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**Intelligent and connected vehicles - Operational design
condition for automated driving system**

智能网联汽车 自动驾驶系统设计运行条件

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Intelligent and connected vehicles - Operational design condition for automated driving system

1 Scope

This document specifies the general requirements and basic element set for the design and operation conditions of the automated driving system.

This document is applicable to categories M and N vehicles equipped with automated driving systems; other types of vehicles or vehicles equipped with other levels of driving automation systems shall refer to it.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB 5768.2 Road traffic signs and markings - Part 2: Road traffic signs

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

GB/T 40429-2021 Taxonomy of driving automation for vehicles

GB/T 44721-2024 Intelligent and connected vehicle - General technical requirements for automated driving system

3 Terms and definitions

The terms and definitions defined in GB/T 40429-2021, as well as the following terms and definitions, apply to this document.

3.1

Automated driving system; ADS

A system composed of hardware and software that implements automated driving functions.

Note: This term refers to the level 3 and above automated driving systems specified in GB/T

V2V: Vehicle to Vehicle

5 General requirements

5.1 ODC shall be designed based on the ODC basic element set and requirements in this document. New ODC elements can be added or new element requirements can be added to the ODC basic element set. When adding new ODC elements or element requirements, they shall not conflict with the ODC basic element set in this document, meanwhile ensure that the newly added ODC elements are reasonably placed in the structure of the ODC basic element hierarchy specified in Chapter 6. See Appendix A for an example of ODC writing.

Note 1: ODC selects some ODC basic elements and different levels of detail in this document according to requirements.

Note 2: The ODC elements specified in 6.2 ~ 6.4 are called ODC basic elements. The set composed of these ODC basic elements is called the ODC basic element set.

5.2 ODC shall be objective, clear, unambiguous, which can be used to build test scenarios.

5.3 The ODC elements included in the ODC definition shall be able to be continuously identified by ADS.

5.4 ODC elements shall at least contain element names and element requirements, it may contain element associations. ODC elements shall meet the following requirements.

- a) Have a clear element name.
- b) Have clear element requirements, that is, the applicability of ADS to the ODC element. Element requirements shall be clearly described as "allowed" or "not allowed", with the following meanings.
 - 1) Allowed: The ODC element does not affect ADS activation; before and during the activation state specified in 7.1.2 of GB/T 44721-2024, the ADS shall be able to identify the ODC element and continue to execute all DDTs in the activation state.
 - 2) Not allowed: The ODC element will inhibit ADS activation or cause ADS to exit. If the ODC element inhibits ADS activation, the ADS shall be able to identify the ODC element and implement a reasonable control strategy, before the activation state specified in 7.1.2 of GB/T 44721-2024. If the ODC element will cause the ADS to exit, the ADS shall be able to identify the ODC element and implement a reasonable control strategy when, it is activated.
- c) Have clear element association relationships (if involved). If the association

- Description: Includes driving areas with special road configurations, or with specific driving regulations, or special environmental conditions. Typical areas include school campuses, traffic control areas, geographic fences, etc.
- Element requirements: The specific area types and scopes that ADS allows/does not allow shall be described.

6.2.1.1.2 Urban roads

This ODC basic element contains the following subdivided ODC basic elements; their descriptions and element requirements are as follows.

a) Expressway:

- 1) Description: A road with a central divider, full access control, controlled entrance and exit spacing and form, to achieve continuous traffic, with no less than two lanes in one direction, generally equipped with supporting traffic safety and management facilities, with no entrances and exits of public buildings that attract a large number of vehicles and people on both sides;
- 2) Element requirements: “Allow/Not Allowed” shall be used to indicate the applicability of ADS to this ODC basic element.

b) Trunk road:

- 1) Description: A road used to connect the main subdistricts of the city, with transportation functions as the main function, meanwhile no entrances and exits of public buildings that attract a large number of vehicles and people on both sides should be set;
- 2) Element requirements: “Allow/Not Allowed” shall be used to indicate the applicability of ADS to this ODC basic element.

c) Secondary trunk road:

- 1) Description: Combined with the main trunk road to form a trunk road network, the road mainly serves the function of collecting and distributing traffic, and also has service functions;
- 2) Element requirements: “Allow/Not Allowed” shall be used to indicate the applicability of ADS to this ODC basic element.

d) Branch road:

- 1) Description: Connected with secondary trunk roads and internal roads such as residential areas, industrial areas, transportation facilities, which solves local area traffic and has service functions as the main function;

- 2) Element requirements: “Allow/Not Allowed” shall be used to indicate the applicability of ADS to this ODC basic element.

Note: For the specific definition of the above ODC basic elements, see CJJ 37.

6.2.1.1.3 Highway

This ODC basic element contains the following subdivided ODC basic elements; their descriptions and element requirements are as follows.

a) Expressway:

- 1) Description: A multi-lane highway for vehicles to travel in different directions and lanes, with full access control;
- 2) Element requirements: “Allow/Not Allowed” shall be used to indicate the applicability of ADS to this ODC basic element.

b) First-class highway:

- 1) Description: A multi-lane highway for vehicles to travel in different directions and lanes, with access control as needed;
- 2) Element requirements: “Allow/Not Allowed” shall be used to indicate the applicability of ADS to this ODC basic element.

c) Second-class highway:

- 1) Description: A two-lane highway for vehicles to travel;
- 2) Element requirements: “Allow/Not Allowed” shall be used to indicate the applicability of ADS to this ODC basic element.

d) Third-class highway:

- 1) Description: A two-lane highway for mixed vehicle and non-vehicle traffic;
- 2) Element requirements: “Allow/Not Allowed” shall be used to indicate the applicability of ADS to this ODC basic element.

e) Fourth-class highway:

- 1) Description: A two-lane or single-lane highway for mixed traffic of automobiles and non-automobile traffic. The design traffic volume of the fourth-class highway is less than that of third class highway;
- 2) Element requirements: “Allow/Not Allowed” shall be used to indicate the applicability of ADS to this ODC basic element.

6.2.1.2 Road surface

6.2.1.2.1 Type

This ODC basic element contains the following subdivided ODC basic elements; its description and element requirements are as follows.

a) Pavement state:

- 1) Description: Contains asphalt concrete pavement state and cement concrete pavement state;
- 2) Element requirements: The type of pavement state allowed or not allowed by ADS shall be stated.

b) Unpaved state:

- 1) Description: The state of the road surface with gravel, stones, soil, etc.;
- 2) Element requirements: The type of unpaved state allowed or not allowed by ADS shall be stated.

6.2.1.2.2 Road surface quality

This ODC basic element contains the following subdivided ODC basic elements; their descriptions and element requirements are as follows.

a) Cracking:

- 1) Description: The phenomenon of cracks on the road surface;
- 2) Element requirements: The severity of cracks allowed or not allowed by ADS, such as crack size, etc.

b) Track:

- 1) Description: The strip-shaped depressions produced along the longitudinal direction of the road surface under the repeated action of wheel loads;
- 2) Element requirements: The severity of track allowed or not allowed by ADS, such as track size, etc.

c) Settlement:

- 1) Description: Local settlement of the road surface;
- 2) Element requirements: The severity of settlement allowed or not allowed by ADS, such as settlement size, etc.

d) Potholes:

- 1) Description: Potholes caused by the partial detachment of road aggregate under the action of driving;
- 2) Element requirements: The severity of potholes allowed or not allowed by ADS, such as pothole size, etc.

e) Congestion:

- 1) Description: The phenomenon of local bulges formed by the pavement material being pushed along by the traffic;
- 2) Element requirements: The severity of the bulges allowed or not allowed by ADS, such as the size of the bulges, etc.

f) Loose surface:

- 1) Description: The phenomenon of aggregates falling off the pavement surface under the action of traffic due to the reduction or disappearance of the viscosity of the binder;
- 2) Element requirements: "Allowed/Not Allowed" shall be used to indicate the applicability of ADS to the relevant road types.

6.2.1.2.3 Road surface covering

The description and element requirements of this ODC basic element are as follows:

- Description: Other materials on the road surface, such as mud, ice, leaves, oil stains, stagnant water, water marks and other coverings;
- Element requirements: The road surface coverings allowed or not allowed by ADS, as well as the degree of permission, shall be stated.

6.2.1.3 Road geometry**6.2.1.3.1 Plane**

This ODC basic element contains the following subdivided ODC basic elements; their descriptions and element requirements are as follows.

a) Straight road:

- 1) Description: Road with plane straight line characteristics;
- 2) Element requirements: "Allowed/Not allowed" shall be used to indicate the applicability of ADS to this ODC basic element.

This ODC basic element contains the following subdivided ODC basic elements; their descriptions and element requirements are as follows.

a) Separation:

- 1) Description: The road uses separation facilities to separate traffic in the same direction or two directions, motor vehicles and non-motor vehicles, vehicles and pedestrians;
- 2) Element requirements: "Allowed/Not allowed" shall be used to indicate the applicability of ADS to this ODC basic element.

b) Cross slope:

- 1) Description: The cross slope of each component of the road width and roadside strip. Refers to the cross slope of the road surface, separation strip, sidewalk, green belt, etc., expressed as a percentage;
- 2) Element requirements: The range of cross slope allowed or not allowed by ADS shall be described.

c) Superelevation:

- 1) Description: In order to offset the centrifugal force generated when vehicles travel on a flat curve section, a one-way cross slope with a higher outer side than the inner side is set on the cross section of the section;
- 2) Element requirements: The range of cross slope allowed or not allowed by ADS shall be described.

d) Sidewalk:

- 1) Description: The part of the road that is separated by curbs, guardrails and other similar facilities for human traffic;
- 2) Element requirements: "Allowed/Not allowed" shall be used to indicate the applicability of ADS to this ODC basic element.

6.2.1.4 Lane characteristics

6.2.1.4.1 Road traffic markings

This ODC basic element contains the following subdivided ODC basic elements; their descriptions and element requirements are as follows.

a) Marking quality:

- 1) Description: The quality of road traffic markings;

- 2) Element requirements: The quality of road traffic markings allowed or not allowed by ADS shall be described, such as clarity, blur, etc.

b) No road traffic markings:

- 1) Description: The road has no road traffic markings;
- 2) Element requirements: "Allowed/Not allowed" shall be used to indicate the applicability of ADS to this ODC basic element. If necessary, the loss of road traffic markings allowed or not allowed by ADS can be described. The road traffic marking loss characteristics allowed or not allowed by ADS, such as the maximum length, can be further described.

c) Marking color:

- 1) Description: The color of the road traffic marking;
- 2) Element requirements: The road traffic marking color allowed or not allowed by ADS shall be described. The specific marking color shall comply with GB 5768.3.

d) Marking type:

- 1) Description: Road traffic marking type;
- 2) Element requirements: The road traffic marking type allowed or not allowed by ADS shall be described. The specific marking type shall comply with GB 5768.3.

e) Marking width:

- 1) Description: The width of the road marking;
- 2) Element requirements: The road traffic marking width allowed or not allowed by ADS shall be described. The specific marking width shall comply with GB 5768.3.

6.2.1.4.2 Lane type

This ODC basic element contains the following subdivided ODC basic elements; their descriptions and element requirements are as follows.

a) Non-motorized vehicle lane:

- 1) Description: A lane dedicated to non-motorized vehicles (except for special circumstances);
- 2) Element requirements: "Allowed/Not Allowed" shall be used to describe the

1) Description: Generally used in expressways or highways, it refers to a lane adjacent to the right-hand motor vehicle lane, including a hard shoulder, with a certain width and length that can meet the parking needs of motor vehicles;

2) Element requirements: "Allowed/Not Allowed" shall be used to describe the applicability of ADS to this ODC basic element.

i) Road exit:

1) Description: A road exit marked with road exit markings, used to guide vehicles to exit;

2) Element requirements: "Allow/Not Allowed" shall be used to explain the applicability of ADS to this ODC basic element.

j) Road entrance:

1) Description: A road entrance marked with road entrance markings, used to guide vehicles to enter;

2) Element requirements: "Allow/Not Allowed" shall be used to explain the applicability of ADS to this ODC basic element.

k) Total number of lane types:

1) Description: The total number of lane types supported by ADS during driving operation;

2) Element requirements: The number range of lane types allowed or not allowed during ADS operation shall be explained.

6.2.1.4.3 Number of lanes

The description and element requirements of this ODC basic element are as follows:

- Description: Used to describe the number of lanes;
- Element requirements: The range of lane numbers allowed or not allowed for ADS operation shall be stated.

6.2.1.4.4 Lane width

The description and element requirements of this ODC basic element are as follows:

- Description: Used to describe the lane width applicable to different types of vehicles and speed ranges;
- Element requirements: The range of lane widths allowed or not allowed for ADS operation shall be stated.

6.2.1.5 Road edge

6.2.1.5.1 Guardrail

The description and element requirements of this ODC basic element are as follows:

- Description: A longitudinal energy-absorbing structure that absorbs collision energy by self-deformation or vehicle climbing, thereby changing the direction of vehicle travel, preventing the vehicle from going out of the road or entering the opposite lane, minimizing the damage to the occupants;
- Element requirements: "Allowed/not allowed" shall be used to indicate the applicability of ADS to this ODC basic element.

6.2.1.5.2 Curb

The description and element requirements of this ODC basic element are as follows:

- Description: Strip structure between the outer side of the road pavement layer and the shoulder;
- Element requirements: "Allowed/Not Allowed" shall be used to indicate the applicability of ADS to this ODC basic element.

6.2.1.5.3 Temporary road edge

The description and element requirements of this ODC basic element are as follows:

- Description: Temporary structure between the outer side of the road pavement layer and the shoulder, such as short columns;
- Element requirements: "Allowed/Not Allowed" shall be used to indicate the applicability of ADS to this ODC basic element.

6.2.1.5.4 Hard shoulder

The description and element requirements of this ODC basic element are as follows:

- Description: Strip part connected to the driving lane with a certain road surface strength;
- Element requirements: "Allowed/Not Allowed" shall be used to indicate the applicability of ADS to this ODC basic element.

6.2.1.5.5 Dirt shoulder

The description and element requirements of this ODC basic element are as follows:

- Description: Dirt shoulder of a certain width outside the road surface layer, in

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