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**Requirements and methods for the road testing of motor
vehicle braking performance based on GNSS**

基于全球卫星导航的机动车制动性能路试检验要求和方法

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1 Scope

China's national requirements and methods for road testing vehicle braking performance using satellite navigation. Measuring a braking test has traditionally meant a fifth wheel or an optical sensor mounted on the vehicle, both of which are cumbersome to fit and prone to their own errors. A GNSS receiver, particularly one using carrier phase and a correction service, measures position and velocity directly to centimetre accuracy at high rate, from which the deceleration, the stopping distance and the initial speed all follow without contact with the road. That makes the test far quicker to set up and removes the calibration of the measuring device from the result. What the method has to fix is everything that then determines whether two tests are comparable - the surface, its condition, the load, the tyre state and the initial speed - since braking distance is far more sensitive to those than to the instrument.

This document specifies the requirements, test methods, data processing and test records for road test of motor vehicle braking performance based on GNSS. This document applies to road test inspection of motor vehicle braking performance.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the version corresponding to that date is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

GB 7258-2017, Technical specifications for safety of power-driven vehicles operating on

roads

GB/T 39267-2020, Terminology for BeiDou navigation satellite system (BDS)

GB/T 39399-2020, General specification for BeiDou navigation satellite system geodetic receiver

3 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in GB 7258-2017, GB/T 39267-2020, and GB/T 39399-2020, apply.

3.1 real-time kinematic; RTK A type of GNSS relative positioning technology that mainly achieves high-precision dynamic relative positioning through real-time data links between base stations and mobile stations and carrier relative positioning fast solution technology. [Source: GB/T 39267-2020, 2.3.38]

3.2 GNSS: Global Navigation Satellite Systems MFDD: Mean Fully Developed Deceleration PPS: Pulse per Second UTC: Coordinated Universal Time

5.1 Environmental conditions

5.1.1 Ambient temperature: 0 °C ~ 40 °C.

5.1.2 The wind speed shall not exceed 3 m/s.

5.1.3 The relative humidity shall not exceed 95%.

5.1.4 When there are special requirements for environmental conditions, the corresponding test methods shall be followed.

5.2 Test road

5.2.1 The test road shall be a flat, clean, dry, and homogeneous concrete or asphalt pavement with good adhesion properties.

5.2.2 The longitudinal slope of the effective test section of the test road shall not be greater than 1.0% within any 50 m length, and the transverse slope shall not be greater than 2.0%.

5.2.3 The test road shall be located in an open area with no strong electromagnetic interference nearby.

5.2.4 When there are special requirements for the test road, the corresponding test method regulations shall be implemented.

5.3 Inspection parameters The motor vehicle braking performance road test process shall include the following parameters:

a) time (t_i), in seconds (s);

b) vehicle speed (v_i), in kilometers per hour (km/h);

c) brake pedal actuation time (t_{a0}), in seconds (s);

d) vehicle position (x_i, y_i, z_i), in meters (m);

6.1.1 The tires on the same axle shall be of the same model and specification, with basically the same tread depth and normal tire pressure; the tire bolts and half-axle bolts shall be complete and tightened; the tread and sidewall of the tire shall not have cracks and cuts longer than 25 mm or deep enough to expose the tire cord layer, as well as other defects, abnormal wear and deformation that affect use.

6.1.2 For vehicles using pneumatic brakes, the air reservoir pressure shall comply with the relevant requirements of

7.8.1 of GB 7258-2017.

6.1.3 For vehicles using a vacuum power servo system, ensure that there is sufficient vacuum when starting to brake.

6.1.4 The steering wheel of the vehicle under test shall be flexible, easy to operate, and free of sticking. When the vehicle under test is driving normally, the gear shifting shall be normal, and there shall be no wheel sticking or locking. When the vehicle under test is braking, the brake pedal shall operate normally and respond quickly.

6.2 Preparation of instruments and equipment

6.2.1 For local base stations, the base station GNSS antenna shall be installed in a relatively open environment, relatively high terrain, with no signal reflectors (large water areas, large buildings, etc.) around, and stable ground, away from electromagnetic interference such as TV transmission towers and mobile phone signal transmission antennas.

6.2.2 For the local reference station, it shall be turned on and preheated before the test begins to ensure that the reference station obtains its own accurate position information.

6.2.3 The main antenna of the RTK receiver shall be placed in the center of the vehicle.

6.2.4 The main antenna and directional antenna of the RTK receiver shall be in an open and unobstructed position, and there shall be no relative displacement between them and the vehicle body during the entire test process.

6.2.5 Install the pedal switch or pedal force meter on the brake pedal.

6.2.6 Check that the instrument is turned on and warmed up to ensure that the RTK is in a fixed solution state.