Annex A.2

China Intelligent-connected Car Assessment Programme

China Intelligent-connected Car Assessment Programme (C-ICAP)

(Version 1.1)

Detailed Rules for Assessment of Navigation Pilot Assistance

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These Rules are applicable to the Navigation pilot assistance system.

Navigation pilot assistance system: The combined driving assistance system applicable to expressway and highway, which can realize point-to-point traffic based on navigation route.

1. Assessment Method

1.1. Indicator System

The indicators for Navigation pilot assistance are shown in Table 1-1.

Table 1- 1 Indicator System for Navigation pilot assistance

	level-1 indicator	**level-2 indicator**	**Level-3 indicator**	**Level-4 indicator**
Navigation pilot assistance	Active lane changing ability	Lane changing for lane occupied	Static obstacle ahead	Daytime-curved road-static passenger vehicle
				Night-curved road-static passenger vehicle
				Daytime-Straight Road-Dotted Line-Static Obstacle
			Slow moving vehicle ahead	Daytime-Curved Road-Dotted Line-Slow Moving Passenger Vehicle Ahead
				Curved Road-Slow Moving Truck (Simulated Scenario)
				Daytime-Straight Road-Change from Congestion in Two Lanes to Smooth Traffic in Adjacent Lane (simulated scenario)
			Front vehicle cut-in	Daytime-straight road-dotted line-front passenger vehicle cut-in
		Lane changing for emergency	Road construction ahead	Daytime-Straight Road-Construction Area (Inclined Conical Barrel)
				Daytime-Straight Road-Construction Area (Inclined Conical Barrel)-Obstacle Vehicle in Adjacent Lane
			Accident area ahead	Accident Vehicle Ahead
				Daytime-inclined truck encroaching on the lane (simulated scenario)
				Middle rain-straight road-front passenger vehicle in rear end collision and pedestrian holding umbrella (simulated scenario)

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		Navigation route changing	Merging into ramp from main road	Daytime-No other Interfering Vehicle
				Daytime-Static Vehicle at Ramp Entrance
				Continuous traffic flow in rightmost lane of main road (simulated scenario)
			Merging into main road from ramp	Daytime-Discontinuous Traffic Flow Behind in Left Adjacent Lane (simulated scenario)
	Continuous operation ability	Traffic success rate	Lane-changing success rate	Lane-changing Success Rate on Highway during Daytime
				Lane-changing Success Rate on Highway at Night
				Lane-changing Success Rate on Expressway at Night
				Lane-changing Success Rate on Expressway at Night
			Success rate of merging into ramp	Success Rate of Merging into Ramp on Highway during Daytime
				Success Rate of Merging into Ramp from Highway at Night
				Success rate of merging into ramp on expressway during daytime
				Success rate of merging into ramp on expressway at night
			Success rate of merging into main road	Success Rate of Merging into Main Road on Highway During Daytime
				Success Rate of Merging into Main Road on Highway at Night
				Success Rate of Merging into Main Road on Expressway During Daytime
				Success Rate of Merging into Main Road on Express at Night
		System takeover frequency	System takeover reminder frequency	System Takeover Reminder Frequency on Highway during Daytime
				System Takeover Reminder Frequency on Highway at Night
				System Takeover Reminder Frequency on Expressway during Daytime
				System Takeover Reminder Frequency on Expressway at Night

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			Active intervention & takeover frequency	Active Intervention & Takeover Frequency on Highway during Daytime
				Active Intervention & Takeover Frequency on Highway at night
				Active Intervention & Takeover Frequency on Expressway during Daytime
				Active Intervention & Takeover Frequency on Expressway at Night
		Driving comfort	Transversal comfort	Transversal Control Comfort on Highway during Daytime
				Transversal Control Comfort on Highway at Night
				Transversal Control Comfort on Expressway during Daytime
				Transversal Control Comfort on Expressway at Night
			Longitudinal comfort	Longitudinal Control Comfort on Highway during Daytime
				Longitudinal Control Comfort on Highway at Night
				Longitudinal Control Comfort on Expressway during Daytime
				Longitudinal Control Comfort on Expressway at Night

1.2. Allocation of Weight to Indicators

1.2.1. Allocation of Weight to Level-1 Indicators

For the Navigation pilot assistance, there are two level-1 indicators: active lane changing ability and continuous operation ability.

The weight of each level-1 indicator is shown in Table 1-2.

Table 1- 2 Weights of Level-1 Indicators for Navigation pilot assistance

	No.	level-1 indicator	Weight
Navigation pilot assistance	1	Active lane changing abilit	80%
	2	Continuous operation ability	20%

1.2.2. Allocation of Weight to Level-Indicators

For the active lane changing ability, there are three level-2 indicators: lane changing for lane occupied, lane changing for emergency, and navigation route changing ability.

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For the continuous operation ability, there are three level-2 indicators: traffic success rate, system takeover frequency and driving comfort.

The weight of each level-3 indicator is shown in Table 1-3.

Table 1- 3 Weights of Level-2 Indicators for Navigation pilot assistance

level-1 indicator	No.	level-2 indicator	Weight
Active lane changing abilit	1	Lane changing for lane occupied	50%
	2	Lane changing for emergency	20%
	3	Navigation route changing	30%
Continuous operation ability	1	Traffic success rate	40%
	2	System takeover frequency	40%
	3	Driving comfort	20%

1.2.3. Allocation of Weight to Level-3 Indicators

1.2.3.1. Allocation of Weight to Lane Changing Ability for Occupation of Lane

For the lane changing ability for lane occupied, there are three level-3 indicators: static obstacle ahead, slow moving vehicle ahead and front vehicle cut-in. The weight of each level-3 indicator is shown in Table 1-4.

Table 1- 4 Weights of Level-3 Indicators for Lane Changing Ability for Lane Occupied

level-2 indicator	No.	Level-3 indicator	Weight
Lane Changing Ability for Lane Occupied	1	Static obstacle ahead	30%
	2	Slow moving vehicle ahead	40%
	3	Front vehicle cut-in	30%

1.2.3.2. Allocation of Weight to Lane Changing Ability for Emergency

For the lane changing ability for emergency, there are two level-3 indicators: road construction ahead and accident area ahead. The weight of each level-3 indicator is shown in Table 1-5.

Table 1- 5 Weights of Level-3 Indicators for Lane Changing Ability for Emergency

level-2 indicator	No.	Level-3 indicator	Weight
Lane Changing Ability for Emergency	1	Road construction ahead	50%
	2	Accident area ahead	50%

1.2.3.3. Allocation of Weight to Navigation Route Changing Ability

For the navigation route changing ability, there are two level-3 indicators: merging into ramp from main road, and merging into main road from ramp. The weight of each level-3 indicator is shown in Table 1-6.

Table 1- 6 Weights of Level-3 Indicators for Navigation Route Changing Ability

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level-2 indicator	No.	Level-3 indicator	Weight
Navigation route changing ability in front of parking space	1	Merging into ramp from main road	100%
	2	Merging into main road from ramp	+1%

1.2.3.4. Allocation of Weight to Traffic Success Rate

For the traffic success rate, there are three level-3 indicators: lane changing success rate, merging-into-ramp success rate, and merging-into-main road success rate. The weight of each level-3 indicator is shown in Table 1-7.

Table 1- 7 Weights of Level-3 Indicators for Traffic Success Rate

level-2 indicator	No.	Level-3 indicator	Weight
Traffic success rate	1	Lane-changing success rate	40%
	2	Success rate of merging into ramp	40%
	3	Success rate of merging into main road	20%

1.2.3.5. Allocation of Weight to System Takeover Frequency

For the system takeover frequency, there are two level-3 indicators: system takeover reminder frequency and active intervention & takeover frequency. The weight of each level-3 indicator is shown in Table 1-8.

Table 1 -8 Weights of Level-3 Indicators for System Takeover Frequency

level-2 indicator	No.	Level-3 indicator	Weight
System takeover frequency	1	System takeover reminder frequency	40%
	2	Active intervention & takeover frequency	60%

1.2.3.6. Allocation of Weight to Driving Comfort

For the driving comfort, there are two level-3 indicators: transversal control comfort, and longitudinal control comfort. The weight of each level-3 indicator is shown in Table 1-9.

Table 1- 9 Weights of Level-3 Indicators for Driving Comfort

level-2 indicator	No.	Level-3 indicator	Weight
Driving comfort	1	Transversal control comfort	50%
	2	Longitudinal control comfort	50%

1.2.4. Allocation of Weight to Level-4 Indicators

1.2.4.1. Allocation of Weight to Static Obstacle Ahead

For the static obstacle ahead, there are three level-4 indicators: daytime-curved road-static passenger

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vehicle, night-curved road-static passenger vehicle, and daytime-straight road-dotted line-static obstacles. The weight of each level-4 indicator is shown in Table 1-10.

1-10 Weights of Level-4 Indicators for Static Obstacle Ahead

Level-3 indicator	No.	Level-4 indicator	Weight of indicator	No.	Test case	Weight of test case
Static obstacle ahead	1	Daytime-curved road-static passenger vehicle	45%	1	Set speed: 80km/h	60%
				2	Set speed: 100km/h	40%
	2	Night-curved road-static passenger vehicle	35%	1	Set speed: 80km/h	60%
				2	Set speed: 100km/h	40%
Static obstacle ahead	3	Daytime-Straight Road-Dotted Line-Static Obstacle	20%	1	Set speed: 60km/h	60%
				2	Set speed: 80km/h	40%

1.2.4.2. Allocation of Weight to Slow Moving Vehicle Ahead

For the slow-moving vehicle ahead, there are three level-4 indicators: daytime-curved road-dotted line-slow moving passenger vehicle ahead, and curved road-slow moving truck (simulated scenario), and daytime-straight road-change from congestion in two lanes to smooth traffic in adjacent lane (simulated scenario). The weight of each level-4 indicator is shown in Table 1-11.

Table 1- 11 Weights of Level-4 Indicators for Slow Moving Vehicle Ahead

Level-3 indicator	No.	Level-4 indicator	Weight of indicator	No.	Test case	Weight of test case
Slow moving vehicle ahead	1	Daytime-Curved Road-Dotted Line-Slow Moving Passenger Vehicle Ahead	100%	1	The speed of VUT shall be 80km/h, and the speed of the VT shall be 40km/h	60%
				2	The speed of VUT shall be 100km/h, and the speed of the VT shall be 40km/h	40%
	2	Curved Road-Slow Moving Truck (simulated scenario)	+3%	1	The speed of VUT shall be 80km/h, and the speed of the VT shall be 60km/h	60%
				2	The speed of VUT shall be 120km/h, and the speed of the VT shall be 60km/h	40%
	3	Daytime-Straight Road-Change from Congestion in Two Lanes to Smooth Traffic in Adjacent Lane (simulated	+3%	1	The initial speed of the VUT shall be set at 100km/h, the two lanes ahead shall be congested, the speed of the VT shall be 40km/h, and the vehicle spacing shall be 3m; after	100%

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Level-3 indicator	No.	Level-4 indicator	Weight of indicator	No.	Test case	Weight of test case
		scenario)			the VUT follows the front vehicle stably, the discontinuous traffic flow in the adjacent lane shall be accelerated to 80km/h.	

1.2.4.3. Allocation of Weight to Front Vehicle Cut-in

For the front vehicle cut-in, there is one level-4 indicator: daytime-straight line-dotted line-front passenger vehicle cut-in. The weight of each level-4 indicator is shown in Table 1-12.

Table 1- 12 Weights of Level-4 Indicators for Front Vehicle Cut-in

Level-3 indicator	No.	Level-4 indicator	Weight of indicator	No.	Test case	Weight of test case
Front vehicle cut-in	1	Daytime-straight road-dotted line-front passenger vehicle cut-in	100%	1	The speed of VUT shall be 80km/h, and the speed of the VT shall be 70km/h	100%

1.2.4.4. Allocation of Weight to Road Construction Ahead

For the road construction ahead, there are two level-4 indicators: daytime- straight road-construction area (inclined conical barrel), and daytime-straight road-construction area (inclined conical barrel)-obstacles in adjacent lane. The weight of each level-4 indicator is shown in Table 1-13.

Table 1- 13 Weights of Level-4 Indicators for Road Construction Ahead

Level-3 indicator	No.	Level-4 indicator	Weight of indicator	No.	Test case	Weight of test case
Road construction ahead	1	Daytime-Straight Road-Construction Area (Inclined Conical Barrel)	60%	1	Set speed: 80km/h	100%
	2	Daytime-Straight Road-Construction Area (Inclined Conical Barrel)-Obstacle Vehicle in Adjacent Lane	40%	1	Set speed: 80km/h	100%

1.2.4.5. Allocation of Weight to Accident Area Ahead

For the accident area ahead, there are three level-4 indicators: accident vehicle ahead, daytime-inclined truck encroaching on the lane (simulated scenario), and middle rain-straight road-front passenger vehicle in rear end collision and pedestrian holding umbrella (simulated scenario). The weight of each level-4

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indicator is shown in Table 1-14.

Table 1- 14 Weights of Level-4 Indicators for Accident Area Ahead

Level-3 indicator	No.	Level-4 indicator	Weight of indicator	No.	Test case	Weight of test case
Accident area ahead	1	Accident Vehicle Ahead	100%	1	The speed of the VUT shall be set at 60km/h, and the test shall start when the speed of VUT reaches a stable state and the distance from VT is greater than 200m. There shall be a VT in front of the road, with an included angle of 30° between the VT and the road.	100%
	2	Daytime-inclined truck encroaching on the lane (simulated scenario)	+2%	1	The speed of the VUT shall be set at 80km/h, an oblique static vehicle (white van, occupying 10% of the adjacent lane) shall appear in front, and a triangle traffic cone shall be placed 150m in front of the van. There shall be discontinuous slow traffic flow in the adjacent lane, of which the speed shall be 60km/h and the vehicle spacing shall be 30m.	50%
				2	The speed of the VUT shall be set at 120km/h, an oblique static vehicle (white van, occupying 10% of the adjacent lane) shall appear in front, and a triangle traffic cone shall be placed 150m in front of the van. There shall be discontinuous slow traffic flow in the adjacent lane, of which the speed shall be 60km/h and the vehicle spacing shall be 30m.	50%
	3	Middle rain-straight road-front passenger vehicle in rear end collision and pedestrian holding umbrella (simulated scenario)	+2%	1	Set speed: 80km/h	50%
				2	Set speed: 100km/h	50%

1.2.4.6. Allocation of Weight to Merging into Ramp from Main Road

For the merging into ramp from main road, there are three level-4 indicators: daytime-no other interfering vehicle, daytime-static vehicle at ramp entrance, and continuous traffic flow in rightmost lane of main road (simulated scenario). The weight of each level-4 indicator is shown in Table 1-15.

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Table 1- 15 Weights of Level-4 Indicators for Merging into Ramp from Main Road

Level-3 indicator	No.	Level-4 indicator	Weight of indicator	No.	Test case	Weight of test case
Merging into ramp from main road	1	Daytime-No other Interfering Vehicle	60%	1	Set speed: 80km/h	40%
				2	Set speed: 100km/h	35%
				3	Set speed: 120km/h	25%
	2	Daytime-Static Vehicle at Ramp Entrance	40%	1	Set speed: 80km/h	40%
				2	Set speed: 100km/h	35%
				3	Set speed: 120km/h	25%
	3	Continuous traffic flow in rightmost lane of main road (simulated scenario)	+2%	1	The speed of the VUT shall be 120km/h, the speed of the traffic flow shall be 70km/h, and the vehicle spacing in the traffic flow shall be 100m.	100%

1.2.4.7. Allocation of Weight to Merging into Main Road from Ramp

For the merging into main road from ramp, there is one level-4 indicator: daytime-fast moving vehicle behind in left adjacent lane (simulated scenario). The weight of each level-4 indicator is shown in Table 1-16.

Table 1- 16 Weights of Level-4 Indicators for Merging into Main Road from Ramp

Level-3 indicator	No.	Level-4 indicator	Weight of indicator	No.	Test case	Weight of test case
Merging into main road from ramp	1	Daytime-Discontinuous Traffic Flow Behind in Left Adjacent Lane (simulated scenario)	100%	1	The speed of the VUT shall be 120km/h, the speed of the traffic flow shall be 70km/h, and the vehicle spacing in the traffic flow shall be 100m.	100%

1.2.4.8. Allocation of Weight to Lane Changing Success Rate

For the lane changing success rate, there are four level-4 indicators: lane changing success rate on highway during daytime, lane changing success rate on highway at night, lane changing success rate on expressway during daytime, and lane changing success rate on expressway at night. The weight of each level-4 indicator is shown in Table 1-17.

Table 1- 17 Weights of Level-4 Indicators for Lane Changing Success Rate

Level-3 indicator	No.	Level-4 indicator	Weight
Lane-changing	1	Lane-changing Success Rate on Highway	25%

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success rate		during Daytime	
	2	Lane-changing Success Rate on Highway at Night	25%
	3	Lane-changing Success Rate on Expressway at Night	25%
	4	Lane-changing Success Rate on Expressway at Night	25%

1.2.4.9. Allocation of Weight to Merging-into-Ramp Success Rate

For the merging-into-ramp success rate, there are four level-4 indicators: merging-into-ramp success rate on highway during daytime, merging-into-ramp success rate on highway at night, merging-into-ramp success rate on expressway during daytime, and merging-into-ramp success rate on expressway at night. The weight of each level-4 indicator is shown in Table 1-18.

Table 1- 18 Weights of Level-4 Indicators for Merging-into-Ramp Success Rate

Level-3 indicator	No.	Level-4 indicator	Weight
Success rate of merging into ramp	1	Success Rate of Merging into Ramp on Highway during Daytime	25%
	2	Success Rate of Merging into Ramp from Highway at Night	25%
	3	Success rate of merging into ramp on expressway during daytime	25%
	4	Success rate of merging into ramp on expressway at night	25%

1.2.4.10. Allocation of Weight to Merging-into-Main Road Success Rate

For the merging-into-main road success rate, there are four level-4 indicators: merging-into-main road success rate on highway during daytime, merging-into-main road success rate on highway at night, merging-into-main road success rate on expressway during daytime, and merging-into-main road success rate on expressway at night. The weight of each level-4 indicator is shown in Table 1-19.

Table 1- 19 Weights of Level-4 Indicators for Merging-into-Main Road Success Rate

Level-3 indicator	No.	Level-4 indicator	Weight
Success rate of merging into main road	1	Success Rate of Merging into Main Road on Highway During Daytime	25%
	2	Success Rate of Merging into Main Road on Highway at Night	25%
	3	Success Rate of Merging into Main Road on Expressway During Daytime	25%
	4	Success Rate of Merging into Main Road on Express at Night	25%

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1.2.4.11. Allocation of Weight to System Takeover Reminder Frequency

For the system takeover reminder frequency, there are four level-4 indicators: system takeover reminder frequency on highway during daytime, system takeover reminder frequency on highway at night, system takeover reminder frequency on expressway during daytime, and system takeover reminder frequency on expressway at night. The weight of each level-4 indicator is shown in Table 1-20.

Table 1- 20 Weights of Level-4 Indicators for System Takeover Reminder Frequency

Level-3 indicator	No.	Level-4 indicator	Weight
System takeover reminder frequency	1	System Takeover Reminder Frequency on Highway during Daytime	25%
	2	System Takeover Reminder Frequency on Highway at Night	25%
	3	System Takeover Reminder Frequency on Expressway during Daytime	25%
	4	System Takeover Reminder Frequency on Expressway at Night	25%

1.2.4.12. Allocation of Weight to Active Intervention & Takeover Frequency

For the active intervention & takeover frequency, there are four level-4 indicators: active intervention & takeover frequency on highway during daytime, active intervention & takeover frequency on highway at night, active intervention & takeover frequency on expressway during daytime, and active intervention & takeover frequency on expressway at night. The weight of each level-4 indicator is shown in Table 1-21.

Table 1- 21 Weights of Level-4 Indicators for Active Intervention & Takeover Frequency

Level-3 indicator	No.	Level-4 indicator	Weight
Active intervention & takeover frequency	1	Active Intervention & Takeover Frequency on Highway during Daytime	25%
	2	Active Intervention & Takeover Frequency on Highway at night	25%
	3	Active Intervention & Takeover Frequency on Expressway during Daytime	25%
	4	Active Intervention & Takeover Frequency on Expressway at Night	25%

1.2.4.13. Allocation of Weight to Transversal Control Comfort

For the transversal control comfort, there are four level-4 indicators: transversal control comfort on highway during daytime, transversal control comfort on highway at night, transversal control comfort on expressway during daytime, and transversal control comfort on expressway at night. The weight of each level-4 indicator is shown in Table 1-22.

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Table 1- 22 Weights of Level-4 Indicators for Transversal Control Comfort

Level-3 indicator	No.	Level-4 indicator	Weight
Transversal control comfort	1	Transversal Control Comfort on Highway during Daytime	25%
	2	Transversal Control Comfort on Highway at Night	25%
	3	Transversal Control Comfort on Expressway during Daytime	25%
	4	Transversal Control Comfort on Expressway at Night	25%

1.2.4.14. Allocation of Weight to Longitudinal Control Comfort

For the longitudinal control comfort, there are four level-4 indicators: longitudinal control comfort on highway during daytime, longitudinal control comfort on highway at night, longitudinal control comfort on expressway during daytime, and longitudinal control comfort on expressway at night. The weight of each level-4 indicator is shown in Table 1-23.

Table 1- 23 Weights of Level-4 Indicators for Longitudinal Control Comfort

Level-3 indicator	No.	Level-4 indicator	Weight
Longitudinal control comfort	1	Longitudinal Control Comfort on Highway during Daytime	25%
	2	Longitudinal Control Comfort on Highway at Night	25%
	3	Longitudinal Control Comfort on Expressway during Daytime	25%
	4	Longitudinal Control Comfort on Expressway at Night	25%

1.3. Scoring Method

The total score of Navigation pilot assistance shall be calculated on the basis of the scores and weights of level-1 indicators, with two decimal places reserved. The calculation method is shown in Formula 1-1.

$$S = \sum_{i=1}^{4} S_i \times b_i \tag{1-1}$$

Where: S is the total score of Navigation pilot assistance, and i is the serial number of level-1 indicator. S_i and b_i are the score and weight of level-1 indicator with the serial number of i.

1.3.1 Scoring Method for Level-1 Indicators

The score of each level-1 indicator shall be calculated on the basis of the scores and weights of level-2 indicators, with two decimal places reserved. The calculation method is as shown in Formula 1-2.

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$$S_i = \sum_{j=1}^{n_i} S_{ij} \times b_{ij} \tag{1-2}$$

Where: S_i is the score of level-1 indicator, i is the serial number of level-1 indicator, j is the serial number of level-2 indicator, and n_i is the number of level-2 indicators. $S_{ij}$and b_{ij} are the score of level-2 indicator and the weight of the corresponding level-2 indicator respectively.

1.3.2 Scoring Method for Level-2 Indicators

The score of each level-2 indicator shall be calculated on the basis of the scores and weights of level-3 indicators, with two decimal places reserved. The calculation method is as shown in Formula 1-3.

$$S_{ij} = \sum_{z=1}^{n_{ij}} s_{ijz} \times b_{ijz} \tag{1-3}$$

Where: S_{ij} is the score of level-2 indicator. i is the serial number of level-1 indicator, j is the serial number of level-2 indicator, z is the serial number of level-3 indicator, and n_{ij} is the number of level-3 indicators. S_{ijz} and b_{ijz} are the score of level-3 indicator and the weight of the corresponding level-3 indicator respectively.

1.3.3 Scoring Method for Level-3Indicators

The score of each level-3 indicator shall be calculated on the basis of the scores and weights of level-4 indicators, with two decimal places reserved. The calculation method is as shown in Formula 1-4.

$$S_{ijz} = \sum_{q=1}^{n_{ijz}} S_{ijzq} \times b_{ijzq} \tag{1-4}$$

Where: S_{ijz} is the score of level-3 indicator. i is the serial number of level-1 indicator, j is the serial number of level-2 indicator, z is the serial number of level-3 indicator, q is the serial number of level-4 indicator, and n_{ijz} is the number of level-4 indicators. S_{ijzq} and b_{ijzq} are the score of level-4 indicator and the weight of corresponding level-4 indicator respectively.

1.3.4 Calculation Method for Score of Level-4 Indicators

The score of each level-4 indicator shall be calculated on the basis of the scores and weights of test cases, with two decimal places reserved. The calculation method is as shown in Formula 1-5.

$$S_{ijzq} = \sum_{m=1}^{n_{ijzq}} S_{ijzqm} \times b_{ijzqm} \tag{1-5}$$

Where: S_{ijzq} is the score of level-4 indicator. i is the serial number of level-1 indicator, j is the serial number of level-2 indicator, z is the serial number of level-3 indicator, q is the serial number of level-4 indicator, m is the serial number of test cases, and n_{ijzq} is the number of test cases. S_{ijzqm} and b_{ijzqm} are the score of the test case and the weight of the corresponding level-4 indicator respectively.

If the test case involves comfort, safety and efficiency, then the weighting processing shall be carried out on the basis of the score and weight of comfort, safety and efficiency.

The process compliance audit and result passing evaluation of simulation test settings involve six test scenarios as specified in 2.5.1.2.2, 2.5.1.2.3, 2.5.2.2.2, 2.5.2.2.3, 2.5.3.1.3 and 2.5.3.2.1.

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Explanation on scoring for process compliance audit: The manufacturer shall be able to provide the proof of compliance of simulation test process, and shall state the key information by reference to the test process audit report template. The test process audit report shall include four parts: the core software and hardware used, the comparison of automotive dynamics calibration results, the equipment tested, and the signal flow diagram. The full score for each part shall be 25 points, and the comprehensive assessment shall be based on the integrity, rationality and authenticity of the contents. If all the above materials are provided and meet the requirements, then 100 points will be obtained for this test item.

Explanation on scoring for result passing evaluation: The corresponding reports shall be provided for the result passing evaluation of simulation test, including test photos (platform configuration, and test implementation), test time, test location, testers, and data analysis curves of test results under various simulation scenarios.

1.3.4.1 Explanation on Scoring for Static Obstacle Ahead

The test shall be repeated for 3 times, and the worst one shall be taken as the final result.

1.3.4.1.1 Daytime-Curved Road-Static Passenger Vehicle, and Night-Curved Road-Static Vehicle

Test results		Score		
		Safety (weight: 40%)	Comfort (weight: 30%)	Efficiency (weight: 30%)
Avoidance of collision during lane changing	Maximum longitudinal deceleration ≤ $2m/s^2$ And maximum transversal acceleration ≤ $2m/s^2$	100	100	100
	$2m/s^2$＜ Maximum longitudinal deceleration ≤ $4m/s^2$ or $2m/s^2$<maximum transversal acceleration < $3m/s^2$	100	60	100
	Maximum longitudinal deceleration＞ $4m/s^2$	100	0	100
Stopping in current lane	Maximum longitudinal deceleration ≤ $2m/s^2$	100	100	0
	$2m/s^2$＜ Maximum longitudinal deceleration ≤ $4m/s^2$	100	70	0
	Maximum longitudinal deceleration＞ $4m/s^2$	100	0	0
Collision occurs, or maximum lateral acceleration > $3m/s^2$		0	0	0

1.3.4.1.2 Daytime-Straight Road-Dotted Line-Static Obstacle

Same as the explanation on scoring for daytime-curved road-static passenger vehicle and night-curved road-static vehicle in 1.3.4.1.1.

1.3.4.2 Explanation on Scoring for Slow Moving Vehicle Ahead

1.3.4.2.1 Daytime-Curved Road-Dotted Line-Slow Moving Passenger Vehicle Ahead

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The test shall be repeated for 3 times, and the worst one shall be taken as the final result.

Test results		Score		
		Safety (weight: 40%)	Comfort (weight: 30%)	Efficiency (weight: 30%)
Avoidance of collision during lane changing	Maximum longitudinal deceleration ≤ $2m/s^2$ And maximum transversal acceleration ≤ $2m/s^2$	100	100	100
	$2m/s^2$＜ Maximum longitudinal deceleration ≤ $4m/s^2$ or $2m/s^2$<maximum transversal acceleration < $3m/s^2$	100	60	100
	Maximum longitudinal deceleration＞ $4m/s^2$	100	0	100
Following in current lane	Maximum longitudinal deceleration ≤ $2m/s^2$	100	100	50
	$2m/s^2$＜ Maximum longitudinal deceleration ≤ $4m/s^2$	100	70	50
	Maximum longitudinal deceleration＞ $4m/s^2$	100	0	50
Stopping in current lane	Maximum longitudinal deceleration ≤ $2m/s^2$	100	100	0
	$2m/s^2$＜ Maximum longitudinal deceleration ≤ $4m/s^2$	100	70	0
	Maximum longitudinal deceleration＞ $4m/s^2$	100	0	0
The VUT collides, or the wheel presses the lane line, or the maximum transversal acceleration is > $3m/s^2$		0	0	0

1.3.4.2.2 Curved Road-Slow Moving Truck

Same as the explanation on scoring for daytime-curved road-dotted line-slowing moving passenger vehicle ahead in 1.3.4.2.1.

1.3.4.2.3 Daytime-Straight Road-Change from Congestion in Two Lanes to Smooth Traffic in Adjacent Lane

Same as the explanation on scoring for daytime-curved road-dotted line-slowing moving passenger vehicle ahead in 1.3.4.2.1.

1.3.4.3 Explanation on Scoring for Front Vehicle Cut-in

The test shall be repeated for 3 times, and the worst one shall be taken as the final result. Same as the explanation on scoring for daytime-curved road-dotted line-slowing moving passenger vehicle ahead in

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1.3.4.2.1.

1.3.4.4 Explanation on Scoring for Ahead Road Construction

The test shall be repeated for 3 times, and the worst one shall be taken as the final result.

1.3.4.4.1 Daytime-Straight Road-Construction Area (Inclined Conical Barrel)

Same as the explanation on scoring for daytime-curved road-static passenger vehicle and night-curved road-static vehicle in 1.3.4.1.1.

1.3.4.4.2 Daytime-Straight Road-Construction Area (Inclined Conical Barrel)-Obstacle Vehicle in Adjacent Lane

Test results		Score	
		Safety (weight: 60%)	Comfort (weight: 40%)
Stopping in current lane	Maximum longitudinal deceleration $\leq 2m/s^2$	100	100
	$2m/s^2 <$ Maximum longitudinal deceleration $\leq 4m/s^2$	100	70
	Maximum longitudinal deceleration $> 4m/s^2$	100	0
The VUT collides or its wheel presses the lane line		0	0

1.3.4.5 Explanation on Scoring for Accident Area Ahead

1.3.4.5.1 Accident Vehicle Ahead

The test shall be repeated for 3 times, and the worst one shall be taken as the final result.

Same as the explanation on scoring for daytime-curved road-static passenger vehicle and night-curved road-static vehicle in 1.3.4.1.1.

1.3.4.5.2 Daytime-inclined truck encroaching on the lane

Same as the explanation on scoring for daytime-curved road-static passenger vehicle and night-curved road-static vehicle in 1.3.4.1.1.

1.3.4.5.3 Middle Rain-Straight Road-Front Passenger Vehicle in Rear End Collision and Pedestrian Holding Umbrella

Same as the explanation on scoring for daytime-curved road-static passenger vehicle and night-curved road-static vehicle in 1.3.4.1.1.

1.3.4.6 Explanation on Scoring for Merging into Ramp from Main Road

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1.3.4.6.1 Daytime-No other Interfering Vehicle

The test shall be repeated for 3 times, and the worst one shall be taken as the final result.

Test results		Score		
		Safety (weight: 40%)	Comfort (weight: 30%)	Efficiency (weight: 30%)
Merging into ramp	Maximum longitudinal deceleration ≤ $2m/s^2$ And maximum transversal acceleration ≤ $2m/s^2$	100	100	100
	$2m/s^2$＜ Maximum longitudinal deceleration ≤ $4m/s^2$ or $2m/s^2$<maximum transversal acceleration < $3m/s^2$	100	60	100
	Maximum longitudinal deceleration＞ $4m/s^2$	100	0	100
The system reminds the driver to take over the control		50	0	0
The VUT drives out of the lane, or collides, or cannot enter the ramp buffer zone, or maximum transversal acceleration >$3m/s^2$		0	0	0

1.3.4.6.2 Daytime-Static Vehicle at Ramp Entrance

The test shall be repeated for 3 times, and the worst one shall be taken as the final result.

Test results		Score	
		Safety (weight: 60%)	Comfort (weight: 40%)
Stopping in current lane	Maximum longitudinal deceleration ≤ $2m/s^2$	100	100
	$2m/s^2$＜ Maximum longitudinal deceleration ≤ $4m/s^2$	100	70
	Maximum longitudinal deceleration＞ $4m/s^2$	100	0
The VUT collides, or the wheel presses the lane line, or the maximum transversal acceleration is > 3m/s2		0	0

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1.3.4.6.3 Continuous Traffic Flow in Rightmost Lane of Main Road

Test results		Score		
		Safety (weight: 40%)	Comfort (weight: 30%)	Efficiency (weight: 30%)
No collision occurs, and the safety time domain with the front vehicle and the rear vehicle is ≥ 0.5s	Maximum longitudinal deceleration ≤ $2m/s^2$ And maximum transversal acceleration ≤ $2m/s^2$	100	100	100
	$2m/s^2$≤ Maximum longitudinal deceleration＜ $4m/s^2$ or $2m/s^2$<maximum transversal acceleration < $3m/s^2$	100	60	100
	Maximum longitudinal deceleration ＞ $4m/s^2$	100	0	100
No collision occurs, and the safety time domain with the front vehicle or the rear vehicle is less than 0.5s	Maximum longitudinal deceleration ≤ $2m/s^2$ And maximum transversal acceleration ≤ $2m/s^2$	60	100	100
	$2m/s^2$≤ Maximum longitudinal deceleration＜ $4m/s^2$ or $2m/s^2$<maximum transversal acceleration < $3m/s^2$	60	60	100
	Maximum longitudinal deceleration ＞ $4m/s^2$	60	0	100
Collision occurs, or maximum lateral acceleration > $3m/s^2$		0	0	0

1.3.4.7 Explanation on Scoring for Merging into Main Road from Ramp

1.3.4.7.1 Daytime-Discontinuous Traffic Flow Behind in Left Adjacent Lane

Same as the continuous traffic flow in rightmost lane of main road in 1.3.4.6.3.

1.3.4.8 Explanation on Scoring for Lane-changing Success Rate

1.3.4.8.1 Lane-changing Success Rate on Highway during Daytime

This shall mean the proportion of the VUT's successful automatic lane changing under the Navigation pilot assistance mode on all highways in the public road test. The successful lane changing shall mean the process that, under the Navigation pilot assistance mode, the system automatically controls the steering operation in light of the traffic conditions, activates the turn lamps in advance, and reasonably changes lanes in the way allowed by the traffic laws and regulations. Lane changing failure shall mean that the system fails to reasonably control the lane changing action under the Navigation pilot assistance mode, such as not turning on the turn lamps, returning to the original lane in the middle of lane changing action, or not changing lanes after the turn lamps are turned on. The lane changing action shall not include the lane changing action when the VUT merges into a ramp. In addition, if the system gives the takeover reminder

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or the driver actively intervenes when the lane changing fails, the takeover will not be included in the evaluation result of takeover frequency indicator.

Lane-changing success rate on highway= $\frac{N_1}{N_1+N_2}$ ×100%, where N_1 is the number of successful lane changing, and N_2 is the number of lane changing failure.

1.3.4.8.2 Lane-changing Success Rate on Highway at Night

Same as the lane-changing success rate on highway during daytime in 1.3.4.8.1.

1.3.4.8.3 Lane-changing Success Rate on Expressway at Night

This shall mean the proportion of the VUT's successful automatic lane changing under the Navigation pilot assistance mode on all expressways in the public road test. The successful lane changing shall mean the process that, under the Navigation pilot assistance mode, the system automatically controls the steering operation in light of the traffic conditions, activates the turn lamps in advance, and reasonably changes lanes in the way allowed by the traffic laws and regulations. Lane changing failure shall mean that the system fails to reasonably control the lane changing action under the Navigation pilot assistance mode, such as not turning on the turn lamps, returning to the original lane in the middle of lane changing action, or not changing lanes after the turn lamps are turned on. The lane changing action shall not include the lane changing action when the VUT merges into a ramp. In addition, if the system gives the takeover reminder or the driver actively intervenes when the lane changing fails, the takeover will not be included in the evaluation result of takeover frequency indicator.

Lane-changing success rate on expressway= $\frac{N_1}{N_1+N_2}$ ×100%, where N_1 is the number of successful lane changing, and N_2 is the number of lane changing failure.

1.3.4.8.4 Lane-changing Success Rate on Expressway at Night

Same as the lane-changing success rate on expressway during daytime in 1.3.4.8.3.

1.34.8.5 Score of Lane-changing Success Rate

Level-3 indicator	No.	Level-4 indicator	100 points	60 points	30 points	0 point
Lane-changing success rate x	1	Lane-changing Success Rate on Highway during Daytime	≥80%	80%＞x≥50%	50%＞x≥20%	＜20%
	2	Lane-changing Success Rate on Highway at Night	≥70%	70%＞x≥50%	50%＞x≥20%	＜20%
	3	Lane-changing Success Rate on Expressway at Night	≥80%	80%＞x≥60%	60%＞x≥20%	＜20%
	4	Lane-changing Success Rate on Expressway at Night	≥80%	80%＞x≥60%	60%＞x≥20%	＜20%

1.3.4.9 Explanation on Scoring for Success Rate of Merging into Ramp

1.3.4.9.1 Success Rate of Merging into Ramp on Highway during Daytime

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This shall mean the proportion of the VUT's successful merging into the correct target ramp under the Navigation pilot assistance mode on all highways in the public road test. For this purpose, the successful merging into ramp shall mean the process that the VUT enters the final target ramp from the rightmost lane of the main road, including lane changing and ramp selection. If the ramp is a Y-shaped ramp and involves multiple merging processes, then the successful merging into ramp shall mean that the VUT runs into the last correct ramp under the Navigation pilot assistance mode. In addition, if the system gives the takeover reminder or the driver actively intervenes when the merging into ramp fails, this takeover will not be included in the evaluation result of takeover frequency indicator.

Success rate of merging into ramp on highway during daytime $=\frac{N_1}{N_1+N_2}\times 100\%$, where N_1 is the number of successful merging into ramp, and N_2 is the number of failure to merge into ramp.

1.3.4.9.2 Success Rate of Merging into Ramp from Highway at Night

Same as the success rate of merging into ramp on highway during daytime in 1.3.4.9.1.

1.3.4.9.3 Success rate of merging into ramp on expressway during daytime

This shall mean the proportion of the VUT's successful merging into the correct target ramp under the Navigation pilot assistance mode on all expressways in the public road test. For this purpose, the successful merging into ramp shall mean the process that the VUT enters the final target ramp from the rightmost lane of the main road, including lane changing and ramp selection. If the ramp is a Y-shaped ramp and involves multiple merging processes, then the successful merging into ramp shall mean that the VUT runs into the last correct ramp under the Navigation pilot assistance mode. In addition, if the system gives the takeover reminder or the driver actively intervenes when the merging into ramp fails, this takeover will not be included in the evaluation result of takeover frequency indicator.

Success rate of merging into ramp on expressway during daytime $=\frac{N_1}{N_1+N_2}\times 100\%$, where N_1 is the number of successful merging into ramp, and N_2 is the number of failure to merge into ramp.

1.3.4.9.4 Success rate of merging into ramp on expressway at night

Same as the success rate of merging into ramp on highway during daytime in 1.3.4.9.3.

1.3.4.9.5 Score of Success Rate of Merging into Ramp

Level-3 indicator	**No.**	**Level-4 indicator**	**100 points**	**60 points**	**30 points**	**0 point**
Success rate of merging into ramp x	1	Success Rate of Merging into Ramp on Highway during Daytime	≥60%	60%＞x≥30%	30%＞x≥10%	＜10%
	2	Success Rate of Merging into Ramp from Highway at Night	≥60%	60%＞x≥30%	30%＞x≥10%	＜10%
	3	Success rate of merging into ramp on expressway during daytime	≥70%	70%＞x≥40%	40%＞x≥10%	＜10%
	4	Success rate of merging into ramp on expressway at night	≥60%	60%＞x≥30%	30%＞x≥10%	＜10%

1.3.4.10 Explanation on Scoring for Score of Success Rate of Merging into Ramp

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1.3.4.10.1 Success Rate of Merging into Main Road on Highway During Daytime

This shall mean the proportion of the VUT's successful merging into main road under the Navigation pilot assistance mode on all highways in the public road test. For this purpose, the successful merging into main road shall mean the process that the VUT runs into the main road of the target highway from the ramp exit, including speed control, compliance with traffic rules, lane changing, and running into the main road. In addition, if the system gives the takeover reminder or the driver actively intervenes when the merging into main road fails, this takeover will not be included in the evaluation result of takeover frequency indicator.

Success rate of merging into main road on highway $=\frac{N_1}{N_1+N_2}\times 100\%$, where N_1 is the number of successful merging into main road, and N_2 is the number of failure to merge into main road.

1.3.4.10.2 Success Rate of Merging into Main Road on Highway at Night

Same as the success rate of merging into main road on highway during daytime in 1.3.4.10.1.

1.3.4.10.3 Success Rate of Merging into Main Road on Expressway During Daytime

This shall mean the proportion of the VUT's successful merging into main road under the Navigation pilot assistance mode on all expressways in the public road test. For this purpose, the successful merging into main road shall mean the process that the VUT runs into the main road of the target expressway from the ramp exit, including speed control, compliance with traffic rules, lane changing, and running into the main road. In addition, if the system gives the takeover reminder or the driver actively intervenes when the merging into main road fails, this takeover will not be included in the evaluation result of takeover frequency indicator.

Success rate of merging into main road on expressway $=\frac{N_1}{N_1+N_2}\times 100\%$, where N_1 is the number of successful merging into main road, and N_2 is the number of failure to merge into main road.

1.3.4.10.4 Success Rate of Merging into Main Road on Express at Night

Same as the success rate of merging into main road on expressway during daytime in 1.3.4.10.3.

1.3.4.10.5 Score of Success Rate of Merging into Main Road

Level-3 indicator	**No.**	**Level-4 indicator**	**100 points**	**60 points**	**30 points**	**0 point**
Success rate of merging into main road x	1	Success Rate of Merging into Main Road on Highway During Daytime	≥60%	60%＞x≥30%	30%＞x≥10%	＜10%
	2	Success Rate of Merging into Main Road on Highway at Night	≥60%	60%＞x≥30%	30%＞x≥10%	＜10%
	3	Success Rate of Merging into Main Road on Expressway During Daytime	≥70%	70%＞x≥40%	40%＞x≥10%	＜10%
	4	Success Rate of Merging into Main Road on Express at Night	≥60%	60%＞x≥30%	30%＞x≥10%	＜10%

1.3.4.11 Explanation on Scoring for System Takeover Reminder Frequency

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1.3.4.11.1 System Takeover Reminder Frequency on Highway during Daytime

In the total highway mileage of the VUT in the public road test, the number of the situations that the Navigation pilot assistance system reminds the driver to take over the vehicle, the function is degraded (to center holding and ACC) and the function exits is n_1, and the total mileage of the test is D_1, excluding the mileage driven for events unrelated to the highway test such as energy supplement and rest.

Takeover reminder frequency on highway = $\frac{100\times n_1}{D_1}$.

However, the reminder for takeover given by the system due to the following circumstances shall not be included in the calculation of score of takeover frequency:

i. During the public road test, any road construction or traffic accidents occurs in the lane where the VUT is located;

ii. During the public road test, the system gives the takeover reminder due to failure to complete the lane changing or failure to merge into the ramp/main road.

1.3.4.11.2 System Takeover Reminder Frequency on Highway at Night

Same as the takeover reminder frequency on highway during daytime in 1.3.4.11.1.

1.3.4.11.3 System Takeover Reminder Frequency on Expressway during Daytime

In the total expressway mileage of the VUT in the public road test, the number of the situations that the Navigation pilot assistance system reminds the driver to take over the vehicle, the function is degraded (to center holding and ACC) and the function exits is n_1, and the total mileage of the test is D_1, excluding the mileage driven for events unrelated to the expressway test such as energy supplement and rest.

Takeover reminder frequency on highway = $\frac{100\times n_1}{D_1}$.

However, the reminder for takeover given by the system due to the following circumstances shall not be included in the calculation of score of takeover frequency:

i. During the public road test, any road construction or traffic accidents occurs in the lane where the VUT is located;

ii. During the public road test, the system gives the takeover reminder due to failure to complete the lane changing or failure to merge into the ramp/main road.

1.3.4.11.4 System Takeover Reminder Frequency on Expressway at Night

Same as the takeover reminder frequency on expressway during daytime in 1.3.4.11.3.

1.3.4.11.5 Score of System Takeover Reminder Frequency

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Level-3 indicator	No.	Level-4 indicator	100 points	60 points	30 points	0 points
System takeover reminder frequency x	1	System Takeover Reminder Frequency on Highway during Daytime	≤20	20＜x≤35	35＜x≤50	＞50
	2	System Takeover Reminder Frequency on Highway at Night	≤25	25＜x≤40	40＜x≤50	＞50
	3	System Takeover Reminder Frequency on Expressway during Daytime	≤15	15＜x≤30	30＜x≤50	＞50
	4	System Takeover Reminder Frequency on Expressway at Night	≤15	15＜x≤30	30＜x≤50	＞50

1.3.4.12 Explanation on Scoring for Active Intervention & Takeover Frequency

1.3.4.12.1 Active Intervention & Takeover Frequency on Highway during Daytime

In the total highway mileage of the VUT in the public road test, the number of the driver's active intervention in vehicle control is n_1, and the total test mileage is D_1, excluding the mileage driven for events unrelated to the highway test such as energy supplement and rest.

Active intervention & takeover frequency on highway = $\frac{100\times n_1}{D_1}$.

The driver's active intervention caused by the following circumstances shall not be included in the calculation of score of takeover frequency:

i. During the public road test, any road construction or traffic accidents occurs in the lane where the VUT is located;

ii. The driver's active takeover due to failure to change lanes or failure to merge into ramp/main road in the public road test.

1.3.4.12.2 Active Intervention & Takeover Frequency on Highway at night

Same as the active intervention & takeover frequency on highway during daytime in 1.3.4.12.1.

1.3.4.12.3 Active Intervention & Takeover Frequency on Expressway during Daytime

In the total expressway mileage of the VUT in the public road test, the number of the driver's active intervention in vehicle control due to emergency (dangerous scenario, wrong way and etc.) is n_1, and the total test mileage is D_1, excluding the mileage driven for events unrelated to the expressway test such as energy supplement and rest.

Active intervention & takeover frequency on expressway = $\frac{100\times n_1}{D_1}$.

The driver's active intervention caused by the following circumstances shall not be included in the calculation of score of takeover frequency:

i. During the public road test, any road construction or traffic accidents occurs in the lane where the VUT is located;

ii. The driver's active takeover due to failure to change lanes or failure to merge into ramp/main

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road in the public road test.

1.3.4.12.4 Active Intervention & Takeover Frequency on Expressway at Night

Same as the active intervention & takeover frequency on expressway during daytime in 1.3.4.12.3.

1.3.4.12.5 Score of Active Intervention & Takeover Frequency

Level-3 indicator	No.	Level-4 indicator	100 points	60 points	30 points	0 point
Active intervention & takeover frequency x	1	Active Intervention & Takeover Frequency on Highway during Daytime	≤15	15＜x≤25	25＜x≤30	＞30
	2	Active Intervention & Takeover Frequency on Highway at night	≤15	15＜x≤25	25＜x≤30	＞30
	3	Active Intervention & Takeover Frequency on Expressway during Daytime	≤8	8＜x≤15	15＜x≤20	＞20
	4	Active Intervention & Takeover Frequency on Expressway at Night	≤8	8＜x≤15	15＜x≤20	＞20

1.3.4.13 Explanation on Scoring for Transversal Control Comfort

1.3.4.13.1 Transversal Control Comfort on Highway during Daytime

In the total highway mileage of the VUT in the public road test, under the condition that the Navigation pilot assistance is activated, the number of transversal deceleration ($2m/s^2 < a \leq 3m/s^2$) is n_1, the number of transversal deceleration ($3m/s^2 < a$) is n_2, and the total test mileage is D_1, excluding the mileage driven for events unrelated to the public road test, such as energy supplement and rest.

$$\text{Transversal control comfort on highway} = \frac{100\times n_1}{D_1} + 2\times\frac{100\times n_2}{D_1}.$$

1.3.4.13.2 Transversal Control Comfort on Highway at Night

Same as the transversal control comfort on highway during daytime in 1.3.4.13.1

1.3.4.13.3 Transversal Control Comfort on Expressway during Daytime

In the total expressway mileage of the public road test, under the condition that the Navigation pilot assistance is activated, the number of transversal deceleration ($2m/s^2 < a \leq 3m/s^2$) is n_1, the number of transversal deceleration ($3m/s^2 < a$) is n_2, and the total test mileage is D_1, excluding the mileage driven for events unrelated to the expressway test, such as energy supplement and rest.

$$\text{Transversal control comfort on highway} = \frac{100\times n_1}{D_1} + 2\times\frac{100\times n_2}{D_1}.$$

1.3.4.13.4 Transversal Control Comfort on Expressway at Night

Same as the transversal control comfort on expressway during daytime in 1.3.4.13.3

1.3.4.13.5 Score of Transversal Control Comfort

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Level-3 indicator	No.	Level-4 indicator	100 points	60 points	30 points	0 point
Transversal control comfort x	1	Transversal Control Comfort on Highway during Daytime	≤8	8＜x≤20	20＜x≤30	＞30
	2	Transversal Control Comfort on Highway at Night	≤10	10＜x≤20	20＜x≤30	＞30
	3	Transversal Control Comfort on Expressway during Daytime	≤8	8＜x≤20	20＜x≤30	＞30
	4	Transversal Control Comfort on Expressway at Night	≤10	10＜x≤20	20＜x≤30	＞30

1.3.4.14 Explanation on Scoring for Longitudinal Control Comfort

1.3.4.14.1 Longitudinal Control Comfort on Highway during Daytime

In the total highway mileage of the VUT in the public road test, under the condition that the Navigation pilot assistance is activated, the number of longitudinal deceleration ($2m/s^2 < a \leq 4m/s^2$) is n_1, the number of longitudinal deceleration ($4m/s^2 < a$) is n_2, and the total test mileage is D_1, excluding the mileage driven for events unrelated to the public road test, such as energy supplement and rest.

Longitudinal control comfort on highway = $\frac{100\times n_1}{D_1} + 2\times\frac{100\times n_2}{D_1}$.

1.3.4.14.2 Longitudinal Control Comfort on Highway at Night

Same as the longitudinal control comfort on highway during daytime in 1.3.4.14.1.

1.3.4.14.3 Longitudinal Control Comfort on Expressway during Daytime

In the total expressway mileage of the VUT in the public road test, under the condition that the Navigation pilot assistance is activated, the number of longitudinal deceleration

($2m/s^2 < a \leq 4m/s^2$) is n1, the number of longitudinal deceleration ($3m/s^2 < a$) is n_2, and the total test mileage is D_1, excluding the mileage driven for events unrelated to the expressway test, such as energy supplement and rest.

Longitudinal control comfort on highway = $\frac{100\times n_1}{D_1} + 2\times\frac{100\times n_2}{D_1}$.

1.3.4.14.4 Longitudinal Control Comfort on Expressway at Night

Same as the longitudinal control comfort on expressway during daytime in 1.3.4.14.3.

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1.3.4.14.5 Score of Longitudinal Control Comfort

Level-3 indicator	No.	Level-4 indicator	100 points	60 points	30 points	0 point
Longitudinal control comfort x	1	Longitudinal Control Comfort on Highway during Daytime	≤15	15＜x≤30	30＜x≤50	＞50
	2	Longitudinal Control Comfort on Highway at Night	≤20	20＜x≤35	35＜x≤50	＞50
	3	Longitudinal Control Comfort on Expressway during Daytime	≤12	12＜x≤25	25＜x≤50	＞50
	4	Longitudinal Control Comfort on Expressway at Night	≤15	15＜x≤30	30＜x≤50	＞50

2. Test Method

2.1. Scope of Application

This Specification is applicable to M_1 passenger vehicles.

2.2. Normative References

The terms and conditions in the following documents constitute the terms and conditions of this Specification through reference in this Specification. For dated references, all subsequent amendments (excluding corrections) or revisions are not applicable to this Specification. For undated references, the latest edition is applicable to this Specification.

ISO 15622-2018 《 Intelligent transport systems — Adaptive Cruise Control systems—Performance requirements and test procedures》

ISO 22178-2009 《 Intelligent transport systems — Low speed following (LSF) systems—Performance requirements and test procedures》

ISO 11270-2010 《 Intelligent transport systems — Lane keeping assistance systems (LKAS) — Performance requirements and test procedures》

ECE R79 《 Uniform provisions concerning the approval of vehicles with regard to steering equipment》

GRVA-ACSF 《Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems》

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

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

ISO 8855-1991 《Road vehicles - Vehicle dynamics and road-holding ability - Vocabulary》

2.3. Definitions

Vehicle Under Test (VUT)

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The vehicle that can continuously control both transversal and longitudinal movements and will be tested in accordance with these Rules.

Vehicle Target (VT)

Vehicle target specified in these Rules.

Time To Collision

The time required for the VUT to collide with VT, adult dummy target, bicycle target or pedal motorcycle target while maintaining the current motion state.

Minimum Risk Manoeuvre

The control strategy adopted by the system to reduce risks when the driver fails to take over the control for a long time after the system sends a takeover request. In this state, the system shall at least maintain the transversal control over the vehicle.

2.4. Test Conditions

2.4.1. Closed Site Test Conditions

2.4.1.1. Requirements on Closed Site Test Equipment

1) The test road surface shall be flat and solid;
2) The test road surface shall be compacted and free of irregularities (such as large inclination, cracks, well covers or reflective bolts) that may cause abnormal operation of the sensor;
3) The lane width shall be 3.75m, and the lane lines shall be white solid lines or white dotted lines. If they are white dotted lines, the blank-line ratio shall be 6/9.
4) Guardrails shall be provided on both sides of the road, and separation strips shall be provided between opposite lanes.

2.4.1.2. Weather Conditions

1) Natural light conditions: for the test conducted under natural light conditions, the lighting conditions in the whole test area shall be consistent, and the light intensity shall not be less than 2,000lux.
2) Night light conditions: For the test under night light conditions, the light conditions in the whole test area shall not be higher than 30lux.
3) Wind speed: no more than 10m/s

2.4.2. Public Road Test Conditions

2.4.2.1. Expressway Test Route in Beijing

The test route in Beijing is from Yizhuang Base of National Intelligent Automotive and Intelligent Transportation (Beijing-Hebei) Demonstration Area to Beijing-Chengde Expressway, as shown in Figure 2-1:

The specific route is: Taihe Toll Station - South Sixth Ring Road - East Sixth Ring Road - North Sixth Ring Road - Louzizhuang Bridge - Beijing-Xinjiang Expressway - Dengzhuang Bridge - Beijing-Tibet Expressway - Yingchengzi Bridge - Beijing-Chongli Expressway - Tucheng Village West Bridge - West Sixth Ring Road - South Sixth Ring Road - Nandahongmen Toll Station (about 255km)

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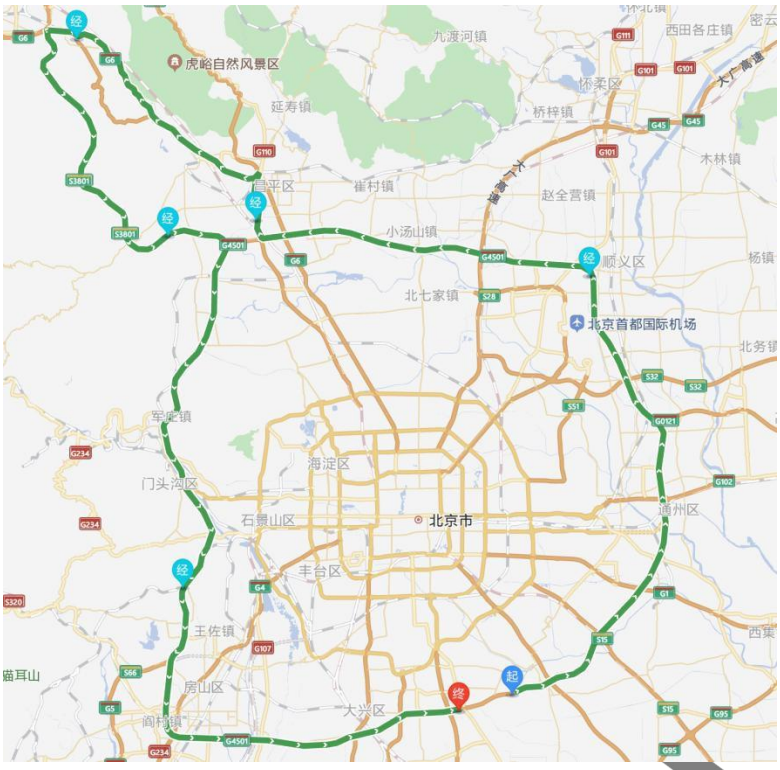

Figure 2-1 Expressway Test Route Map in Beijing

2.4.2.2. Highway Test Route in Beijing

The specific route in Beijing is as follows: Xingyi Road Entrance of Beijing-Taibei Expressway - Beijing-Taibei Expressway - Jiugong New Bridge - South Fifth Ring Road - East Fifth Ring Road - Pingfang Bridge - Airport Second Expressway – Guantou Bridge Entrance of Beijing-Pinggu Expressway - Wenyu Bridge - Airport Expressway - Wuyuan Bridge - North Fifth Ring Road - East Fifth Ring Road - South Fifth Ring Road - Yizhuang Bridge - intersection of South Fifth Ring Road and Santaishan Road (about 80km).

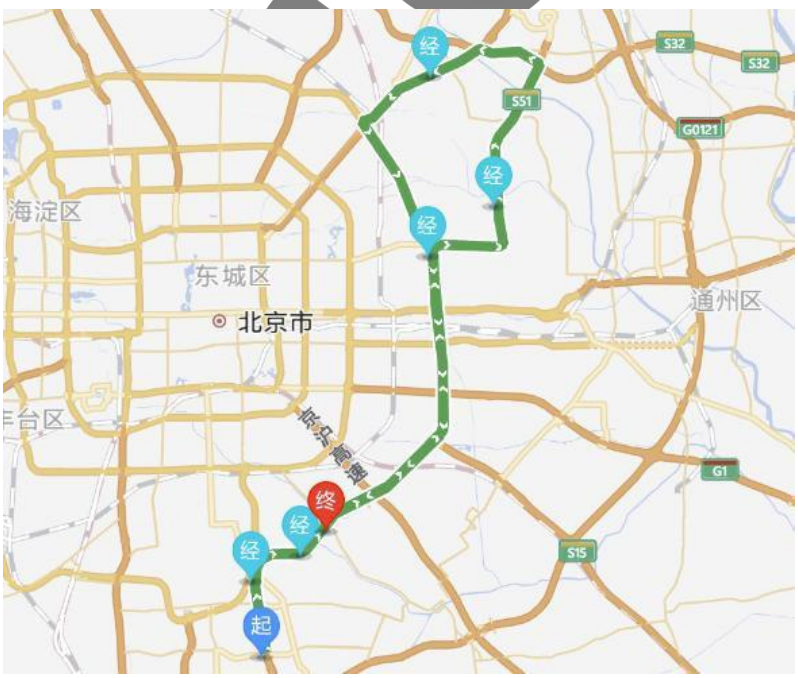

Figure 2-2 Highway Test Route Map in Beijing

2.4.2.3. Expressway Test Route in Tianjin

The specific route in Beijing is as follows: Jinqiao Toll Station - S51 Tranquility Expressway - S2 Jinning Expressway - S30 Jingjin Expressway - G25 Tangjin Expressway - S21 Tangcheng Expressway - G0111 Qinbin Expressway - G2502 Binbao Expressway - S21 Tangcheng Expressway - G0111 Qinbin Expressway - G25 Tangjin Expressway - S50 Jinjin Expressway - S51 Tranquility Expressway - Xinzhuang Toll Station (approximately 198.0km).

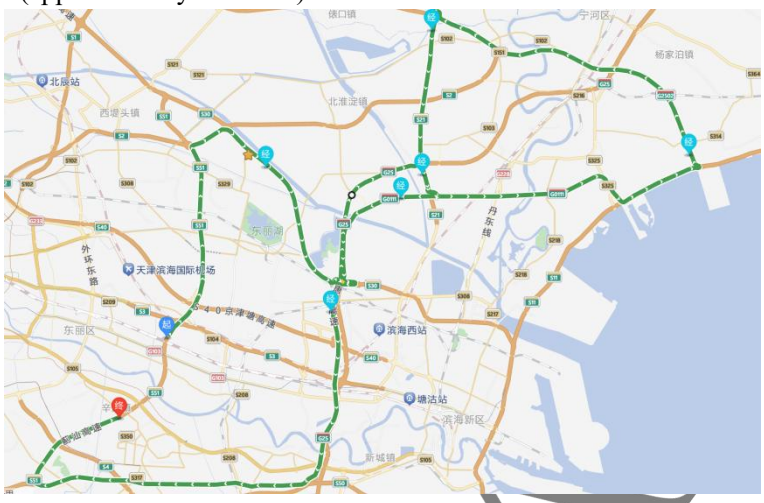

Figure 2-3 Expressway Test Route Map in Tianjin

2.4.2.4. Highway Test Route in Tianjin

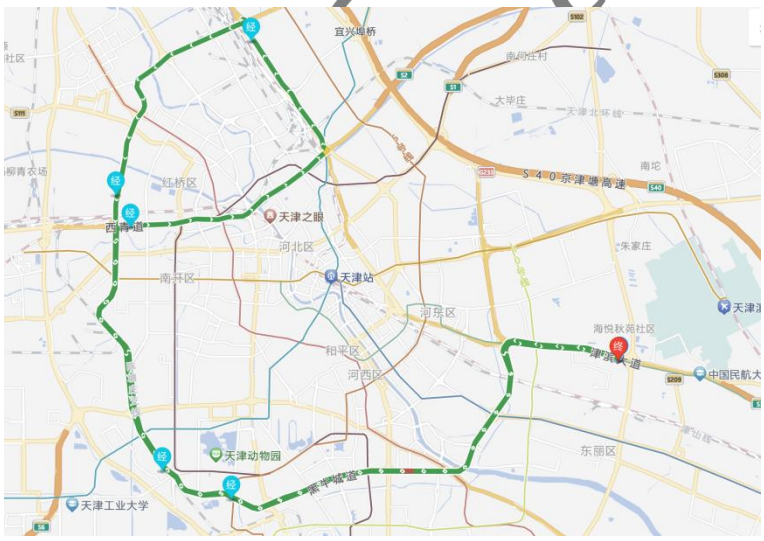

Figure 2-2 Highway Test Route Map in Tianjin

The specific route in Beijing is as follows: Intersection of Jinbin Avenue and Outer Ring East Road - Jinbin Avenue - Jinkun Bridge - Kunlun Road - Heiniucheng Road - Hongqi South Road - Miyun Road - Qingyun Bridge - Xiqing Road - Zhicheng Road - Tiedongbei Road - Chentai Bridge - Nanchang Road - Xihengdi - Miyun Road - Hongqi South Road - Heiniucheng Road - Kunlun Road - Jinbin Avenue - Intersection of Jinbin Avenue and Outer Ring East Road (approximately 78.9km).

The real world test will be conducted on highways and expressways in Beijing or Tianjin, and each real world test of the Navigation Pilot Assistance system will only be conducted on a route from one city.

The test routes on highway and expressway shall be tested in the following three time periods respectively, and one test shall be conducted in each time period, so that the highway and expressway in Beijing shall be tested three times respectively, and the test routes shall be tested six times in total.

Departure time at start point of test route in the day: 7:50-8:10

Departure time at start point of test route in the day: 13:50-14:10

Departure time at start point of test route at night: 19:50-20:10

2.4.3. Equipment Requirements

2.4.3.1. Requirements on Closed Site Test Equipment

2.4.3.1.1 The test equipment shall meet the requirements of sampling and storage of dynamic data, and the sampling and storage frequency shall at least be 100Hz. The DGPS time shall be used for data synchronization between the VT and the VUT.

2.4.3.1.2 Data Acquisition and Target Control Accuracy

The data acquisition accuracy of the VT and the VUT during the test shall at least meet the following requirements:

1) Speed accuracy: 0.1km/h;
2) Accuracy of transversal and longitudinal position: 0.03m;
3) Accuracy of longitudinal acceleration: 0.1m/ s^2;
4) Accuracy of angular velocity of steering wheel: 1.0°/s

Target control accuracy:

1) Position accuracy: 0.05m;
2) Speed accuracy: 2km/h;
3) Acceleration accuracy: 0.25m/ s^2;

2.4.3.1.3 Filtering Requirements

2.4.3.1.3.1 The original data shall be used for position and speed, without filtering;

2.4.3.1.3.2 The acceleration shall be filtered by a 12-pole stepless Butterworth filter, with the cut-off frequency being 10Hz;

2.4.3.1.3.3 Requirements on VT

As shown in Figure 2-5, the VT shall be a M_1 passenger vehicle or a soft target used to replace the actual M_1 passenger vehicle. Such soft target shall be used to replace the real vehicle (including visual, radar, lidar and PMD attributes). For the requirements on specifications of soft target, please refer to ISO19206.

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Figure 2-5 Appearance Diagram of Soft Vehicle Target

2.4.3.2. Requirements on Public Road Test Equipment

At least the following data shall be recorded during the public road test:

(1) Control mode of the VUT, such as manual control mode, and Navigation pilot assistance system control mode;

(2) Traffic status video information around the VUT;

(3) Video and voice monitoring information of test safety officer and human-computer interaction status (tester's face, instrument panel, steering wheel, central control screen, and pedal);

(4) Motion state parameter of VUT

a. Test timeline

b. Transverse and longitudinal speed of vehicle

c. Transverse and longitudinal acceleration of vehicle

The accuracy of test equipment shall meet the following requirements:

(1) Frequency of sampling and storage of motion state:

a. The sampling frequency of the test equipment for motion state of VUT shall be at least 50Hz;

b. The video sampling frame rate shall be at least 30fps;

(2) The resolution of video capture equipment shall not be less than 1920 * 1080 pixels;

(3) The acquisition accuracy of the speed of VUT shall be at least 0.1km/h;

(4) The acquisition accuracy of the acceleration of VUT shall be at least 0.1m/ s^2.

The installation and operation of the test equipment shall not affect the normal operation of the VUT and its Navigation pilot assistance function.

2.4.4. Test Procedures

2.4.4.1. Preparation of VUT

2.4.4.1.1. Confirmation on Tyre Conditions

The test shall be conducted with the brand new and genuine tyres consistent with the tyre configuration (supplier, model, size, speed and load class) specified by the manufacturer. To the extent that the tyre configuration (supplier, model, size, speed and load grade) is consistent with that specified by the manufacturer, the replacement tyre provided by the manufacturer or the agent designated by the manufacturer may be used. The tyres shall be inflated to the standard cold air pressure recommended by the manufacturer, which shall be at least suitable for normal load conditions.

2.4.4.1.2. Confirmation on Vehicle Conditions

2.4.4.1.2.1. It shall be ensured that the spare wheel (if equipped) and on-board tools are loaded on the VUT.

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There shall be no other objects on the VUT.

2.4.4.1.2.2. It shall be ensured that all tyres are inflated to the manufacturer's recommended tyre pressures for the current load state.

2.4.4.1.2.3. Measure the front and rear axle loads of the vehicle, calculate the total vehicle mass, which shall be regarded as the curb weight of the vehicle and recorded.

2.4.4.1.3. Equipment Installation and Loading

2.4.4.1.3.1. Install the instruments and equipment for the test.

2.4.4.1.3.2. Load the vehicle according to the weight requirements (200kg minus the weight of test driver and test equipment), and fix the load securely.

2.4.4.1.3.3. With the driver included, measure the front and rear axle loads of the vehicle.

2.4.4.1.3.4. Compare it with the curb weight of the vehicle.

2.4.4.1.3.5. The difference between the total vehicle mass measured and the curb weight +200kg shall be within ±1%, and the difference between the front and rear axle load distribution and the axle load distribution of the vehicle with full oil and no load shall be less than 5%. If the actual situation of the vehicle fails to meet this requirement, the load shall be adjusted without affecting the performance of the vehicle, and shall be firmly fixed after the adjustment.

2.4.4.1.3.6. The operations in 2.4.4.1.3.3 through 2.4.4.1.3.5 shall be repeated until the front/rear axle load and the total mass of the vehicle can meet the requirements. The load shall be carefully adjusted until it is as close as possible to the original property of the vehicle, and the final axle load shall be recorded.

2.4.4.2. Preparation for Test

2.4.4.2.1. Function Setting

It shall be ensured that the automatic emergency braking system (AEB) is turned on. For systems with different following distances and alarm levels, the following distance and alarm level shall be set to the intermediate level or the level immediately above the intermediate level (i.e., the following distance will be shorter and the alarm will be given later under the same conditions) before the test starts. The configuration diagrams are shown in Figure 2-6 and Figure 2-7.

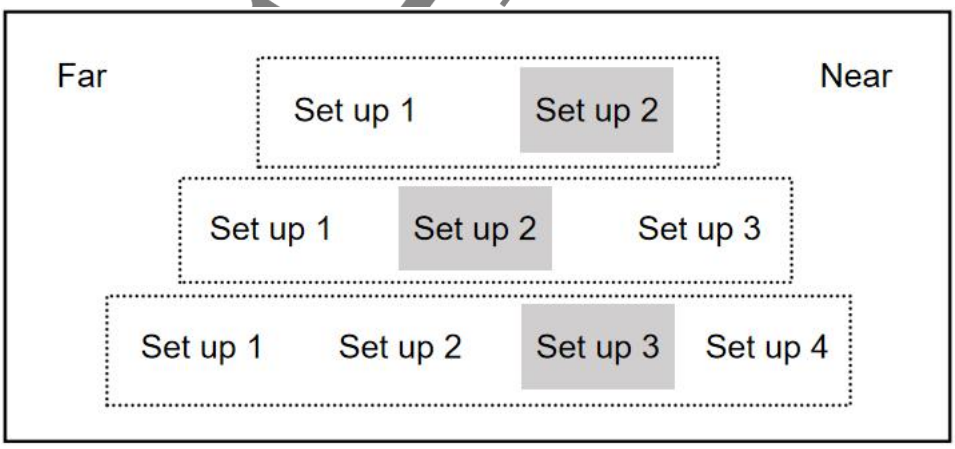

Figure 2-6 Schematic Diagram of Following Distance Setting

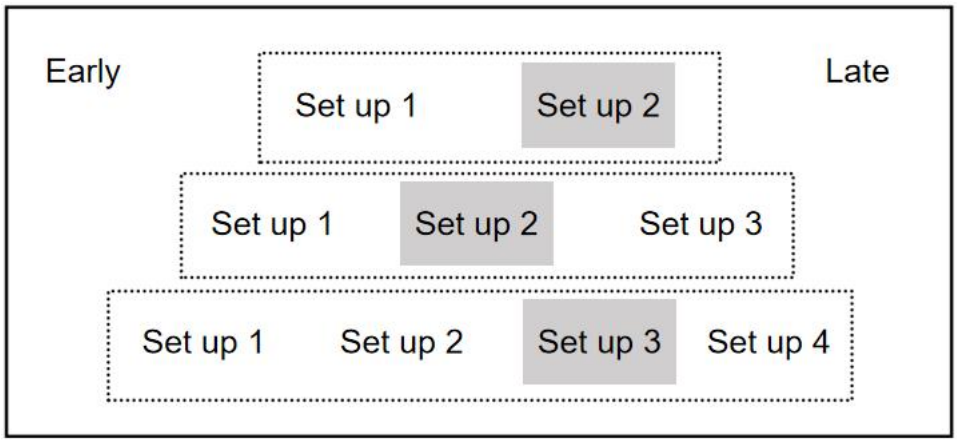

Figure 2-7 Schematic Diagram of Alarm Time Setting

2.4.4.2.2. Active hood system

If the failure of the vehicle's active hood system will not affect the normal operation of the system, the system shall be disabled before the test on closed site is carried out. During the test on public road, it shall be ensured that the active hood system works normally.

2.4.4.2.3. Airbag system

If the failure of the airbag system will not affect the normal operation of the system, the system shall be disabled before the test on closed site is carried out. During the test on public road, it shall be ensured that the active hood system works normally.

2.5. Test Items

2.5.1. Lane Changing Ability for Lane Occupied

2.5.1.1. Static obstacle ahead

2.5.1.1.1 Daytime-Curved Road-Static Passenger Vehicle, and Night-Curved Road-Static Vehicle

(1) Test Scenarios

The test road shall be a combination of a long straight road and a curved road, with smooth transition at the junction. The length of the curved road shall meet the requirements that the running time of the vehicle is more than 5s. The lane line on one side shall be a white dotted line, and there shall be no other traffic participant. The VUT shall run from the long straight road to the curved road.

(2) Test Method

The VUT shall be set with the speed of 80km/h and 100km/h respectively under the condition that the Navigation pilot assistance system is activated. When the speed is stable, the vehicle shall enter the curved road from the straight road. The test shall be carried out during the daytime and at night, and the static vehicle shall be placed at the exit of the curved road and in the middle of the road, as shown in Figure 2-8.

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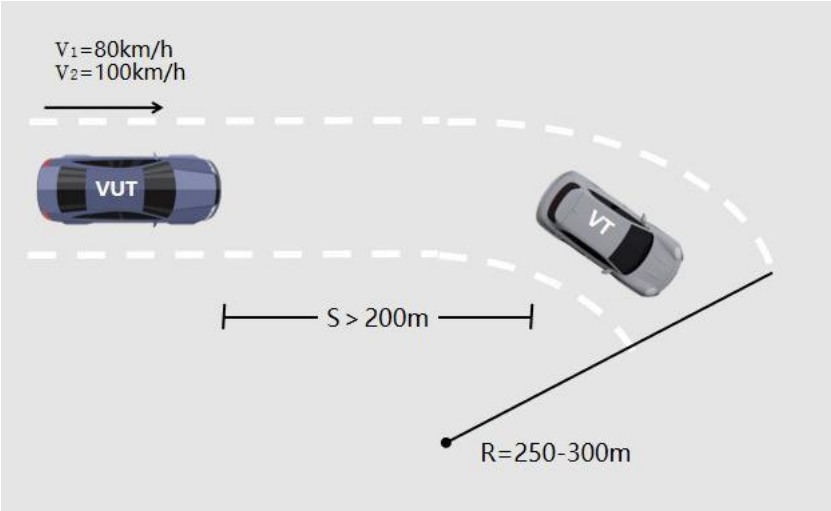

Figure 2-8 Schematic Diagram of Test Scenario for Static Obstacle Ahead

The above test shall be conducted once during the daytime and at night respectively.

(3) Exit Conditions

a) If a collision occurs and the speed of the VUT is greater than 50km/h, or the deceleration of the VUT is less than 5km/h, then the test of this item shall be terminated.

b) If the daytime test fails, the night test will not be carried out.

c) If the VUT running at the speed of 80km/h and 100km/h respectively does not decelerate when the distance between the VUT and the VT is 45m and 55m respectively, the test shall be terminated.

2.5.1.1.2 Daytime-Straight Road-Static Obstacle

(1) Test Scenarios

The test road shall be a long straight road with at least two lanes. The middle lane line shall be a white dotted line, and the lane width shall be 3.75m. The VUT shall run in any lane. There shall be a static obstacle in front of the VUT, which shall be placed in the middle of the lane. The obstacle shall be a brown cardboard box or a white foam box, and the dimension thereof shall not be less than 60cm * 60cm * 60cm.

(2) Test Method

The speed of the VUT shall be set at 60km/h and 80km/h respectively under the condition that the Navigation pilot assistance system is activated. The test shall start when the speed of the VUT reaches a stable state and the distance from the obstacle is more than 200m, as shown in Figure 2-9.

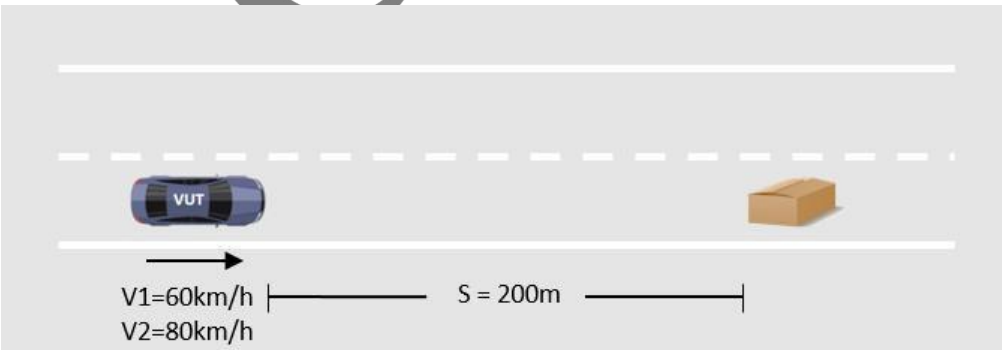

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Figure 2-9 Schematic Diagram of Test Scenario for Daytime-Straight Road-Static Obstacles

(3) Exit Conditions

a) If the VUT collides with the obstacle, the test of this item shall be terminated.

b) If the VUT does not change lanes after braking, the single test shall be ended.

c) If the VUT successfully changes lanes, the single test shall be ended.

2.5.1.2. Slow moving vehicle ahead

2.5.1.2.1. Daytime-Curved Road-Dotted Line-Slow Moving Passenger Vehicle Ahead

(1) Test Scenarios

The test road shall be a curved road with at least two lanes, and the radius of the curved road shall be 250-300m. The middle lane line shall be a dotted line. The VUT shall run to the VT ahead.

(2) Test Method

The speed of the VUT shall be set at 80km/h and 100km/h respectively under the condition that the Navigation pilot assistance system is activated. The test shall start when the speed of the VUT reaches a stable state and the distance from the VT is more than 200m. The VT shall be placed in the middle of the road, and its speed shall be 40km/h, as shown in Figure 2-10.

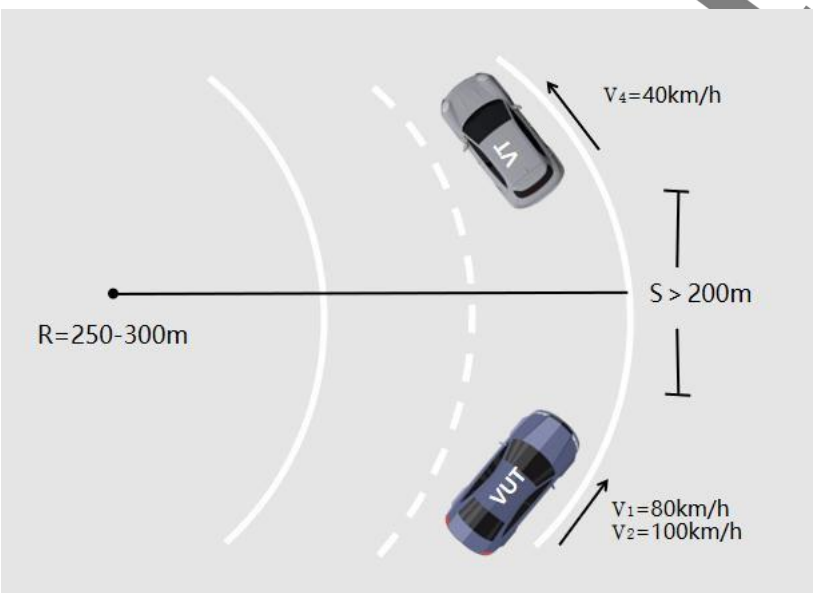

Figure 2-10 Schematic Diagram of Test Scenario for Daytime-Curved Road-Dotted Line-Slow Moving Passenger Vehicle Ahead

(3) Exit Conditions

a) If a collision occurs and the speed of the VUT is greater than 50km/h, or the deceleration of the VUT is less than 5km/h, then the test of this item shall be terminated.

b) If the VUT running at the speed of 80km/h and 100km/h respectively does not decelerate when the distance between the VUT and the VT is 45m and 55m respectively, the test shall be terminated.

2.5.1.2.2. Curved Road-Slow Moving Truck (Simulated Scenario)

(1) Test Scenarios

The test road shall be a curved road with at least two lanes. The radius of the curved road shall be 650m. The middle lane line shall be a dotted line. The VUT shall encounter a slow-moving truck ahead.

(2) Test Method

The speed of the VUT shall be set at 80km/h and 120km/h respectively under the condition that the Navigation pilot assistance system is activated. The test shall start when the speed of the VUT reaches a stable state and the distance from the VT is more than 200m. The VT shall be placed in the middle of the road, and its speed shall be 60km/h, as shown in Figure 2-11.

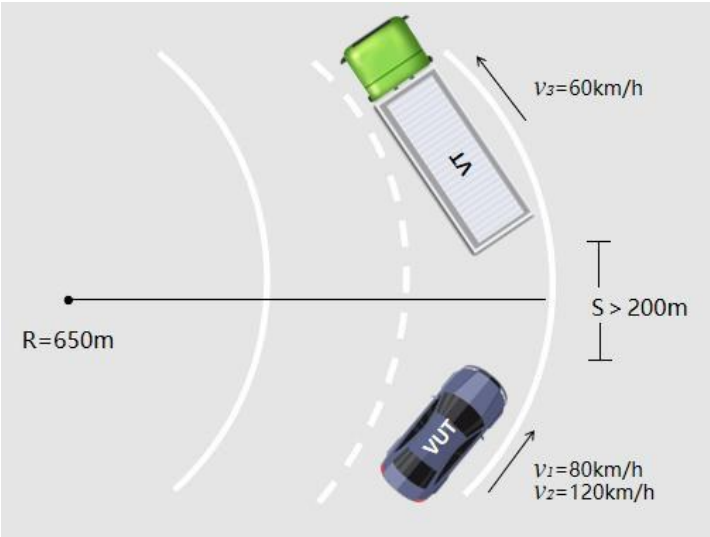

Figure 2-11 Schematic Diagram of Test Scenario for Curved Road-Slow Moving Truck

(3) Exit Conditions

a) If the collision occurs, the test of this item shall be terminated.

b) If the VUT follows the front vehicle steadily, the single test shall be ended.

c) If the VUT successfully changes lanes or completes the overriding over the VT, the single test shall be ended.

2.5.1.2.3. Daytime-Straight Road-Change from Congestion in Two Lanes to Smooth Traffic in Adjacent Lane (simulated scenario)

(1) Test Scenarios

The test road shall be a straight road with at least two lanes, the middle lane line shall be a dotted line, the VUT shall be in the rightmost lane, and there shall be passenger vehicles flowing slowly on ahead sections in two lanes. After the VUT achieves the stable following, the discontinuous traffic flow composed of five vehicles in the left lane shall be change from congestion to smooth traffic.

(2) Test Method

The speed of the VUT shall be set at 100km/h under the condition that the Navigation pilot assistance system is activated. The speed of the surrounding traffic flow shall be set at 40km/h, and the spacing between the VUT and such traffic flow shall be 3m. The speed of discontinuous traffic flow in the left lane shall be changed to 80km/h after the VUT has achieved the stable following, and the VUT shall pass quickly, as shown in Figure 2-12.

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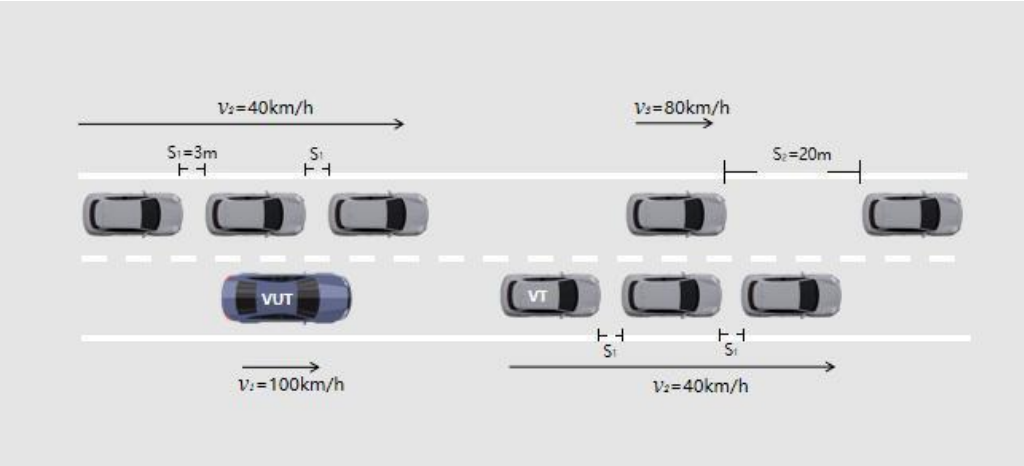

Figure 2-12 Schematic Diagram of Test Scenario for Daytime-Straight Road-Change from Congestion in Two Lanes to Smooth Traffic in Adjacent Lane

(3) Exit Conditions

a) If the collision occurs or the VUT gives the takeover request, the test of this item shall be terminated.

b) If the VUT fails to change lanes successfully, the single test shall be ended.

c) If the VUT successfully changes lanes, the single test shall be ended.

2.5.1.3. Front vehicle cut-in

2.5.1.3.1. Daytime-straight road-dotted line-front passenger vehicle cut-in

(1) Test Scenarios

As shown in Figure 2-13, the test road shall be a long straight road with at least two lanes, the middle lane line shall be a white dotted line, and the lane width shall be 3.75m. The VUT and VT shall run in their respective lanes. When the VUT approaches the VT, the VT shall cut into the lane where the VUT is located.

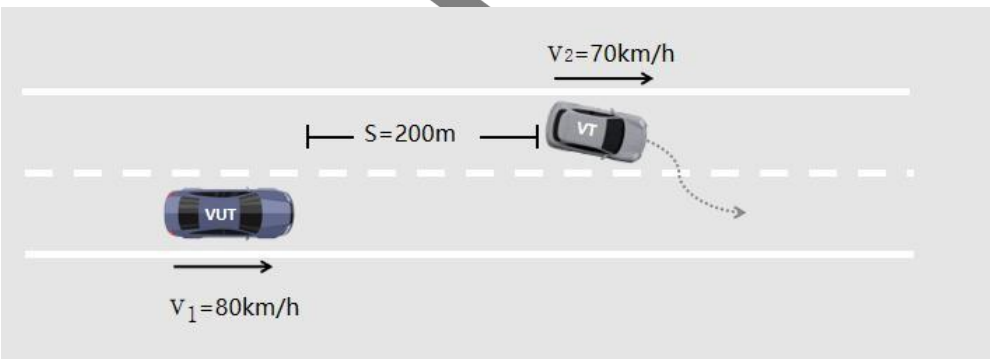

Figure 2-13 Schematic Diagram of Test Scenario for Daytime-Straight Road-Dotted Line-Front Passenger Vehicle Cut-in

(2) Test Method

After the system is activated, the vehicle speed shall be set from low to high for test. The VUT shall reach the expected speed before it is 200m away from the VT, and run steadily in the lane. The VT shall run at a constant speed along the middle of the adjacent lane in the same direction, quickly cut in the lane where the

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VUT is located, and run along the middle of the lane. During this process, the driver shall hold the steering wheel with both hands and shall not interfere with the normal operation of the system. The set speed of the VUT, the speed of the VT, the distance between the VT and the VUT when the VT cuts in, and the duration of the cut-in operation of the VT are shown in Table 2-1.

Table 2 - 1 Table of Test Parameters for Front Vehicle Cut-in Identification and Response

Set speed of the VUT (km/h)	Speed of VT (km/h)	Time gap between front end and the rear end of VT (s)	Duration of cut-in operation (s)
80	70	1.5	2.2

(3) Exit Conditions

a) If a collision occurs and the speed of the VUT is greater than 50km/h, or the deceleration of the VUT is less than 5km/h, then the test of this item shall be terminated.

b) If the VUT does not decelerate when the distance between the VUT and the VT is 6m, the test shall be terminated.

2.5.2. Lane Changing Ability for Emergency

2.5.2.1. Road construction ahead

2.5.2.1.1. Daytime-Straight Road-Construction Area (Inclined Conical Barrel)

(1) Test Scenarios

The test road shall be a long straight road with at least two lanes. The middle lane line shall be a dotted line. In the middle of the lane, five traffic cones (recommended size: 50cm * 35cm) inclined at an angle of 30 degrees in the road direction shall be placed as obstacles. The VUT shall run at a constant speed towards the obstacles ahead.

(2) Test Method

The speed of the VUT shall be set at 80km/h under the condition that the Navigation pilot assistance system is activated. The test shall start when the speed of the VUT reaches a stable state and the distance from the conical barrels is more than 200m, as shown in Figure 2-14

Figure 2-14 Schematic Diagram of Test Scenario for Daytime-Straight Road-Construction Area (Inclined Conical Barrel)

(3) Exit Conditions

a) When the VUT completes the lane changing action, the single test shall be completed;

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b) If the VUT fails to complete the lane changing, the test of this item shall be terminated.

2.5.2.1.2. Daytime-Straight Road-Construction Area (Inclined Conical Barrel)-Obstacle Vehicle in Adjacent Lane

(1) Test Scenarios

The test road shall be a long straight road with at least two lanes. The middle lane line shall be a dotted line. In the middle of the lane, five traffic cones (recommended size: 50cm * 35cm) inclined at an angle of 30 degrees in the road direction shall be placed as obstacles. The VUT shall run at a constant speed towards the obstacles ahead.

(2) Test Method

The speed of the VUT shall be set at 80km/h under the condition that the Navigation pilot assistance system is activated. The test shall start when the speed of the VUT reaches a stable state and the distance from the cone barrels is more than 200m. The VT in the adjacent lane shall run within the range from 3m in front of the VUT to 3m behind the VUT, as shown in Figure 2-15.

Figure 2-15 Schematic Diagram of Test Scenario for Daytime-Straight Road-Construction Area (Inclined Conical Barrel)-Obstacle Vehicle in Adjacent Lane

(3) Exit Conditions

a) If the VUT fails to complete the lane changing, the single test shall be ended;

b) If the VUT runs out of the lane or a collision occurs, the test of this item shall be terminated.

2.5.2.2. Accident area ahead

2.5.2.2.1. Accident Vehicle Ahead

The test road shall be a long straight road with at least two lanes. A static VT shall be placed transversely in the middle of the lane as an obstacle. The VUT shall run at a constant speed towards the obstacle ahead, as shown in Figure 2-16.

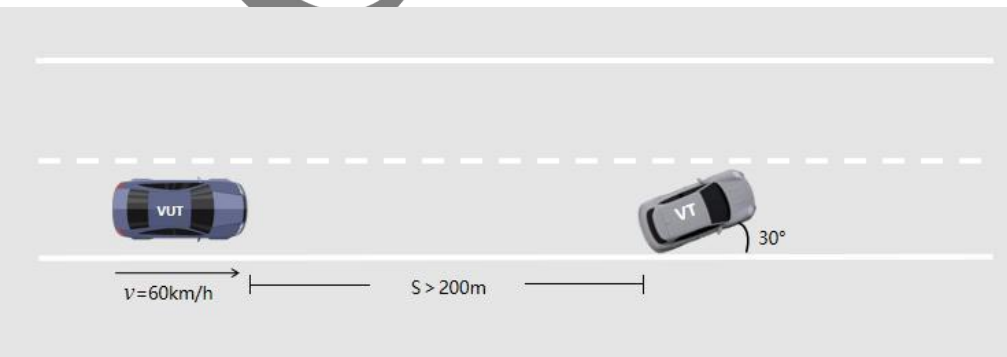

Figure 2-16 Schematic Diagram of Test Scenario for Accident Vehicle Ahead

(2) Test Method

The speed of the VUT shall be set at 60km/h under the condition that the Navigation pilot assistance system is activated. The test shall start when the speed of the VUT reaches a stable state and the distance from the VT is more than 200m. The VT shall exist in front of the road, and the included angle between the VT and the road shall be 30°.

(3) Exit Conditions

a) If a collision occurs and the speed of the VUT is greater than 50km/h, or the deceleration of the VUT is less than 5km/h, then the test of this item shall be terminated.

b) If the VUT does not decelerate when the distance between the VUT and the VT is 33m, the test shall be terminated.

2.5.2.2.2. Daytime-inclined truck encroaching on the lane (simulated scenario)

(1) Test Scenarios

The test road shall be a long straight road with at least two lanes, and the middle lane line shall be a dotted line.

(2) Test Method

The test personnel shall set the end point according to the system prompts and ensure that the path passes through the accident area. The speed of the VUT shall be set at 80km/h and 120km/h respectively under the condition that the Navigation pilot assistance system is activated. In the accident area in front of this lane, a white van shall be placed at an angle. A triangle warning sign shall be placed 150m behind the van, and one end of the van shall invade the adjacent lane by 10%. The test shall start when the speed of the VUT reaches a steady state and the distance from the warning triangle is 200m. In the adjacent lane, there shall be a discontinuous slow traffic flow composed of at least 20 vehicles, with a speed of 60km/h and a spacing of 30m, as shown in Figure 2-17.

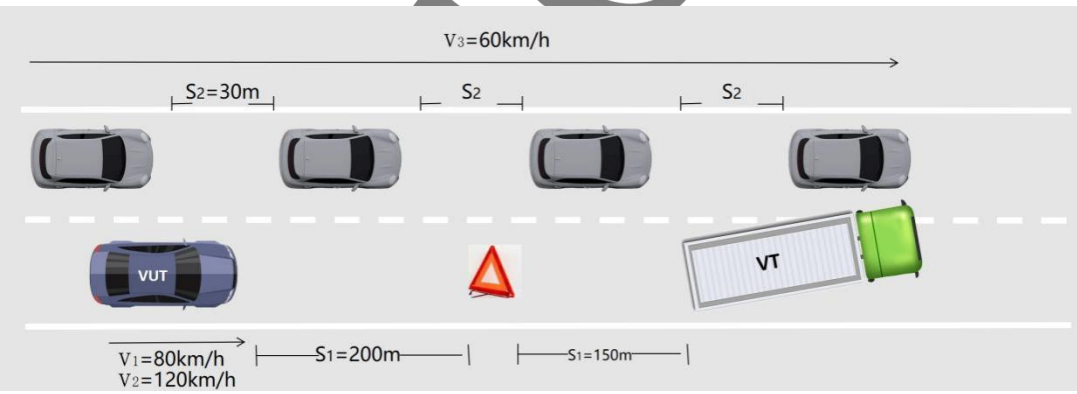

Figure 2-17 Schematic Diagram of Test Scenario for Daytime-Inclined Truck Encroaching on the Lane

(3) Exit Conditions

a) If the VUT collides with the van, the test shall be terminated.

b) If the VUT does not change lanes after braking, the single test shall be ended.

c) If the VUT successfully changes lanes, the single test shall be ended.

2.5.2.2.3. Middle rain-straight road-front passenger vehicle in rear end collision and pedestrian holding umbrella (simulated scenario)

(1) Test Scenarios

The weather shall be moderate rain with rainfall of 3mm/h, the test road shall be a long straight road with at least two lanes, the middle lane line shall be dotted line, and the friction coefficient of the road shall be 0.4.

(2) Test Method

The test personnel shall set the end point according to the system prompts and ensure that the path passes through the accident area. The speed of the VUT shall be set at 80km/h and 100km/h respectively under the condition that the Navigation pilot assistance system is activated. The test shall start when the speed of the VUT reaches a stable state and the distance from the accident vehicle is 200m. Two passenger vehicles involved in rear-end collision shall be placed in front of this lane, and the static pedestrians holding umbrella shall be set 1m behind the passenger vehicles, as shown in Fig. 2-18.

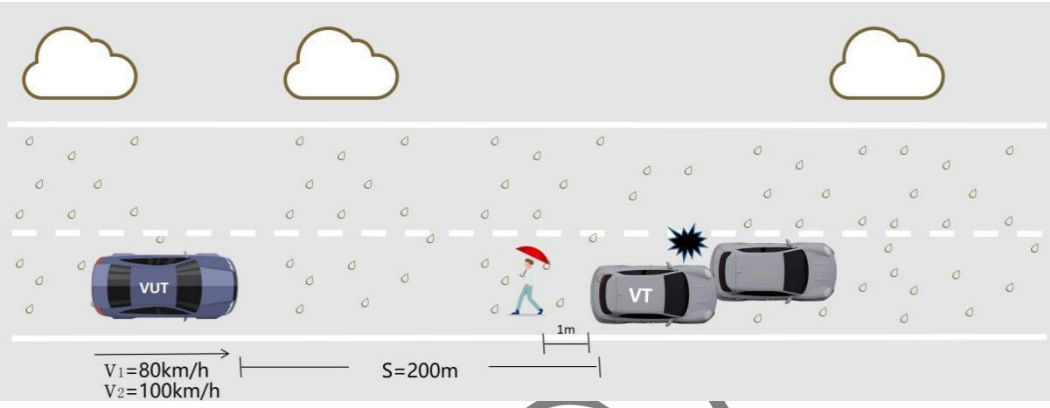

Figure 2-18 Schematic Diagram of Test Scenario for Middle Rain-Straight Road-Front Passenger Vehicle in Rear End Collision and Pedestrian Holding Umbrella

(3) Exit Conditions

a) If the VUT collides with the accident vehicle or pedestrian, the test of this item shall be terminated.

b) If the VUT does not change lanes after braking, the single test shall be ended.

c) If the VUT successfully changes lanes, the single test shall be ended.

2.5.3. Navigation route changing ability

2.5.3.1. Merging into ramp from main road

2.5.3.1.1. Daytime-No other Interfering Vehicle

(1) Test Scenarios

The test road shall be a long straight road with at least two lanes, the middle lane line shall be a dotted line, and there shall be a ramp in front of the test road.

(2) Test Method

The test personnel shall set the end point according to the system prompts and ensure that the path passes the down ramp. The speed of the VUT shall be set at 80km/h, 100km/h and 120km/h respectively under the condition that the Navigation pilot assistance system is activated. The test shall start when the speed of the

VUT reaches a stable state and the distance from the ramp is more than 200m, as shown in Figure 2-19.

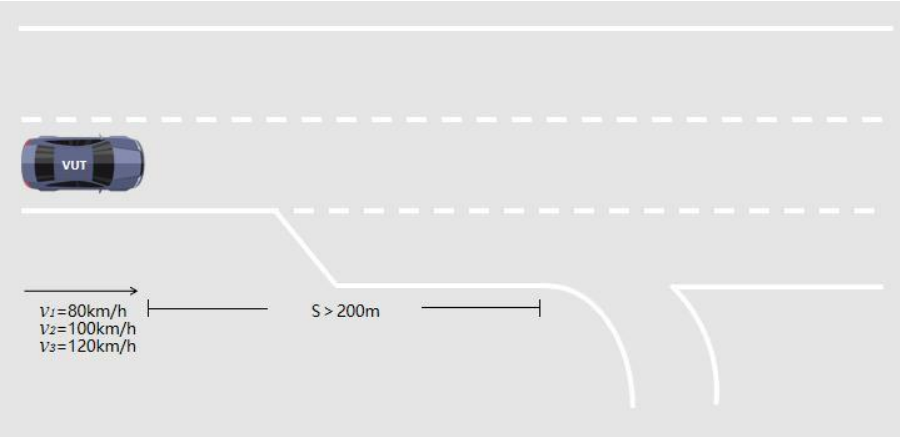

Figure 2- 19 Schematic Diagram of Test Scenario for Daytime-No other Interfering Vehicle

(3) Exit Conditions

a) When the VUT completes the lane changing action, the single test shall be completed;

b) If the VUT fails to complete the lane changing, the test of this item shall be terminated.

2.5.3.1.2. Daytime-Static Vehicle at Ramp Entrance

(1) Test Scenarios

The test road shall be a long straight road with at least two lanes, the middle lane line shall be a dotted line, and there shall be a ramp in front of the test road.

(2) Test Method

The test personnel shall set the end point according to the system prompts and ensure that the path passes the down ramp. The speed of the VUT shall be set at 80km/h, 100km/h and 120km/h respectively under the condition that the Navigation pilot assistance system is activated. The test shall start when the speed of the VUT reaches a steady state and the distance from the ramp is more than 200m. There shall be a static vehicle at the ramp entrance, as shown in Figure 2-20.

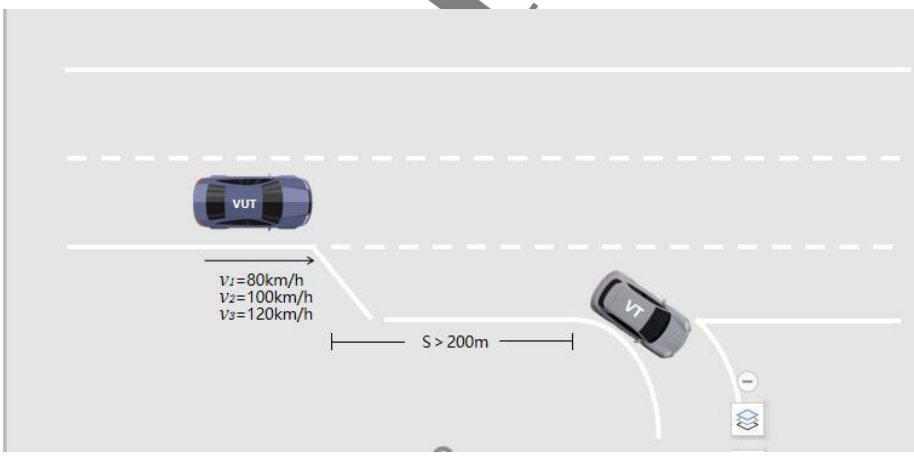

Figure 2-20 Schematic Diagram of Test Scenario for Daytime-Static Vehicle at Ramp Entrance

(3) Exit Conditions

a) If the VUT fails to complete the lane changing, the test of this item shall be terminated.

b) If the collision occurs, the test of this item shall be terminated.

c) If the VUT fails to slow down after entering the buffer section from the main road, the test shall be ended.

2.5.3.1.3. Continuous Fast Traffic Flow in Rightmost Lane of Main Road (Simulated Scenario)

(1) Test Scenarios

The test road shall be a long straight road with at least two lanes, the middle lane line shall be a dotted line, the VUT shall run in the leftmost lane, and there shall be a ramp in front of the road.

(2) Test Method

The test personnel shall set the end point according to the system prompts and ensure that the path passes the down ramp. The speed of the VUT shall be set at 120km/h under the condition that the Navigation pilot assistance system is activated. The test shall start when the VUT is 1km away from the ramp. In the right lane, there shall be continuous traffic flow, the speed of traffic flow shall be set at 70km/h, and the vehicle spacing within the traffic flow shall be 100m. The time when the center point of the VUT reaches the center line (point A) of the lane where the continuous traffic flow is located shall be recorded as T1, and the time when the center points of the VTs (the vehicle behind and the vehicle in front) reach point A shall be recorded as T2 and T1-T3 respectively; the safety time domain is T2-T1 or T1-T3, as shown in Figure 2-21.

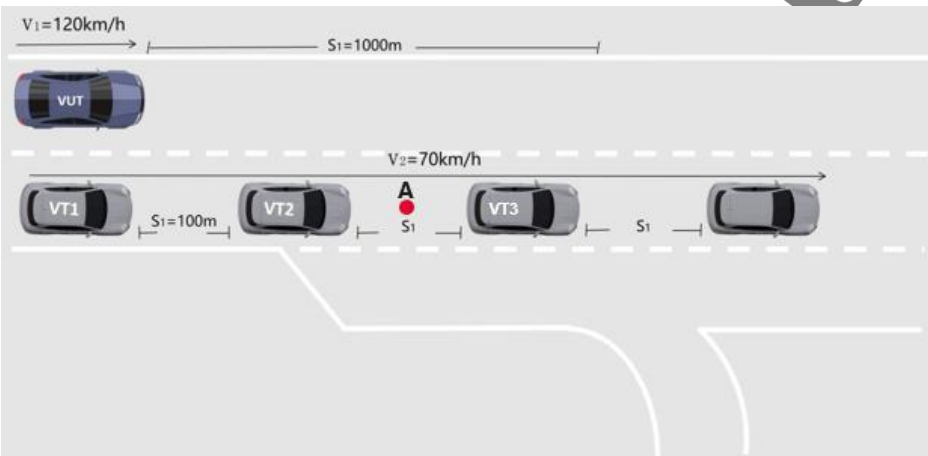

Figure 2-21 Schematic Diagram of Test Scenario for Continuous Fast Traffic Flow in Rightmost Lane of Main Road

(3) Exit Conditions

a) If the VUT successfully changes lanes and runs into the ramp, the single test shall be ended.

b) If the collision occurs or the VUT fails to change lanes, the test of this item shall be terminated.

2.5.3.2. Merging into main road from ramp

2.5.3.2.1. Daytime-Discontinuous Traffic Flow Behind in Left Adjacent Lane (simulated scenario)

(1) Test Scenarios

The test road shall be a long straight road with at least two lanes. The middle lane line shall be a dotted line. The VUT shall enter the main road from the ramp.

(2) Test Method

The VUT shall enter the main road from the ramp with the Navigation pilot assistance system activated, and the initial speed shall be set at 120km/h. The test shall start when the vehicle reaches the buffer section. In the right most lane of the main road, there shall be 10 discontinuous vehicles with the speed of 70km/h and the vehicle spacing of 100m, as shown in Figure 2-22.

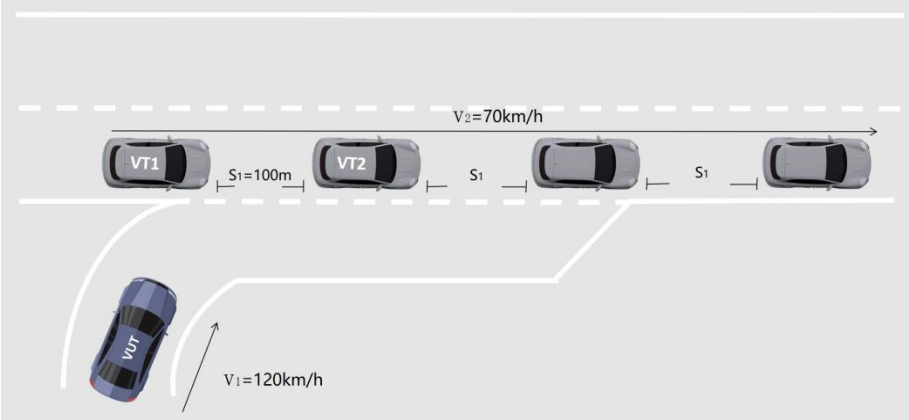

Figure 2-22 Schematic Diagram of Test Scenario for Daytime- Continuous Fast Traffic Flow in Adjacent Left Lane

(3) Exit Conditions

a) If the VUT successfully changes lanes and enters the main road, the single test shall be ended.

b) If the VUT fails to change lanes or the collision occurs, the test of this item shall be terminated.

Annex 1 Simulation Test Process Compliance Report Template

Simulation Test Process Audit Report				
No.	Name	Information record		
1	Software and hardware of test bench frame	Software	Scenario simulation software	CarMaker_HIL11.0
			Automotive dynamics software	CarMaker_HIL11.0
			Test management software	CarMaker_HIL11.0
			Automated test software	CarMaker_HIL11.0
		Hardware	Millimeter wave radar echo simulator	dSPACE
			Video black box	dSPACE
			Real time simulation system	dSPACE SCALEXIO
			I/O channel	dSPACE SCALEXIO
			Cabinet	dSPACE SCALEXIO
		Key		

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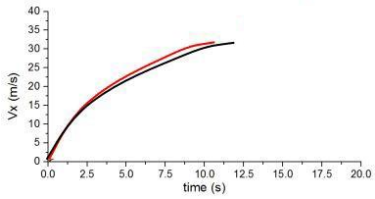
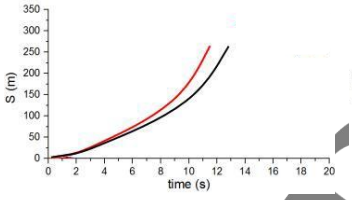
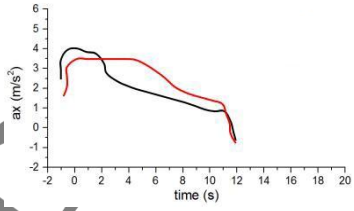
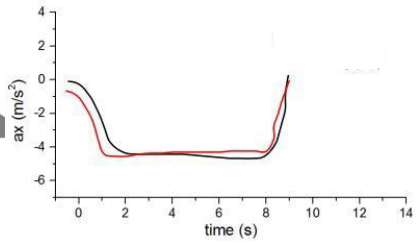
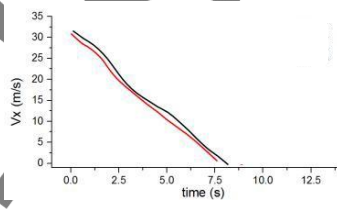
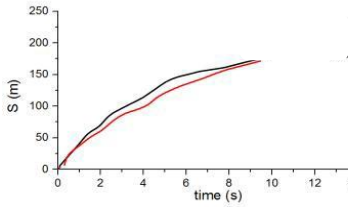
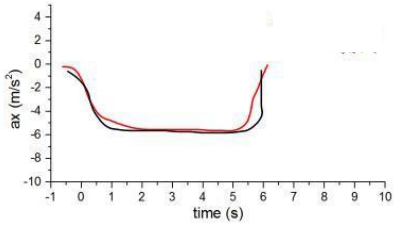
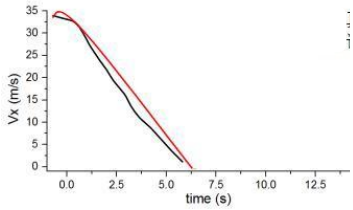
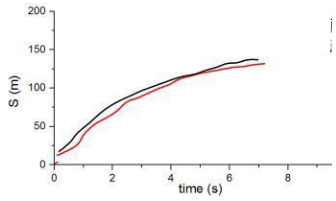
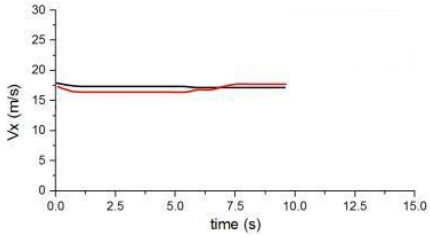
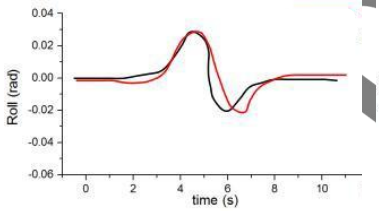
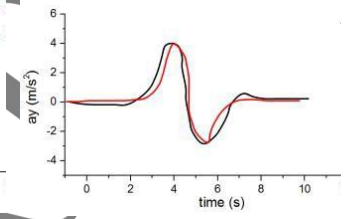
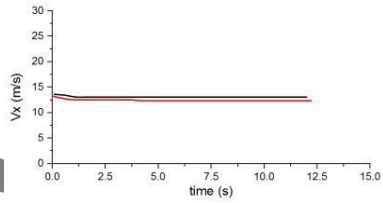
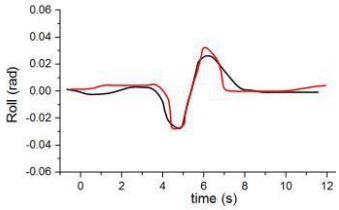
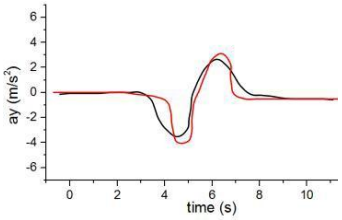
		photos of frame		
2	Automotive dynamics calibration	Longitudinal operating condition	Full throttle acceleration	 Longitudinal speed  Longitudinal displacement of vehicle  Longitudinal acceleration of vehicle
2	Automotive dynamics calibration	Longitudinal operating condition	Braking with deceleration of -4m/s²	 Longitudinal deceleration of vehicle  Longitudinal speed of vehicle  Braking distance of vehicle
			Braking with deceleration of -6m/s²	 Longitudinal deceleration of vehicle

				 Longitudinal speed of vehicle  Braking distance of vehicle
2	Automotive dynamics calibration	Transversal operating condition	Left-shift operating condition	 Longitudinal speed of vehicle  Roll angle of vehicle  Lateral acceleration of vehicle
			Right-shift operating condition	 Longitudinal speed of vehicle  Roll angle of vehicle  Lateral acceleration of vehicle
3	Tested equipment		Tested object	ADAS domain controller
			Brief description of function	

4	Signal flow diagram	The HIL test is carried out based on video black box and millimeter wave radar callback simulation.

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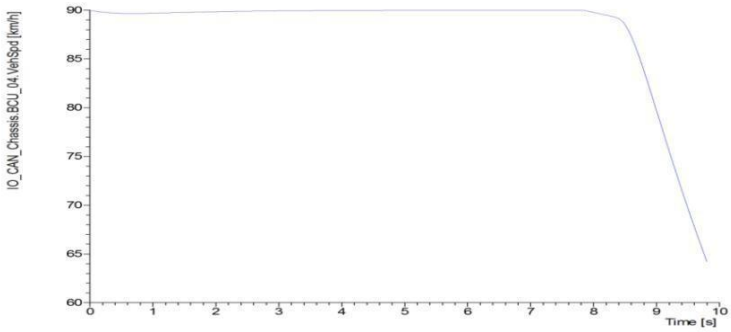
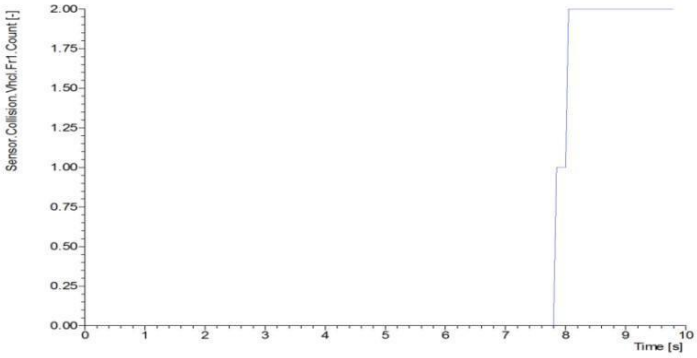
Annex 2 Simulation Test Results Passing Report Template

Record of Simulation Test Results		
Case name	Curved Road-Slow Moving Truck	
Case No.	Virtual01	
Test time	19:00, October 27, 2022	
Test location	Intelligent Cab of Tianjin Dongli District Tianjian Center	
Testers	Zhang San, and Li Si	
Test conditions		Description of test scenario:
Test data	 Fig. 2: Vehicle_Speed  Fig. 1: Collision_Count	
Conclusion	No collision occurred, and the vehicle passed the test.	