microphone

4.2.3.2.1 Camera

a) Resolution: 1080 P;

b) Refresh rate: 30 fps.

4.2.3.2.2 Microphone

a) Frequency response: 20~20 KHz;

b) SNR: >80 dB.

4.2.3.2.3 Installation of camera and microphone

Fix the camera in the vehicle with the mounting fixture, with the lens plane parallel to the central console or instrument panel (image warning display screen of attention monitoring system), so as to ensure that the vehicle screen is completely within the field of view of the camera. Integrate the microphone in the camera and ensure that the microphone can clearly record the audible warning signal from the driver attention monitoring system.

4.2.3.3 Checkerboard chart

The chart shall meet the following requirements:

a) The unit size is 300 mm * 300 mm;

b) The black and white cells are arranged alternately.

Place checkerboard charts around the SV. The checkerboard charts shall cover at least 2000 mm in front of and behind the SV, and 1500 mm beyond the outer edges on the left and

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right. The cell boundary lines of the checkerboard chart shall be parallel or perpendicular to the axis of the vehicle (as shown in Fig. 13).

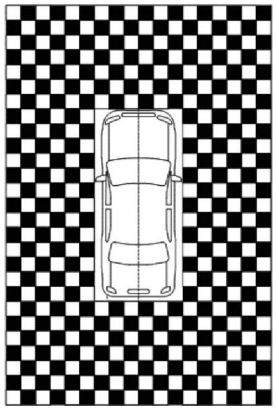


Fig. 13 Checkerboard Chart Layout Requirements

4.2.3.4 Stereo loss chart

The chart shall meet the following requirements:

a) Height 1050 mm, width 1000 mm;

b) From the bottom to the top, there is a horizontal ruler with different alternating color blocks of the same length as the width of the test plate and not less than 50 mm in height every 200 mm;

c) The width of a single color block on the horizontal ruler is 100 mm, with red and white blocks alternating.

d) Place the test chart vertically on the ground, with the center of the bottom edge aligned with the splicing seam and the bottom edge perpendicular to the splicing seam (or to the tangent line of the splicing seam). The test plate shall be placed 1 m away from the vehicle. Test the four views (front left, front right, rear left, and rear right) respectively.

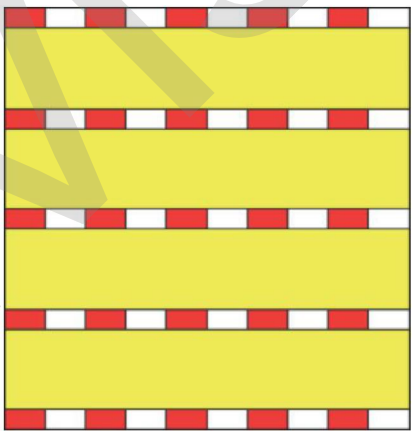


Fig. 14 Requirements for Stereo Loss Chart

4.2.4 Data acquisition equipment requirements

Requirements for test data acquisition equipment in closed test site:

a) Sampling and storage frequency of dynamic data: not less than 50 Hz;

b) Speed accuracy of the SV: 1.0 km/h.

c) The acceleration accuracy of the SV shall be 0.1 m/s^2.

4.2.5 Requirements for cybersecurity and privacy security test equipment

a) Check the working status and power supply of the test instrument to ensure its normal operation;

b) According to the test requirements, calibrate and verify the test instrument to eliminate the influence of instrument errors on the test results;

c) Ensure that the test instrument is fixed and installed firmly to avoid unnecessary movement or vibration during the test;

d) When deploying the network environment, adopt security configurations, including firewall settings and network isolation, to prevent potential cyberattacks.

4.3 Subject Vehicle

4.3.1 System initialization

If necessary, combined driver assistance systems can be initialized before the test, including calibration of sensors such as radar and camera.

4.3.2 Vehicle status confirmation

Before the test, the state of the SV shall meet the following requirements:

a) The vehicle under test (SV) shall be new with a traveled mileage of not more than 5000 km;

b) The SV shall be equipped with original new tyres designated by the manufacturer. The tyre pressure shall be the standard cold tyre pressure recommended by the manufacturer. If more than one value is recommended for tyre pressure, the tyre shall be inflated to the pressure with the lightest load;

c) The SV shall be refueled to not less than 90% of the fuel tank capacity, with other fluids (such as coolant, brake fluid and engine oil) added at least to the minimum indicated position. During the test, the fuel may decrease but shall not be lower than 50% of the fuel tank capacity;

d) For off-vehicle-chargeable new energy vehicles, the traction battery shall be fully charged according to GB/T 18385. For non-off-vehicle-chargeable new energy vehicles, the test shall be prepared in their normal operation states. During the test, the battery SOC may decrease, but it shall not be less than 50%.

4.3.3 Functional inspection

4.3.3.1 Function check of cybersecurity and privacy

Before the test starts, the functional inspection of the SV shall include but is not limited to the following aspects:

a) The wireless communication devices of the SV, such as on-board communication module, wireless network card, Wi-Fi/hotspot and Bluetooth communication, shall function normally;

b) The digital keys for the SV (such as RFID key, NFC key, and BLE key) are functioning properly;

c) The navigation and positioning function of the SV is normal;

d) The vehicle control application of the SV functions normally;

e) Each interface of the SV functions normally.

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4.3.4 Function settings

Following time gap:

Unless otherwise specified, the AES system shall remain enabled throughout the test..

System ON:

Unless otherwise specified, the AES system shall be activated when following another vehicle using the combined driver assistance system throughout the entire test.

The requirements for the system alarm level setting are as follows:

a) If the alarm level of the AEB and FCW system(s) of the SV is settable, it shall be set to the middle level before the test starts. If there is an even number of alarm levels, the higher of the two middle levels shall be set, as shown in Fig. 15.

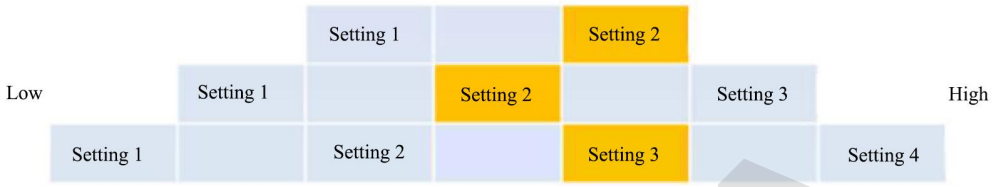


Fig. 15 Alarm Levels

b) If the SV is provided with LDW and LDP alarm function(s) and the alarm level is settable, the alarm level shall be set to the middle alarm sensitivity level before the test starts. If there is an even number of alarm levels, the sensitivity level shall be set to the higher of the two middle levels, as shown in Fig. 16.

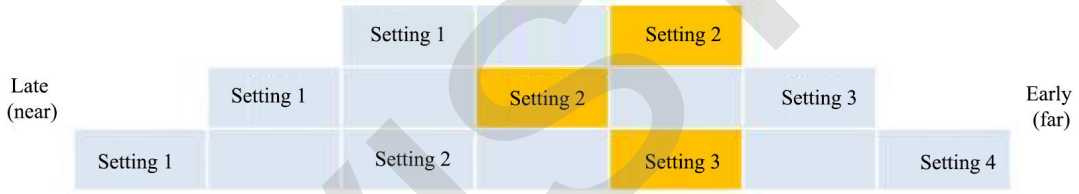


Fig. 16 LDW/LDP Alarm Level Settings

c) For tests conducted at night, in rainy conditions, or in fog, the lighting requirements for test vehicles are as follows:

1) If the system may only be activated under the relevant AUTO lighting settings, the headlamp of the SV shall be adjusted to the AUTO setting;

2) If the system may only be activated under low beam, the SV shall be set to low beam;

3) If the system can only be activated under high beam, the SV shall be set to high beam;

4) If the system can be activated under low beam, high beam, and/or related light AUTO settings, the SV shall be set to low beam.

4.3.5 Aiming requirements for SV equipped with intelligent lighting

a) Prior to the start of testing, the vehicle must be aligned in accordance with the alignment method specified in Annex C of GB 4599-2024, adjusting the alignment so that it meets the requirements of 5.2.6 in GB 4785-2019 without exceeding the specified limits.

b) The headlamp aiming shall be adjusted before the test vehicle has been loaded with counterweights.

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c) Before adjusting the headlamp aiming, the headlights shall be left on for at least 30 minutes.

4.4 Requirements for data processing and recording

4.4.1 Data record contents

4.4.1.1 Requirements for recording complex scenario safety test data

4.4.1.1.1 Contents of closed proving ground test data record

a) Velocity of SV;

b) Longitudinal acceleration of SV;

c) Position and motion data of the object target;

d) Video information reflecting the driver and human-machine interaction state;

e) Video information reflecting the driving state and external environment of the SV.

4.4.1.1.2 Simulation test data record contents

During the simulation test, in addition to recording the information of each test item in 5.2.3 respectively, the following information shall also be recorded:

a) in-loop testing mode of simulation test;

b) configuration and version information of the simulation test toolchain;

c) configuration and version information of the automated driving system under test;

d) simulation platform architecture information;

e) information on the relative distance of the outer edge of the wheel of the SV from that of the lane line;

f) information on the minimum distance of the outer contour of the SV from the road infrastructure (such as road traffic signs and tunnels) or other information for judging whether there is a collision.

4.4.1.2 Data recording requirements for driving interaction safety testing

4.4.1.2.1 Smart lighting data recording content:

a) Pitch angle and speed: Use the original data recorded by the equipment.

b) Distance: Use the original data recorded by the equipment.

c) Illuminance: Based on the original data recorded by the equipment, eliminate the ambient light error, and then perform smoothing filter processing.

4.4.2 Data processing requirements

The test data processing shall meet the following requirements:

a) The SV speed shall be GPS speed, and the original data shall be used, in km/h.

b) The longitudinal acceleration data of the SV needs to be filtered by a 12-order phaseless Butterworth filter with a cutoff frequency of 6 Hz, the average value taken every 2 s and measured in m/s^2.

4.4.3 Test shooting requirements

The test shooting shall meet the requirements below:

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a) Before installing the test equipment, take photos of the front left 45° of the SV and the nameplate of the vehicle;

b) After the test equipment is installed, take photos of the test equipment inside and outside the SV.

5 Test Method

5.1 Overview

The intelligent safety real vehicle test items include three parts: complex scenario safety, driving interaction safety, and cybersecurity and privacy. The test methods of each part are independent, and the test contents are carried out in accordance with the specifications of this part. Safety in complex scenarios mainly includes three aspects: urban scenarios, highway/expressway scenarios, and simulation tests, and is adapted for C-V2X (Cellular Vehicle-to-Everything) functional testing; driver interaction safety mainly includes two aspects: driving and riding interaction safety, and intelligent lighting safety testing methods; cybersecurity and privacy security mainly includes cybersecurity and privacy safety testing methods. See Table 5 for specific test items.

Table 5 Overview of Intelligent Safety Test Contents

Test and Evaluation Dimensions	Test Items	Secondary Items
Complex scenario safety	Urban scenario	Real vehicle test in complex urban scenarios
	Highway and expressway scenarios	Real vehicle test in complex highway and expressway scenarios
	Simulation test	Consistency evaluation and extension test of simulation results
Driving interaction safety	Driver interaction safety	Driver state monitoring
		Driving visual assistance
		Speech interaction safety (penalty item)
	Intelligent lighting safety	Adaptive driving beam
		Assistance projection function (bonus item)
Cybersecurity and privacy security	Cybersecurity	Remote control anti-theft
		In-vehicle network protection
	Privacy security	Personal privacy security
		Personal rights and interests protection

5.2 Test method for complex scenario safety

5.2.1 Overview of complex scenario safety test

One test shall be conducted for each test condition. Provided that the test conditions are valid, the test for that condition is considered passed if no collision occurs involving the test vehicle in that scenario; otherwise, it is considered failed. The complex scenario safety test is divided into three parts: urban scenario, highway and expressway scenarios and simulation test. See Table 6 for detailed test contents.

Table 6 Test Contents of Complex Scenario Safety

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S/N	Target Element	Test Items
1	Urban scenario	Multiple pedestrians crossing with obstruction (supports C-V2X functionality)
2		Longitudinal movement of pedestrian holding an umbrella and child on a rainy day
3		Forward vehicle cutting out and encountering bicyclist at nighttime
4		Nighttime cut-in by a motor-scooter
5		Diagonal crossing of tricycle
6		Reversing of light truck with obstruction
7		Diagonal crossing of bicycle with obstruction
8		Passenger car crossing (supports C-V2X functionality)
9	Highway and expressway scenarios	Vehicle ahead cutting out on a curve (supports C-V2X functionality)
10		Vehicle ahead cutting out in rainy conditions (supports C-V2X functionality)
11		Forward vehicle lane changing
12		Continuous accident recognition
13		Secondary accident involving passenger vehicle in foggy weather
14		Light truck cutting in
15		Scattering object target recognition
16		Secondary accident recognition in rainy conditions
17	Simulation test	Consistency evaluation of simulation results
18		Expansion tests in urban, highway, and expressway scenarios

5.2.2 Test method for urban scenario

5.2.2.1 Multiple pedestrians crossing with obstruction

5.2.2.1.1 Scenario description

Under daytime intersection conditions, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 50 km/h on a straight road. A stationary TV is set in the right lane of the SV at the stop line position of the intersection. At 3.0 m and 5.0 m ahead of the stationary TV, adult pedestrian targets and child pedestrian targets walk opposite to each other respectively. The intersection supports C-V2X functionality, as shown in Fig. 17.

5.2.2.1.2 Test method

This test is used to evaluate the ability of the advanced combined driver assistance function to decelerate and avoid collisions of the SV when, at an intersection, the SV moves forward and encounters multiple pedestrians crossing with obstructions, and an object target ahead crosses in front. The test is carried out as shown in Fig. 17. The path of the object target is set according to the definition in Fig. 17. The right side is selected as the crossing direction of the object target for testing. The test steps are as follows:

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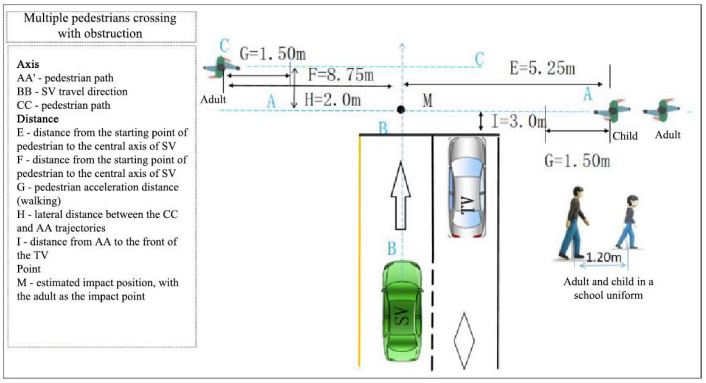


Fig. 17 Scenario of Multiple Pedestrians Crossing with Obstruction

a) The SV enables the advanced combined driver assistance function, the SV travels in the left lane at a set speed of 50 km/h; the TV remains stationary and centered in the lane, stopped before the stop line at the intersection;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the impact point;

c) The travel paths of the two sets of dummy targets are perpendicular to that of the SV; they accelerate to 5 km/h over a 1.5 m acceleration section and then cruise at a constant speed;

d) The SV can be tested using C-V2X functionality.

5.2.2.1.3 Conditions for end of test

a) The test ends when the SV avoids a collision with the crossing CPT and APT;

b) The test ends when the SV collides with the crossing CPT or APT;

c) The test ends when the SV collides with other traffic participants.

5.2.2.1.4 Test validity requirements

The test requirements are as follows:

a) The SV speed shall be kept at the specified speed ±1 km/h, and the dummy target speed at (5±0.2) km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.2.2 Longitudinal movement of pedestrian holding an umbrella and child in rainy weather

5.2.2.2.1 Scenario description

Under conditions of a brief, intense rainstorm during the day (6±0.3 mm/10 min), the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 60 km/h on a straight road. There is a pedestrian target holding an umbrella and child target (wearing a raincoat) walking forward right ahead of the SV. The pre-impact point is set on the right side of the front end of the SV, as shown in Fig. 18.

5.2.2.2.2 Test method

This test is used to evaluate the ability of the advanced combined driver assistance function to decelerate the SV and avoid a collision with a pedestrian target ahead, when the SV moves forward and encounters a pedestrian moving forward in conditions of a brief, intense rainstorm during the day. The test is carried out as shown in Fig. 18, and the path of the object target is set according to the definition in Fig. 18. The test steps are as follows:

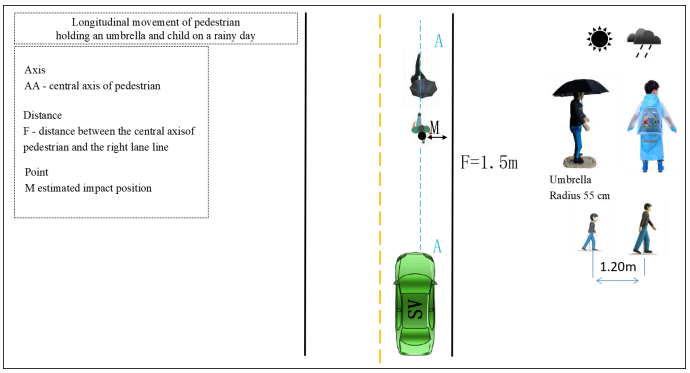


Fig. 18 Longitudinal Scenario for Pedestrian Holding an Umbrella and Child on a Rainy Day

a) The SV enables the advanced combined driver assistance function, and the set speed of the SV is 60 km/h;

b) The SV has the advanced combined driver assistance function enabled, and begins recording valid test data when it is 150 m away from the child target; moreover, the SV must travel 120 m on a rainy road.

c) The dummy target travels in a path parallel to that of the SV, moving at a constant speed of 5 km/h;

d) This test condition is conducted in rainy weather; rainfall is initiated 5 minutes before the start of the test and maintained at the level of a short-duration torrential rain (short-term rainfall intensity of 6±0.3 mm/10 min). The illuminance during the rainy-day test condition shall be no less than 180 lx. During the test, the SV shall turn on its low beam headlights and activate the automatic windshield wipers; if automatic wipers are not available, the wipers shall be set to the high setting. If there are additional sub-settings under the high setting, the wipers shall be set to "high and fast speed."

Note: Rainfall classification refers to the short-duration torrential rain grade for 10-minute rainfall, as specified in T/CMSA 0013-2019 *The Grade of Rainfall in Short Time Weather Service*.

5.2.2.2.3 Conditions for end of test

a) The test ends when the SV avoids a collision with the dummy targets walking longitudinally;

b) The test ends when the SV collides with the dummy target;

c) The test ends when the SV collides with other traffic participants.

5.2.2.2.4 Test validity requirements

The test requirements are as follows:

a) The SV speed shall be kept at the specified speed ±1 km/h, and the dummy target speed at (5±0.2) km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and

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sudden braking or steering by the tester is not allowed;

c) During testing, the SV operated normally. The test was deemed valid if there were no traffic accidents, no forced interventions by test personnel, no reboots of the combined driver assistance system, no downgrades of the combined driver assistance system, and collisions were avoided, provided that the combined driver assistance system issued a DCA alert 4 seconds before entering a rainy environment.

5.2.2.3 Forward vehicle cutting out and encountering bicyclist at nighttime

5.2.2.3.1 Scenario description

At night, with no streetlights, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 60 km/h on a straight road. There is a TV, partially blocking, positioned directly in front of the SV, and in front of the TV are a moving adult and a bicycle being pushed. as shown in Fig. 19.

5.2.2.3.2 Test method

This test is designed to evaluate the deceleration and collision avoidance capabilities of the advanced combined driver assistance function when, under unlit nighttime conditions, the SV is traveling forward and, after the vehicle ahead (TV, with low beams on) pulls out at 60 km/h, encounters scenarios with a bicycle being pushed and an adult pedestrian walking ahead. The test is carried out as shown in Fig. 19, and the path of the object target is set according to the definition in Fig. 19. The test steps are as follows:

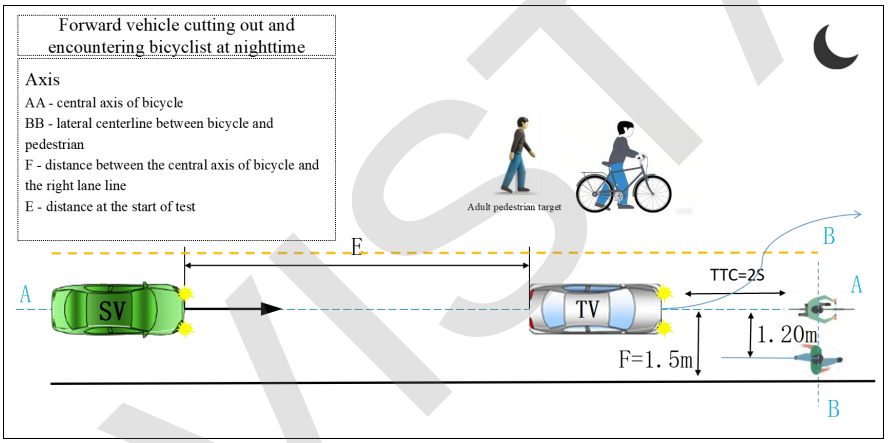


Fig. 19 Scenario of Forward Vehicle Cutting out and Encountering a bicycle being pushed and an adult pedestrian at Nighttime

Table 7 TV1 Cut-out Path

Target Vehicle Speed V (km/h)	Curved Section 1			Curved Section 2		Curved Section 3			Straight Section L	Curved Section 4			Curved Section 5		Curved Section 6		
	Starting radius R1 (m)	Ending radius R2 (m)	Angle α (°)	Arc section radius R2 (m)	Angle β (°)	Initial radius R2 (m)	Ending radius R1 (m)	Angle γ (°)	Straight section length L (m)	Starting radius R1 (m)	Ending radius R2 (m)	Angle γ (°)	Arc section radius R2 (m)	Angle β (°)	Initial radius R2 (m)	Ending radius R1 (m)	Angle α (°)
60	1500	200	1.20	200	3.60	200	1500	1.20	8.5	1500	200	1.20	200	3.60	200	1500	1.20

a) The SV enables the advanced combined driver assistance function, and the set speed of the SV is 60 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins

recording valid test data when it is 150 m from the rear wheel of the bicycle;

c) The dummy target travels along a path parallel to that of the SV; the bicycle target is pushed at a constant speed of 5 km/h, and the dummy target moves at a constant speed of 5 km/h;

d) In this test, when the TTC between the TV and the bicycle target is 2.0 s, the TV cuts out to the left. The path is shown in Table 7. It takes 4 s for the TV to complete lane change.

5.2.2.3.3 Conditions for end of test

a) The test ends when the SV avoids collision with the test target;

b) The test ends when the SV collides with the test target;

c) The test ends when the SV collides with other traffic participants.

5.2.2.3.4 Test validity requirements

The test requirements are as follows:

a) The SV's speed is maintained at the specified speed ±1 km/h; the bicycle target is pushed at a constant speed of (5 ± 0.2) km/h; and the dummy target's speed is maintained at (5 ± 0.2) km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.2.4 Nighttime cut-in by a motor-scooter

5.2.2.4.1 Scenario description

Under nighttime conditions with no streetlights and backlighting, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 60 km/h on a straight road. TV2 is stationary on the front right of the SV with its low beams on, while TV1 in the oncoming lane has its high beams on. The pre-impact point is set at the rear of a motor-scooter, as shown in Fig. 20.

5.2.2.4.2 Test method

This test is used to evaluate the deceleration and collision avoidance capability of the advanced combined driver assistance function when, under nighttime conditions without street lighting and against backlight, the SV runs forward and a scooter (target object) cuts in ahead. The test is carried out as shown in Fig. 20, and the path of the object target is set according to the definition of Fig. 20. The test steps are as follows:

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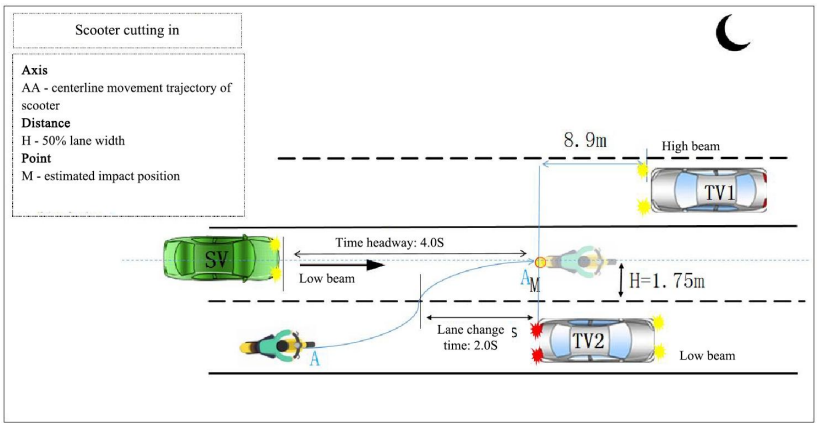


Fig. 20 Scenario of Scooter Cutting in at Nighttime

Table 8 Lane Change Restrictions for Scooters

Speed (km/h)	Lateral Speed (m/s)	Maximum Lateral Acceleration (m/s^2)	Lane Change Time (s)
15	0.94	2	4

a) The SV enables the advanced combined driver assistance function, and the set speed of the SV is 60 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the pre-impact point;

c) In this test, when the SV is 4 s away from the rear of the motor-scooter, the motor-scooter moves forward at a constant speed of 15 km/h and cuts in to the left when the TTC from the rear of TV2 is 4 s.

5.2.2.4.3 Conditions for end of test

a) The test ends when the SV avoids collision with the motor-scooter;

b) The test ends when the SV collides with the motor-scooter;

c) The test ends when the SV collides with other traffic participants.

5.2.2.4.4 Test validity requirements

The test requirements are as follows:

a) The SV speed is kept at the specified speed ±1 km/h, and the scooter target moves at a constant speed of 15 ±0.5 km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.2.5 Diagonal crossing of tricycle

5.2.2.5.1 Scenario description

In daytime conditions, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 60 km/h on a straight road. As shown in the figure,

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stationary TV2 and TV3 are positioned on the left side of the road directly in front of the SV. A tricycle target moves forward at a 45-degree angle to the lane markings, and the pre-impact point is set at the 50 % mark of the tricycle target, as shown in Fig. 21.

5.2.2.5.2 Test method

This test is used to evaluate the capability of the advanced combined driver assistance function to decelerate and avoid collisions after a scenario of a tricycle crossing ahead is detected when the SV runs forward and encounters a tricycle crossing ahead in daytime. The test is carried out as shown in Fig. 21, and the path of the object target is set according to the definition of Fig. 21. The test steps are as follows:

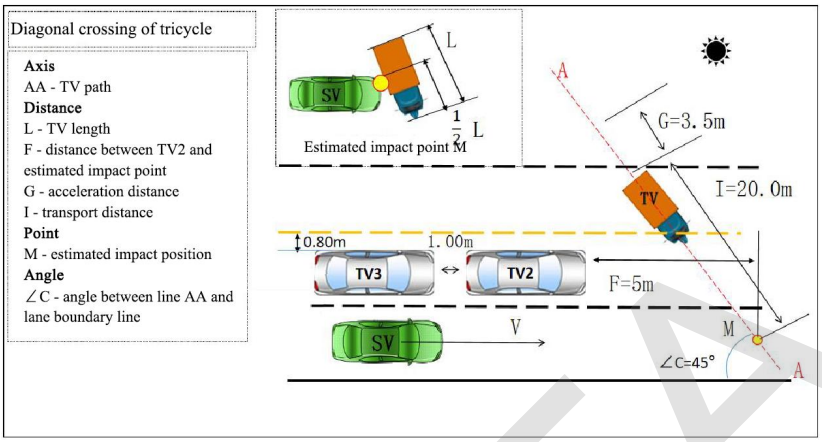


Fig. 21 Scenario of Tricycle Diagonal Crossing in Daytime

a) The SV enables the advanced combined driver assistance function, and the set speed of the SV is 60 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the pre-impact point;

c) The tricycle target moves forward at a constant speed of 15 km/h and triggers a collision with the SV;

d) The position of the left TV for this test is shown in the figure.

5.2.2.5.3 Conditions for end of test

a) The test ends when the SV avoids collision with the tricycle;

b) The test ends when the SV collides with the tricycle;

c) The test ends when the SV collides with other traffic participants.

5.2.2.5.4 Test validity requirements

The test requirements are as follows:

a) The SV speed is kept at the specified speed ±1 km/h, and the tricycle target moves at a constant speed of 15 ±0.5 km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

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5.2.2.6 Reversing of light truck with obstruction

5.2.2.6.1 Scenario description

Under daytime conditions, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 60 km/h on a straight road. TV 1 and TV 2 are present in the lane to the right of the SV. As the SV moves forward, it encounters a light truck reversing; the pre-impact point is set at the 50 % mark of the test lane, as shown in the figure.

5.2.2.6.2 Test method

This test is designed to evaluate the deceleration and collision-avoidance capabilities of the advanced combined driver assistance function when the SV is traveling forward during daytime conditions with visual obstruction and encounters a light-duty truck reversing ahead. The test is carried out as shown in Fig. 22, and the path of the object target is set according to the definition of Fig. 22. The test steps are as follows:

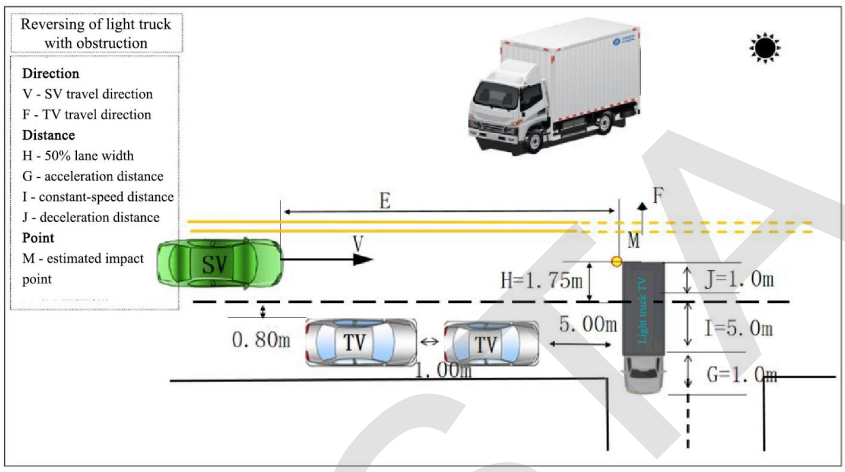


Fig. 22 Scenario of Light Truck Reversing

a) The SV enables the advanced combined driver assistance function, and the set speed of the SV is 60 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the impact point;

c) The target light truck accelerates to 5 km/h within 1 m, maintains a constant speed for 5 m, then decelerates within 1 m to a stop at the centerline of the lane, creating a pre-impact scenario with the SV at the 50 % mark of the test lane;

d) The position of the right TV for this test is shown in the figure.

5.2.2.6.3 Conditions for end of test

a) The test ends when the SV avoids collision with the light truck;

b) The test ends when the SV collides with the light truck;

c) The test ends when the SV collides with other traffic participants.

5.2.2.6.4 Test validity requirements

The test requirements are as follows:

a) The SV speed is kept at the specified speed ±1 km/h, and the light truck target moves at a constant speed of 5 ±0.5 km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and

sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.2.7 Diagonal crossing of bicycle with obstruction

5.2.2.7.1 Scenario description

In daytime conditions, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 60 km/h within the lane, with a curve radius of 250 meters. At a point 100 meters beyond the end of the straight section of road directly ahead and to the left of the SV, stationary vehicles TV1 and TV2 are present. To the right of TV2, a bicycle is positioned to cross diagonally; the bicycle's trajectory forms a 45° angle with the extended line of TV2's side and moves forward. The pre-impact point is set at the 50 % mark of the bicycle, as shown in Fig. 23.

5.2.2.7.2 Test method

This test is designed to evaluate the deceleration and collision-avoidance capabilities of the advanced combined driver assistance function when the SV is traveling forward under daytime conditions and encounters a bicycle crossing in front. The test is carried out as shown in Fig. 23, and the path of the object target is set according to the definition of Fig. 23. The test steps are as follows:

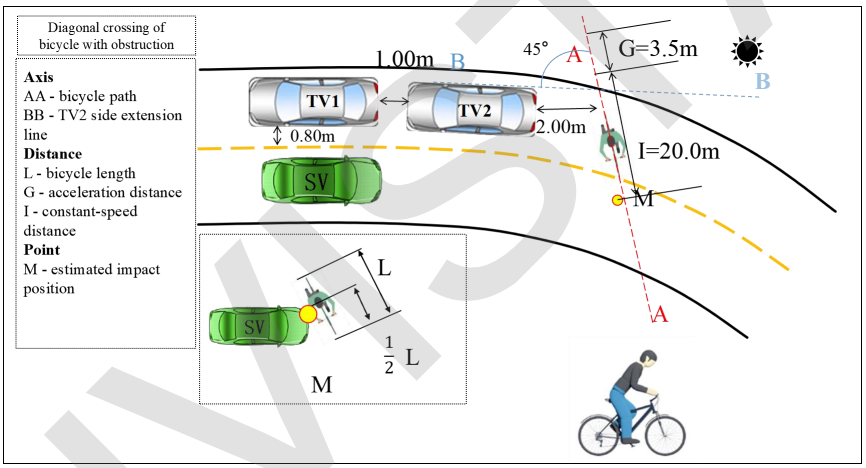


Fig. 23 Scenario of Bicycle Diagonal Crossing with Obstruction

a) The SV enables the advanced combined driver assistance function, and the set speed of the SV is 60 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the pre-impact point;

c) The bicycle target moves forward at a constant speed of 10 km/h, triggering a collision at the 50 % mark of the bicycle target.

d) The position of the left TV for this test is shown in the figure.

5.2.2.7.3 Conditions for end of test

a) The test ends when the SV avoids collision with the bicycle;

b) The test ends when the SV collides with the bicycle;

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c) The test ends when the SV collides with other traffic participants.

5.2.2.7.4 Test validity requirements

The test requirements are as follows:

a) The SV speed is kept at the specified speed ±1 km/h, and the bicycle target moves at a constant speed of 10 ±0.5 km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.2.8 Passenger vehicle crossing

5.2.2.8.1 Scenario description

At an intersection, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 50 km/h on a straight road. Upon encountering a crossing TV at the intersection, the TV travels at 60 km/h until it reaches a point 35 m before impact point M, where it begins to decelerate to 30 km/h. It then travels at a constant speed for 10 meters to reach the pre-impact point, as shown in Fig. 24.

5.2.2.8.2 Test method

This test is designed to evaluate the deceleration and collision-avoidance capabilities of the advanced combined driver assistance function when the SV is traveling forward at an intersection and encounters a passenger car crossing its path. The test was conducted as shown in Fig. 24. The TV is configured as defined in Fig. 24, and the right side of the TV is selected as the collision test direction. The TV may be equipped with C-V2X direct communication capabilities. The test procedure is as follows:

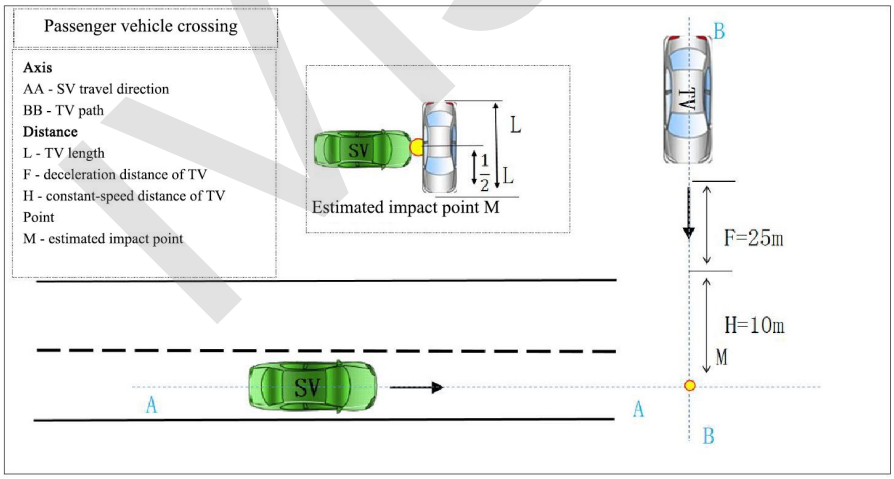


Fig. 24 Scenario of Passenger Vehicle Crossing

a) The SV has the advanced combined driver assistance function enabled and is set to 50 km/h, traveling in the right-hand lane. The TV's path is perpendicular to the SV's; it initially travels at 60 km/h, begins decelerating to 30 km/h at a point 35 m from impact point M, then continues at a constant 30 km/h for 10 m to reach the pre-impact point;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the pre-impact point;

5.2.2.8.3 Conditions for end of test

a) The test ends when the SV avoids collision with the crossing TV;

b) The test ends when the SV collides with the crossing TV;

5.2.2.8.4 Test validity requirements

The test requirements are as follows:

a) The SV speed shall be kept at the specified speed ± 1 km/h, and the TV speed at (30±1) km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.3 Test method for highway and expressway scenarios

5.2.3.1 Forward vehicle cutting out on a curve

5.2.3.1.1 Scenario description

At night under conditions with no street lighting, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 100 km/h on a straight road. Directly ahead of the SV, TV1 has its low beam on. TV2 is stationary with its low beams on, located 100 m beyond the end of the straight section. As the SV proceeds and the preceding vehicle pulls out, the SV encounters the stationary faulty vehicle. The pre-impact point is set at the rear of TV2. TV2 may be equipped with C-V2X direct communication capability, as shown in the figure.

5.2.3.1.2 Test method

This test is designed to evaluate the deceleration and collision-avoidance capabilities of the advanced combined driver assistance system when a vehicle traveling forward encounters the forward vehicle cutting out at night under conditions without street lighting. The test is carried out as shown in Fig. 25, and the path of the object target is set according to the definition of Fig. 25. The test steps are as follows:

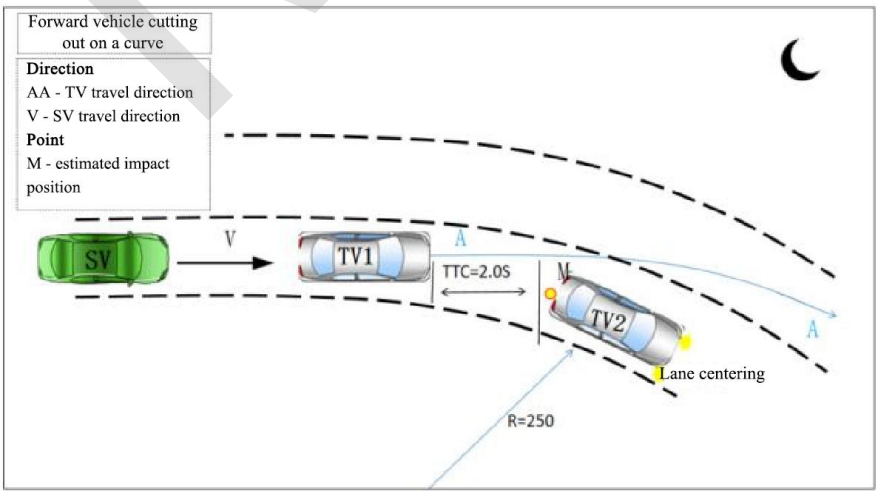


Fig. 25 Scenario of Forward Vehicle Cutting out on a Curve

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Table 9 Road Cut-off Path

TV1 Speed (km/h)	Section 1			Section 2	Section 3			Section 4			Section 5		
	Starting radius R1 (m)	Closing radius R2 (m)	Angle α (deg)	Straight Road (m)	Starting radius R1 (m)	Closing radius R2 (m)	Angle β (deg)	Starting radius R1 (m)	Closing radius R2 (m)	Angle γ (deg)	Starting radius R1 (m)	Closing radius R2 (m)	Angle δ (deg)
100	2000	200	2.2	4	150	250	1.7	100	100	6	250	250	8.1

a) The SV has the advanced combined driver assistance function enabled and is set to a speed of 100 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the pre-impact point;

c) TV1 travels forward at a constant speed of 100 km/h along the lane centerline; when its time headway to target vehicle TV2 reaches 2 s, TV1 cuts out to the left;

d) The position of the front TV2 on the lane centerline for this test is shown in the figure.

5.2.3.1.3 Conditions for end of test

a) The test ends when the SV avoids colliding with the TV;

b) The test ends when the SV collides with the TV;

c) The test ends when the SV collides with other traffic participants.

5.2.3.1.4 Test validity requirements

The test requirements are as follows:

a) The SV speed is kept at the specified speed ±1 km/h, and the TV1 moves at a constant speed of 100 km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.3.2 Forward vehicle cutting out on a rainy day

5.2.3.2.1 Scenario description

Under rain conditions (short-duration heavy rain: 4 ± 0.3 mm/10 min), the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 80 km/h on a straight road. Directly ahead of the SV are TV1 and TV2; TV2 is stationary in the center of the lane with its hazard warning lights on, as shown in the figure. As the SV proceeds, after the vehicle in front moves aside, the SV encounters the stationary faulty vehicle. The pre-impact point is set at the rear of TV2. TV2 may be equipped with C-V2X direct communication capability, as shown in the figure.

5.2.3.2.2 Test method

This test is designed to evaluate the deceleration and collision-avoidance capabilities of the advanced combined driver assistance function when the SV is traveling forward in rainy

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conditions and the preceding vehicle disappears from view. The test is carried out as shown in Fig. 26, and the path of the object target is set according to the definition of Fig. 26. The test steps are as follows:

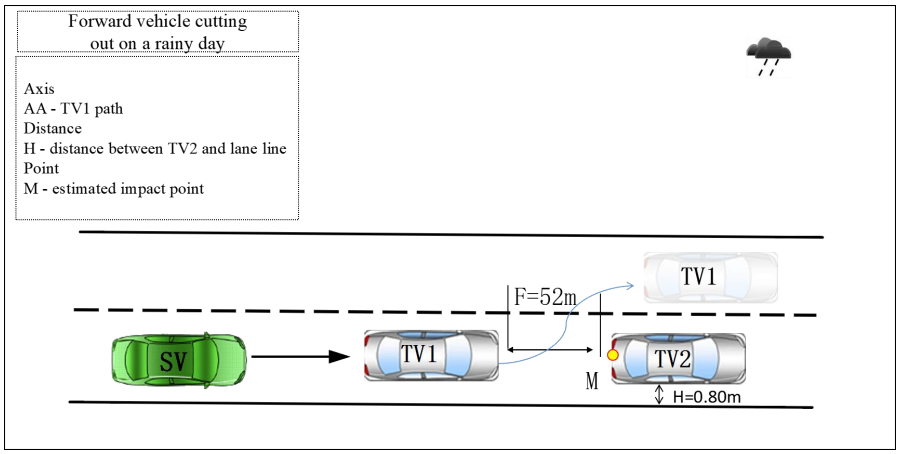


Fig. 26 Scenario of Forward Vehicle Cutting out on a Rainy Day

a) The SV has the advanced combined driver assistance function enabled and is set to a speed of 80 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the pre-impact point;

c) TV1 travels forward at a constant speed of 80 km/h and initiates a left lane change when its distance to TV2 is 52 m. The lane-exit maneuver lasts less than 2 s.;

Note: The rainfall grade refers to the short time heavy rain grade for 10-minute rainfall as specified in T/CMSA 0013-2019 *The Grade of Rainfall in Short Time Weather Service*.

5.2.3.2.3 Conditions for end of test

a) The test ends when the SV avoids colliding with the TV;

b) The test ends when the SV collides with the TV;

c) The test ends when the SV collides with other traffic participants.

5.2.3.2.4 Test validity requirements

The test requirements are as follows:

a) The SV speed is kept at the specified speed ±1 km/h, and the TV moves at a constant speed of 80 km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV operated normally. The test was deemed valid if there were no traffic accidents, no forced interventions by test personnel, no reboots of the combined driver assistance system, no downgrades of the combined driver assistance system, and collisions were avoided, provided that the combined driver assistance system issued a DCA alert 4 seconds before entering a rainy environment.

5.2.3.3 Forward vehicle lane changing

5.2.3.3.1 Scenario description

Under daytime conditions, the SV has the advanced combined driver assistance system

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enabled and cruises at a set speed of 80 km/h on a straight road. Directly ahead, TV1 is traveling at 80 km/h. In the third lane to the right of the direction of travel, TV2 is traveling at 60 km/h. When the SV is 40 m from the rear of TV2, a manual stalk input is made to initiate a lane change. As the test vehicle moves right to change lanes, TV2 simultaneously begins to change lanes to the left while continuing forward at 60 km/h, as shown in Fig. 27.

5.2.3.3.2 Test method

This test evaluates, under daytime conditions, the SV's ability with the advanced combined driver assistance system enabled to decelerate and avoid a collision when a vehicle ahead on the right changes lane to the left into its path. The test is carried out as shown in Fig. 27, and the path of the object target is set according to the definition of Fig. 27. The test steps are as follows:

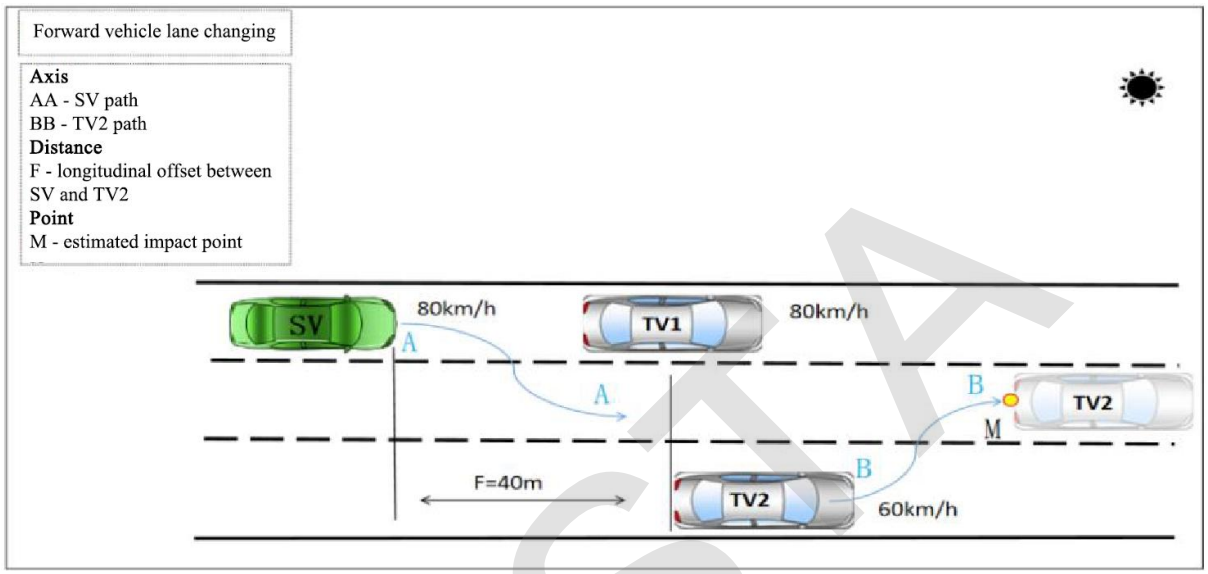


Fig. 27 Scenario of Forward Vehicle Lane Changing

a) The SV has the advanced combined driver assistance function enabled and is set to a speed of 80 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m away from the rear of TV2;

c) TV1 travels forward at a constant 80 km/h and maintains a 3-second time headway to the SV. When the SV is 40 m from TV2, a right-stalk input is used to initiate a right lane change;

d) When the SV initiates a right lane change, TV2 begins a left lane change. The lane-change trajectory is given in Table 7. TV2 proceeds forward at 60 km/h.

5.2.3.3.3 Conditions for end of test

a) The test ends when the SV avoids colliding with the TV;

b) The test ends when the SV collides with the TV;

c) The test ends when the SV collides with other traffic participants.

5.2.3.3.4 Test validity requirements

The test requirements are as follows:

a) The SV speed is kept at the specified speed ±1 km/h, and the TV1 moves at a constant speed of 80 km/h;

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b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.3.4 Continuous accident recognition

5.2.3.4.1 Scenario description

Under nighttime conditions, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 80 km/h on a straight road. A stationary target vehicle, TV2, is present directly ahead in the SV's lane. In the lane to the right there is a parallel target vehicle, TV1, traveling at 60 km/h. When the SV is 100 m from TV2, a manual stalk input is used to initiate a right lane change. After TV1 has passed TV2, TV1 begins to decelerate, move into the left lane, and comes to a stop, as shown in the figure.

5.2.3.4.2 Test method

This test evaluates, under nighttime conditions, the advanced combined driver assistance function's ability to detect a low-speed target vehicle TV1 on the right and to recognize and respond to the process of decelerating and changing lanes to the left, when the SV, while traveling forward and encountering a stationary vehicle ahead, is given a manual right-stalk lane-change command. The test is carried out as shown in Fig. 28, and the path of the object target is set according to the definition of Fig. 28. The test steps are as follows:

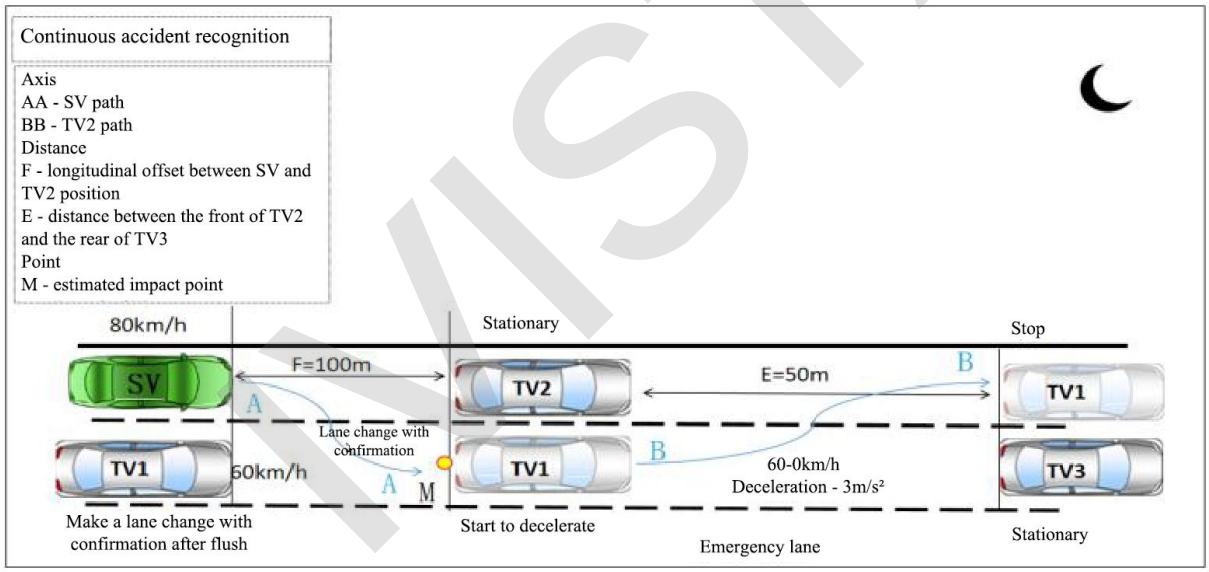


Fig. 28 Scenario of Continuous Accident Recognition

a) The SV has the advanced combined driver assistance function enabled and is set to a speed of 80 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m away from the rear of TV2;

c) TV2 and TV3 are stationary in the center of the lane with their hazard lights on, while TV1 is moving forward at a constant speed of 60 km/h;

d) After TV1 overtakes TV2, it begins to slow down, changes lanes to the left, and comes to a stop; refer to Table 7 for the lane-changing trajectory.

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5.2.3.4.3 Conditions for end of test

a) The test ends when the SV avoids collision with the TV;

b) The test ends when the SV collides with other traffic participants.

5.2.3.4.4 Test validity requirements

The test requirements are as follows:

a) The SV maintains a speed within ±1 km/h of the specified value, while the TV maintains a constant speed of 60 km/h ±1 km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.3.5 Secondary accident involving passenger vehicle in foggy weather

5.2.3.5.1 Scenario description

Under daytime foggy conditions (background illuminance > 150 lx, visibility 90–110 m), the SV has the advanced combined driver assistance system enabled and cruises at 80 km/h on a straight road. An adult dummy and a stationary passenger car are positioned directly ahead of the SV. TV1 (EVT target vehicle) and TV2 have their fog lamps on. The accident scenario layout is shown in the figure.

5.2.3.5.2 Test method

This test evaluates, under daytime foggy conditions, the SV's ability, with the advanced combined driver assistance function enabled, to decelerate and avoid a collision when encountering a stationary secondary-accident scenario ahead while traveling forward. The test is carried out as shown in Fig. 29, and the path of the object target is set according to the definition of Fig. 29. The test steps are as follows:

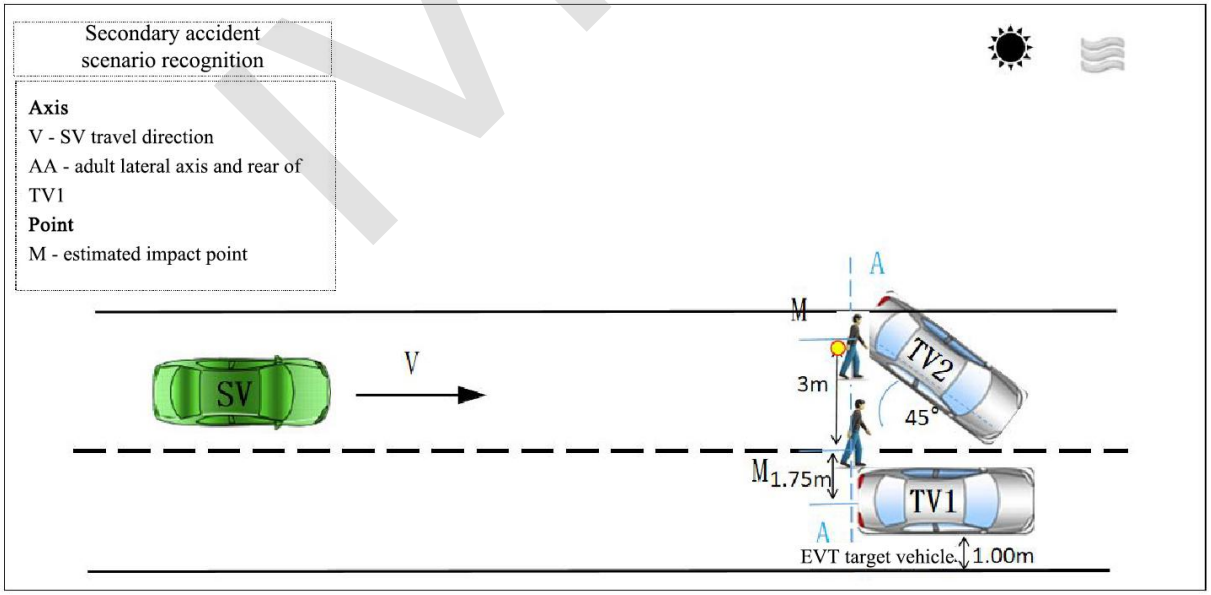


Fig. 29 Scenario of Secondary Accident Involving Passenger Vehicle in Foggy Weather

a) The SV has the advanced combined driver assistance function enabled and is set to a

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speed of 80 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the AA axis shown in Fig. 29;

c) The TV and adult are placed as shown in the figure 29.

5.2.3.5.3 Conditions for end of test

a) The test ends when the SV avoids collision with the object target;

b) The test ends when the SV collides with other traffic participants.

5.2.3.5.4 Test validity requirements

The test requirements are as follows:

a) The SV's speed shall be maintained within ±1 km/h of the specified speed;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV operated normally. The test was deemed valid if there were no traffic accidents, no forced interventions by test personnel, no reboots of the combined driver assistance system, no downgrades of the combined driver assistance system, and collisions were avoided, provided that the combined driver assistance system issued a DCA alert 4 seconds before entering a foggy environment.

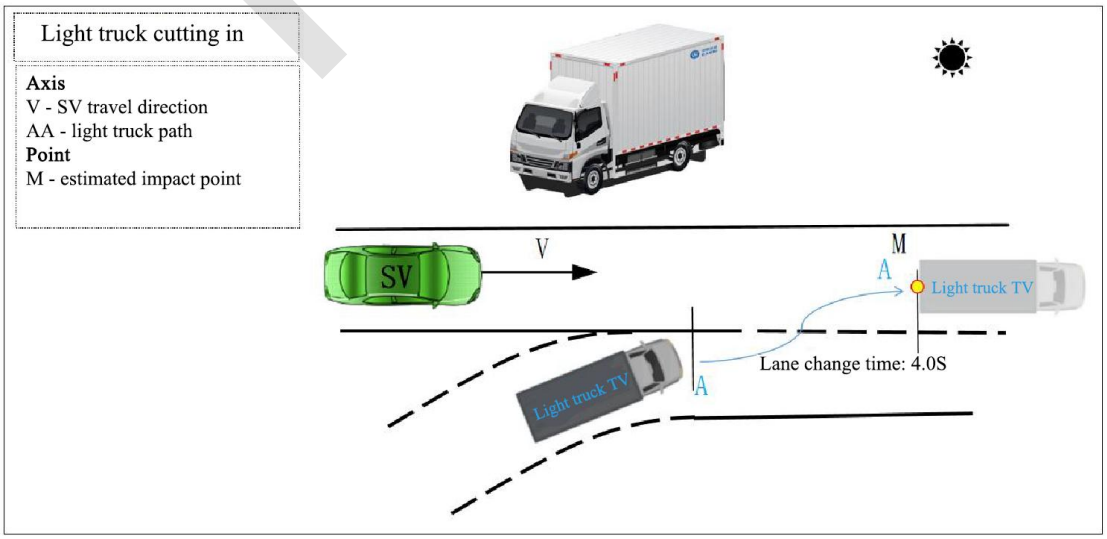
5.2.3.6 Light truck cutting in

5.2.3.6.1 Scenario description

Under daytime conditions, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 100 km/h on a straight road. A light-duty truck cuts in from the road on the right directly ahead of the SV, and the TV cuts in from the right-hand edge of the test lane. The pre-impact point is set at the rear of the TV, as shown in Fig. 30.

5.2.3.6.2 Test method

This test evaluates, under daytime conditions, the SV's ability, with the advanced combined driver assistance function enabled, to decelerate and avoid a collision when a vehicle ahead cuts into its lane while the SV is traveling forward. Testing is conducted as shown in Fig. 30. The object target performs a lane change into the left adjacent lane as illustrated, with a lane-change duration of 4 s. The test steps are as follows:



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Fig. 30 Schematic Diagram of Light Truck Cut-in Scenario at Daytime

a) The SV has the advanced combined driver assistance function enabled and is set to a speed of 100 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the pre-impact point;

c) The target vehicle moves to the left at a constant speed of 40 km/h to change lanes, with the entire lane-change process taking 4 seconds.

5.2.3.6.3 Conditions for end of test

a) The test ends when the SV avoids collision with the light truck;

b) The test ends when the SV collides with the light truck;

c) The test ends when the SV collides with other traffic participants.

5.2.3.6.4 Test validity requirements

The test requirements are as follows:

a) The SV maintains a speed within ±1 km/h of the specified value, while the TV maintains a constant speed of 40 km/h ±1 km/h;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.3.7 Scattering object target recognition

5.2.3.7.1 Scenario description

Under daytime conditions, the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 80 km/h on a straight road. In the lane to the right of the SV, directly ahead, there is a stationary TV1 (light-duty truck). A stationary tire (tire size 700R16) target is placed in the center of the lane to the left of TV1, as shown in Fig. 31.

5.2.3.7.2 Test method

This test evaluates, under daytime conditions, the SV's ability, with the advanced combined driver assistance function enabled, to decelerate and avoid a collision when encountering a stationary tyre while traveling forward. The test is carried out as shown in Fig. 31, and TV1 is set according to the definition of Fig. 31. The test steps are as follows:

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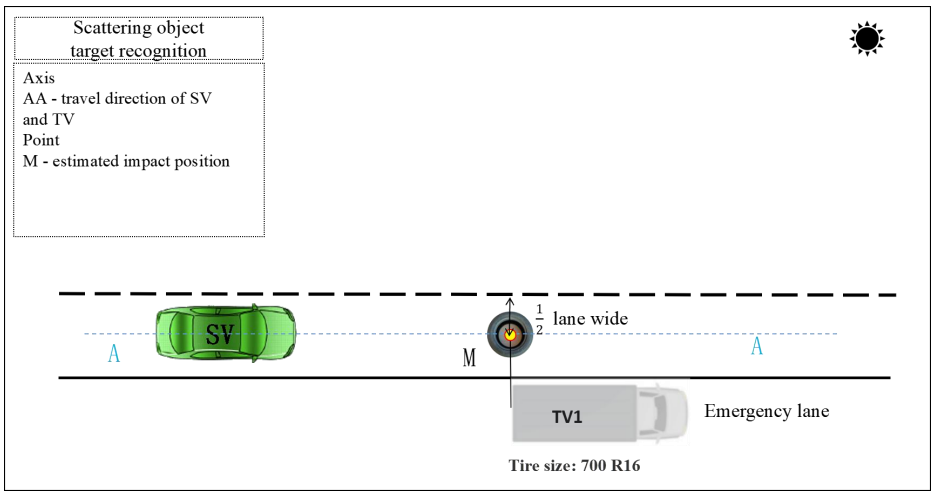


Fig. 31 Scattered Object Target Recognition Scenario

a) The SV has the advanced combined driver assistance function enabled, is set to cruise at 80 km/h, and is configured to the minimum following distance;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the tyre target;

5.2.3.7.3 Conditions for end of test

a) The test ends when the SV avoids collision with the tyre target;

b) The test ends when the SV collides with the tyre target;

c) The test ends when the SV collides with other traffic participants.

5.2.3.7.4 Test validity requirements

The test requirements are as follows:

a) The SV's speed shall be maintained within ±1 km/h of the specified speed;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV must operate normally without any traffic accidents, without test personnel having to manually intervene, without restarting the combined driver assistance system, and without the system downgrading its performance while successfully avoiding collisions; such a test is considered valid.

5.2.3.8 Secondary accident recognition on a rainy day

5.2.3.8.1 Scenario description

Under daytime short-duration heavy rain conditions (6 ± 0.3 mm/10 min), the SV has the advanced combined driver assistance system enabled and cruises at a set speed of 80 km/h on a straight road. An adult pedestrian dummy holding an umbrella and a stationary passenger car are positioned directly ahead of the SV. TV1 is overturned in the lane, lying at a 45° angle to the lane line. The adult pedestrian dummy is aligned with the rear of TV1 and positioned between the lane line and the overturned vehicle. The accident scenario layout is shown in Fig. 32.

5.2.3.8.2 Test method

This test evaluates, under daytime rainy conditions, the SV's ability, with the advanced combined driver assistance function enabled, to decelerate and avoid a collision when

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encountering a stationary secondary-accident scenario ahead while traveling forward. The test is carried out as shown in Fig. 32, and the path of the object target is set according to the definition of Fig. 32. The test steps are as follows:

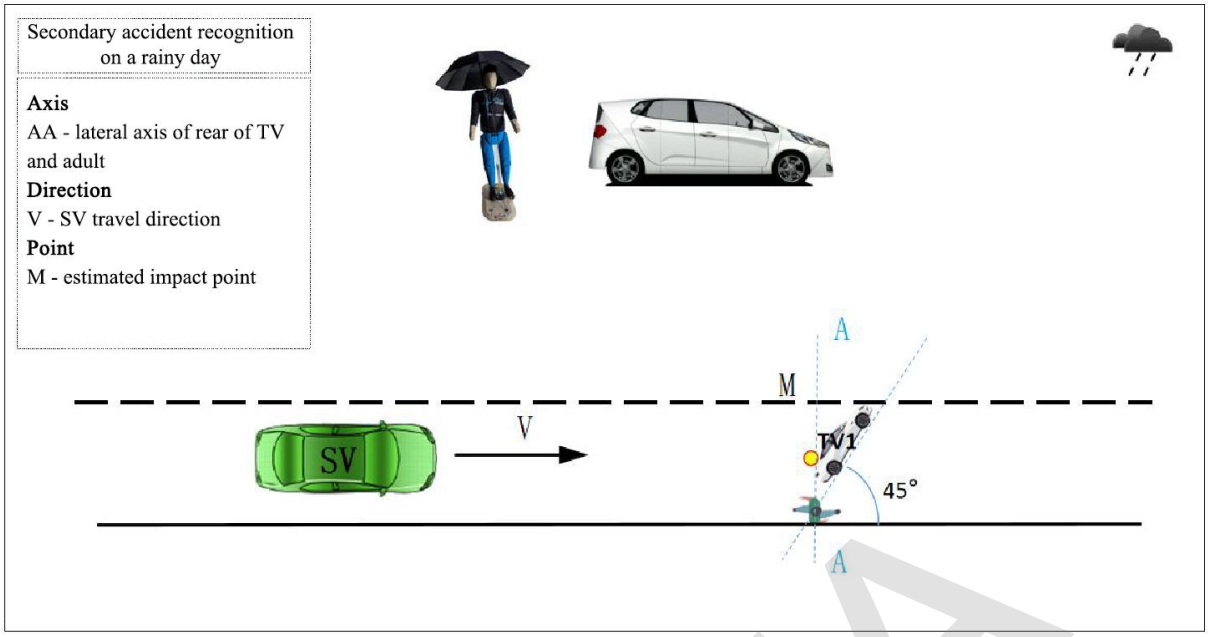


Fig. 32 Scenario for Identifying Secondary Accidents in Rainy Days

a) The SV has the advanced combined driver assistance function enabled and is set to a speed of 80 km/h;

b) The SV has the advanced combined driver assistance function enabled and begins recording valid test data when it is 150 m from the AA axis shown in Fig. 32;

c) The TV and adult dummy are placed as shown in the figure.

Note: Rainfall classification refers to the short-duration torrential rain grade for 10-minute rainfall, as specified in T/CMSA 0013-2019 *The Grade of Rainfall in Short Time Weather Service*.

5.2.3.8.3 Conditions for end of test

a) The test ends when the SV avoids collision with the object target;

b) The test ends when the SV collides with other traffic participants.

5.2.3.8.4 Test validity requirements

The test requirements are as follows:

a) The SV's speed shall be maintained within ±1 km/h of the specified speed;

b) The brake pedal of the SV shall not be depressed before the end of the test, and sudden braking or steering by the tester is not allowed;

c) During testing, the SV operated normally. The test was deemed valid if there were no traffic accidents, no forced interventions by test personnel, no reboots of the combined driver assistance system, no downgrades of the combined driver assistance system, and collisions were avoided, provided that the combined driver assistance system issued a DCA alert 4 seconds before entering a rainy environment.

5.2.4 Simulation test method

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5.2.4.1 Overview of simulation test

The simulation test includes two parts: consistency assessment of simulation results and extended test. The consistency assessment is to ensure the credibility of simulation test results, and the extended test is to further predict the safety performance of the system under different vehicle speeds, object targets and other conditions. The scenarios and conditions for consistency assessment are the same as those for proving ground tests; the scenarios and conditions for extended test are generalized based on the closed proving ground test scenarios of actual vehicles, and need to be carried out after the consistency assessment is passed. The specific indicators and scoring criteria of the simulation test shall be implemented in accordance with the requirements in 6.2.2.

This test protocol does not specify the simulation test mode. The test may be conducted in hardware-in-the-loop (HIL) test mode, software-in-the-loop (SIL) test mode, model-in-the-loop (MIL) test mode, vehicle-in-the-loop (VIL) test mode or cloud simulation mode. After a test mode is selected, it cannot be changed.

The simulation test may be conducted by the following 3 methods:

a) Witness test: The SV's manufacturer or its supplier shall carry out the simulation test by itself, and the qualified official witnesses of IVISTA China Intelligent Vehicle Index shall review the test report and the simulation tools or relevant supporting materials used in the test;

b) On-site test: The qualified official testers of IVISTA China Intelligent Vehicle Index shall go to the SV's manufacturer or its supplier to review the simulation tools of the SV's manufacturer or its supplier, and use them to carry out the simulation test;

c) Third-party test: The simulation test shall be carried out by a qualified third-party organization.

Note: The SV's manufacturer or its supplier may choose one of the three simulation test methods for implementation according to the actual situation.

5.2.4.2 Setting of Simulation Test Scenario Parameters

In the simulation test, the default parameter settings for the test scenarios are shown in Table 10.

Table 10 Default Parameters of Simulation Test Scenarios

S/N	Type	Content
1	Default parameters for road	Slope: flat; Lane line width: 0.15 m; Radius of curvature: 0 m.
2	Default parameters for transportation infrastructure	Curb: present;
3	Default parameters for temporary road conditions	Road surface condition: dry; Lane line status: clear.
4	Default parameters for movement status	SV type: passenger car; TV type: passenger car; SV offset: 0.
5	Default parameters for road traffic environment	Lighting: front lighting; Weather: sunny.

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5.2.4.3 Consistency assessment method of simulation results

Consistency evaluation of simulation results requires conducting simulation tests under all test scenarios and conditions corresponding to the closed proving ground tests. The specific parameters are shown in Table 11.

Table 11 Simulation Consistency Test Parameters

Scenario 1: Obstructed crossing of multiple pedestrians			
Set speed of SV, V_{SV} (km/h)	Pre-impact point		Target speed (km/h)
50	(50±5) %		5
Scenario 2: Longitudinal movement of pedestrian holding an umbrella and child in rainy weather			
Set speed of SV, V_{SV} (km/h)	Pre-impact point	Target speed (km/h)	Target Type
60	(25±5) %	5	Adult pedestrian and child targets
Scenario 3: Forward vehicle cutting out and encountering bicyclist at nighttime			
Set speed of SV, V_{SV} (km/h)	Target speed (km/h)	TTC	Target Type
60	5	2s	Adult pedestrian and bicycle targets
Scenario 4: Nighttime cut-in by a motor-scooter			
Set speed of SV, V_{SV} (km/h)	Pre-impact point	Target speed (km/h)	Target Type
60	(50±5) %	15	Scooter target
Scenario 5: Diagonal crossing of tricycle			
Set speed of SV, V_{SV} (km/h)	Pre-impact point	Target speed (km/h)	Target Type
60	(50±5) %	15	Tricycle target
Scenario 6: Light truck reversing blocked			
Set speed of SV, V_{SV} (km/h)	Pre-impact point	Target speed (km/h)	Target Type
60	(50±5) %	5	Truck target
Scenario 7: Bicycle obstruction and diagonal crossing			
Set speed of SV, V_{SV} (km/h)	Pre-impact point	Target speed (km/h)	Target Type
60	(50±5) %	10	Bicycle target
Scenario 8: Passenger vehicle crossing			
Set speed of SV, V_{SV} (km/h)	Pre-impact point	Target speed before collision (km/h)	Target Type
50	(50±5) %	30	Passenger Car
Scenario 9: Forward vehicle cutting out on a curve			
Set speed of SV, V_{SV}	Curve Radius (m)	TTC between TV1 and	TV Type

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(km/h)		TV2 during cutting out (s)	
100	250	2	Passenger Car
Scenario 10: Forward vehicle cutting out in rainy days			
Set speed of SV, V_{SV} (km/h)	Distance between TV1 and TV2 during cutting out (m)		TV Type
80	52		Passenger Car
Scenario 11: Forward vehicle changing lanes			
Set speed of SV, V_{SV} (km/h)	Longitudinal Offset between SV and TV2 during Lane Change (m)		TV Type
80	40		Passenger Car
Scenario 12: Continuous accident recognition			
Set speed of SV, V_{SV} (km/h)	Deceleration (m/s^2)		TV Type
80	-3		Passenger Car
Scenario 13: Secondary accident involving passenger car in foggy weather			
Set speed of SV, V_{SV} (km/h)	Visibility in Foggy Weather (m)		TV Type
80	100		Passenger Car
Scenario 14: Light truck cut-in at daytime			
Set speed of SV, V_{SV} (km/h)	Target speed (km/h)	Pre-impact point	TV Type
100	40	(50±5) %	Truck
Scenario 15: Recognition of scattering object targets			
Set speed of SV, V_{SV} (km/h)	Pre-impact point		TV Type
80	(50±5) %		Passenger Car
Scenario 16: Recognition of secondary accidents in rainy days			
Set speed of SV, V_{SV} (km/h)	Pre-impact point		TV Type
80	(50±5) %		Passenger Car

5.2.4.4 Extended test method

5.2.4.4.1 Scene with multiple pedestrians crossing with obstruction

5.2.4.4.1.1 Scenario description

Refer to 5.2.2.1 for scenario description and schematic diagram.

5.2.4.4.1.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and is set to travel at speed V_{SV} in the left-hand lane. The TV is stationary at the intersection stop line;

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b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) The test condition parameters are shown in Table 12;

d) The pedestrian target TV2's walking path is perpendicular to the SV's path; TV2 accelerates over a 1.5 m acceleration segment to reach V_{TV2}, then continues forward at a constant speed.

Table 12 Test Scenario Parameters

Set Speed of SV Before the SV Enters the Intersection, V_{SV} (km/h)	Target Crossing Speed V_{TV2} (km/h)	Impact point (%)		
		10	50	90
30	5			
	10			
35	5			
	10			
40	5			
	10			
45	5			
	10			
50	5			
	10			
55	5			
	10			
60	5			
	10			
65	5			
	10			
70	5			
	10			

5.2.4.4.1.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.1.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

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b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.2 Longitudinal scenario of an object target on a rainy day

5.2.4.4.2.1 Scenario description

Refer to 5.2.2.2 for scenario description and schematic diagram.

5.2.4.4.2.2 Test method

The test steps are as follows:

a) The SV, with the advanced combined driver assistance function enabled, runs at the set speed V_{SV}. The traveling path of the object target is parallel to that of the SV, and it moves at a set speed V_{TV};

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) The test condition parameters are shown in Table 13;

Table 13 Test Scenario Parameters

Set speed of SV, V_{SV} (km/h)	Speed of object target, V_{TV1} (km/h)			
	-5	0	5	10
40				
45				
50				
55				
60				
65				
70				
75				
80				

5.2.4.4.2.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.2.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.3 Nighttime forward-vehicle cut-out encountering target-object scenario

5.2.4.4.3.1 Scenario description

NISTA

Refer to 5.2.2.3 for scenario description and schematic diagram.

5.2.4.4.3.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and is driving at the set speed V_{SV}. The targets' paths are parallel to the SV's; the target vehicle (TV) travels at the same speed as the SV. The bicycle target travels at a constant 5 km/h, and the pedestrian travels at a constant 5 km/h;and the traffic cones remain stationary.

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) When the time-to-collision (TTC) between TV and the object target reaches the specified value, TV initiates a left lane change;

d) The test condition parameters are shown in Table 14;

Table 14 Test Scenario Parameters

Set speed of SV, V_{SV} (km/h)	Type of object target	TTC(s)		
		1.2	1.6	2
40	Bicyclist			
	Traffic cone			
45	Bicyclist			
	Traffic cone			
50	Bicyclist			
	Traffic cone			
55	Bicyclist			
	Traffic cone			
60	Bicyclist			
	Traffic cone			
65	Bicyclist			
	Traffic cone			
70	Bicyclist			
	Traffic cone			
75	Bicyclist			
	Traffic cone			
80	Bicyclist			
	Traffic cone			

5.2.4.4.3.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

NISTA

5.2.4.4.3.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.4 Nighttime motor-scooter cut-in scenario

5.2.4.4.4.1 Scenario description

Refer to 5.2.2.4 for scenario description and schematic diagram.

5.2.4.4.4.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and travels at the set speed V_{SV};

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) In this test, the motorcycle target moves forward at a constant speed of 15 km/h. When the TTC between the subject vehicle and the rear of target vehicle TV2 is TSV_TV2, and at the moment when the TTC between the motorcycle target and the rear of TV2 is 4 s, the motorcycle target cuts in to the left;

d) The test condition parameters are shown in Table 15;

Table 15 Test Scenario Parameters

Set speed of SV, V_{SV} (km/h)	TSV_TV2(s)			
	3	3.5	4	4.5
40				
45				
50				
55				
60				
65				
70				
75				
80				

5.2.4.4.4.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.4.4 Test validity requirements

NISTA

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.5 Tricycle diagonal crossing scenario

5.2.4.4.5.1 Scenario description

Refer to 5.2.2.5 for scenario description and schematic diagram.

5.2.4.4.5.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and is set to travel at speed V_{SV};

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) The tricycle target moves forward at a constant speed V_{TV};

d) The test condition parameters are shown in Table 16;

Table 16 Test Scenario Parameters

Set Speed of SV, V_{SV} (km/h)	Diagonal speed of target, V_{TV} (km/h)			
	10	15	20	25
30				
35				
40				
45				
50				
55				
60				
65				
70				

5.2.4.4.5.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.5.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

NISTA

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.6 Scenarios involving reversing of light truck with obstruction

5.2.4.4.6.1 Scenario description

Refer to 5.2.2.6 for scenario description and schematic diagram.

5.2.4.4.6.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and travels at the set speed V_{SV};

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) The light truck target accelerates over 1 m to 5 km/h, maintains a constant speed for 5 m, then decelerates over 1 m and stops at the lane centerline, forming a pre-collision condition with the subject vehicle in the test lane;

d) The test condition parameters are shown in Table 17;

Table 17 Test Scenario Parameters

Set speed of SV, V_{SV} (km/h)	Impact point (%)		
	10	50	90
40			
45			
50			
55			
60			
65			
70			
75			
80			

5.2.4.4.6.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.6.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

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5.2.4.4.7 Scenario of diagonal crossing of bicycle with obstruction

5.2.4.4.7.1 Scenario description

Refer to 5.2.2.7 for scenario description and schematic diagram.

5.2.4.4.7.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and travels at the set speed V_{SV};

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) The bicycle target moves forward at a constant speed VTV, and a collision is triggered at the 50% overlap point with the subject vehicle;

d) The test condition parameters are shown in Table 18;

Table 18 Test Scenario Parameters

Set Speed of SV, V_{SV} (km/h)	Diagonal speed of target, V_{TV} (km/h)			
	5	10	15	20
30				
35				
40				
45				
50				
55				
60				
65				
70				

5.2.4.4.7.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.7.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.8 Passenger car crossing scenario

5.2.4.4.8.1 Scenario description

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Refer to 5.2.2.8 for scenario description and schematic diagram.

5.2.4.4.8.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and is set to travel at speed V_{SV} in the right-hand lane;

b) The target vehicle initially travels at 60 km/h and is located 35 m before impact point M; after its speed changes to the set speed V_{TV}, it proceeds at a constant speed for 10 m to reach the pre-impact point;

c) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

d) The test condition parameters are shown in Table 19.

Table 19 Test Scenario Parameters

Set Speed of SV Before the SV Enters the Intersection, V_{SV} (km/h)	Set Speed of TV before Collision, V_{TV} (km/h)				
	30	40	50	60	70
30					
35					
40					
45					
50					
55					
60					
65					
70					

5.2.4.4.8.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.8.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.9 Curved-road forward-vehicle cut-out scenario

5.2.4.4.9.1 Scenario description

Refer to 5.2.3.1 for scenario description and schematic diagram.

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5.2.4.4.9.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and travels at the set speed V_{SV};

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) TV1 moves forward at a constant speed V_{SV}, and cuts out to the left when it is at a set longitudinal distance from target vehicle TV2;

d) The test condition parameters are shown in Table 20;

Table 20 Test Scenario Parameters

Following Speed of SV, V_{SV} (km/h)	Distance between TV1 and TV2 during cut-out (m)			
	40	50	60	70
80				
85				
90				
95				
100				
105				
110				
115				
120				

5.2.4.4.9.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.9.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.10 Rainy-weather forward-vehicle cut-out scenario

5.2.4.4.10.1 Scenario description

Refer to 5.2.3.2 for scenario description and schematic diagram.

5.2.4.4.10.2 Test method

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The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and is following at the set speed V_{SV};

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) TV1 initiates a cut-out to the left at the specified distance;

d) The test condition parameters are shown in Table 21;

Table 21 Test Scenario Parameters

Following Speed of SV, V_{SV} (km/h)	Distance between TV1 and TV2 during cut-out (m)			
	35	45	55	65
60				
65				
70				
75				
80				
85				
90				
95				
100				

5.2.4.4.10.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.10.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.11 Forward-vehicle lane-change scenario

5.2.4.4.11.1 Scenario description

Refer to 5.2.3.3 for scenario description and schematic diagram.

5.2.4.4.11.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and travels at

the set speed V_{SV};

b) The SV starts recording valid test data when it is 150 m away from the rear of TV2;

c) TV1 travels forward at a constant 80 km/h. After the SV has been following steadily for 3 s, the SV changes lanes to the right;

d) As the SV initiates the right lane change, TV2 begins a left lane change and proceeds forward at 60 km/h;

e) The test condition parameters are shown in Table 22;

Table 22 Test Scenario Parameters

Following Speed of SV, V_{SV} (km/h)	Longitudinal Offset between SV and TV2 during Lane Change (m)		
	20	30	40
65			
70			
75			
80			
85			
90			
95			
100			
105			
110			

5.2.4.4.11.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.11.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.12 Consecutive-accident recognition scenario

5.2.4.4.12.1 Scenario description

Refer to 5.2.3.4 for scenario description and schematic diagram.

5.2.4.4.12.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and travels at

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the set speed V_{SV};

b) The SV starts recording valid test data when it is 150 m away from the rear of TV2;

c) TV1 proceeds forward at 60km/h, maintaining a constant speed;

d) After passing TV2, TV1 decelerates at the specified deceleration rate, changes lanes to the left, and comes to a stop;

e) The test condition parameters are shown in Table 23;

Table 23 Test Scenario Parameters

Set speed of SV, V_{SV} (km/h)	Deceleration of TV1 (m/s^2)		
	3	5	7
65			
70			
75			
80			
85			
90			
95			
100			
105			
110			

5.2.4.4.12.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.12.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.13 Foggy-weather secondary passenger-vehicle accident scenario

5.2.4.4.13.1 Scenario description

Refer to 5.2.3.5 for scenario description and schematic diagram.

5.2.4.4.13.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and travels at the set speed V_{SV};

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b) The SV starts recording valid test data when it is 200 m away from the pre-impact point;

c) The object target is placed as shown in the figure;

d) The test condition parameters are shown in Table 24;

Table 24 Test Scenario Parameters

Set speed of SV, V_{SV} (km/h)	Impact point (%)	
	10	90
65		
70		
75		
80		
85		
90		
95		
100		
105		
110		

5.2.4.4.13.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.13.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.14 Daytime light-truck cut-in scenario

5.2.4.4.14.1 Scenario description

Refer to 5.2.3.6 for scenario description and schematic diagram.

5.2.4.4.14.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and travels at the set speed V_{SV};

b) The SV starts recording valid test data when it is 150 m away from the pre-impact

point;

c) The target light truck (TV) travels forward at the set speed V_{TV}, maintaining a constant speed, and performs a left cut-in lane change. It straddles the lane line for 4 s before completing the lane change. The impact point is set at the center of the target vehicle's rear once the lane change is complete;

d) The test condition parameters are shown in Table 25;

Table 25 Test Scenario Parameters

Set speed of SV, V_{SV} (km/h)	Speed of Target Truck, V_{TV} (km/h)			
	30	40	50	60
80				
85				
90				
95				
100				
105				
110				
115				
120				

5.2.4.4.14.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.14.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.15 Scattered target-object scenario

5.2.4.4.15.1 Scenario description

Refer to 5.2.3.7 for scenario description and schematic diagram.

5.2.4.4.15.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and is set to travel at speed V_{SV} in the right-hand lane;

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

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c) he test condition parameters are shown in Table 26.

Table 26 Test Scenario Parameters

Set speed of SV, V_{SV} (km/h)	Impact point (%)		
	10	50	90
65			
70			
75			
80			
85			
90			
95			
100			
105			
110			

5.2.4.4.15.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.15.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.2.4.4.16 Rainy-weather secondary accident scenario

5.2.4.4.16.1 Scenario description

Refer to 5.2.3.8 for scenario description and schematic diagram.

5.2.4.4.16.2 Test method

The test steps are as follows:

a) The SV has the advanced combined driver assistance function enabled and is traveling at the set speed V_{SV} in the right-hand lane;

b) The SV starts recording valid test data when it is 150 m away from the pre-impact point;

c) The object target is placed as shown in the figure;

d) The test condition parameters are shown in Table 27;

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Table 27 Test Scenario Parameters

Set speed of SV, V_{SV} (km/h)	Impact point (%)	
	10	90
65		
70		
75		
80		
85		
90		
95		
100		
105		
110		

5.2.4.4.16.3 Conditions for end of test

The test ends when any of the following conditions occurs:

a) The SV avoids a collision with the object target;

b) The SV collides with any traffic participant.

5.2.4.4.16.4 Test validity requirements

To ensure test validity, the following shall be guaranteed throughout the test:

a) The speed of the SV is maintained within the specified speed ±1 km/h, and the speed of the object target is maintained at the specified speed;

b) During the test, the vehicle can pass normally without restarting the combined driver assistance system or degrading the intelligent driving system.

5.3 Test method for driving interaction safety

5.3.1 Overview of driving interaction safety test

The driving interaction safety test mainly covers two dimensions: driver interaction safety and intelligent lighting safety. Driver interaction safety includes driver state monitoring, driving visual assistance, and speech interaction safety, whereas intelligent lighting safety includes adaptive high-beam headlamps and assistance projection function. See Table 28 for detailed test contents.

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Table 28 Test Items of Driving Interaction Safety

Rating Items		Test scenario
Driver interaction safety	Driver state monitoring	Distraction monitoring
		Fatigue monitoring
	Driving visual assistance	Surround view
	Speech interaction safety (penalty item)	Vehicle control
		Driver assistance
Intelligent lighting safety	Adaptive driving beam	Glare control
		Masking precision and accuracy
	Assistance projection function (bonus item)	Projection luminance uniformity
		Vertical and horizontal distortion

5.3.2 Test method for driver interaction safety

5.3.2.1 Test methods for driver condition monitoring

5.3.2.1.1 Test methods for distraction monitoring

a) Test steps for manual driving scenario:

1) Adjust the system under test (SUT) to the standby status, and calibrate the eye tracker for the driver to ensure that the eye tracker records gaze points the same as real gaze points;

2) The driver starts the vehicle and increases the speed to meet the activation requirement of the driver condition monitoring system;

3) The driver, following the prolonged distraction viewing mode, looks at the designated distraction test points: the in-vehicle information system, the center console armrest area, and the front passenger footwell. The camera and microphone record the system's alarm signals (visual or audible). (The locations of the distraction points are shown in Fig. 33)

4) Each distraction point is tested three times. The driver continuously keeps gazing at the distraction point area for 3 seconds. If the system triggers an alarm within 1.5 seconds after this threshold is met, the test is considered successful and the result is recorded.

Note:

① The maximum allowable alarm cooling interval of the driver state monitoring system during a power-on and power-off journey is 5 minutes.

② The sensitivity selection basis for the driver state monitoring system test is the default sensitivity when the vehicle is started.

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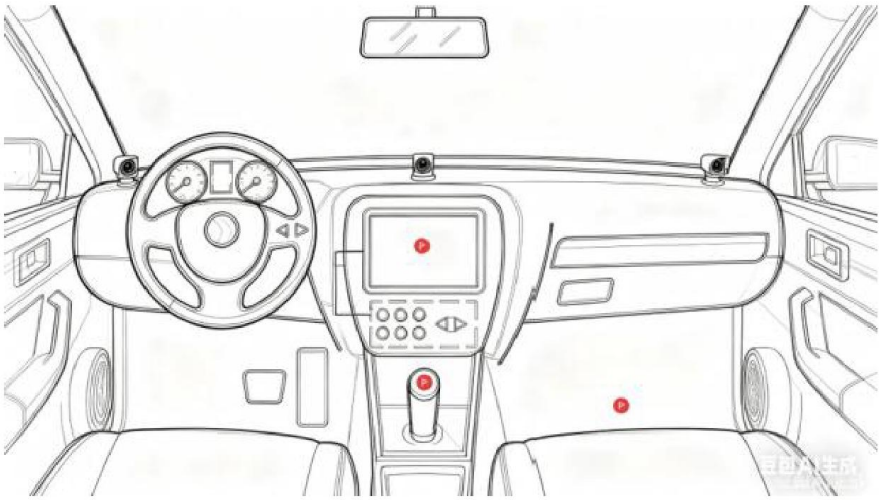


Fig. 33 Location of Distraction Point

b) Test steps for assisted driving scenario:

1) Adjust the system under test (SUT) to the standby status, and calibrate the eye tracker for the driver to ensure that the eye tracker records gaze points the same as real gaze points;

2) The driver shall wear sunglasses, which shall meet the requirements of Class 3 and above in GB 10810.3, with light transmittance > 10 % and shall not block infrared light;

3) The driver, following the prolonged distraction viewing mode, looks at the designated distraction test points: the in-vehicle information system, the center console armrest area, and the front passenger footwell. The camera and microphone record the system's alarm signals (visual or audible). (The locations of the distraction points are shown in Fig. 33)

4) Each distraction point is tested three times. The driver must gaze at the distraction point area for at least 5 seconds. The system considers the test successful if an alarm is triggered within the 5-second observation period, and the results are recorded.

5.3.2.1.2 Test methods for fatigue monitoring

a) Test steps for manual driving scenario:

1) Adjust the system under test (SUT) to the standby status, and calibrate the eye tracker for the driver to ensure that the eye tracker records gaze points the same as real gaze points;

2) The driver starts the vehicle and increases the speed to meet the activation requirement of the driver condition monitoring system;

3) When the driver closes his/her eyes, the camera and microphone record the visual or audible alarm response signal of the system;

4) Conduct three tests. The driver must keep their eyes closed for 3 seconds. If the driver continues to keep their eyes closed and the system issues an alarm within 1.5 seconds of reaching this threshold, the test is considered successful, and the results are recorded.

Note:

① The maximum allowable alarm cooling interval of the driver state monitoring system during a power-on and power-off journey is 5 minutes.

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② The sensitivity selection basis for the driver state monitoring system test is the default sensitivity when the vehicle is started.

b) Test steps for assisted driving scenario:

1) Adjust the system under test (SUT) to the standby status, and calibrate the eye tracker for the driver to ensure that the eye tracker records gaze points the same as real gaze points;

2) The driver shall wear sunglasses, which shall meet the requirements of Class 3 and above in GB 10810.3, with light transmittance > 10 % and shall not block infrared light;

3) When the driver closes his/her eyes, the camera and microphone record the visual or audible alarm response signal of the system;

4) Conduct the test three times. The test is considered successful if the driver keeps their eyes closed for at least 5 seconds and the system issues an alarm within that 5-second period; record the results.

5.3.2.2 Driving visual assistance

5.3.2.2.1 Test method for surround view

5.3.2.2.1.1 Splicing loss area

The splicing loss area test steps shall meet the following requirements:

a) The laboratory ambient lighting range is set at 100 lx - 150 lx;

b) Enable the surround view system, adjust the steering wheel angle to 0°, and turn off the icons that obstruct the test chart images in the surround view splicing view. The vehicle manufacturer may provide a method for disabling such icons. If no method is provided, keep the default setting.

c) Ensure that the splicing view plane image is completely visible, and the shooting direction of the image acquisition equipment shall be parallel to the normal line of the display terminal. Acquire the splicing view plane image from the display terminal of the surround view system.

d) Import the images into the test system and record the software-analyzed data.

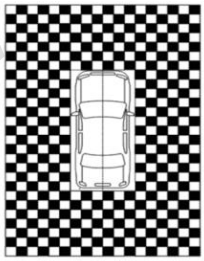


Fig. 34 Schematic Diagram of Splicing Loss Area and Splicing Field-of-vision Distortion

5.3.2.2.1.2 Splicing field-of-vision distortion

The test steps and requirements for splicing field-of-vision distortion are consistent with those for splicing loss area; please refer to them accordingly.

5.3.2.2.1.3 Stereo loss in field of vision

The stereo loss in field of vision test steps shall meet the following requirements:

a) The laboratory ambient lighting range is set at 100 lx - 150 lx;

b) Place the test plate vertically on the ground, with the center of the bottom edge aligned with the splicing seam and the bottom edge perpendicular to the splicing seam (or to the tangent line of the splicing seam). The test plate shall be placed 1 m away from the vehicle;

c) Enable the surround view system, adjust the steering wheel angle to 0°, and turn off the icons that obstruct the test chart images in the surround view splicing view. The vehicle manufacturer may provide a method for disabling such icons. If no method is provided, keep the default setting.

d) Ensure that the splicing view plane image is completely visible, and the shooting direction of the image acquisition equipment shall be parallel to the normal line of the display terminal. Acquire the splicing view plane image from the display terminal of the surround view system.

e) Test the four view angles (front left, front right, rear left, and rear right) respectively, import the collected images into the test system, and record the software-analyzed data.

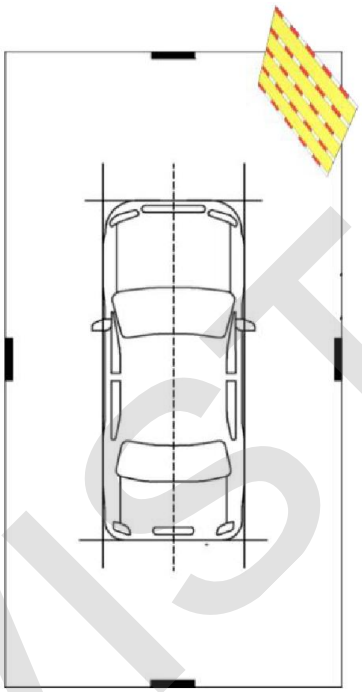


Fig. 35 Schematic Diagram of Stereo Loss in Field of Vision

5.3.2.3 Speech interaction safety

5.3.2.3.1 Vehicle control

5.3.2.3.1.1 Headlamp control

The vehicle is traveling on the road at a speed of 30 km/h with the headlamps/automatic headlamps turned on. The driver or passenger issues the voice command: "Turn off the headlamps/Turn off the automatic headlamps." The test is repeated three times to verify the vehicle's response.

5.3.2.3.1.2 Door control

The vehicle is traveling at 30 km/h on the road with the doors closed. The driver or passenger issues the voice command: "Open the door." The test is repeated three times to verify the vehicle's response.

5.3.2.3.1.3 Driver's seat control

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The vehicle is traveling on the road at a speed of 30 km/h. The driver and passengers issue the voice command: "Adjust the driver's seat position." The test is repeated three times to verify the vehicle's performance.

5.3.2.3.2 Driver assistance

5.3.2.3.2.1 Deactivation of driver assistance function

The vehicle is traveling on the road at a speed of 30 km/h with the driver condition monitoring function enabled. The driver or passenger issues the voice command: “Turn off the driver condition monitoring function.” The test is repeated three times to verify the vehicle’s response.

5.3.3 Test method for intelligent lighting safety

5.3.3.1 Overview of intelligent lighting safety test

The adaptive driving beam test for glare control and glare masking precision and accuracy is conducted on-site, while the performance test of the auxiliary projection lamps is carried out in the vehicle darkroom. The test condition is shown in Table 29.

Table 29 Adaptive Driving Beam Test Conditions

Rating Items		Test Method	SV Speed	Type of object target	Driving Scenario	Lane type
Adaptive driving beam	Glare control	Vehicle test site	45 km/h	Four-wheeler	Same-direction driving	Straight road
		Vehicle test site	45 km/h	Four-wheeler		R = 150 m, right curve
		Vehicle test site	60 km/h	Four-wheeler		R = 250 m right curve
		Vehicle test site	45 km/h	Four-wheeler	Oncoming vehicle	Straight road
		Vehicle test site	45 km/h	Four-wheeler		R = 150 m, left curve
		Vehicle test site	60 km/h	Four-wheeler		R = 250 m, left curve
	Masking precision and accuracy	Vehicle test site	45 km/h	Four-wheeler	Oncoming vehicle	Straight road, 100 m
		Vehicle test site	45 km/h	Four-wheeler	Oncoming vehicle	Straight road, 50 m
		Vehicle test site	45 km/h	Four-wheeler	Same-direction driving	Straight road, 100 m
		Vehicle test site	45 km/h	Four-wheeler	Same-direction driving	Straight road, 50 m
Assistance projection function (bonus item)	Projection luminance uniformity	Vehicle lighting darkroom	NA	All white pattern	NA	NA
	Vertical and horizontal	Vehicle lighting	NA	Black-and-	NA	NA

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Rating Items		Test Method	SV Speed	Type of object target	Driving Scenario	Lane type
	distortion	darkroom		white dot matrix		

5.3.3.2 Test steps

The adaptive driving beam test process is divided into two scenarios according to the content: glare control and masking accuracy; the auxiliary projection lighting test examines the distortion and uniformity of the projection.

5.3.3.2.1 Glare test of adaptive driving beam

The test steps are as follows:

For the glare control performance of the adaptive driving beam system, a vehicle field test method is adopted, covering multiple working conditions: the speed of the SV is 45 km/h and 60 km/h; four-wheeled vehicles are used as stimulus vehicles, with two driving scenarios set: "same-direction driving" and "oncoming vehicles"; according to the site road types (left turn, right turn, straight road), different evaluation intervals (such as 15 m ≤ s ≤ 50 m, 15 m ≤ s ≤ 80 m) are matched. The glare control capability of the adaptive driving beam system in various typical scenarios is comprehensively verified. The stimulus devices required for the test are detailed in Appendix A.

a) Select the conditions to be tested from Table 29 *Adaptive Driving Beam Test Conditions*, and specify the SV speed (45 km/h or 60 km/h), type of object target (four-wheeled stimulus vehicle), driving scenario (same-direction driving or oncoming vehicles), site road type (left turn, right turn, straight road) and evaluation interval (e.g. 15 m ≤ s < 50 m).

b) Arrange the test scenario according to the selected working conditions with reference to the test specifications: ensure that the lane where the subject vehicle under test runs is flat; position the four-wheeled stimulus vehicle as required; restore the road type of the test site (left turn, right turn, or straight road); deploy test equipment such as the stimulus test fixture and imaging luminance meter to ensure that the equipment functions properly.

c) Park the SV at the starting position of a flat lane. After checking the vehicle status, enable the adaptive driving beam function of the vehicle and the lights of the four-wheeled stimulus vehicle at the same time. Debug the stimulus test fixture and imaging luminance meter to make them in a state to be recorded;

d) Accelerate the SV under test to the speed specified for the working condition and maintain a stable speed. Continuously monitor the distance between the SV and the stimulus device using the ranging device. The test officially begins when the distance reaches the start point of the evaluation interval corresponding to the working condition.

e) During the test, the illuminometer shall continuously record the illuminance data. When the trailing edge of the SV passes over the measuring point and the timing reaches 5 s, the test and data recording shall be stopped.

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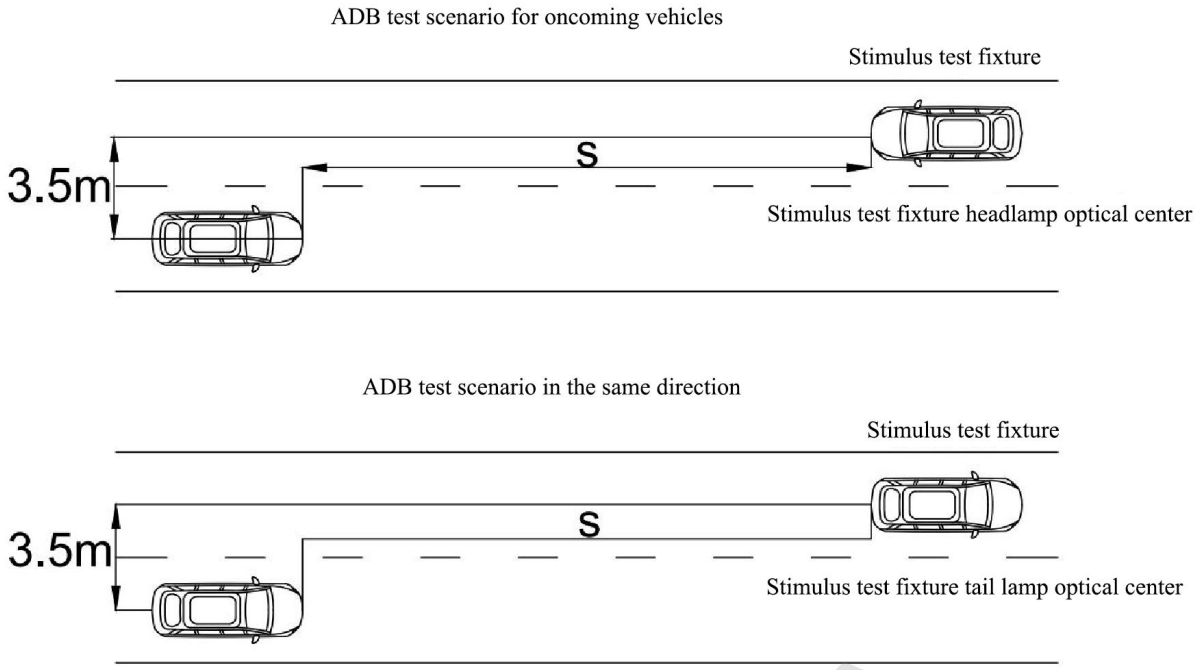


Fig. 36 Adaptive Driving Beam Test Scenario

5.3.3.2.2 ADB masking precision and accuracy

The ADB masking precision and accuracy test includes the same-direction and opposite-direction driving scenarios. During the test, the SV is first parked at a distance greater than s = 200 m from the stimulus device. The initial projected area of the stimulus device on the screen is recorded using a high-frequency imaging luminance meter. The test procedure is detailed as follows. For the schematic diagram, see Fig. 37 Working Condition Layout of ADB Masking Precision and Accuracy:

a) The scenario of same-direction driving is adopted, and the SV stops at a distance greater than s = 200 m. An imaging luminance meter is used to record the projection of the stimulus device on the screen at that moment. This projection is the initial projection area;

b) Select the corresponding test conditions, arrange the corresponding test scenarios, and keep the curtain perpendicular to the ground and the curtain perpendicular to the center line of the vehicle;

c) The SV under test is located on a flat road, the adaptive driving beam function of the SV is enabled, the lights of the stimulus vehicle are turned on, and the imaging luminance meter is turned on;

d) The vehicle accelerates to the set working speed. When the distance reaches the effective evaluation distance of the corresponding working condition, the test officially begins;

e) The SV gradually approaches and passes the measuring point, and the imaging luminance meter records the projection of the stimulus device on the screen during the whole process;

f) The speed shall be kept stable during the test, and the SV speed shall be kept at the specified speed ±2 km/h;

g) The lateral distance of the SV during the test shall not exceed ±0.1 m of the specified driving path.

h) End the test 5 s after the rear edge of the SV passes over the measuring point.

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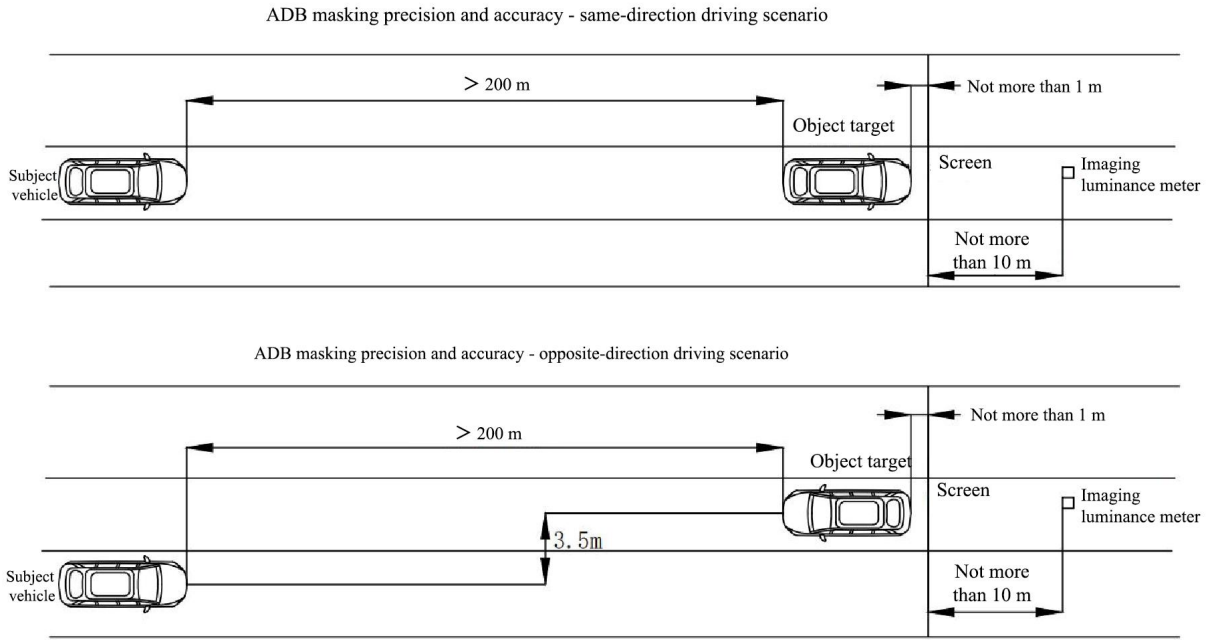


Fig. 37 Working Condition Layout of ADB Masking Precision and Accuracy

5.3.3.2.3 Assistance projection function test

5.3.3.2.3.1 Collection of basic experimental data

The testing process for assistance projection function is divided into two test criteria based on content: vertical and horizontal distortion, and projection luminance uniformity. The following preparations must be made before beginning the test:

a) Collect the distance from the centre of reference of the low beam and high beam of the headlamp to the ground and the lateral distance between the centres of reference of the low beam and high beam as shown in Fig. 38, and record the initial downward inclination angle value of the low beam displayed on the manufacturer's nameplate or the mark around the headlamp;

A1 and A2: Represent the positions of the centre of reference for the low beam of the right and left headlamps respectively.

B1, B2: Represent the positions of the centre of reference for the high beam of the right and left headlamps respectively.

H1: the vertical distance from the centre of reference of the high beam of the headlamp to the ground;

H2: the vertical distance from the centre of reference of the low beam of the headlamp to the ground;

R1: the lateral distance from the centre of reference of the high beam of the right headlamp to the longitudinal centre plane of the vehicle (V - V);

R2: the lateral distance from the centre of reference of the low beam of the right headlamp to the longitudinal centre plane of the vehicle (V - V);

L1: the lateral distance from the centre of reference of the high beam of the left headlamp to the longitudinal centre plane of the vehicle (V - V);

L2: the lateral distance from the centre of reference of the low beam of the left headlamp to the longitudinal centre plane of the vehicle (V - V);

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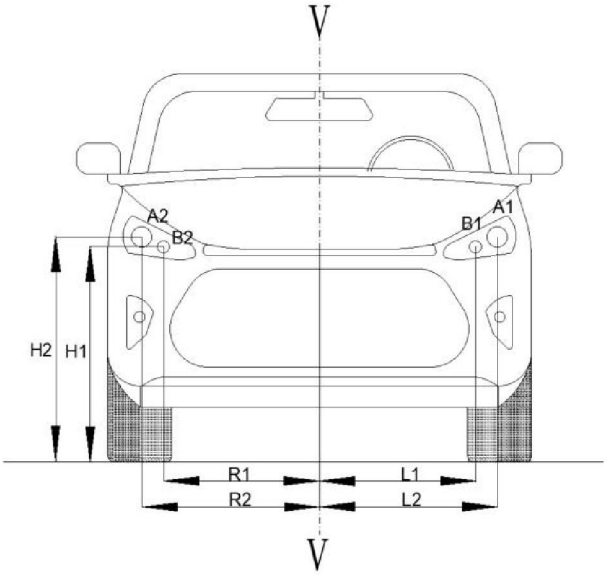


Fig. 38 Centre of Reference Dimension Mark of Headlamp

b) For fuel-powered vehicles, start the engine, collect the terminal voltage at the vehicle battery terminal, and record the value as V0 after the terminal voltage stabilizes. When testing the intelligent lights of fuel-powered vehicles, use a regulated power supply to power the lights using V0;

c) When testing electric vehicles, there is no need to use a voltage-stabilized power supply, and the traction battery directly supplies power;

5.3.3.2.3.2 Vertical and horizontal distortion

The distortion test steps in the vertical and horizontal directions are as follows, and the relevant schematic diagram is shown in Fig. 39.

a) Activate the projection function of the SV and project a black-and-white dot matrix in the vertical direction to the test screen or designated imaging plane;

b) Use an imaging brightness meter to measure the height of the rectangle formed by the center points on the four sides of the projected image, and record the height as H;

c) Use an imaging brightness meter to consecutively measure the height difference between the four corner points of the projected image and the corresponding centre points on the four sides, and record the height difference as ΔH (for example: the height difference between the upper centre point and the upper left and upper right corner points, the height difference between the lower centre point and the lower left and lower right corner points, and so on);

d) According to the formula DTVn = ΔH/H × 100% or DTVn = ΔL/L × 100%, calculate the distortion amount DTVn of the upper, lower, left and right sides respectively;

e) Take the maximum value among the distortion variables of the four sides, record it as DTV = max (DTVn), and complete the test data recording.

MISTA

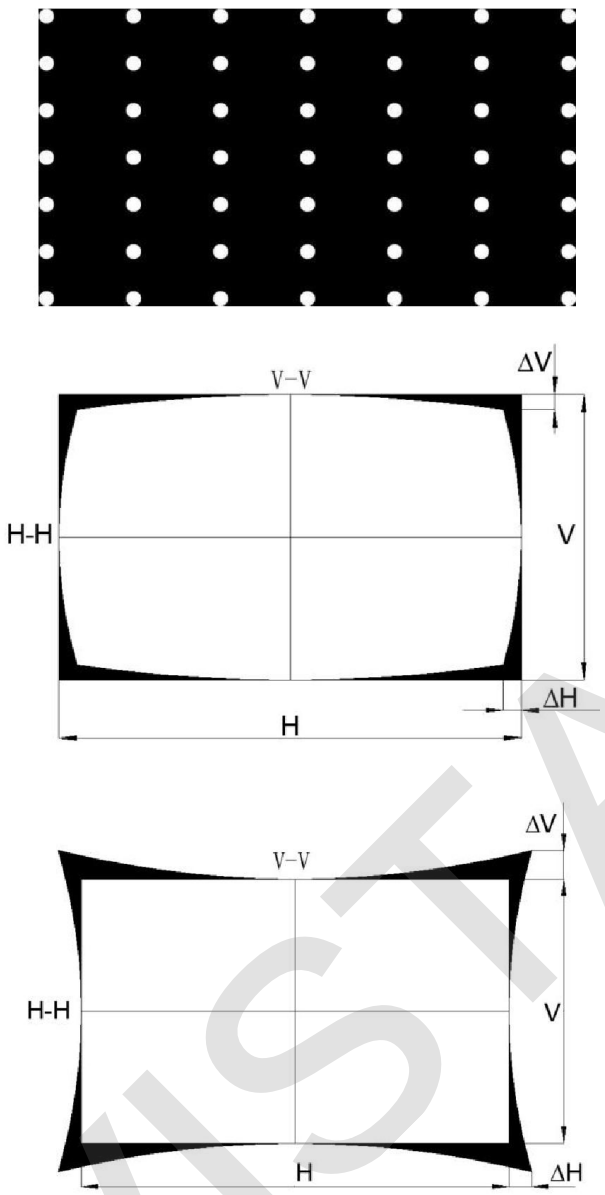


Fig. 39 Distortion in Vertical and Horizontal Directions

5.3.3.2.3.3 Projection luminance uniformity

a) Test point distribution: Set the diameter of the test points to min (0.01 H, 0.01 V), where H and V are the image width and height, respectively. The distance between the edge points and the edges is 0.1 V and 0.1 H. The remaining points are evenly distributed. Refer to Fig. 40 for test points;

b) Project a pure white image and capture the resulting image; use the software to measure the luminance at test points 1 to 81 and calculate their values;

c) Calculate the maximum luminance (Lmax) and minimum luminance (Lmin) on the same horizontal line.

d) Calculate the ratio of the maximum luminance to minimum luminance on the same horizontal line according to the formula U(n)=Lmax/Lmin.

e) Calculate the overall uniformity index U=Max (U(n)).

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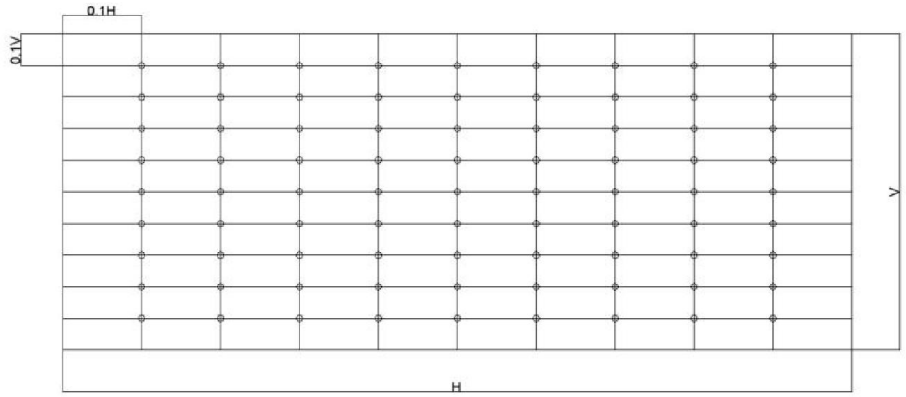


Fig. 40 Test Point Location Map

5.3.3.3 Test requirements

Do not move the vehicle or turn the steering wheel during the test.

5.4 Test method for cybersecurity and privacy security

The cybersecurity and privacy test is divided into two parts: cybersecurity and privacy security. See Table 30 for detailed test contents.

Table 30 Cybersecurity and Privacy Security Test Content

S/N	Test Element	Test Dimension	Test Item
1	Cybersecurity	Remote control anti-theft	Security of vehicle control via digital keys
2			Security of hardening for vehicle control apps
3			4G/5G signal hijacking and spoofing
4		In-vehicle network security	Navigation and positioning security
5			Wi-Fi/Hotspot communication attacks
6	Privacy	Personal privacy safeguard	Continuous data collection notification
7			In-vehicle voiceprint authentication anti-attack
8		Personal rights and interests safeguard	Prominent notice in personal information processing
9			Biometric information protection
10			Personal privacy data isolation

5.4.1 Test method for cybersecurity

5.4.1.1 Test method for remote control anti-theft

5.4.1.1.1 Test for security of vehicle control via digital keys

5.4.1.1.1.1 Test for digital key integration attacks

This test is used to evaluate the vehicle's capability to resist replay attacks from RFID/BLE/NFC keys when locked; it is also used to determine the technical level and test coverage of digital keys adapted to different vehicle models.

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a) Test method:

1) Adaptability confirmation and test priority:

Confirm the key capabilities supported by the vehicle (based on vehicle configuration, manual, APP function switch, key type, in-vehicle infotainment menu, etc.) to form an applicability level as follows:

Basic: radio frequency identification key (RFID);

Enhanced: Bluetooth key (BLE);

Advanced: NFC key (card/smart device).

2) Execution order (advanced, enhanced, basic): For a certain vehicle model, begin testing from the highest supported adaptation level;

3) Place the vehicle in an open and spacious test field. Within the vehicle's reception response range, use the digital key test kit to record and replay the digital key unlocking signal, and observe whether the vehicle is unlocked (if the vehicle is not unlocked, proceed to the next step; if the vehicle is unlocked, the test ends);

4) Place the vehicle in an open and spacious test field. Outside the vehicle's reception response range, use the digital key test kit to record and replay the digital key unlocking signal, and observe whether the vehicle is unlocked.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

Table 31 Result Recording for Digital Key Integration Attacks Test

Test Dimension	Test Item	Test scenario	Result Recording	Result Indicator
Remote control anti-theft	Security of vehicle control via digital keys	Digital key integration attacks	Is the vehicle unlocked within the vehicle's reception response range	□Yes □No □N/A
			Is the vehicle unlocked outside the vehicle's reception response range	□Yes □No □N/A

Note: The vehicle unlocking state includes flashing lights, folding and unfolding of rearview mirrors, pop-up door handles, and vehicle door unlocking prompt sounds.

5.4.1.1.2 Test for security hardening for vehicle control apps

5.4.1.1.2.1 Test for security hardening for vehicle control apps

This test is used to evaluate whether the vehicle control application has taken effective security hardening measures to prevent reverse analysis, dynamic debugging, and code tampering.

a) Test method:

1) Vehicle control application packing detection: Use shell detection tools (such as ApkScan, PKID, DexExtractor, etc.) to analyze the vehicle control application and check whether it contains third-party packing/protection shells (such as Tencent Legu, Bangbang Protection, 360 Protection, etc.); if the tool detects packing characteristics, record the shell type and version. If no packing feature is detected, try to parse the code using a decompilation tool (such as Jadx, Ghidra, etc.) and check whether packing causes decompilation failure or

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abnormal code structure.

2) Vehicle control application code obfuscation: Use decompilation tools (such as Jadx, JEB, etc.) to analyze the APP code structure, check whether the class names, method names, and variable names have been replaced with meaningless strings (such as a, b, c), and check whether the code logic contains redundant instructions or control flow obfuscation (such as fake branches or flattening).

3) Bypassing the security mechanism of the vehicle control application: Install Xposed framework and common Hook modules (such as JustTrustMe, SSLUnpinning, etc.) on a standard test machine, try to inject dynamic code into the vehicle control application, and observe whether the vehicle control application triggers security detection (such as crash, pop-up warning, or feature limitation). If the APP does not have a security detection mechanism, the test ends; if there is a security detection mechanism, use the Frida tool to inject into the vehicle control application process, try to hook key functions (such as encryption algorithms, identity authentication logic, etc.), and record whether the security detection mechanism is successfully bypassed.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

Table 32 Result Recording for Security Hardening for Vehicle Control Apps Test

Test Dimension	Test Item	Test Scenario	Result Recording	Result Indicator
Remote control anti-theft	Security hardening for vehicle control apps	Security hardening for vehicle control apps	Whether the vehicle control application has a protection shell (packing shell)	□ Yes, Hardening Type: Version: □ No □ Not applicable
			Whether the vehicle control application has code obfuscation	□Yes □No □N/A
			Does the vehicle control application have security detection mechanisms, and are there any instance being bypassed	□ Yes, bypassing the security check mechanism failed □ Yes, bypassing the security check mechanism succeeded □ No □ Not applicable

5.4.1.1.3 Test for 4G/5G hijacking and spoofing

5.4.1.1.3.1 Test for 4G/5G rogue base station attacks

This test is designed to evaluate a vehicle's ability to resist attacks from 4G/5G rogue base station.

a) Test method:

1) Place the test vehicle in a shielded room. Use a cellular network test platform that supports 4G LTE and/or 5G NR protocols (such as a base station simulator or channel emulator combined with software-defined radio (SDR) or dedicated test phones/modules) to set up a rogue base station. Trigger the vehicle's external communication process and observe whether the vehicle connects to the rogue base station (if the vehicle connects to the rogue base station, proceed to the next step; if the vehicle does not connect to the rogue base station, the test is concluded);

2) Check whether the test vehicle's external communication functions are working properly.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

Table 33 Result Recording for 4G/5G Rogue Base Station Attacks Test

Test Dimension	Test Item	Test Scenario	Result Recording	Result Indicator
Remote control anti-theft	4G/5G hijacking and spoofing	4G/5G rogue base station attacks	Is the vehicle connected to a rogue base station	□Yes □No □N/A
			Is the vehicle's external communication function normal	□Yes □No □N/A

5.4.1.2 Test method for in-vehicle network security

5.4.1.2.1 Test for navigation and positioning security

5.4.1.2.1.1 Test for GNSS spoofing

This test is used to evaluate the ability of the vehicle to resist false GNSS signals to avoid positioning errors or being misled.

a) Test method:

1) Start the vehicle, enable the vehicle's wireless communication (such as Bluetooth communication and Wi-Fi communication), place the GNSS test kit in an open area 5–15 meters away from the SV, configure the kit to generate GPS L1 and L2 frequency signals, set the transmission power to 15 dBm, and set the sampling rate to 10 MHz. Enable the GNSS test kit and transmit forged GNSS signals to the SV. Test duration: 10 minutes. Observe whether the vehicle positioning is accurate (if the vehicle positioning is accurate, proceed to the next step; if the vehicle positioning is inaccurate, the test ends).

2) Turn off the vehicle's wireless communication (such as Bluetooth communication and Wi-Fi communication), place the GNSS test kit in an open area 5-15 meters away from the SV, configure the kit to generate GPS L1 and L2 frequency signals, set the transmitting power to 15 dBm and the sampling rate to 10 MHz. Enable the GNSS test kit and transmit forged GNSS signals to the SV. Test duration: 10 minutes. Observe whether the vehicle positioning is accurate.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

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Table 34 Result Recording for GNSS Spoofing Test

Test Dimension	Test Item	Test Scenario	Result Recording	Result Indicator
In-vehicle network security	Navigation and positioning security	GNSS spoofing	Enable the vehicle's wireless communication, launch the GNSS test kit, and check whether the vehicle's positioning results are accurate	□ Yes □ No □N/A
			Turn off the vehicle's wireless communication, enable the GNSS test kit, and check whether the vehicle's positioning results are accurate	□ Yes □ No □N/A

5.4.1.2.2 Test for Wi-Fi/hotspot communication attacks

5.4.1.2.2.1 Test for malicious phishing Wi-Fi/hotspot attacks

This test is used to evaluate the vehicle's ability to resist malicious phishing Wi-Fi/hotspot attacks when connected to Wi-Fi/hotspot.

a) Test method:

Use the Wi-Fi/Hotspot test kit to create a phishing Wi-Fi/hotspot with the same network name as the test host's hotspot. If the original Wi-Fi/hotspot has a password, the phishing Wi-Fi/hotspot will not have a password; if the original Wi-Fi/hotspot does not have a password, the phishing Wi-Fi/hotspot will be assigned a random password. Start the vehicle and turn on Wi-Fi/hotspot, then observe whether the vehicle automatically connects to a malicious phishing Wi-Fi network or hotspot, or whether it issues a risk warning.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

Table 35 Result Recording for Malicious Phishing Wi-Fi/Hotspot Attacks Test

Test Dimension	Test Item	Test Scenario	Result Recording	Result Indicator
In-vehicle network security	Wi-Fi/Hotspot communication attacks	Malicious phishing Wi-Fi/hotspot attacks	Whether the vehicle automatically connects to the malicious phishing Wi-Fi/hotspot	□ Yes □ No □N/A
			Does the vehicle issue a risk warning	□ Yes □ No □N/A

5.4.2 Test method for privacy

5.4.2.1 Test method for personal privacy safeguard

5.4.2.1.1 Test for continuous data collection notification

5.4.2.1.1.1 Test for in-vehicle personal information continuous collection status notification

This test is used to evaluate how the vehicle provides notification of the continuous collection status of personal information inside the vehicle.

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a) Test method:

According to the list of functions for processing personal information and in combination with the use scenarios of in-vehicle camera, in-vehicle microphone and vehicle positioning function specified in the privacy policy, trigger the functions involving continuous collection of relevant personal information respectively, and check whether the vehicle gives clear prompts or marks to users through instruments, screens, indicators or other means when relevant functions are operating at the front end and in the background. The test contents include:

1) Whether there is an operating status prompt when the in-vehicle image and video data are continuously collected;

2) Whether there is an operating status prompt when the in-vehicle audio data is continuously collected;

3) Whether there is an operating status prompt when the vehicle position data is continuously collected.

Note: In order to realize the speech recognition function to determine the vehicle control commands in real time and process the speech command data outside the vehicle, it shall be explained through privacy policy, function description, prompt information and other means that speech information will be collected around the vehicle body.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

Table 36 Result Recording for In-vehicle Personal Information Continuous Collection Status Notification Test

Test Dimension	Test Item	Test Scenario	Result Recording	Result Indicator
Personal privacy safeguard	Continuous data collection notification	In-vehicle personal information continuous collection status notification	Whether there are prompt signs or information for continuous collection of in-vehicle image and video data	□ Yes □ No □N/A
			Whether there are prompt signs or information for continuous collection of in-vehicle audio data	□ Yes □ No □N/A
			Whether there are prompt signs or information for continuous collection of vehicle position data	□ Yes □ No □N/A

5.4.2.1.2 Test for in-vehicle voiceprint authentication anti-attack

5.4.2.1.2.1 Test for in-vehicle voiceprint authentication anti-attack capability

This test is used to evaluate whether the in-vehicle voiceprint authentication process has the capability to detect voice attacks, and to activate the appropriate response mechanisms—such as validation failure/error messages, risk warnings, or non-execution of commands—when the voice attack is detected. The types of attacks tested include:

1) Imitated voice: The attacker imitates the target speaker's voice;

2) Synthetic voice: Artificial voice generated using mechanical, electronic, or other AI algorithms;

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3) Replay voice: Repeated playback of the prerecorded target user's voice;

a) Test method:

1) Enable the in-vehicle voiceprint authentication system and register voiceprints from at least five target speakers;

2) Use the three attack methods described above to generate fake voice samples of the registered target speaker (with an equal number of samples for each attack type, and no fewer than 200 samples for each); then use these samples to interact with the in-vehicle system from the main driver’s seat while the voiceprint authentication feature is enabled;

3) Observe whether any handling mechanisms—such as verification failure, error message for the target speaker, risk warnings, or unexecuted commands—occur when playing the fake voice samples. Record and calculate the false acceptance rate (FAR) for each type of attack during the voiceprint authentication process.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

Table 37 Result Recording for In-vehicle Voiceprint Authentication Anti-attack Capability Test

Test Dimension	Test Item	Test Scenario	Result Recording	Result Indicator
Personal privacy safeguard	In-vehicle voiceprint authentication anti-attack	In-vehicle voiceprint authentication anti-attack capability	Detection capability of imitated voice: FAR ≤ 20%	□ Yes □ No
			Detection capability of synthetic voice: FAR ≤ 20%	□ Yes □ No
			Detection capability of replay voice: FAR ≤ 20%	□ Yes □ No

5.4.2.2 Test method for personal rights and interests safeguard

5.4.2.2.1 Test for prominent notice in personal information processing

5.4.2.2.1.1 Test for personal information sharing and children's information protection notification

This test is used to evaluate the effectiveness of notifications provided by the in-vehicle infotainment system regarding personal information sharing and children's information protection.

a) Test method:

Check the in-vehicle infotainment system privacy policy to see whether users are informed of the information about third parties and the purposes of data use when sharing or disclosing personal information to third parties, whether they are informed that guardian consent is required for collecting children's personal information as well as the measures to protect children's information security, and whether the information provided is clear, understandable, easily accessible, and unambiguous.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

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Table 38 Result Recording for Personal Information Sharing and Children's Information Protection Notification Test

Test Dimension	Test Item	Test Scenario	Result Recording	Result Indicator
Personal rights and interests safeguard	Prominent notice in personal information processing	Personal information sharing and children's information protection notification	Whether the privacy policy informs users of the purpose, scope, data type and usage method for collecting personal information, whether it informs users that guardian consent is required for collecting children's personal information, and whether it informs users of the measures to protect children's information security. The notice shall be clear, understandable and accessible without ambiguity.	□ Yes □ No □N/A

5.4.2.2.2 Test for biometric information protection

5.4.2.2.2.1 Test for biometric information local processing and identity authentication methods

This test is used to evaluate the vehicle's compliance with biometric information use and authentication mechanisms.

a) Test method:

According to the list of functions for processing personal information, select functions involving biometric recognition feature information collection and identity authentication. The test contents include, but are not limited to, the following:

1) Whether it is clearly stated through privacy policies, function descriptions, prompt information, etc. that biometric recognition information is only used for local comparison processing at the vehicle end and there is no transmission of biometric recognition information to the outside of the vehicle;

2) When the user refuses to provide biometric feature information, is it still possible to complete user identity authentication by other means?

Note: Data processing involving vehicle and off-vehicle functions will be deleted immediately after use and will not be used for other purposes.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

Table 39 Result Recording of Biometric Information Local Processing and Identity Authentication Methods Test

Test Dimension	Test Item	Test Scenario	Result Recording	Result Indicator
Personal rights and interests safeguard	Biometric information protection	Biometric information local processing and identity authentication methods	Whether the vehicle does not collect biometric information, or whether it is clearly stated, through the privacy policy, function description, prompt information and other means, that biometric information is only	□ Yes □ No □N/A

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Test Dimension	Test Item	Test Scenario	Result Recording	Result Indicator
			used for in-vehicle comparison and is not transmitted outside the vehicle.	
			Whether the vehicle supports user identity authentication by other means than biometric recognition information	□ Yes □ No □N/A

5.4.2.2.3 Test for personal privacy data isolation

5.4.2.2.3.1 Test for vehicle owner and other account data isolation

This test is used to evaluate whether there is data isolation capability between different accounts of the in-vehicle infotainment system.

a) Test method:

Log in separately with the owner account, authorized account, and guest account, and generate different data in applications such as navigation, photo album, dashcam, and calendar. Then, log in again with each account to check whether data generated by other accounts can be accessed, and test whether data isolation exists between different accounts.

b) Result recording:

Observe and record the vehicle response, and fill in the following table:

Table 40 Result Recording of Vehicle Owner and Other Account Data Isolation Test

Item	Test Type	Test scenario	Result Recording	Result Indicator
Personal rights and interests safeguard	Personal privacy data isolation	Vehicle owner and other account data isolation	Whether there is isolation between vehicle owner account and other account data	□ Yes □ No □N/A

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6 Assessment Method

6.1 Overview of intelligent safety evaluation

The total score of the intelligent safety sub-index evaluation content is 100 points, including 70 points for complex scenario safety, 20 points for driving interaction safety, and 10 points for cybersecurity and privacy. The specific score proportion is shown in the following table:

Table 41 Overall Score Proportion of Intelligent Safety Sub-index

Rating Dimension	Rating Items	Score of Sub-items	Score
Complex scenario safety	Urban scenario	30	70
	Highway and expressway scenarios	30	
	Simulation test	10	
Driving interaction safety	Driver interaction safety	10	20
	Intelligent lighting safety	10	
Cybersecurity and privacy	Cybersecurity	5	10
	Privacy security	5	

6.2 Evaluation method for complex scenario safety

6.2.1 Overview of test and evaluation of complex scenario safety

The rating of complex scenario safety has a total score of 70 points, including 30 points for urban scenario test, 30 points for highway and expressway scenarios and 10 points for simulation test.

Table 42 Overall Scoring for Complex Scenario Safety

Item	Rating Items	Rating Indicator	Score	Total score
Urban scenario	Actual vehicle test under urban working conditions	Whether it collides with the object target	See Table 43	30
Highway and expressway scenarios	Actual vehicle test in highway and expressway scenarios	Whether it collides with the object target	See Table 43	30
Simulation test	Consistency evaluation of simulation results	Fitness of path and yaw angle curves Fitness of speed and yaw rate curves TTC at brake trigger moment Braking distance TTC at emergency obstacle avoidance trigger moment	10	10
	Extended tests in urban, highway, and expressway scenarios	Brake to stop and avoid collision, no early degradation reminder from the system		

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Table 43 Evaluation of Real Vehicle Test Scenarios

Item	Test scenario	Rating Indicator	Score	Total score
Urban scenario	Diagonal crossing of bicycle with obstruction	Avoid a collision or come to a stop	2	30
	Passenger vehicle crossing	Avoid a collision or come to a stop	3	
	Multiple pedestrians crossing with obstruction	Avoid a collision or come to a stop	3	
	Nighttime cut-in by a motor-scooter	Avoid a collision or come to a stop	4	
	Longitudinal movement of pedestrian holding an umbrella and child on a rainy day	Avoid a collision or come to a stop; DCA is issued 4 seconds in advance	4	
	Forward vehicle cutting out and encountering bicyclist at nighttime	Avoid a collision or come to a stop	4	
	Diagonal crossing of tricycle	Avoid a collision or come to a stop	5	
	Reversing of light truck with obstruction	Avoid a collision or come to a stop	5	
Highway and expressway scenarios	Secondary accident recognition on a rainy day	Avoid a collision or come to a stop; DCA is issued 4 seconds in advance	2	30
	Scattering object target recognition	Avoid a collision or come to a stop	3	
	Forward vehicle cutting out on a curve	Avoid a collision or come to a stop	3	
	Forward vehicle lane changing	Avoid a collision or come to a stop	4	
	Forward vehicle cutting out on a rainy day	Avoid a collision or come to a stop; DCA is issued 4 seconds in advance	4	
	Continuous accident recognition	Avoid a collision or come to a stop	4	
	Secondary accident involving passenger vehicle in foggy weather	Avoid a collision or come to a stop; DCA is issued 4 seconds in advance	5	
	Light truck cutting in	Avoid a collision or come to a stop	5	

6.2.2 Assessment method of simulation test

6.2.2.1 Consistency evaluation of simulation results

The total score of the simulation test is 10 points, including consistency evaluation of simulation results based on field test scenarios and extended tests of corresponding scenarios. The consistency evaluation method is shown in Table 44.

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Table 44 Scoring for Consistency of Simulation Results

<table>
<tr><td rowspan="2">Test scenario (specific scenario parameter settings are consistent with those of the field test)</td><td colspan="2">Indicator</td><td colspan="2" rowspan="2">Calculation of consistency score</td></tr>
<tr><td>Prerequisite indicators</td><td>Process indicators</td></tr>
<tr><td rowspan="11">Diagonal crossing of bicycle with obstruction
Passenger vehicle crossing
Multiple pedestrians crossing with obstruction
A motor-scooter cuts in at night
Longitudinal movement of pedestrian holding an umbrella and child on a rainy day
Forward vehicle cutting out and encountering bicyclist at nighttime
Tricycle crossing
Reversing of light truck with obstruction
Secondary accident recognition on a rainy day
Scattering object target recognition
Forward vehicle cutting out on a curve
Forward vehicle lane changing
Forward vehicle cutting out on a rainy day
Continuous accident recognition
Secondary accident involving passenger vehicle in foggy weather
Light truck cutting in</td><td rowspan="11">Consistency of results between simulation and field tests</td><td>Fitness of yaw angle curve</td><td rowspan="3">$R_j^2 = 1 - \frac{\sum_{i=0}^{n}(X_i - Y_i)^2}{\sum_{i=0}^{n}(X_i - \bar{X})^2}$
If $R^2 \geq 0.9$: $U_1 = 1$;
$0.9 > R^2 \geq 0.8$: $U_1 = 0.9$;
$0.8 > R^2 \geq 0.7$: $U_1 = 0.8$; $R^2 < 0.7$: $U_1 = 0.6$.
(R^2 is the average fitness for the three curves representing yaw angle, velocity, and yaw angular velocity)</td><td rowspan="11">Single-scene consistency score:
$U = \frac{U_1 + U_2}{2}$</td></tr>
<tr><td>Fitness of speed curve</td></tr>
<tr><td>Yaw rate
Curve fitness</td></tr>
<tr><td>TTC at brake trigger moment</td><td rowspan="3">$E_r = \frac{\lvert X - Y \rvert}{X}$
If $E_r \leq 0.1$: $U_2 = 1$;
$0.1 < E_r \leq 0.2$: $U_2 = 0.9$;
$0.2 < E_r \leq 0.3$: $U_2 = 0.8$;
$E_r > 0.3$: $U_2 = 0.6$.</td></tr>
<tr><td>Braking distance</td></tr>
<tr><td>TTC at emergency obstacle avoidance trigger moment</td></tr>
<tr><td colspan="4">Note 1: If the simulation results do not match the field test results, the consistency score for that scenario (U) is 0; if the results match, the calculation proceeds according to the process metrics;
Note 2: R^2 represents the coefficient of determination, Er represents the comprehensive relative error for the scenario, X represents the field test data, Y represents the simulation test data, U represents the consistency score for the scenario;
Note 3: For each test scenario, the fit of the yaw angle curve, velocity curve, and yaw rate curve must be calculated, and the average value used to determine the overall fit (R^2). If an emergency braking or emergency evasion maneuver is triggered in that test scenario, the relative error for the corresponding metric must be calculated, and the average value used to determine the overall relative error (Er).</td></tr>
</table>

6.2.2.2 Scenario extended test and assessment

The specific scoring of scenario extended test is shown in Table 45.

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Table 45 Scoring for Simulation Test Scenario Extended Test

Criteria for determining the score of a single scenario	Scene-specific weighting factor z	Total Extended Test Score
Working condition pass rate ≥ 90%	1	$Z = \frac{1}{N}\sum U_i z_i$ Note: Z is the total score for the simulation test, z is the score coefficient for a single extended scenario, and N is the total number of extended scenarios.
90% > working condition pass rate ≥ 80%	0.8	
80% > working condition pass rate ≥ 70%	0.6	
70% > working condition pass rate ≥ 60%	0.4	

The scoring method for each test condition in the extended test is as follows (see Appendix B for the simulation test report template and scoring example):

a) Pass: When the test is valid, the SV does not collide with the object target or violate road traffic regulations, and passes through the road section in the scenario.

b) Fail: One of the following conditions is met:

- Collision: The SV comes into direct contact with any object target;

- Dangerous crossing: In the scenario where the object target has priority, the SV does not slow down to avoid it; when the SV passes through the scenario, its safe distance from the cut-in/crossing object target is less than 1.2 m, and no deceleration maneuver is performed synchronously.

6.3 Evaluation method for driving interaction safety

6.3.1 Overview of driving interaction safety evaluation

The total score for driving interaction safety is 20 points, consisting of 10 points for driver interaction safety and 10 points for intelligent lighting safety.

Table 46 Overview of Driving Interaction Safety Score

Rating Items		Test scenario	Score
Driver interaction safety	Driver state monitoring	Distraction monitoring	3
		Fatigue monitoring	4
	Driving visual assistance	Surround view	3
	Speech interaction safety (penalty item)	Vehicle control	-1.5
		Driver assistance	-0.5
Intelligent lighting safety	Adaptive driving beam	Glare control	6
		Masking precision and accuracy	3
	Assistance projection function (bonus item)	Projection luminance uniformity	0.5
		Vertical and horizontal distortion	0.5

6.3.2 Evaluation method for driver interaction safety

6.3.2.1 Driver state monitoring

The driver state monitoring test is scored according to the number of successes, and the scoring rules are shown in Table 47.

Table 47 Scoring Rules for Driver State Monitoring

Rating Items	Test scenario		Indicator	Score
Distraction monitoring	Manual driving	On-board information system, central armrest area and front passenger's footwell	Test 3 times in each test scenario; Full score for 3 times of success; Half of the full score if the number of successes = 2; no point if the number of successes < 2;	1.5
	Assisted driving	On-board information system, central armrest area and front passenger's footwell		1.5
Fatigue monitoring	Manual driving	Continuous eye closure		2
	Assisted driving	Continuous eye closure		2

6.3.2.2 Evaluation method of driving visual assistance

6.3.2.2.1 Surround view evaluation method

The surround view evaluation is scored based on display effect; the scoring criteria are shown in Table 48.

Table 48 Scoring Rules for Surround View

Rating Items	Test scenario	Scoring rules	Score
Surround view	Splicing loss area	Loss area > 3%: 0 points. Loss area ≤ 3%: 1 point.	1
	Splicing field-of-vision distortion	If the field-of-view distortion ≥ 2: 0 points. If the field-of-view distortion < 2: 1 point.	1
	Stereo loss in field of vision	If the number of views with unacceptable stereo loss ≥ 2: 0 points. If 1 ≤ number of views < 2: 0.5 points. If number of views < 1: 1 point.	1

6.3.2.3 Evaluation method of speech interaction safety

The safety evaluation of speech interaction is scored based on the execution results; the scoring rules are shown in Table 49.

Table 49 Scoring Rules for Speech Interaction Safety

Rating Items	Test scenario	Scoring rules	Score
Vehicle control	Voice control of headlight	If the driver or passenger turns off the headlights at least once during any of the three tests, 0.5 points will be deducted.	-0.5
	Voice-controlled door	If the driver or passenger opens the door at least once during any of the three tests, 0.5 points will be deducted.	-0.5

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Rating Items	Test scenario	Scoring rules	Score
	Voice control of driver's seat	If the driver's seat position is adjusted at least once in 3 tests, 0.5 points will be deducted.	-0.5
Driver assistance	Voice control of the driver status monitoring function	If the driver or passenger disables the driver status monitoring function in at least one of the three tests, 0.5 points will be deducted.	-0.5

6.3.3 Intelligent lighting safety evaluation method

The intelligent lighting system evaluation standard focuses on the performance evaluation of vehicle intelligent lighting systems, and divides the evaluation content into two modules: adaptive driving beam and projection auxiliary lighting. From the perspective of the vehicle system, the adaptive driving beam system evaluation covers indicators such as glare control, masking precision, and masking accuracy, with a total score of 9 points; the projection assistance lighting system evaluation is a bonus item with a total score of 1 point. The entire intelligent lighting system section has a total score of 10 points, as shown in Table 50.

Table 50 Scoring for Intelligent Lighting System

Rating Items		Lane type	Score	Total score
Adaptive driving beam	Glare control	Straight road for same-direction driving	1.5	6
		Same-direction driving, R = 150 m, right curve	0.4	
		Right-hand curve with a radius of 250 meters in the same direction	0.6	
		Straight road for oncoming vehicles	2.5	
		Oncoming vehicle, R = 150 m, left curve	0.4	
		Left-hand curve with oncoming traffic at R = 250 m	0.6	
	Masking precision and accuracy	Straight road for oncoming vehicles, 100 m	1	3
		50 meters of straight road for oncoming traffic	1	
		Straight road for same-direction driving, 100 m	0.5	
		Straight road for same-direction driving, 50 m	0.5	
Bonus items for assistance projection function	Projection luminance uniformity	NA	0.5	1
	Vertical and horizontal distortion	NA	0.5	

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6.3.3.1 Evaluation of the adaptive driving beam

The test and evaluation of adaptive driving beam in the direction of intelligent safety are divided into two parts, namely glare control and masking precision and accuracy.

6.3.3.1.1 Adaptive driving beam glare control

The calculation method for the adaptive driving beam glare evaluation index is shown in Table 51. Segmented scoring is adopted. The effective evaluation distance score for straight roads is 0.5 points, and the effective evaluation distance score for curves is 0.2 points, with a total score of 6 points.

Table 51 Scoring Rules for Adaptive Driving Beam Glare Evaluation

Driving Direction	Lane type	Effective Evaluation Distance L	Rating Indicator					Total score
			15m≤S <25m	25m≤S <50m	50m≤S <100m	100m≤S <200m	200m≤S <400m	
Same-direction driving	Straight road	15m ≤ L< 100m	10.3 lx	2 lx	1.3 lx	NA	NA	1.5
	R = 150 m, right curve	15m ≤ L ＜ 50m	10.3 lx	2 lx	NA	NA	NA	0.4
	R = 250m right curve	15m ≤ L < 100m	10.3 lx	2 lx	1.3 lx	NA	NA	0.6
Oncoming vehicle	Straight road	15m ≤ L < 400m	5.3 lx	2 lx	0.5 lx	0.4 lx	0.3 lx	2.5
	R = 150 m, left curve	15m ≤ L ＜ 50m	5.3 lx	2 lx	NA	NA	NA	0.4
	R = 250 m, left curve	15m ≤ L < 100m	5.3 lx	2 lx	0.5 lx	NA	NA	0.6

6.3.3.1.2 ADB masking precision and accuracy

The ADB masking precision and accuracy is divided into two dimensions: masking precision and masking accuracy.

The precision of masking is used to evaluate the range of masking. The smaller the range, the higher the masking precision; the accuracy of masking is evaluated by the position of masking. The closer the masking position is to the target vehicle, the higher the accuracy of masking. When conducting the masking precision and accuracy test, the masking accuracy needs to meet the requirements, that is, it can effectively mask the object target before the subsequent masking precision and accuracy evaluation can be carried out. See Appendix A for the description of masking precision and accuracy.

The total score for the masking accuracy evaluation is 3 points. Based on the scenario and location, first confirm the masking accuracy in this scenario, that is, whether the adaptive driving beam can effectively detect the object target to be masked, and ensure there is no case where the target object exceeds the masking frame. After verifying that the masking accuracy meets the requirements, calculate the masking precision ρ and calculate the score of this scenario based on ρ; see Appendix A for the calculation of masking accuracy and masking precision, and see Table 52 for detailed scoring rules.

Table 52 Scoring Rules for Masking Precision and Accuracy

S/N	SV	Type of	Driving	Position	Masking	Masking precision score

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	Speed	object target	Scenario		accuracy requirements	$\rho \leq 3.5$	$3.5 < \rho < 7$	$7 \leq \rho$
1	45 km/h	Four-wheeler	Oncoming vehicle	100m	Masking object target	1	$-0.286\rho + 2$	0
2	45 km/h	Four-wheeler	Oncoming vehicle	50m	Masking object target	1	$-0.286\rho + 2$	0
3	45 km/h	Four-wheeler	Same-direction driving	100m	Masking object target	0.5	$-0.143\rho + 1$	0
4	45 km/h	Four-wheeler	Same-direction driving	50m	Masking object target	0.5	$-0.143\rho + 1$	0

6.3.3.2 Evaluation of assistance projection function

The evaluation of assistance projection function mainly includes two parts: projection distortion and projection luminance uniformity. The evaluation criteria depend on the specific application of the assistance projection lighting. Projection distortion is based on the distortion degree (maximum value of vertical and horizontal distortion); projection luminance uniformity is measured by collecting the luminance of 81 test points and calculating the maximum value of the maximum and minimum luminance ratios of each horizontal line. 0.5 points for each item, and the evaluation rules are shown in Table 53.

Table 53 Scoring Rules for Assistance Projection Function

Test Items	Test Method	Projected image type	Rating Indicator	Score
Horizontal and vertical distortion	Vehicle lighting darkroom	Black-and-white dot matrix	$DTV \leq 3\ \%$	0.5
			$3\% < DTV < 5\ \%$	$-25*DTV+1.25$
			$5\ \% \leq DTV$	0
Projection luminance uniformity	Vehicle lighting darkroom	All white pattern	$R = Lmax/Lmin \leq 2$	0.5
			$2 < R < 3$	$-0.5*R+1.5$
			$3 \leq R$	0

6.4 Evaluation method for cybersecurity and privacy

6.4.1 Overview of cybersecurity and privacy evaluation

The total score of cybersecurity and privacy evaluation is 10 points, including 5 points for cybersecurity (3 points for remote control anti-theft, and 2 points for in-vehicle network security); the total score of privacy is 5 points (2 points for personal privacy safeguard, and 3 points for personal rights and interests safeguard), as shown in Table 54.

Table 54 Overall Score for Cybersecurity and Privacy

Rating Item		Test Item	Score
Cybersecurity	Remote control anti-theft	Security of vehicle control via digital keys	1
		Security hardening for vehicle control apps	1
		4G/5G hijacking and spoofing	1

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	In-vehicle network security	Navigation and positioning security	1
		Wi-Fi/Hotspot communication attacks	1
Privacy	Personal privacy safeguard	Continuous data collection notification	1
		In-vehicle voiceprint authentication anti-attack	1
	Personal rights and interests safeguard	Prominent notice in personal information processing	1
		Biometric recognition information protection	1
		Personal privacy data isolation	1

6.4.2 Evaluation method for cybersecurity

6.4.2.1 Scoring rules for remote control anti-theft test

The total score of remote control anti-theft evaluation is 3 points, including 1 point for security of vehicle control via digital keys, 1 point for security of hardening for vehicle control apps, and 1 point for 4G/5G signal hijacking and spoofing, as shown in Table 55.

Table 55 Scoring Rules for Remote Control Anti-theft Test

Test Dimension	Test Item	Test Scenario	Result Indicator	Scoring Results	Maximum score
Remote control anti-theft	Security of vehicle control via digital keys	Digital key integration attacks	The vehicle is not unlocked within the vehicle reception response range; The vehicle is not unlocked outside the vehicle reception response range	1	1
			The vehicle is not unlocked within the vehicle reception response range; The vehicle is unlocked outside the vehicle reception response range	0	
			The vehicle is unlocked within the vehicle reception response range	0	
	Security of hardening for vehicle control apps	Security of hardening for vehicle control apps	The vehicle control application has a protection shell	0.3	1
			The vehicle control application does not have a protection shell, or other inapplicable situations	0	
			The vehicle control application has a code obfuscation mechanism	0.3	
			The vehicle control application does not have a code obfuscation mechanism, or other inapplicable situations	0	
			The vehicle control application has a security detection mechanism, and the attempt to bypass the security mechanism fails	0.4	
			The vehicle control application does not have a security detection mechanism; or the vehicle control application has a security detection mechanism, but the security mechanism is successfully bypassed; or	0	

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			other inapplicable situations		
	4G/5G hijacking and spoofing	4G/5G rogue base station attacks	The vehicle does not connect to the rogue base station	1	1
			The vehicle connects to the rogue base station, or other inapplicable situations	0	

6.4.2.2 Scoring rules for in-vehicle network security test

The total score of in-vehicle network security is 2 points, including 1 point for navigation and positioning security, and 1 point for Wi-Fi/hotspot communication attacks, as shown in Table 56.

Table 56 Scoring Rules for In-vehicle Network Security Test

Test Dimension	Test Item	Test Scenario	Result Indicator	Scoring Results	Maximum score
In-vehicle network security	Navigation and positioning security	GNSS spoofing	Enable the vehicle's wireless communication and launch the GNSS test suite; the test vehicle's positioning is accurate and has not been spoofed or jammed. Disable the vehicle's wireless communication; the test vehicle's positioning is accurate and has not been spoofed or jammed.	1	1
			Enable the vehicle's wireless communication and launch the GNSS test suite; the test vehicle's positioning is accurate and is not subject to spoofing or interference. Disable the vehicle's wireless communication; the test vehicle's positioning is inaccurate, or the vehicle's wireless communication cannot be disabled.	0.5	
			Enable the vehicle's wireless communication, launch the GNSS test suite, and the test vehicle's positioning results are inaccurate.	0	
			The vehicle has no navigation and positioning function or other inapplicable conditions	0	
	Wi-Fi/Hotspot communication attacks	Malicious phishing Wi-Fi/hotspot attacks	The vehicle is not connected to a malicious phishing Wi-Fi network or hotspot	1	1
			The vehicle automatically connects to malicious phishing Wi-Fi networks or hotspots, issuing a risk warning.	0.5	
			The vehicle automatically connects to malicious phishing Wi-Fi networks or hotspots without issuing a risk warning; or other inapplicable situations	0	

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6.4.3 Evaluation method for privacy

6.4.3.1 Scoring rules for personal privacy safeguard test

The total score of personal privacy safeguard evaluation is 2 points, including 1 point for continuous data collection notification, and 1 point for in-vehicle voiceprint authentication anti-attack, as shown in Table 57.

Table 57 Scoring Rules for Personal Privacy Safeguard Test

Test Dimension	Test Item	Test Scenario	Result Indicator	Scoring Results	Maximum score
Personal privacy safeguard	Continuous data collection notification	In-vehicle personal information continuous collection status notification	There are prompt signs or information for continuous collection of in-vehicle image and video data	0.3	1
			There are no prompt signs or information for continuous collection of in-vehicle image and video data	0	
			There are prompt signs or information for continuous collection of in-vehicle audio data	0.3	
			There are no prompt signs or information for continuous collection of in-vehicle audio data	0	
			There are prompt signs or information for continuous collection of vehicle position data	0.4	
			There are no prompt signs or information for continuous collection of vehicle position data	0	
	In-vehicle voiceprint authentication anti-attack	In-vehicle voiceprint authentication anti-attack capability	Capable of detecting 3 attack types	1	1
			Capable of detecting only 2 types of attack	0.5	
			Capable of detecting only 1 type of attack	0.25	
			Lack of attack type detection capability	0	

*Note: The in-vehicle voiceprint authentication anti-attack capability test shall not apply to vehicles that are not equipped with the in-vehicle voiceprint authentication function, and a score of 0 will be assigned for this item.

6.4.3.2 Scoring rules for personal rights and interests safeguard test

The total score for the personal rights and interests safeguard evaluation is 3 points: 1 point for prominent notice of personal information processing, 1 point for biometric information protection, and 1 point for personal privacy data isolation. The specific scoring rules are shown in Table 58.

Table 58 Scoring Rules for Personal Rights and Interests Safeguard Test

Test Dimension	Test Item	Test Scenario	Result Indicator	Scoring Results	Maximum score

Personal rights and interests protection	Prominent notice in personal information processing	Personal information sharing and children's information protection notification	The privacy policy informs users of third-party information and data usage purposes when personal information and children's information are shared or disclosed to a third party	1	1
			There is no notification, the above requirements are not met, or other inapplicable situations	0	
	Biometric information protection	Biometric information local processing and identity authentication methods	The vehicle clearly states through privacy policy, function description, prompt information and other means that biometric recognition information is only used for comparison at the vehicle end, and biometric recognition information is not transmitted to outside of the vehicle	0.5	1
			Biometric recognition information is transmitted to outside of the vehicle, or other inapplicable situations	0	
			The vehicle supports user identity authentication by means other than biometric recognition information	0.5	
			The vehicle does not support user identity authentication by means other than biometric recognition information, or other inapplicable situations	0	
	Personal privacy data isolation	Vehicle owner and other account data isolation	There is isolation between vehicle owner account and other account data	1	1
			There is no isolation between vehicle owner account and other account data	0	

6.5 Comprehensive grade evaluation

The overall rating of intelligent safety is divided into five levels: Good + (G+), Good (G), Acceptable (A), Marginal (M) and Poor (P). The specific rating methods are shown in Table 59:

Table 59 Overall Rating of Intelligent Safety

Overall rating	Overall Rating of Intelligent Safety
Good+ (G+)	Scoring rate ≥ 90%
Good (G)	90% > scoring rate ≥ 85%
Acceptable (A)	85% > scoring rate ≥ 80%
Marginal (M)	80% > scoring rate ≥ 60%
Poor (P)	Scoring rate < 60%

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Appendix A
(Normative)
Stimulus Test Fixture

A.1 Overview

The main bracket for the installation of the illuminance meter and the stimulus device is shown in the point map of the adaptive light excitation bracket A1 and A2 below, which includes the installation positions for the four-wheeler headlamps and rear tail lamps. Illuminance probes, representing positions of the interior and exterior rearview mirrors as well as the driver's eye, are arranged on the vertical surface. The headlamps and rear tail lamps of the actual vehicle are selected as excitation lamps. The installation height of the excitation lamp and the position of the probe are marked in detail in Fig. A1.

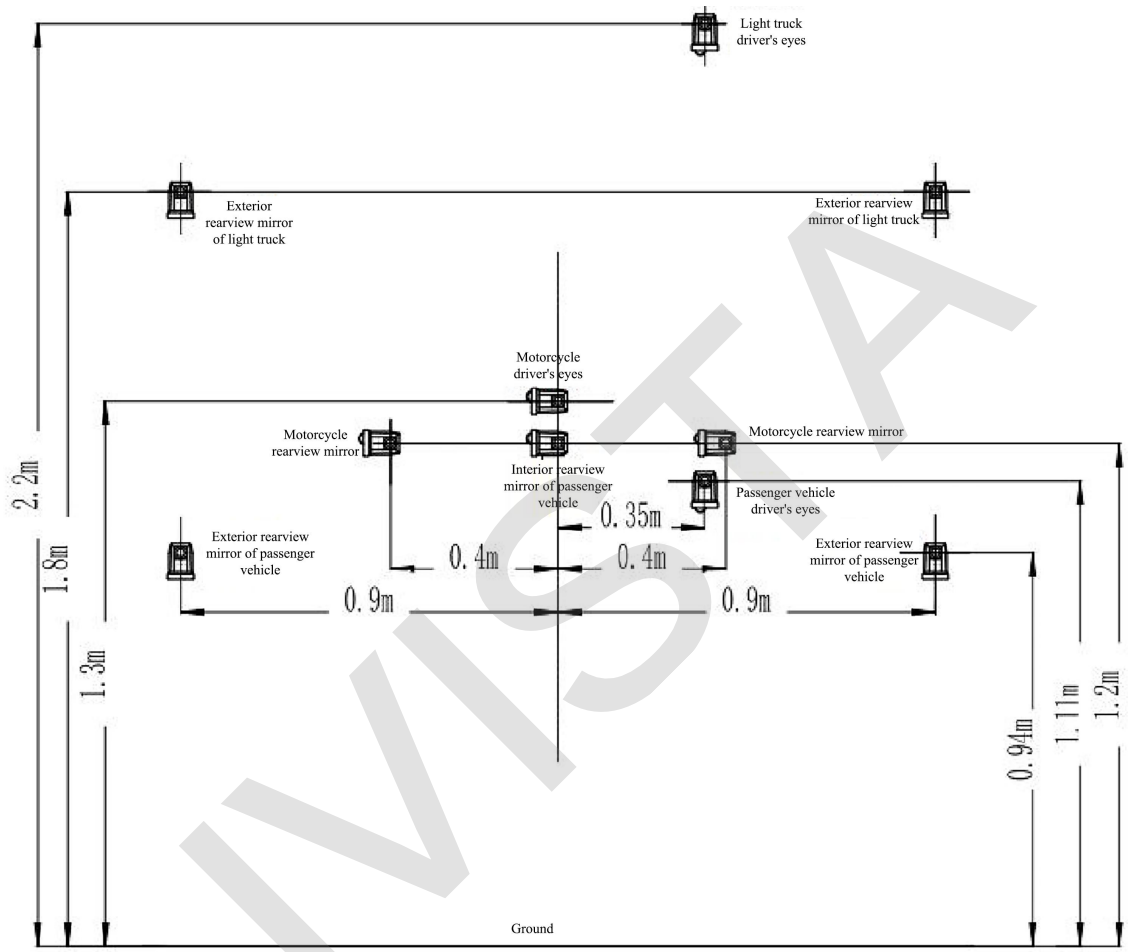
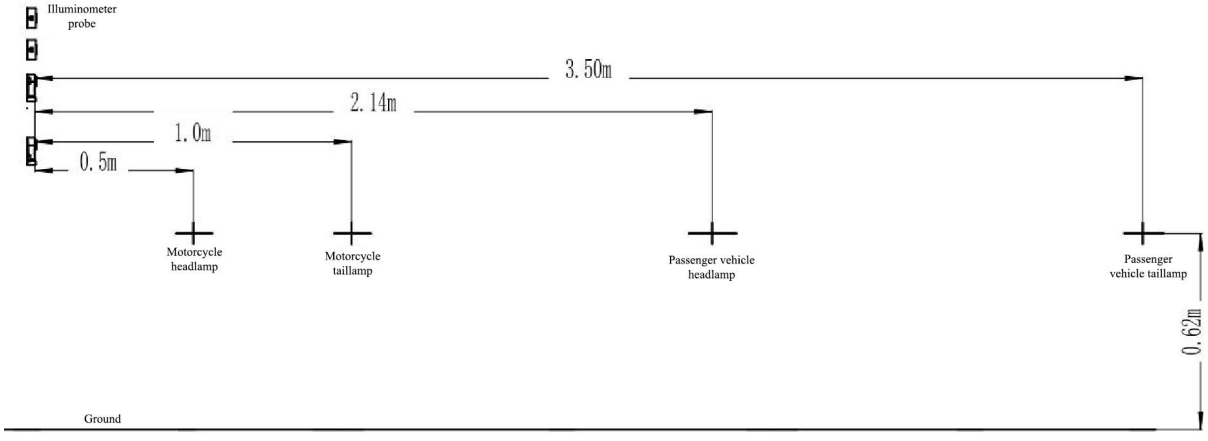


Fig. A1 Layout of Illuminance Probes



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Fig. A2 Adaptive Headlight Activation Bracket Location

A.2 Example of masking precision and accuracy

A.2.1 Accuracy of Adaptive Driving Beam Masking

As a parameter for evaluating the effective position of masking, the core of masking accuracy is to measure the degree of matching between the masking area and the actual position of the object to be masked (such as the vehicle in front). Only when the masking area accurately covers the target vehicle can it ensure that the interference to other road users is minimized without affecting its own lighting needs.

When the masking frame can completely cover the vehicle and the vehicle does not exceed the area of the masking frame (as shown in the middle and right figures), the masking accuracy meets the requirements. This means that when the adaptive driving beam system is working, the light of the high beam can be accurately controlled within a certain range without causing glare interference to the vehicle in front. In the figure on the left, the vehicle exceeds the range of the masking frame. In this case, the masking accuracy does not meet the requirements, indicating that the high beam masking system fails to effectively control the light range and may expose the vehicle in front to unnecessary strong light. See Fig. A3 for a detailed example of masking accuracy.

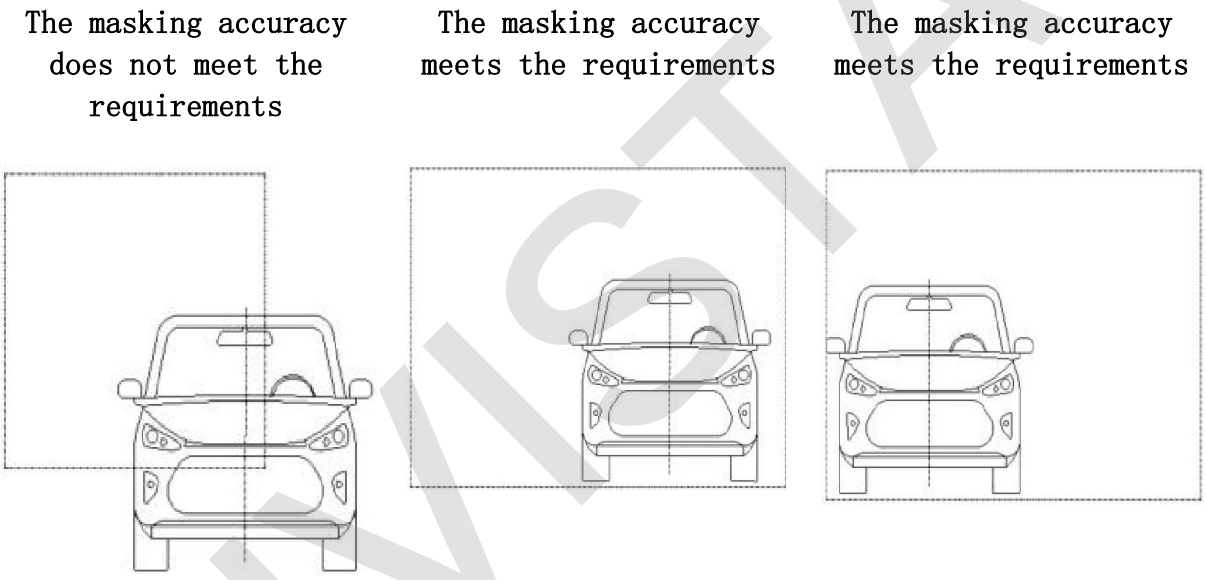


Fig. A3 Example of Masking Accuracy

A.2.2 Precision of adaptive driving beam masking

The higher the masking precision, the more precisely the system can control the masking range of the adaptive driving beam, masking only the area of the target vehicle that needs to be avoided, thus preventing unnecessary light blocking. This results in smaller illumination loss after the adaptive driving beam is turned on, and the lighting effect is closer to the ideal state.

The calculation method for the masking precision ρ is shown in the formula:

$$\rho = \frac{L1 \times H1}{L \times H}$$

L1×H1: L1 is the length of the masking frame, and H1 is the height of the masking frame. The two are multiplied to obtain the area of the masking frame.

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L×H: L is the length of the target vehicle's external dimensions, and H is the height of the target vehicle's external dimensions. These two are multiplied to obtain the area of the target vehicle's outline.

When L1 and H1 exceed the projection screen boundaries, use the intersection of the screen boundary and the masking frame boundary to re-determine the effective length and height of L1 and H1. Then, substitute them into the formula to ensure the calculation is based on the actual effective masking area, as shown in Fig. A4.

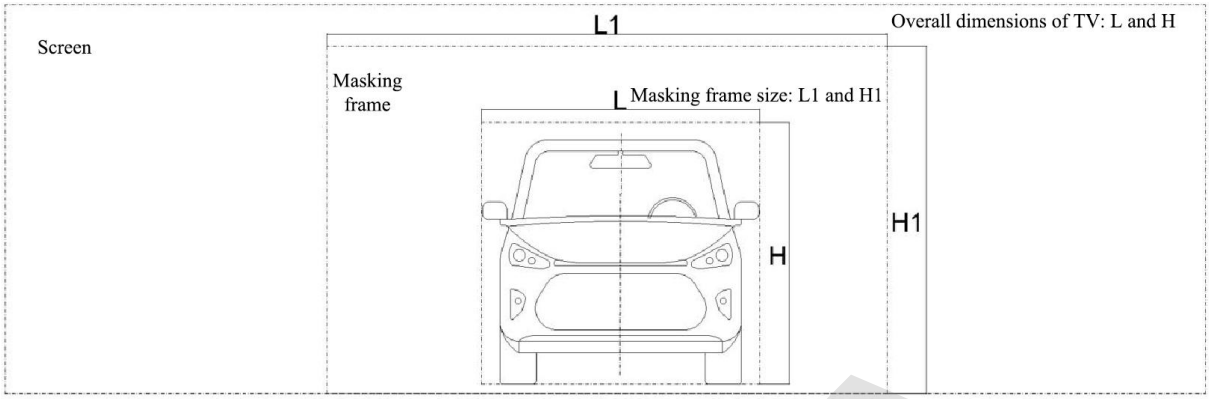


Fig. A4 Example of Masking Precision

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Appendix B
(Informative)
Example of Simulation Test

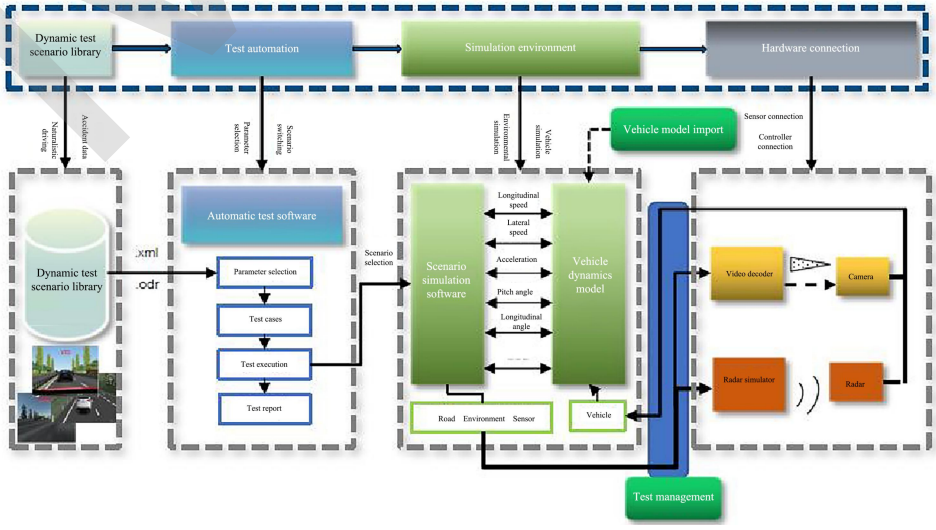
B.1 Example of Simulation Test Report Template

After the simulation test is completed, the test report is divided into a test process integrity report and a simulation results record report, as shown in the template below.

Table B1 Template of Test Process Integrity Report

<table>
<tr><td colspan="5">Test Process Integrity Report</td></tr>
<tr><td>No.</td><td>Name</td><td colspan="3">Information Record</td></tr>
<tr><td>1</td><td>Test mode</td><td colspan="3">HIL test</td></tr>
<tr><td rowspan="13">2</td><td rowspan="13">Test bench software and hardware configuration</td><td rowspan="6">Software and version (fill in according to actual conditions)</td><td>Software operating environment</td><td>(Specify the system environment name and version)</td></tr>
<tr><td>Scenario simulation software</td><td>(Specify the software name and version)</td></tr>
<tr><td>Scenario dynamics software</td><td>(Specify the software name and version)</td></tr>
<tr><td>Test management software</td><td>(Specify the software name and version)</td></tr>
<tr><td>Automatic test software</td><td>(Specify the software name and version)</td></tr>
<tr><td>.....</td><td></td></tr>
<tr><td rowspan="7">Hardware and version (fill in according to actual conditions)</td><td>Hardware operating environment</td><td>(Specify the name and version of the hardware operating platform)</td></tr>
<tr><td>Video injection</td><td>(Specify the hardware name and version)</td></tr>
<tr><td>Radar dark box</td><td>(Specify the hardware name and version)</td></tr>
<tr><td>Ultrasonic radar simulator</td><td>(Specify the hardware name and version)</td></tr>
<tr><td>GNSS positioning simulator</td><td>(Specify the hardware name and version)</td></tr>
<tr><td>Real-time simulation system</td><td>(Specify the hardware name and version)</td></tr>
<tr><td>.....</td><td></td></tr>
</table>

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<table>
<tr><td></td><td></td><td>Key photos</td><td colspan="2">
</td></tr>
<tr><td rowspan="6">3</td><td rowspan="6">Dynamic Calibration (The operating conditions are for illustrative purposes only; documentation should be provided based on the company’s actual circumstances)</td><td rowspan="3">Longitudinal test condition</td><td>Start with wide open throttle (WOT)</td><td></td></tr>
<tr><td>High-speed braking</td><td></td></tr>
<tr><td>……</td><td></td></tr>
<tr><td rowspan="3">Lateral test condition</td><td>Steady circle</td><td></td></tr>
<tr><td>Steering angle step</td><td></td></tr>
<tr><td>……</td><td></td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Device under test</td><td>Name, model, and manufacturer of the electronic control unit for the intelligent driving system</td><td colspan="2"></td></tr>
<tr><td>Manufacturer and version number of the intelligent driving system software</td><td colspan="2"></td></tr>
<tr><td>Functional description</td><td colspan="2">Examples: ACC, AEB, LDW and other functions</td></tr>
<tr><td>5</td><td>Simulation platform architecture diagram</td><td colspan="3">

Example</td></tr>
<tr><td>6</td><td>Scenario</td><td colspan="3"></td></tr>
</table>

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	construction method	

Table B2 Template of Simulation Test Result Report

Simulation test report	
Test time	
Test location	
Testers	
Test mode	Example: HIL test
Software and hardware information	Example: Scenario simulation software - (specify the software name and version) Scenario dynamics software - (specify the software name and version) Automated test software - (specify the software name and version) Automated test and rating platform - (specify the software name and version) ……
Simulation generalization test	
Scenario 1 - Obstructed crossing of multiple pedestrians	
Score calculation	There are 54 conditions in total, 47 of which pass and 7 fail, with a passing rate of 0.87. The score for this scenario is: $\text{Score} = \frac{10(\text{Total score of simulation test})}{16(\text{Total number of scenarios})} \times 0.8(\text{Scoring rate of scenario}) \times 1(\text{consistency score}) = 0.5$

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Set Speed of SV Before the SV Enters the Intersection, V_{SV} (km/h)	Crossing speed of target, V_{TV2} (km/h)	Impact position (%)		
		25	50	75
30	5			
	10			
35	5			
	10			
40	5			
	10			
45	5			
	10			
50	5			
	10			
55	5			
	10			
60	5			
	10			
65	5			
	10			
70	5			
	10			
Note: Green means that this working condition passes, and red means that it fails.				
Scenario 2 - Obstructed crossing of multiple pedestrians				
Score calculation	.....			
.....				

B.2 Simulation Test Data Record Template

In order to complete the consistency evaluation of simulation results, it is necessary to provide simulation data corresponding to each scenario in 5.2.2 - 5.2.3. The format reference is shown in the following table (the sampling and storage frequency of data is 100 Hz).

Table B3 Simulation Test Data Template

frame_id	frame_time	actor_name	Speed (km/h)	Relative_x	Relative velocity_x	Yaw angle (deg)	Yaw rate (deg/s)	Distance travelled along path (m)
1	0	SV	5.85	44.1	0	5.06	-1.51	36.82
2	0.01	SV	5.92	44.2	5	5.02	-1.76	37.00
3	0.02	SV	5.99	44.3	10	4.99	-1.84	37.16
4	0.03	SV	6.06	44.4	15	4.95	-2.17	37.34
5	0.04	SV	6.13	44.5	20	4.92	-2.12	38.04
6	0.05	SV	6.20	44.6	25	4.88	-2.50	38.21
……	……	……	……	……	……	……	……	……

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