Research report on the comparison between Chinese and German ICV type approval systems

VDA

GPQI
Dialogues for Innovation and Trade

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

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Title: zinetroN/Shutterstock

On behalf of
German Federal Ministry for Economic Affairs and Climate Action (BMWK)
Berlin, Germany 2023
Beijing, China 2023

The German Federal Ministry for Economic Affairs and Climate Action (BMWK) has commissioned the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH to implement the Global Project Quality Infrastructure (GPQI).

Implemented by

Federal Ministry for Economic Affairs and Climate Action

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

This publication is a result of the Sub-Working Group (SWG) Automotive Safety of the Sino-German Accreditation and Conformity Assessment Working Group in cooperation with the National Certification and Accreditation Administration of the People's Republic of China (CNCA).

CNCA

Partners involved

Sino-German Accreditation and Conformity Assessment Working Group (WGACA)
The WGACA was established as a result of the close cooperation between the German Federal Ministry for Economic Affairs and Climate Action (BMWK) and the National Certification and Accreditation Administration of the People's Republic of China (CNCA) since 2013, governed by the BMWK/CNCA Cooperation Agreement.

Since June 2019, the cooperation has been further strengthened by a Memorandum of Understanding between BMWK and the State Administration for Market Regulation of the People's Republic of China (SAMR). The WGACA operates independently and complements the existing Sino-German Working Group on Product Safety, which previously dealt with accreditation and conformity assessment issues.

The main objective of the WGACA is to promote the bilateral harmonisation of accreditation and conformity assessment procedures. It aims to improve market access opportunities for products and testing bodies from both Germany and China.

Sub-Working Group Automotive Safety Project Line 1:
Technical Innovation and Technical Harmonization
In 2014, the Sub-Working Group (SWG) Automotive Safety was set up as an exchange platform for the automotive industry and relevant authorities to engage in regulatory dialogue. The objective of all activities under the SWG is to address urgent challenges regarding the safety and the trade of automotive products and components. Further, it is the SWG's objective to contribute to the enhancement of product safety and the reduction of technical barriers to trade.

The Project Line 1 (PL1) under the framework of the WGACA aims to promote harmonization of homologation and certification requirements, in particular for innovative automotive technologies. It serves as an exchange mechanism between the German automotive industry, conformity assessment bodies, and CNCA. At the technical level, PL1 includes industrial representatives from German OEMs, suppliers and certification bodies that are operating in China. The technical lead is VDA China, which gathers industry concerns to address them in one voice. On the Chinese side, major certification bodies that are designated by CNCA to offer compulsory certification services for automotive products are participating in PL1 activities.

VDA | German Association of the Automotive Industry

VDA

The German Association of the Automotive Industry (VDA) was founded in 1901 and headquartered in Berlin with more than 650 member companies. They develop innovative mobility services and produce automobiles, trailers, bodies, buses, automotive parts and accessories in Germany and worldwide. The task of the VDA is to ensure the right framework conditions so that companies, from start-ups to global corporations, can realize their visions and successfully bring their offers to market. VDA is also the organizer of the top auto show IAA (IAA Mobility & IAA Commercial Vehicles) in Germany with over 120-year history.

中国汽车工业协会
China Association of Automobile Manufacturers

CAAM

The China Association of Automobile Manufacturers (CAAM) was established in 1990 in Beijing. CAAM is a permanent member of the World Organization of Automobile Manufacturers (OICA) and has established close contacts with international automotive industry organizations and automotive related organizations in many countries and regions. CAAM is consisted of 8 Departments, 42 Branches (including preparation), and 20 Working Platforms. CAAM has over 3300 membership units, widely distributed in various sectors such as automotive manufacturing, parts, etc.

GPQI
Dialogues for Innovation and Trade

Global Project Quality Infrastructure

To promote the development of well-functioning and internationally coherent quality infrastructures, the German Federal Ministry for Economic Affairs and Climate Action (BMWK) has established the Global Project Quality Infrastructure (GPQI). GPQI supports the political and technical dialogues and implements bilaterally agreed activities in collaboration with all relevant stakeholders. The project aims to reduce technical barriers to trade and enhance product safety through bilateral political and technical dialogues on QI with some of Germany's key trading partners.

Contents

Contents

1. Overview

1.1 Abstract

The report collects and introduces type approval-related administrative provisions and technical regulations, as well as their drafts in China, Germany and across the European Union, and analyses similarities and differences between the relevant technical requirements and test methods herein. The aim is to improve mutual understanding and communication between the Chinese and German automotive industries on technical regulations relating to ntelligent and Connected Vehicles (ICVs), thus promoting exchange and cooperation between the two countries on type approval for ICVs and related products.

1.2 Introduction

Intelligent and connected vehicles, ICVs, are vehicles equipped with advanced on-board sensors, controllers, actuators, etc., which can exchange and share intelligent information with X (vehicle, road, human, cloud, etc.) based on modern communication and network technologies, with functions that include even complex environmental perception, intelligent decision-making, cooperative control, etc. Vehicles are transformed from a 'hardware-based' industrialised product to a new mobile intelligent terminal, thanks to integration with artificial intelligence (AI), big data, cloud computing and other relevant technologies. Such intelligent iteration can significantly improve traffic safety, save energy and reduce emissions, ease traffic congestion, enhance traffic efficiency and drive the integrated development of sectors including automobiles, electronics and communication.

China's ICV industry has continued its rapid growth over the past two years. In 2021, China's intelligent connected passenger car sales exceeded 3.032 million units, up 107% year-on-year, with the market penetration rate reaching around 15%. The new car market penetration rate of China's L2 intelligent connected passenger cars (dominated by electric new energy vehicles) was approaching 20% in the same year, and regular passenger- or cargo-carrying tests and demos of high-level ICVs were performed in many places across China.

According to statistics from the National Development and Reform Commission (NDRC), China's intelligent vehicle penetration rate will reach 82% in 2025 and 95% in 2030; the car parc for this category will be 38 million. Against the backdrop of declined overall sales of passenger cars, the ICV market has still grown significantly against all odds, indicating that ICVs already occupy a place in the market by virtue of good user experience.

As the industry enters a rapid growth phase, China has incorporated ICV development into national top-level planning and formed an all-round support system. ICV-related laws and regulations released in succession have further cleared the way for the industrialisation of ICVs. In March 2021, Article 155 of the Road Traffic Safety Law (Revised Draft) provided for road tests, road access, data recording, driver supervision, accident liability determination, testing of autonomous driving functions, etc. for vehicles with autonomous driving functions. The revised draft clarified the legality of ICV testing and road access for the first time from the perspective of higher-level law, and now plays a guiding role in the formulation of subsequent regulations and departmental rules.

In April 2021, the Ministry of Industry and Information Technology (MIIT) released the Guideline for the Administration of the Access of Ntelligent and Connected Vehicle Manufacturers and Products (Trial) (Draft for Comments) to set out requirements for product safety from the perspec-

tive of the 'multi-pillar approach'. This entails test requirements for functional safety, safety of the intended functionality (SOTIF), simulation, road test, cybersecurity, software upgrades and data storage. In July 2021, the MIIT, Ministry of Public Security and Ministry of Transport jointly issued their Management Specifications for Road Testing and Demonstration Application of Intelligent and Connected Vehicles (Trial), proposing specific requirements for ICVs on road testing and demonstration operation concerning seven aspects. These include road testing and demonstration subjects, drivers and vehicles, road testing applications, demonstration applications, road testing and demonstration management, etc., and thus lay a solid policy and regulatory basis for the industrialisation of ICVs.

In addition, in August 2021, the Opinions on Strengthening the Management of Intelligent and Connected Vehicle Manufacturers and Product Access issued by MIIT put forward clear requirements for enterprises in dimensions such as data strengthening and cybersecurity management, regulation of online software updates, optimisation of product management and implementation of supporting measures, further clarifying the requirements and guidelines for market players and products.

In order to support the national policies and comprehensively promote the development of technologies and standards for the V2X industry, as well as to promote healthy and sustainable growth across the entire market, in 2018 the MIIT and Standardization Administration of China (SAC) formulated and released Guidelines on Building National V2X Industry Standards System. This made clear that the construction objectives of the standards system should be based on current ICV technologies, the needs of industrial applications and future development trends.

An ICV standards system applicable to China's national conditions and in line with international standards should be established by stages. The ICV standards system initially formed in 2020, which supports driver assistance and low-level autonomous driving, will be converted to one that supports high-level autonomous driving by 2025. More than 100 ICV-related standards will be developed, covering intelligent automatic control, connected cooperative decision-making technologies and technical requirements and evaluation methods relating to autonomous driving functions and performance in typical scenarios, so as to promote the integrated development of 'intelligent + connected' ICVs and facilitate comprehensively the adoption of relevant technologies and products. In March 2022, MIIT announced the key points of automotive standardisation, emphasising the need to continue improving the top-level design of standards and accelerate the development of standards in emerging sectors, especially in the field of ICVs.

By establishing an all-round standards system for ICVs, we will guide and drive the development of ICV technologies and application of relevant products, foster an independent environment for ICV technology innovation in China, improve China's overall technology competence and international competitiveness, and therefore build a safe, efficient, healthy and intelligent automotive ecosystem for the future.

On 2 November 2022, the Ministry of Industry and Information Technology (MIIT) of the People's Republic of China issued a Notice on Carrying out the Pilot Work of ICV Access and Road Traffic (Draft for Comments) to solicit public opinion on access and road traffic access for Intelligent and Connected Vehicles (ICVs).

The main pilot includes the following contents: on the basis of the National Intelligent and Connected Vehicle Test and Demonstration Application Program, the Ministry of Industry and Information Technology and Ministry of Public Security will select eligible vehicle manufacturers and ICVs equipped with autonomous driving functions that meet the conditions for mass production to carry out tests on selected public roads in pilot cities; ICV products that have passed the access pilot may carry out the road traffic pilot in the limited public road area of the pilot city; notably, the autonomous driving function carried by ICVs hereinafter refers to Level 3 (conditional autonomous driving) and Level 4 (highly autonomous driving) functions defined in the national stan-

dard Taxonomy of Driving Automation for Vehicles (GB/T 40429-2021).

At the same time, EU countries are also actively planning and investing into the field of ICVs. Statistics show that the EU has invested more than EUR 5.7 billion in the R&D of ICVs and autonomous driving technologies every year since 2019, which accounts for over 28% of annual total R&D investment for the entire EU and has top ranking for this region. Now with global opportunities for ICV development, EU countries have accelerated their strategic deployment to promote industrialisation of the sector by issuing top-level policies and plans, formulating/revising relevant regulations, incentivising technology R&D and supporting road testing demonstration and operation projects.

As a party to the UN Vienna Convention on Road Traffic, Germany's autonomous driving sector is also bound by the Convention. In March 2016, the UN had Article 8 of the Convention amended to allow the responsibility of driving a vehicle to be handled by autonomous driving technologies in transport, provided that the technologies are in full compliance with relevant UN vehicle regulations or can be turned off/overridden by the driver. In addition, in May 2017, Germany enacted the world's first autonomous driving-related law, the Eighth Act Amending the Road Traffic Act, which permits autonomous driving systems rather than humans to drive vehicles under certain conditions.

The EU is also actively promoting research and development of ICV standards and regulations. In December 2019, Regulation (EU) 2019/2144 passed by the European Parliament and the Council, which updated existing technical requirements for certain items, introduced alternative regulations (UNECE) for some items to enhance coordination of global technical regulation, and planned for the addition of around 20 new ICV certification items (including areas of software updates, vehicle resistance to cyberattack, driver assistance systems, conditional automated driving systems, etc.).

The release of the new Regulation (EU) 2019/2144 provides a clear direction both for development of the EU automotive industry and in terms of the overall requirements and timeline for the work of its technical committees on relevant standards and regulations.

Intelligent connectivity – the core of future competition in the auto sector – is of great strategic significance in promoting the transformation and upgrading of this sector in all countries. To further strengthen cooperation between China and Germany in the automotive market and drive ICV development in both countries, former premier Li Keqiang and former Chancellor Angela Merkel met in Germany in July 2018 for discussions on how to intensify bilateral cooperation in the automotive industry.

Witnessed by these two important figures, China and Germany signed the Joint Declaration of Intent on Cooperation in the Field of Automated and Connected Driving, and in so doing established a high-level dialogue mechanism to strengthen multi-level exchanges and cooperation between government departments, industry organisations, and enterprises in the field of automated and connected driving.

Based on the above-mentioned information, this report will focus on existing regulations in China, Germany and the EU that relate to access for ICV products, and analyse the corresponding technical standards that have been released or are under formulation to support further implementation of the Joint Declaration.

2. Similarities and differences between China and Germany in the ICV type approval management system

2.1 Comparison of mandatory management provisions

China's mandatory regulations on motor vehicle products and their manufacturers principally include for vehicles made in China the Administrative Regulations on Admission of Road Motor Vehicle Manufacturers and Products and Regulations on the Access Management of New Energy Vehicle Manufacturers and Products; for imported vehicles there exists the Detailed Implementation Rules for China Compulsory Certification – Vehicles.

Both the regulations for vehicles made in China and those for imported vehicles are based on high-level laws, including the Product Quality Law of the People's Republic of China and the Standardization Law of the People's Republic of China.

These aim to regulate the admission of road motor vehicle manufacturers and products, thereby safeguarding the lives of citizens, property safety and public safety, protecting the environment and promoting development of the auto industry. The regulation currently in force in the EU is Regulation (EU) 2018/858 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles.

This regulation implements what is stated in Article 26(2) of the Treaty on European Union[1] , cornerstone of the EU, that 'the internal market shall comprise an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured, while the rules shall be clear, transparent, consistent and effective to provide clarified legal certainty for the benefit of companies and consumers.

At the same time, it establishes a comprehensive legal framework for market access and market surveillance of motor vehicles and related products, so as to safeguard the safety of life and property of all road traffic participants as well as protect the environment.

China and Germany share a high degree of consistency in the management of motor vehicle products, both aiming to protect the safety of consumers, road traffic participants and the environment. In terms of management concepts, both countries have put forward a series of requirements covering the entire product life cycle, from product type approval and factory review prior to launch through to product consistency verification and market supervision post launch.

This high degree of consistency has laid solid foundations for discussion and cooperation between the two sides on anything new encountered in the development of the automotive industry, particularly in the field of ICVs.

As the framework regulation for motor vehicle products in the EU, Regulation (EU) 2018/858 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units contains provisions from the content perspective on relevant processes and various types of templates, as well as those on technical requirements for specific certification items; from the structural point of view, there are provisions for single certification items, such as Directive 2005/64/EC on recovery rate, and also small framework rules for one specific area or several areas, such as

[1] Treaty on European Union, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A12012E%2FTXT

Regulation (EU) 2019/2144 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, which covers the majority of requirements for type approval of EU vehicles relating to intelligent connectivity. As described in the Introduction section of the report herein, discussions on development of the Regulation were initiated as early as 2014 by a wide range of government authorities, auto industry representatives and other stakeholders in EU member states, before it was formally put forward as a legislative proposal in 2017 and finally published officially in December 2019. It contains the following functional certification requirements for ICVs:

Table 1: Certification items and standards

Certification items	Implementing standards
Advanced emergency braking systems phase II: pedestrians and cyclists	(UN R 152)
Pedestrian and cyclist collision warning	(UN R 159)
Blind spot information system	(UN R 151)
Reversing detection	(UN R 158)
Lane departure warning system	(UN R 130)
Emergency lane-keeping system	(Del. Reg.)
Advanced emergency braking system	(EU)2021/646)
Advanced emergency braking systems phase I: obstacles and moving vehicles	(UN R 131)
Protection of vehicle against cyberattacks	(UN R 152)
Intelligent speed assistance	(UN R 155)
Emergency stop signal	(Del.Reg.(EU)2021/1958)
Driver drowsiness and attention warning	(UN R 48)
Advanced driver distraction warning	(Del. Regulation (EU) 2021/1341)
Driver availability monitoring system	(Del. Regulation (EU) 2023/XXXX)
Event data recorder	(UN R 157)
Systems to replace the driver's control of the vehicle, including signaling, steering, accelerating and braking	(UN R 160)
Systems to provide the vehicle with real-time information on the state of the vehicle and the surrounding area	(UN R 157)
Platooning	(UN R 157)
Systems to provide safety information to other road users	_

At the time the regulation was released, although nearly 20 ICV-related certification items were clearly proposed – including mandatory installation requirements and mandatory installation requirements for L3 and above only – most of the certification items did not correspond to any type approval technical requirements or testing methods (corresponding implementing technical standards only available for lane departure warning systems and advanced emergency braking systems used for heavy vehicles for many years). Although incomplete, this sub-framework regulation provided greater policy transparency to the whole industry as early as possible, especially to those non-EU enterprises not involved in the drafting process (in particular, Chinese companies planning to export to the EU), and helped companies to understand at an early stage the EU competent authorities' new certification requirements over the next 3 to 5 years for ICV functions. Moreover, it has helped to focus corporate resources in following the drafting process of relevant technical regulations or standards, and contributes to timely development or improvement of products, so as to meet future certification requirements. Following publication of sub-framework Regulation (EU) 2019/2144 – general safety requirements in the field of ICV in December 2019, the official regulations below and Regulation (EU) 2019/2144 – general safety regulation – secondary legislation[2] were also published in the EU from 2020 to 2021 to supplement the previously vacant implementing standards (see the implementing regulations in parentheses in Table 1).

Table 2: Implementing regulations

Release date	Regulation name
6 April 2021	Comission Implementing Regulation (EU) 2021/535 laying down rules for the application of Regulation (EU) 2019/2144 of the European Parliament and of the Council as regards uniform procedures and technical specifications for the type-approval of vehicles, and of systems, components and separate technical units intended for such vehicles, as regards their general construction characteristics and safety General structure implementing regulation, which integrates a number of previously separate regulations and updates some of the technical requirements, including those on nameplates, licence plate mounting space, wipers, wheel guards, defrost and defogging, traction devices, anti-splash systems, shift instructions, operability, reverse gear, etc.
20 April 2021	Comission Implementing Regulation (EU) 2021/646 laying down rules for the application of Regulation (EU) 2019/2144 of the European Parliament and of the Council as regards uniform procedures and technical specifications for the type approval of motor vehicles with regard to their emergency lane-keeping systems (ELKS) ELKS implementing regulation, which specifies uniform procedures and technical specifications for ELKS type approval.
30 July 2021	Comission Delegated Regulation (EU) 2021/1243 supplementing Regulation (EU) 2019/2144 of the European Parliament and of the Council by laying down detailed rules concerning the alcohol interlock installation facilitation in motor vehicles and amending Annex II to that Regulation Alcohol interlock installation facilitation (interface) delegated regulation, which requires mandatory installation of interfaces for alcohol interlocks in compliance with relevant EN standards.

[2] General Safety Regulation – Secondary Legislation, https://ec.europa.eu/docsroom/documents/48576

Release date	Regulation name
16 August 2021	Comission Delegated Regulation (EU) 2021/1341 supplementing Regulation (EU) 2019/2144 of the European Parliament and of the Council by laying down detailed rules concerning the specific test procedures and technical requirements for type approval of motor vehicles with regard to their driver drowsiness and attention warning systems and amending Annex II to that Regulation. Driver drowsiness and attention warning (DDAW) delegated regulation, which provides for testing procedures and technical requirements for DDAW type approval. It should be noted that this regulation applies mainly to driver attention detection systems based on vehicle motion parameters, driver (steering) input, and distance between the outer edge of the wheels and the lane lines. The unified process and technical requirements for the certification of camera-based driver attention detection systems will be specified in a separate delegated regulation, scheduled for release in 2023.
17 November 2021	Comission Delegated Regulation (EU) 2021/1958 supplementing Regulation (EU) 2019/2144 of the European Parliament and of the Council by laying down detailed rules concerning the specific test procedures and technical requirements for type approval of motor vehicles with regard to their intelligent speed assistance systems and for type approval of those systems as separate technical units, amending Annex II to that Regulation ISA delegated regulation, which specifies the testing procedures and technical requirements for ISA system type approval.

With the introduction of the above regulations, in particular the secondary legislation, a clear trend (certification items) towards the certification management of ICV functions for vehicle type approval has been set in the EU; following this, the implementing technical standards for each new certification item have gradually been completed. For UNECE regulations in parentheses, if these are going to be released by the EU, then they will be similar to the announcement on adjustment of the standard for compulsory certification of automotive products issued by China's Certification and Accreditation Administration (CNCA) (e.g. Announcement [2019] No. 6)[3] or the management notice issued by the Equipment Industry Development Center of MIIT (e.g. Equipment Center [2020] No. 103).[4]

The regulation is currently reported to WTO/TBT (G/TBT/N/EU/878). The release of such delegated regulations means that the EU has established a comprehensive type-approval requirement system (certification items, applicable vehicle types, implementing time and standards) for functions similar to those described for Level 0-3 in China's GB/T 40429-2021 Taxonomy of Driving Automation for Vehicles, including especially certification management requirements and technical requirements for cybersecurity and software updates. For fully automated vehicles[5] at L4 and above, relevant EU authorities have also gathered national authorities, industry bodies and corporate technical experts from member states since 2021 to discuss and draft regulations for the next step of type approval reform in the following two aspects:

- Revise Regulation (EU) 2018/858, the overall framework for vehicle type approval in the EU, and identify for such products the certification items, applicable vehicle types and implementing time. This part has been reported to the WTO / TBT.[6]

[3] https://www.cnca.gov.cn/zwxx/gg/2019/art/2023/art_9974da006f-9847669fe0cc39c5f1b9b6.html
[4] http://www.miit-eidc.org.cn/art/2020/4/7/art_360_5423.html
[5] 'fully automated vehicle' means a motor vehicle that has been designed and constructed to move autonomously without any driver supervision;
[6] https://www.epingalert.org/en#/browse-notifications/details/91766

- Make new regulations and modify Regulation (EU) 2019/2144, the EU general safety regulation, and provide for the type-approval process and technical requirements for such products. The draft regulation has been notified to the WTO/TBT (G/TBT/N/EU/884).

China's motor vehicle product access system includes mainly the Detailed Implementation Rules for China Compulsory Certification[7], governed by CNCA, and the Administrative Regulation on Admission of Road Motor Vehicle Manufacturers and Products[8] and Administrative Regulation on Admission of New Energy Vehicle Manufacturers and Products[9], governed by MIIT, containing both the certification process and capability and technical requirements for manufacturers and road motor vehicle products.

With the respect to ICVs, China has not yet issued administration measures containing clear certification items, applicable vehicle types or implementing time and standards; however, the MIIT has provided the following guidelines and management advice in 2021 for the problems manifested in the booming development of the ICV industry:

- Guideline for the Administration of the Access of Intelligent and Connected Vehicle Manufacturers and Products (Trial) (Draft for Comments)
- Opinions on Strengthening the Management of Intelligent and Connected Vehicle Manufacturers and Product Access
- Several Provisions on the Management of Automobile Data Security (for Trial Implementation)
- Notice on Strengthening the Cybersecurity and Data Security of V2X.

In spite of the absence of explicitly proposed certification items and technical requirements, these documents reflect to a certain extent the competent authorities' competence requirements for enterprises, the importance attached to relevant functions, and the overall requirements for road testing, functional safety, data security, cybersecurity, etc.

Based on the departmental regulations set out above and the following construction guidelines for standards systems, which were in part formulated and issued by MIIT, enterprises will find it easier to sort out key standards and begin developing and rectifying their products as early as possible.

- Guidelines for the Construction of the V2X Industry Standards System (Intelligent and Connected Vehicles)
- Guidelines for the Construction of the V2X Industry Standards System (Electronic Products and Service Standards System)
- Guidelines for the Construction of the V2X Industry Standards System (Vehicle Intelligent Management)
- Guidelines for the Construction of the V2X Industry Standards System (Intelligent Transport Related)
- Guidelines for the Construction of V2X Cybersecurity and Data Security Standards System

With more diversified ICV products and a higher assembly rate in the Chinese market, MIIT and other relevant authorities are leading certification and testing institutions as well as top companies in the industry to jointly investigate the current market situation and progress in formulating international standards and regulations, and also to develop an access management approach for ICVs that ia applicable to the Chinese market.

In order to make the management approach more practical for enterprises and more secure for consumers and road traffic participants, MIIT and other relevant authorities are planning to assemble a few enterprises in a number of cities to conduct actual road tests with vehicles to ensure that the new management approach effectively addresses the issues arising from development of the industry, rather than over-constraining new growth in the ICV sector. This will help ensure that the industry's development is healthy, high speed and of high quality.

[7] https://www.cnca.gov.cn/zwxx/gg/2020/art/2022/art_23593a70a58b43a4ba08bf85428fa010.html
[8] http://www.gov.cn/gongbao/content/2019/content_5380357.htm
[9] http://www.gov.cn/xinwen/2020-08/19/content_5535780.htm

Table 3: Differences in the management systems for access and certification of automotive products between China and Germany

Role	German authority	Concordance with international standards
Formulation of product access-related mandatory standards	National Technical Committee of Auto Standardization (China Automotive Technology and Research Center Standardization Institute)	Technical Committee – Motor Vehicles/GROW – Internal Market, Industry, Entrepreneurship and SMEs/ EU Commission
Review of product access and type approval	Enterprise and product access: Equipment Industry Development Center of MIIT Compulsory product certification: coordinated and managed by CNCA and implemented by the designated compulsory product certification company	Competent organisations[10] for type approval in each member state (Germany: KBA)
Testing organisations	CATARC Automotive Test Center (Tianjin) Co., Ltd. China Automotive Engineering Research Institute Co., Ltd. Shanghai Motor Vehicle Inspection Certification & Tech Innovation Center Co., Ltd. China Merchants Testing Vehicle Technology Research Institute Co., Ltd. Xiangyang Da'an Automobile Inspection Centre Co., Ltd. Changchun Automobile Testing Center Co., Ltd.	See relevant German testing organisations at[11] , including but not limited to: DEKRA Automobil Test Center der DEKRA Automobil GmbH SGS-TÜV Saar GmbH TÜV SÜD Auto Service GmbH Technischer Dienst der TÜV Rheinland Kraftfahrt GmbH TÜV NORD Mobilität GmbH & Co. KG IFM - Institut für Fahrzeugtechnik und Mobilität

[10] Motor vehicles – Approval authorities in the Member States https://ec.europa.eu/docsroom/documents/48035
[11] ttps://www.kba.de/EN/Themen_en/Typgenehmigung_en/Benennung_Technischer_Dienste_en/Benannte_techn_dienste_en/benannte_techn_dienste_node_en.html

Based on the above introduction to exploration into the reform of ICV type-approval certification and management by China and the EU respectively, it can be concluded that both sides are highly consistent in the management of traditional road motor vehicle product certification; both have seized new opportunities for development of the auto industry (ICV technology), formulated or amended relevant regulations and departmental rules based on their respective national conditions to lift unreasonable constraints in the market, and both have provided guidance on problems encountered in industry development, thus improving the original access management system and establishing a type-approval management system and technical standards compatible with ICV technologies.

However, due to differences between the two sides in the legal status of access management documents for vehicle type approval, as well as differences in the development path of companies and development stage of ICV technologies, the EU's regulations and draft bills are mostly planned and published early, and therefore require more comments and more frequent revisions, leading to a more comprehensive management system; China, on the other hand, on the premise of ensuring safety, grants more opportunities to the industry to conduct various pilots, so that more management experience can be accumulated before gradually arriving at an allround ICV management approach.

As two powerhouses in the global automotive industry, China and Germany share a high degree of consistency in their access management methods for road motor vehicle products. This goes hand in hand with widespread and sustained cooperation results between the two countries and their enterprises throughout the electrification process for automobiles.

Given the challenges of ICV transformation, if the two sides can enjoy further extensive and detailed exchanges and cooperation in management methods and related implementing standards, greater effective guidance will be available for future development of the auto industry in the two countries, and will provide greater protection to the safety of consumers and road traffic participants on both sides, thus promoting the globalisation of enterprises in both countries and consolidating their respective positions in the global auto market.

3. Similarities and differences between Chinese and German standards on ICV type approval

3.1 Driver assistance systems

3.1.1 Advanced Emergency Braking System (AEBS) for passenger cars

3.1.1.1 Regulation/standard briefing

GB/T 39901-2021 Performance Requirements and Test Methods for Advanced Emergency Braking System (AEBS) of Passenger Cars, a recommended Chinese national standard, shall apply to M1 vehicles equipped with AEBS.

UN Regulation No. 152 Uniform provisions concerning the approval of motor vehicles with regard to the Advanced Emergency Braking System, adopted by the EU for whole vehicle type approval and mandatory installation, shall apply to M1 and N1 vehicles fitted with an AEBS.

3.1.1.2 Analysis of main similarities and differences

The Chinese standard provides for C2C, while R152 specifies C2C, C2B and C2P. The similarities and differences between the two in the case of C2C are shown in Table 4.

Table 4: AEBS standards differences

Function		GB GB/T 39901-2021	EU UN Regulation No. 152	Remarks
Scope	/	**1.** The Chinese standard specifies terms and definitions, technical requirements and test methods for AEBS of passenger cars. The Chinese standard shall apply to M1 vehicles equipped with AEBS.	**1.** This UN Regulation shall apply to the approval for vehicles of Category M1 and N1 with regard to an on-board system to **(a)** avoid or mitigate the severity of a rear-end in-lane collision with a passenger car; **(b)** avoid or mitigate the severity of an impact with a pedestrian; **(c)** avoid or mitigate the severity of an impact with a bicycle.	The UN regulation sets a wider AEB objective scope.
Performance requirements	**Collision warning time**	**4.3** The subject vehicle shall use at least two modes of acoustic, tactile and optical early warnings 1s before the start of the emergency braking phase at the latest.	**5.2.1.1** When a collision is imminent with a preceding vehicle of Category M1 – driving in the same lane and with a relative speed above the speed up to which the subject vehicle is able to avoid collision – at least two modes of acoustic, tactile and optical warning shall be triggered at the latest 0.8s before the start of emergency braking. However, in case the collision cannot be anticipated in time to give a collision warning 0.8s ahead of emergency braking, a collision warning shall be provided no later than the start of emergency braking intervention.	Chinese standard: 1s; EU regulation: 0.8s; R152 provides for emergency circumstances that cannot be alarmed earlier.
	Warning signals after system failure	**4.4** The always-on optical warning signal, which meets the requirements, will be activated at the latest when the vehicle reaches a speed greater than 15km/h for 10s. As long as the failure exists and the vehicle is at a standstill after turning the ignition switch off and then on again, the failure warning signal will be re-illuminated immediately.	**5.1.4.1.2** If the system has not been initialised after a cumulative driving time of 15s above a speed of 10km/h, information about this status will be indicated to the driver. This information will continue until the system has been successfully initialised.	The driving distance is the same despite different driving times and speeds.

Table 4: AEBS standards differences

Function		GB GB/T 39901-2021	EU UN Regulation No. 152	Remarks
Performance requirements	Emergency braking deceleration	**3.7** The subject vehicle decelerates with a deceleration of at least 4 m/s² under the control of AEBS	**5.2.1.2** When the system has detected the possibility of an imminent collision, there will be a braking demand of at least 5.0 m/s² to the service braking system of the vehicle.	Chinese standard: 4 m/s²; EU regulation: 5 m/s²
	Speed scope	**4.3.1** The system will operate normally between a vehicle speed of 15 km/h and the maximum operating speed of the AEBS system in all vehicle load conditions, unless deactivated.	**5.2.1.3** The system will be active at least within the vehicle speed range of 10 km/h to 60 km/h and in all vehicle load conditions, unless deactivated.	The Chinese standard has more elastic requirements for normal working speed.
Test requirements	/	**Five test scenarios:** **5.3** Start-up test under stationary target conditions **5.4** Start-up test under moving target conditions **5.5** Start-up test under braking target conditions **5.6** Warning signal detection test after system failure **5.7** Driver intervention performance test **Two error response scenarios:** **5.8** Error response performance of vehicles in adjacent lanes **5.9** Error response test of iron plate in lane	**Four test scenarios:** **6.4** Start-up test under stationary target conditions **6.5** Start-up test under moving target conditions **6.6** Start-up test with a pedestrian target **6.7** Start-up test with a bicycle target **Four error response scenarios** (Annex II Appendix 2): 1. Turn at intersection 2. Turn while following other cars 3. Place target outside the curve 4. Change lanes as indicated by traffic signs	Different test scenarios

In terms of the test requirements for test scenarios, UN R152 differs greatly from GB/T 39901-2021. The differences are briefed below, with the same contents being omitted.

Notably, there are two kinds of test mass stipulated in UN R152: the maximum mass and the mass of a vehicle in running order. Maximum mass refers to the maximum mass stated by the vehicle manufacturer to be technically permissible (this mass may be higher than the 'permissible maximum mass' laid down by the national administration).

Mass of a vehicle in running order means the mass of an unladen vehicle with bodywork,

including coolant, oils, at least 90% of fuel, 100% of other liquids, driver (75 kg) but excluding used waters, tools and spare wheels.

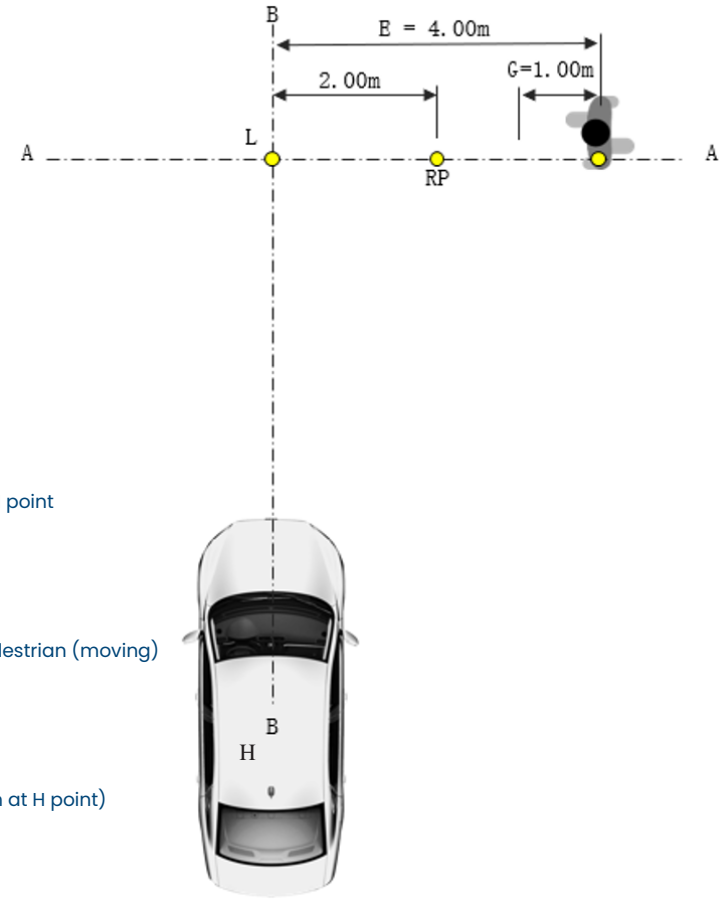
For the test scenarios specified in UN R152, both maximum mass and mass of a vehicle in running order need to be tested and have corresponding pass criteria. However, according to the definition of the mass of a vehicle in running order, if the test vehicle is fitted with test equipment and there is an equipment operator sitting in the front passenger seat, the total mass will exceed the mass of a vehicle in running order and the pass criteria should then be based on the maximum mass. It is therefore recommended to give priority to the test scenarios under maximum mass load.

UN R152 also lays down rules on C2P, C2B and robustness as follows.

a) Start-up test with a child pedestrian target (see 5.2.2 and 6.6 in UN R152)

The start-up test with a child pedestrian target under UN R152 specifies that the unobstructed crossing child will have a lateral speed of not more than 5 km/h, without provisions for crossing direction. The test vehicle speed ranges between 20 km/h and 60 km/h.

In accordance with the CPNC scenario in Euro NCAP 2020, the recommendation is to test the CPNC in an unobstructed state, as shown below:



Axle

AA -Pathway of dummy pedestrian at H point

BB -Central axle of subject vehicle

Distance

G-Acceleration distance of dummy pedestrian (moving)

Point

L-Collision point in CPNC-50

RP-Reference point (Dummy pedestrian at H point)

Figure 1: Child pedestrian crossing scenario

b) Start-up test with a bicycle target (see 5.2.3 and 6.7 in UN R152)

The start-up test with a bicycle target under UN R152 specifies that the unobstructed crossing bicycle will have a lateral speed of 10-15 km/h, without provision for crossing direction. The test vehicle speed ranges between 20 km/h and 60 km/h.

In accordance with the CBNA scenario in Euro NCAP 2020, the recommendation is to first test the CBNA in an unobstructed state, as shown below:

c) Four error response scenarios (see Annex 3 – Appendix 2 in UN R152)

In addition to normal test scenarios, the UN R152 also provides for functional safety, i.e. four error response scenarios. However, the test requirements have been loosened as appropriate and vehicle manufacturers may submit any one or more forms of proof, such as simulation results, real test data, tracking test data, etc.

d) Robustness (see 6.10 in UN R152)

UN R152 specifies the pass rate of scenarios (i.e. robustness), where the vehicle-to-vehicle and vehicle-to-pedestrian failure rate should not be greater than 10% of the total number of tests, and car-to-bicycle failure rate not greater than 20% of the total number of tests.

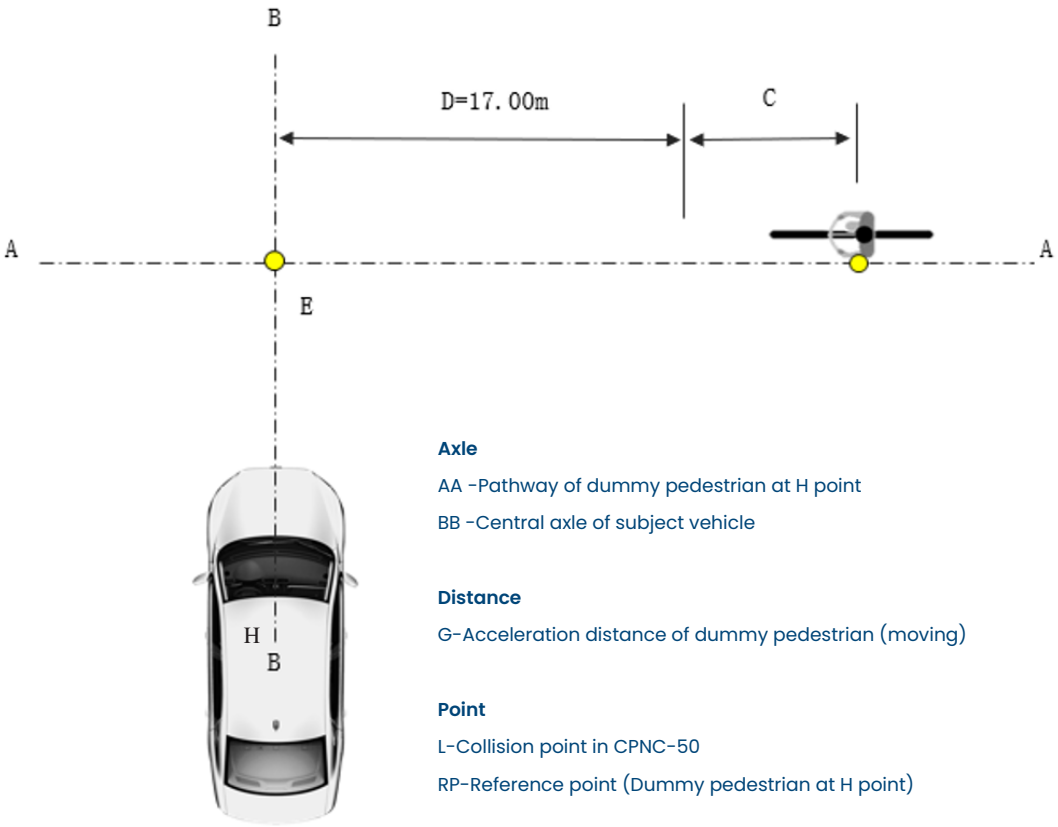


Figure 2: Bicycle crossing scenario

3.1.1.3 Type approval

The respective type approval time is shown below.

Table 5 Standard type approval for AEBS for passenger cars

Standard	Approval	Implementation content	Time
GB/T 39901-2021	Not incorporated, to be discussed	/	/
UN Regulation No. 152	Incorporated	Vehicle-to-vehicle Vehicle-to-pedestrian/ bicycle	B C, D

Table 6 Type approval timeline

Type	Non-approved vehicle type	Approved vehicle type
A	2020.07.06 (as from the date when GSR took effect)	
B: Car2Car	2022.07.06	2024.07.07
C: Car2Pedestrian	2024.07.07	2026.07.07
D: Car2Bycycle	2026.01.07	2029.01.07

Note: The specified approval time in subsequent chapters is the same as in this table.

3.1.1.4 Summary

GB/T 39901-2021 and UN R152 stipulate basically the same, with the exception of some GB/T 39901 indexes which set stricter requirements. To be more specific, UN R152 contains broader requirements for tests and sets out four error response scenarios as well as robustness test requirements.

In terms of type approval and access, GB/T 39901-2021 entered into force on 1 October 2021, with the approval time still under discussion; the vehicle-to-vehicle provisions of UN R152 entered into force on 6 July 2022 for non-approved vehicle types and will come into force on 7 July 2024 for type-approved vehicles; the vehicle-to-pedestrian/bicycle provisions of UN R152 will be extended for two years on top of this.

3.1.2 AEBS for commercial vehicles

3.1.2.1 Regulation/standard briefing

GB/T 38186-2019 Performance Requirements and Test Methods for Advanced Emergency Braking System (AEBS) of Commercial Vehicles, a recommended Chinese national standard, specifies the terms and definitions, technical requirements and test methods for AEBS for commercial vehicles. The standard shall apply to M2, M3 and N vehicles equipped with AEBS.

UN R131 – Uniform provisions concerning the approval of motor vehicles with regard to the Advanced Emergency Braking Systems (AEBS), adopted by the EU for whole vehicle type approval and mandatory installation, shall apply to M2, M3, N2 and N3 vehicles configured with AEBS.

3.1.2.2 Analysis of similarities and differences

With regards to the performance and functional safety requirements for AEBS testing in commercial vehicles, GB/T 38186-2019 and UN R131 stipulate basically the same with minor differences in test content.

The former sets out driver intervention performance testing to measure how driver intervention acts on the system during test warning and emergency braking, whereas the latter specifies a deactivation test to see whether AEBS can be deactivated as required, as shown in Table 7.

Table 7: Commercial vehicle AEBS standards differences

Function		GB GB/T 38186-2019	EU UN Regulation No. 131	Remarks
Test requirements	/	**Five test scenarios:** **5.4** Start-up test under stationary target conditions **5.5** Start-up test under moving target conditions **5.6** Warning signal detection test after system failure **5.7** Driver intervention performance test **5.8** Error response test	**Five test scenarios:** **6.4** Start-up test under stationary target conditions **6.5** Start-up test under moving target conditions **6.6** Warning signal detection test after system failure **6.7** System deactivation test **6.8** Error response test	Test scenario differences

3.1.2.3 Type approval

The respective type approval time is shown below:

Table 8: Commercial vehicle AEBS type approval

Standard	Approval	Implementation content	Time
GB/T 38186-2019	Incorporated	The AEBS shall be installed in buses and coaches with a length of more than 11m; M_2, M_3 and N vehicles must meet the standard requirements if equipped with an AEBS.	2022.7.8
UN Regulation No. 131	Incorporated	M_2, M_3, N_2, N_3	A

3.1.2.4 Summary

With regard to the performance and functional safety requirements for AEBS testing of commercial vehicles, GB/T 38186-2019 and UN R131 stipulate basically the same with minor differences in test content. The former incorporates a driver intervention performance test to measure how driver intervention acts on the system during test warning and emergency braking, whereas the latter specifies a deactivation test to see whether AEBS can be deactivated as required.

For type approval and access, GB/T 38186-2019 came into effect as of 1 May 2020 and will be certificated from 8 July 2022, and mandatory from 1 July 2023, while UN R131 became valid as of 6 July 2020.

3.1.3 Lane Keeping Assist (LKA)

3.1.3.1 Regulation/standard briefing

GB/T 39323-2020 Performance Requirement and Testing Method for Lane Keeping Assist (LKA) Systems of Passenger Cars is a recommended Chinese national standard that specifies the requirements, test conditions and test methods for LKAs in passenger cars. The standard shall apply to M1 vehicles fitted with an LKA system.

UN Regulation No. 79 – Uniform provisions concerning the approval of vehicles with regard to steering equipment, adopted by EU for whole vehicle type approval, specifies the requirements, test conditions and test methods for CSF, ACSF and ESF. The regulation shall apply to M, N and O vehicles equipped with steering equipment.

3.1.3.2 Analysis of main similarities and differences

GB/T 39323-2020 only specifies LKA functions, while UN R79 provides for low-speed parking, lane centering, automated lane keeping, emergency lane keeping, lane departure, etc. The intelligent driver assistance steering systems specified in UN R79 include Automatically Commanded Steering Function (ACSF) (Category A including RCP, Category B including B1 & B2, plus Category C, D and E), Corrective Steering Function (CSF), and Emergency Steering Function (ESF), as correlated in the table below:

Table 9: Specified functions in UN R79

System		APA	RCP	LDP	ELK	LKA	ALC
ACSF of Category A	Automatically commanded steering function Designed to assist driver when driving below 10km/h or parking.	✓	✓	–	–	–	–
ACSF of Category B1	L2.0, Lane Centering Control, Hands-on	–	–	–	–	o	–
ACSF of Category B2	L2.5, Lane Centering Control, Hands-off	–	–	–	–	✓	–
ACSF of Category C	L2.0, driver determines the lane to change to and activate it	–	–	–	–	–	o
ACSF of Category D	L2.5, vehicle determines the lane to change to and driver confirm it	–	–	–	–	–	✓
ACSF of Category E	L3.0, vehicle changes the lane continuously	–	–	–	–	–	✓
CSF	Corrective Steering Function	–	–	o	–	–	–
ESF	Emergency Steering Function	–	–	–	o	–	–

Note: ✓ represents systems with technical requirements in ECE_R79; O represents systems with technical requirements and test methods in ECE_R79.

To better distinguish the two, Table 10 compares GB/T 39323-2020 and UN R79 with regard to ACSF for Category B1, while other contents of UN R79 will be discussed later.

Table 10: LKA standards differences

Functions	GB	EU	Remarks
	GB/T 39323-2020	UN Regulation No. 79	
General requirements	**4.1.2** The system shall at least have lane departure prevention or lane centering control functions.	Three functions of CSF, ACSF and ESF are stipulated.	GB/T 39323-2020 adopts IDT method for the parts that are identical in technical content and structure.
Performance requirements	**4.2.1** The function of lane departure prevention shall ensure that the lane departure does not exceed 0.4m outside the lane boundary line; the function of lane centering control shall ensure that lane departure does not exceed the outside lane boundary line. **4.2.2** The longitudinal deceleration of the vehicle caused by the lane departure prevention function shall be no more than 3m/s2, and the reduction in vehicle speed shall be no more than 5m/s. **4.2.3** The lateral acceleration of the vehicle caused by the system activation shall be no greater than 3m/s2, and the rate of change of the lateral acceleration of the vehicle shall be no great than 5m/s3. **4.2.4** The system shall operate normally within the speed range of at least 70-120km/h.	**5.6.2** Special provisions for ACSF of Category B1 (related to lane keeping) **5.6.2.1.1** The vehicle does not cross a lane marking for lateral accelerations below the maximum lateral acceleration at 3m/s2. **5.6.2.1.2** The vehicle shall be able to activate and deactivate ACSF of Category B1. **5.6.2.1.3** The moving average over half a second of the lateral jerk generated by the system shall not exceed 5m/s3. **5.6.2.2.5** When the system is active and in the speed range between 10km/h or Vsmin whichever is higher, and Vsmax, it shall provide a means of detecting that the driver is holding the steering control. If, after a period of no longer than15 seconds the driver is not holding the steering control, an optical warning signal shall be provided. This signal may be the same as the single specified below in this paragraph. The optical warning signal shall indicate to the driver to place their hands on the steering control.	GB/T 39323-2020 adopts IDT method for the parts that are identical in technical content and structure. UN R79 requires monitoring of whether the driver places their hands on the steering wheel.
Test requirements	**Three tests:** **6.2** Straight lane departure prevention test **6.3** Curve lane departure prevention test **6.4** Lane centering control test	**Test of ACSF of Category B1:** • Lane keeping test • Maximum lateral acceleration test • Overriding force test • Hands-off test	GB/T 39323-2020 adopts IDT method for the parts that are identical in technical content and structure.

3.1.3.3 Other systems with technical requirements and test methods in UN R79

In terms of test content, UN R79 also specifies CSF, ESF and ACSF of Category C in addition to ACSF of Category B1, as seen in the table below.

Table 11: Other test contents of UN R79

Test system	CSF	ESF	ACSF of Category C
Test contents	Warning test	a_i/a_ii category scenario test	Lane change function test
	Overriding force test	a_iii category scenario test	Minimum activation speed test
	—	b category scenario test	Overriding force test
	—	Performance test for vehicle-free lane	Lane change prevention test
	—	(a_i/a_ii/a_iii/b category scenario test)	Sensor performance test
	—	ESF error response test in b category scenario	Sensor failure test
	—	—	Engine start/stop activation conditions test

Table 12: a & b category scenario

No.	ESF	Descriptions	Remarks
1	a_i category scenario	Another vehicle driving in an adjacent lane in the reverse direction drifts towards the path of the subject vehicle, with collision risks.	2.3.4.3_(a)_(i)
2	a_ ii category scenario	Another vehicle driving in an adjacent lane in the same direction departs from the path of the subject vehicle, with collision risks.	2.3.4.3_(a)_(ii)
3	a_iii category scenario	Subject vehicle changes to the path of an adjacent vehicle and is likely to collide with it.	2.3.4.3_(a)_(iii)
4	b category scenario	An obstacle obstructing the path of the subject vehicle or when the obstruction of the subject vehicle's path is deemed imminent.	2.3.4.3_(b)

It merits note that UN R79 requires subject vehicles to complete all scenario tests with lane lines and without lane lines with regard to ESF testing.

3.1.3.4 Type approval

The respective type approval time is shown below:

Table 13: Type approval

Standard	Approval	Implementation content	Time
GB/T 39323-2020	not incorporated	/	/
UN Regulation No. 79	incorporated	/	B

3.1.3.5 Summary

In a nutshell, GB/T 39323-2020 specifies only the LKA function of vehicles, while EU R79 widely covers low-speed parking, lane centering, automated lane keeping, emergency lane keeping and lane departure.

The two norms basically stipulate the same concerning LKA function, with UN R79 setting a good example for other counterparts to set other functional requirements.

With regard to type approval and access, GB/T 39323-2020 took effect on 1 June 2021, but with approval time to be determined. UN R79 entered into effect on 6 July 2022 for non-approved vehicles, and will come into force on 7 July 2024 for type-approved vehicles.

3.1.4 Emergency Lane Keeping Assist (ELKS)

3.1.4.1 Regulation/standard briefing

Regulation (EU) 2021/646 – Uniform procedures and technical specifications for type approval of motor vehicles with regard to their Emergency Lane Keeping Systems (ELKS) is a compulsory EU regulation that specifies the requirements, test conditions and test methods for the Lane Departure Warning System (LDWS) and Corrective Directional Control Function (CDCF), and shall apply to M1 and N1 vehicles equipped with ELKS and other functions.

3.1.4.2 Analysis of main similarities and differences

The current Chinese standards do not stipulate ELK function separately.

GB/T 39323-2020, mentioned above, provides for a lane departure function which is similar to CDCF in ELKS; the similarities and differences between the two functions are detailed below:

Table 14: ELKS standards differences

Function		GB	EU	Remarks
		GB/T 39323-2020	Regulation (EU) 2021/646	
Performance requirements	1. LDWS	/	**3.5.1** The LDWS shall be active at least within the vehicle speed range between 65 km/h and 130 km/h (or the maximum vehicle speed if it is lower than 130 km/h) and under all vehicle load conditions, unless deactivated as per Article 3.2.	
	2. CDCF	**4.2.1** The function of lane departure prevention shall ensure that the lane departure does not exceed 0.4m outside the lane boundary line. **4.2.2** The longitudinal deceleration of the vehicle caused by the lane departure prevention function shall be no more than 3m/s2, and the reduction in vehicle speed shall be no more than 5m/s-2. **4.2.4** The system shall operate normally within the speed range of 70-120km/h.	**3.6** The CDCF shall be active at least between 70 km/h and 130 km/h (or the maximum vehicle speed if it is below 130 km/h) and at all vehicle load conditions, unless deactivated as per Article **3.2.** However, in the event of the vehicle reducing its speed from above 70 km/h to below 70 km/h, the system shall be active at least until the vehicle speed falls below 65 km/h. **3.6.4** Every CDCF intervention shall immediately be indicated to the driver.	IDT
Test requirements	/	**Three tests:** **6.2** Straight lane departure prevention test **6.3** Curve lane departure prevention test **6.4** Lane centering control test	**Two tests:** **1. LDW test** • Visual warning signal verification • Lane departure warning test • Deactivation test **2. CDCF test** • Warning indication test • Steering override test • Lane keeping test	GB/T 39323-2020 requires performance of curve and straight lane departure test, while EU R2021/646 focuses only on straight solid-line lanes.

EU R2021/646 stipulates the application scope and test content of LDWS and CDCF in detail. The CDCF warning indication test requires CDCF to trigger two or more interventions in a short time, in order to indicate how the warning signals vary. The steering override test calls for driver intervention in the course of CDCF activation, to check whether the function can operate normally.

Although categorised as EU regulations, EU 2021/646 and EU R79 differ from each other. In EU R79, the LKA functions of ASCF for Category B1 include correction or centering, while in EU 2021/646, CDCF functions only include correction and the lane lines involved are solid.

There are no corresponding national standards issued in China, so EU 2021/646 and EU R79 could hopefully provide reference.

3.1.4.3 Type approval

The respective type approval time is shown below:

Table 15: Type approval

Standard	Approval	Implementation content	Time
Regulation (EU) 2021/646	Incorporated	M1	B
		N1	B

3.1.4.4 Summary

EU 2021/646 is a compulsory EU regulation that specifies the requirements, test conditions and test methods for LDWS and CDCF. The regulation shall apply to M1 and N1 vehicles fitted with KLKS and related functions. There are no national standards in China that are completely equivalent.

3.1.5 Automated Lane Keeping Assist (ALKS)

3.1.5.1 Regulation/standard briefing

The Technical Requirements and Testing Methods for Combined Driver Assistance System of Intelligent and Connected Vehicles – Part 1: Single-lane Manoeuvre is a recommended Chinese national standard that shall apply to M and N vehicles equipped with the single-lane manoeuvre (combined driver assistance) system.

UN Regulation No. 157 – Proposal for a new UN Regulation on uniform provisions concerning the approval of vehicles with regards to Automated Lane Keeping System is a compulsory EU standard that shall apply to M1 vehicles equipped with an ALKS.

3.1.5.2 Analysis of main similarities and differences

The similarities and differences between the two are detailed as follows on page 30.

Table 16: ALKS standards differences

Function		GB	EU	Remarks
		Single-lane manoeuvre	UN R157	
General requirements	Speed range	/	**5.2.3.1** The maximum speed up to which the system is permitted to operate is 60 km/h.	/
	Minimum following distance	/	**5.2.3.3** The activated system shall detect the distance to the vehicle i n front as defined in paragraph 7.1.1 and shall adapt the vehicle speed in order to avoid collision. While the ALKS vehicle is not at standstill, the system shall adapt vehicle speed so that the distance to a vehicle in the same lane ahead is equal to or greater than the minimum following distance.	/
Performance requirements	Object & event detection and response	/	**7.1.1** The manufacturer shall declare the forward detection range measured from the forward most point of the vehicle. This declared value shall be at least 46m. **7.1.2** The manufacturer shall declare the lateral detection range. The declared range shall be sufficient to cover the full width of the lane immediately to the left and of the lane immediately to the right of the vehicle.	UN R157 sets requirements for lateral & longitudinal detection range.
	Lateral control	Requirements are made for the maximum lateral acceleration permitted at different speed, allowing for overshooting.	/	/
	Longitudinal control	Requirements are made for the acceleration, deceleration and variation of deceleration permitted at different speed	/	/

Table 16: ALKS standards differences

Function		GB	EU	Remarks
		Single-lane manoeuvre	UN R157	
Storage system	/	/	**8** Each vehicle equipped with ALKS (the system) shall be fitted with a DSSAD that meets the requirements specified below. Fulfilment of the provisions of Article 8 shall be demonstrated by the manufacturer to the technical service department during inspection of the safety approach as part of the assessment to Annex 4.	UN R157 requires ALKS-enabled vehicles to install data storage system.
Test requirements	/	**Four tests:** **6.5** Straight single-lane manoeuvre test **6.6** Hand-off warning test **6.7** Maximum lateral acceleration test **6.8** Detection coverage test	**Six tests:** • Lane keeping • Avoid a collision with a road user or object blocking the lane • Following a lead vehicle • Lane change of another vehicle into lane • Stationary obstacle after lane change of the lead vehicle • Field of view test	The single-lane manoeuvre part sets a clear scenario while UN R157 does not and involves many tests.

With regard to ALKS, the Chinese standard and UN R157 stipulate differently, as detailed below:

For general requirements, UN R157 permits the system to operate at a maximum speed of 60km/h, which is rather low, whereas the Chinese standard does not specify in this regard and the function is available in all speed ranges. After a lead vehicle is detected, UN R157 makes detailed provisions for the following distance at each speed, and this is not referred to in Part 1 Single-lane Manoeuvre and only mentioned at limited length in Part 2 Multi-lane Manoeuvre.

For performance requirements, UN R157 stipulates the lateral and longitudinal detection range of objects, whereas the Chinese standard makes detailed requirements for lateral and longitudinal acceleration at all speeds. In addition, UN R157 stipulates that ALKS-enabled vehicles must install DSSAD to record data during driving.

For test requirements, the Chinese standard sets a clear scenario, while UN R157 does not and involves many tests.

3.1.5.3 Type approval

The respective type approval time is shown below:

Table 17: Type approval

Standard	Approval	Implementation content	Time
Technical Requirements and Testing Methods for Combined Driver Assistance System of Intelligent and Connected Vehicles – Part 1: Single-lane Manoeuvre	/	/	/
Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems	Incorporated	/	Valid (L3) as of 1 July 2022

3.1.5.4 Summary

In terms of ALKS, the Technical Requirements and Testing Methods for Combined Driver Assistance System of Intelligent and Connected Vehicles and UN R157 stipulate differently, as seen below. For general requirements, UN R157 permits the system to operate at a maximum speed of 60km/h, whereas the Chinese standard does not specify in this regard. After a lead vehicle is detected, UN R157 makes detailed provisions for the following distance at each speed.

For performance requirements, UN R157 stipulates the lateral and longitudinal detection range of objects, whereas the Chinese standard makes detailed requirements for lateral and longitudinal acceleration at all speeds. In addition, UN R157 stipulates that ALKS-enabled vehicles must install DSSAD to record data during driving. For test requirements, the Chinese standard sets a clear scenario while UN R157 does not and involves many tests.

With regard to type approval and access, the Technical Requirements and Testing Methods for Combined Driver Assistance System of Intelligent and Connected Vehicles – Part 1: Single-lane Manoeuvre is still draft for review with time for approval to be determined, and UN R157 was amended in July 2022.

3.1.6 Intelligent Speed Assistance (ISA)

3.1.6.1 Regulation/standard briefing

The Performance Requirements and Test Methods for Intelligent Speed Limit System of Vehicles (Draft for Review) is a recommended national standard. The standard specifies the general requirements, performance and test methods for the intelligent speed limit system (ISLS). The standard shall apply to M and N vehicles equipped with an ISLS;

Commission Delegated Regulation (EU) 2021/1958 supplementing Regulation (EU) 2019/2144 of the European Parliament and of the Council by laying down detailed rules concerning the specific test procedures and technical requirements for type approval of motor vehicles with regard to their intelligent speed assistance systems and for type approval of those systems as separate technical units, and amending Annex II to that Regulation, as compulsory EU regulations, apply to vehicles of Category M and N equipped with intelligent speed-limit system, as well as those installed with an approved ISA system as STU.

3.1.6.2 Analysis of main similarities and differences

The similarities and differences between the two are shown in table 18 (p 36):

Table 18: ISA standards differences

Function		Performance Requirements and Test Methods for Intelligent Speed Limit System of Vehicles (Draft for Review)	REGULATION (EU) 2021/1958	Remarks
Terms & definitions		**3.** Terms & definitions	**ANNEX1-1** Definitions	IDT
General requirements		**4.** General requirements	**ANNEX1-1** General technical requirements	IDT
Specific technical requirements	1. Permissible speed error	Null	**3.2.4** The speedometer speed is considered equal to the perceived speed limit if the speedometer speed indication is within 1.0 km/h over the perceived speed limit.	EU regulation clearly sets an allowable speed error.
Performance requirements	1. Speed limit indication function (SLIF)	**5.1.1** Tested as per Article 6.4.1, the system shall meet the following requirements: **a)** the speed limit information shall be displayed no later than 2 seconds after the headway plane exceeds the speed limit sign; **b)** a minimum threshold of display distance for the system is specified (Table 1).	**3.4.1.2** In the absence of conditions leading to deactivation of the system in accordance with Clauses 3.2.1 and 3.2.2, the SLIF display shall display the perceived speed limit to the driver at least when the speedometer speed is greater than the perceived speed limit, for speeds of 5 km/h or less	The Chinese national standard lays down detailed rules on speed limit indication distance at each vehicle speed.

Table 18: ISA standards differences

Function		Performance Requirements and Test Methods for Intelligent Speed Limit System of Vehicles (Draft for Review)	REGULATION (EU) 2021/1958	Remarks
Performance requirements	2. Speed limit warning function (SLWF)	**5.2.2** The following requirements shall be fulfilled by each type of indication: **a)** The optical signal shall be provided within 1.5 seconds and easily recognisable and noticeable by the driver, apparently differing from intelligent speed limit display information. Optical signal and other additional information can be leveraged to indicate the magnitude of the speed limit exceeded. **b)** Where an acoustic signal is employed, the signal shall be easily recognisable and noticeable by the driver and may be continuous or intermittent. The acoustic warning may be varied to indicate the magnitude of the speed limit exceeded and the system may interrupt the acoustic signal after 2 seconds of indication. **c)** Where a haptic signal is employed, the signal shall be easily recognisable and noticeable by the driver and provided directly or indirectly through the accelerator control. This can be achieved by increasing the restoring force of the accelerator control or by vibrating the accelerator control. The haptic signal vibration frequency or other means easily noticeable by driver may be varied to indicate the magnitude by which the perceived speed limit has been exceeded.	**3.5.2.1** Visual warning and cascaded acoustic or visual warning and cascaded haptic warning. **3.5.2.1.1** The visual warning shall be noticeable and easily recognisable by the driver and be provided by flashing of the SLIF display or flashing of an additional optical signal adjacent to the SLIF display. It shall be provided within 1.5 seconds from when the speedometer speed exceeds the perceived speed limit and last until at least 5.0 seconds after the timeout of the cascaded acoustic or cascaded haptic warning or until the speedometer speed is less than or equal to the perceived speed limit when this occurs earlier. **3.5.2.1.2** The cascaded acoustic warning shall be noticeable by the driver, unique and easily recognisable and be provided by a continuous or intermittent sound signal or by vocal information. Where vocal information is employed, the vehicle manufacturer shall ensure that it is easily configurable by the driver to use any of the EU official languages. The acoustic warning may be varied to indicate the magnitude or time by which the perceived speed limit has been exceeded. **3.5.2.1.3** The cascaded haptic warning shall be noticeable by the driver and be provided directly or indirectly through the accelerator control when the driver maintains an application force as well as a driving speed that exceeds the perceived speed limit. This shall be achieved by any of the following: (a) increasing the restoring force of the accelerator control; or (b) vibrating the accelerator control. **3.5.2.1.4** The cascaded acoustic warning and cascaded haptic warning shall be provided for constant vehicle speeds when any of the following conditions are met:	With regard to speed limit warning, the EU regulation makes clear provisions on warning duration and cascade warning details, which are absent in the Chinese standard. The EU regulation allows deployment of haptic warning only, whereas the Chinese standard does not.

Table 18: ISA standards differences

Function		Performance Requirements and Test Methods for Intelligent Speed Limit System of Vehicles (Draft for Review)	REGULATION (EU) 2021/1958	Remarks
Performance requirements	2. Speed limit warning function (SLWF)		**(a)** speedometer speed ≥ 130 % perceived speed limit, for 3.0 seconds and longer; **(b)** speedometer speed ≥ 120 % perceived speed limit, for 4.0 seconds and longer; **(c)** speedometer speed ≥ 110 % perceived speed limit, for 5.0 seconds and longer; **(d)** speedometer speed > 100 % perceived speed limit, for 6.0 seconds and longer. The system may be designed in such a way that it employs a linearly interpolated time between the respective speed and time values for points (a) and (d). Detailed rules are made on the warning duration above. Articles 3.5.2.1.5 to 3.5.2.1.8 lay down provisions concerning cascaded warnings, which are absent in the Performance Requirements and Test Methods for Intelligent Speed Limit System of Vehicles. The EU regulation allows deploament of haptic warning only, whereas the Chinese standard does not.	
Test requirements	1. Speed limit indication function (SLIF)	**Two tests:** **6.4.1** Threshold of display distance test **6.4.2** Continuous speed limit sign identification test	**Three tests:** **4.1** Perceived speed limit determination through observation of explicit speed limit signs test **4.2** Perceived speed limit determination through observation of implicit road signs and signals test **4.3** Real-world driving reliability test	Overall, the EU regulation sets forth more tests and adds reliability test requirements. For speed control function, the EU regulation adds acceleration test, deactivation test and override test compared to the Chinese counterpart.
	2. Speed control function (SCF)	**One test:** **6.6** Response test	**Four tests:** **4.5.3.1** Acceleration test **4.5.3.2** Response test **4.5.3.3** Deactivation test **4.5.3.4** Override test	

In summary, compared to the Chinese counterpart, the EU regulation lays down more detailed rules concerning intelligent speed assistance with clearer test divisions.

In terms of performance requirements, the Chinese standard makes two requirements for speed limit information display: a) the speed limit information shall not be later than 2 seconds after the headway plane exceeds the speed limit sign; b) the minimum threshold of display distance shall meet the requirements contained in Table 1.

The Chinese standard lays down clear rules on the display distance at each vehicle speed, whereas the EU regulation only makes similar provisions for point a) without detailed rules on the threshold of display distance. As for speed limit warning, the EU regulation sets clear requirements for the warning duration and cascade warning details, which are absent in the Chinese standard. The EU regulation allows deployment of a haptic warning, whereas the Chinese counterpart does not.

Regarding test requirements, it is noteworthy that the EU regulation adds robustness test and includes an acceleration test, deactivation test and override test for speed control function compared to the Chinese standard.

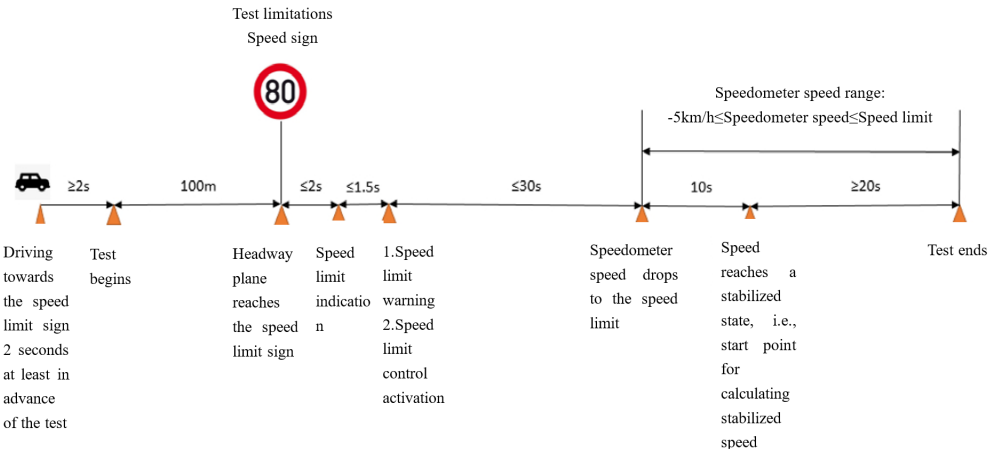


Figure 3: Test flow for Intelligent Speed Limit Control

3.1.6.3 Type approval

The respective type approval time is shown below.

Table 19: Type approval

Standard	Status	Approval	Implementation content	Time
Performance Requirements and Test Methods for Intelligent Speed Limit System of Vehicles	Approved	/	/	/
REGULATION (EU) 2021/4455	Issued	Incorporated	All	B

3.1.6.4 Summary

In terms of the definition of and general requirements for intelligent speed assistance, the Chinese standard and EU regulation are similar, with appropriate variations in line with respective national circumstances. With regard to performance, EU Regulation 2021/1958 sets out more detailed requirements, in particular for speed limit warnings.

For speed limit warning requirements, the EU regulation sets out clear provisions on warning duration and cascade warning details, which are unavailable in the Chinese standard. The EU regulation allows deployment of haptic warning only, whereas the Chinese standard does not. With regard to test requirements, it is worth noting that the EU regulation adds robustness test requirements and entails more test items for the speed control function test.

As for type approval and access, the Performance Requirements and Test Methods for Intelligent Speed Limit System of Vehicles (Draft for Review) is still at the approval stage, while Regulation (EU) 2021/1958 came into force on 6 July 2022 for non-approved vehicles and will do so on 7 July 2024 for approved vehicles.

3.1.7 Driver Drowsiness and Attention Warning (DDAW) (ISA)

3.1.7.1 Regulation/standard briefing

GB/T 41797-2022 Performance Requirements and Test Methods for Driver Attention Monitoring Systems is a recommended national standard. The standard specifies the terms, definitions, requirements and test methods for DDAW. The standard shall apply to M and N vehicles configured with DDAW systems.

Regulation (EU) 2021/1341 – Type approval of motor vehicles with regard to their Driver Drowsiness and Attention Warning Systems stipulates that the system shall be installed in all M and N vehicles designed to operate at a maximum speed over 70km/h.

3.1.7.2 Analysis of main similarities and differences

The similarities and differences between the two are shown in table 20 (p 41):

Table 20: DDAW standards differences

Function		GB GB/T 41797-2022	EU REGULATION (EU) 2021/1341	Remarks
General requirements		**4.1** Functional requirements **4.2** Self-check **4.3** State conversion and warning requirements **4.4** Failure warning **4.5** Electromagnetic compatibility	**2.1** Functional requirements **2.2** Error response avoidance **2.3** Privacy and personal information protection	Despite dimensional differences, the EU regulation does not specify requirements for state conversion and warning, while laying down requirements for failure warning and electromagnetic compatibility in other chapters, but it supplements rules concerning personal data privacy and protection. The data collected and recorded by the system shall be used in a closed manner and it is not permitted to collect personal biometric information for facial recognition. In terms of error response rate, the EU regulation sets only qualitative requirements and does not give any quantitative requirements, as the Chinese standard does.

Table 20: DDAW standards differences

Function		GB GB/T 41797-2022	EU REGULATION (EU) 2021/1341	Remarks
Technical requirements	1. Activation methods	**4.1.2** Once powered on and self-checked normally, the system shall be automatically activated through either or both of the following methods: • Power-on activation: Once powered on and self-checked normally, the system shall be automatically activated; • Minimum speed activation: the system shall be automatically activated at a minimum activation speed.	**3.1.4** The DDAW system shall be automatically activated above the speed of 70 km/h. **3.1.5** Once activated, the DDAW system shall operate normally within the speed range of 65-130 km/h or the vehicle's maximum allowed speed, whichever is lower. The DDAW system shall not be automatically deactivated at speeds above 130 km/h (although the system's behaviour can be adapted to the degraded situation).	In light of activation methods, the Chinese standard allows for power-on activation. The biggest difference is that the national standard stipulates that the system may be manually turned on or off by the driver, whereas the EU regulation does not allow the driver to manually turn off the entire system.
	2. Warning methods	**4.1.3.1** The system shall use at least two of the visual, optical and haptic methods to send signals to the driver. These signals shall differ from other system signals.	**3.4.1.1** Visual and acoustic or any other warning used by the DDAW system to alert the driver shall be presented as soon as possible after occurrence of the trigger behaviour and may cascade and intensify until acknowledgement thereof by the driver.	The Chinese standard requires the system to employ two or more warning methods, while the EU regulation does not specify the number of warning methods.
	3. Failure warning	**4.4** In the case of a failure, the system shall have a failure warning function to send a constant optical failure warning signal to the driver. This signal shall differ from other system signals and be visible.	**3.5** A constant visual failure warning signal (e.g. warning reflecting the relevant Diagnostic Trouble Codes (DTC) for the system, telltale, pop-up message, etc.) shall be provided when there is a failure detected in the DDAW system, as a result of which the DDAW system does not meet the requirements of this Annex. A temporary visual failure warning signal can be used as complementary information to the constant optical failure warning signal.	IDT

Table 20: DDAW standards differences

Function		GB	EU	Remarks
		GB/T 41797-2022	REGULATION (EU) 2021/1341	
Technical requirements	1. Function test	**5.2** While active and having normal functions, the system shall allow for five actions of closing eyes, yawning, abnormal head posturing, holding a mobile phone and smoking. A driver shall be permitted to do each action 3 times. During this period, the system shall be active and every two actions must follow an interval of 5 seconds. During the test, a recording is made to assess whether the alarm time and alert message meet the requirements.	**5** The level of drowsiness shall be measured using the KSS.	On test contents, the two differ greatly. The Chinese standard defines five actions, and tests whether the DDAW system can meet requirements, while the EU regulation introduces the KSS drowsiness rating scale, stipulating that prior to the test, it is necessary to give the selected driver a KSS training session; during the test, driver drowsiness shall be measured using KSS at an interval of 5 minutes. Assessment of the performance of DDAW systems shall be based on a statistical approach. It is notable that the EU regulation permits the use of alternative methods to KSS, such as electroencephalogram (EEG) or PERCLOS (percentage of eyelid closure), and also sleep expert to perform sleep video analysis.
	2. Performance test	**5.3** Under different light and wearing conditions, the system shall repeat 5 actions and record whether the warning time and signal meet requirements.		

In terms of DDAW, there are differences between the Chinese standard and the EU regulation. As the number of DDAW systems installed is small, the Chinese standard and EU regulation do not prescribe detailed rules for the established AEB test regulation, and the EU regulation exempts vehicles from the obligation to configure DDAW systems if they have a maximum design speed of 70 km/h or less.

In terms of activation methods, the Chinese standard allows for two activation methods – power-on activation and minimum speed activation – while EU Regulation 2021/1341 specifies only the minimum speed activation method. DDAW defines two scenarios (fatigue and distraction) and specifies different requirements. The Chinese standard defines attention monitoring based on camera technology, and specifies the dummy test method.

On driver warning methods, the Chinese standard requires the use of at least two methods of visual, acoustic and haptic warning, while the EU Regulation 2021/1341 stipulates only one warning method. For test contents, the Chinese standard

defines five actions – closing eyes, yawning, abnormal head posturing, holding of mobile phones and smoking – and tests the performance of the DDAW system, while the EU regulation introduces the KSS drowsiness rating scale, stipulating that prior to the test the selected driver must receive a KSS training session; during the test, driver drowsiness shall be measured using KSS at intervals of 5 minutes, and assessment of the performance of DDAW systems shall be based on a statistical approach.

It should be noted that the EU regulation permits the use of alternative methods to KSS, such as electroencephalogram (EEG) or PERCLOS (percentage of eyelid closure), as well as a sleep expert to perform sleep video analysis.

3.1.7.3 Type approval

The respective type approval time is shown below:

Table 21: Type approval

Standard	Approval	Implementation content	Time
GB/T 41797-2022	/	/	/
Regulation (EU) 2021/1341	Incorporated	MN	B

3.1.7.4 Summary

For the DDAW system, the Chinese standard and EU regulation do not lay down detailed rules, as the vehicles manufactured are exempt from the obligation to install such a system and both are at the exploratory stage. Moreover, the EU regulation exempts vehicles with a maximum design speed of 70 km/h or below from the obligation to configure DDAW systems.

Regarding type approval and access, GB/T 41797-2022 Performance Requirements and Test Methods for Driver Attention Monitoring Systems (Draft for Approval) is implemented from 1 May 2023 and the type approval time is to be determined, while EU regulation 2021/1341 entered into force on 6 July 2022 for non-approved vehicles and will do so on 7 July 2024 for type-approved vehicles.

3.1.8 Blind Spot Detection (BSD)

3.1.8.1 Regulation/standard briefing

GB/T 39265-2020 Road Vehicles – Performance Requirements and Testing Methods for Blind Spot Detection (BSD) Systems is a recommended Chinese national standard that shall apply to M and N vehicles fitted with BSD systems. This standard does not apply to automotive trains, articulated passenger cars and special operating vehicles.

UN Regulation No. 151 – Uniform provisions concerning the approval of motor vehicles with regard to the Blind Spot Information System for the detection of bicycles is a compulsory EU standard. It shall apply to N2 (technically permissible maximum mass >8 t) and N3 vehicles configured with BSD systems. For N2 (technically permissible maximum mass ≤8 t), M2 and M3 vehicles, the manufacturers' requirements shall prevail.

3.1.8.2 Analysis of main similarities and differences

The similarities and differences between the two are shown below:

Table 22: BSD performance requirements differences

Function		GB GB/T 39265-2020	EU UN Regulation No. 151	Remarks
Scope	/	**1.** This standard specifies the general requirements, performance requirements and test methods of the BSD system. This standard shall apply to M and N vehicles equipped with blind spot detection systems. This standard does not apply to automotive trains, articulated passenger cars and special operating vehicles.	**1.1** This Regulation shall apply to the blind spot information system for vehicles of categories N2 (> 8 t of technically permissible maximum mass) and N3. Vehicles of categories N2 (≤ 8 t of technically permissible maximum mass), M2 and M3 may be approved at the request of the manufacturer. **1.2** The requirements of this Regulation are so worded as to apply to vehicles which are developed for right-hand traffic. In vehicles that are developed for left-hand traffic, these requirements shall be applied by inverting the criteria, where appropriate.	The scope of requirements differs.
Performance requirements	General requirements	**4.1.1** When the subject is driving in a straight line, the blind spot detection system of M/N vehicles shall be able to detect the target vehicle in the left and right-hand adjacent areas of the subject vehicle. **4.1.2** When the subject vehicle turns right, the blind spot detection system of M2/M3/N2/N3 vehicles shall be able to detect the target vehicle in the adjacent area to the right of the subject vehicle.	Not clearly specified	Not clearly specified The Chinese standard specifies blind spot detection functions according to test scenarios.
	Activation requirements	**4.3** The system can be activated in three ways: a) start activation b) lowest speed activation c) turn signal activation	**5.3.1.3** The BSIS shall at least operate for all forward vehicle speeds from standstill to 30km/h for ambient light conditions above 15 lux.	The Chinese standard introduces more diversified activation methods.

Table 22: BSD performance requirements differences

Function	GB GB/T 39265-2020	EU UN Regulation No. 151	Remarks
Test requirements	**Five tests under straight-line driving conditions and right turn test**: **6.3.2.1** Target vehicle (motorcycle) identification test **6.3.2.2** Straight road merge test **6.3.2.3** Test of target vehicle overtaking the subject vehicle on straight road **6.3.2.4** Test of target vehicle changing lanes and overtaking the subject vehicle **6.3.2.5** Dual target vehicle overtaking subject vehicle on straight road **6.3.3** Test of M2/M3/N2/N3 vehicles turning right	**Five tests:** **6.4** Optical failure warning signals verification test **6.5** Blind spot information dynamic test **6.6** Blind spot information static test **6.7** Failure detection test **6.9** Automatic deactivation test	The Chinese standard specifies tests respectively for straight driving and right turn and widely targets motorcycle and vehicles. The EU regulation introduces simple test scenarios but sets out static and dynamic tests for the performance of BSD systems installed in vehicles. It should be noted that the EU regulation mainly specifies the motorcycle as the object of BSD.

The Chinese standard and EU regulation differ on BSD requirements as follows:

In terms of general requirements, the Chinese standard stipulates that M and N vehicles must have blind spot detection function available on both sides when driving in a straight line, and on the right side only when turning right. UN R151 underlines the function to be installed on trucks for turning right.

Given activation methods, the Chinese standard specifies that the system can be activated in at least three ways: start activation, lowest speed activation and turn signal activation, whereas UN R151 lays down rules that the BSD shall be activated normally at speeds greater than 30km/h.

In the light of test requirements, the Chinese standard specifies tests respectively for straight driving and right turn, as well as tests for a target vehicle overtaking the subject vehicle on a straight road, widely targeting motorcycles and vehicles. UN R151 introduces simple test scenarios, but sets out static and dynamic tests for the performance of BSD systems installed in vehicles. It should be noted that the EU regulation mainly specifies the motorcycle as the object of BSD.

3.1.8.3 Type approval

The respective type approval time is shown below:

Table 23: Type approval

Standard	Approval	Implementation content	Time
GB/T 39265-2020	/	/	/
UN Regulation No. 151	Incorporated	M_2, M_3, N_2, N_3	B

3.1.8.4 Summary

In respect of blind spot detection, GB/T 39265-2020 lays down more detailed rules with bicycles, motorcycles and vehicles as the objects, whereas UN R151 covers only bicycles. Where activation methods are concerned, GB/T 39265-2020 sets out more diverse activation methods.

For test requirements, GB/T 39265-2020 requires testing of lane-change and override performance in the case of straight driving, while UN R151 includes simple test scenarios but sets out static and dynamic tests for BSD performance.

In terms of type approval and access, GB/T 39265-2020 entered into force on 1 June 2021, yet its time for approval is not agreed. UN R151 became valid on 6 July 2022 for non-approved M2, M3, N2 and N3 vehicles and will do so on 7 July 2024 for type-approved M2, M3, N2 and N3 vehicles.

3.1.9 Lateral and longitudinal manoeuvring of ICVs

3.1.9.1 Regulation/standard briefing

The Technical Requirements and Testing Methods for Combined Driver Assistance System of Intelligent and Connected Vehicles (Draft for Comments) is a recommended Chinese national standard that shall apply to M and N vehicles with combined driver assistance systems.

3.1.9.2 Analysis of main similarities and differences

Below is a comparison of the two parts of the Technical Requirements and Testing Methods for Combined Driver Assistance System of Intelligent and Connected Vehicles (Draft for Comments), as well as differences between the Chinese standard and UN R79 with regard to ACSF (B1, C) functions, as shown in the table below; the contents of UN R79 mentioned above are not repeated here.

Table 24: Comparison of Part 1 and Part 2 and differences with R79

Function		GB		EU	Remarks
		Part 1: Single-lane manoeuvre	Part 2: Multi-lane manoeuvre	UN R79	
General requirements	Common requirements	**4.2** System on and off. The system shall be provided with a device that enables the driver to turn it on and off. At any time the driver shall be able to turn it off by a single operation. Once switched off, the system may only be switched on again by the driver. **Note:** Off means that the system does not perform single-lane manoeuvres. **4.3** System activation **a)** The system shall have clear activation conditions and when activated shall provide optical warning to the driver; **b)**When activated, the system shall manoeuvre the subject vehicle; when not activated, it shall not manoeuvre the subject vehicle; **c)** In the case of a failure, the system may not be activated.	**4.1.1** The system stipulated herein shall only be turned on on roads where pedestrians and cyclists are prohibited, that are equipped with a physical separation and have at least two lanes in the direction the vehicles are driving. The system shall be able to identify whether the road the vehicle is driving on meets these requirements by two separate methods. **4.1.2** The system shall be able to detect such traffic participants as vehicles in the lane occupied by the subject vehicle and neighbouring lanes, and shall change lane only when there is a safe space between the subject vehicle and other traffic participants.	**4.1.1** The system stipulated herein shall only be turned on on roads where pedestrians and cyclists are prohibited, that are equipped with a physical separation and have at least two lanes in the direction the vehicles are driving. The system shall be able to identify whether the road the vehicle is driving on meets these requirements by two separate methods. **4.1.2** The system shall be able to detect such traffic participants as vehicles in the lane occupied by the subject vehicle and neighbouring lanes, and shall change lane only when there is a safe space between the subject vehicle and other traffic participants.	Activation requirements for the multi-lane driving assistance function are stricter. Adoption of provisions of UN R79 for identical contents

Table 24: Comparison of Part 1 and Part 2 and differences with R79

Function		GB		EU	Remarks
		Part 1: Single-lane manoeuvre	Part 2: Multi-lane manoeuvre	UN R79	
General requirements	Common requirements	/	**4.1.5** The system shall be used with the single-lane driving function activated and shall take over from the single-lane driving function during the period when it is activated and no lane change is performed to centre the vehicle in the lane. **4.1.6** The system may only change one lane per activation when performing a lane change and is not allowed to change lanes continuously.	**5.6.4.1** A vehicle equipped with an ACSF of Category C shall also be equipped with an ACSF of Category B1. When the ACSF of Category C is activated, the ACSF of Category B1 shall aim to centre the vehicle in the lane.	Multi-lane function shall be used with single-lane function activated. Adoption of the provisions of UN R79 for identical contents.
		The system shall only be turned on and off by the driver. A hands-off warning function shall be available, with upgrades over time.		**5.6.2.2.5** The system shall provide a means of detecting that the driver is holding the steering control.	IDT

Table 24: Comparison of Part 1 and Part 2 and differences with R79

Function		GB		EU	Remarks
		Part 1: Single-lane manoeuvre	Part 2: Multi-lane manoeuvre	UN R79	
Performance requirements	Lateral	Requirements are made for the maximum lateral acceleration permitted at different speeds, allowing for overshooting.	The average lateral acceleration generated by the system shall be less than 1 m/s2 during lane change preparation and lane change execution, except in the case of turning; the maximum lateral acceleration generated by the vehicle during lane change preparation and lane change execution shall not exceed 3 m/s2 and shall comply with the requirements of Table 1. The limits may be exceeded temporarily when a lane change is withdrawn.	**5.6.2.1.1** The system may exceed the specified value aysmax by not more than 0.3 m/s2, while not exceeding the maximum value specified in the table in paragraph 5.6.2.1.3. of this Regulation. **5.6.4.4** The lateral acceleration induced by the system during the lane change manoeuvre: (a) shall not exceed 1 m/s2 in addition to the lateral acceleration generated by the lane curvature, and (b) shall not cause the total vehicle lateral acceleration to exceed the maximum value (3m/s2) indicated in the table in paragraph 5.6.2.1.3. of this Regulation.	The lateral requirements for multi-lane driving are stricter. Adoption of the provisions of UN R79 for identical contents
	Longitudinal	Requirements are made for the acceleration, deceleration and variation of deceleration permitted at different speeds.	Requirements are made for the minimum activation speed, longitudinal deceleration, variation of deceleration, and safe time interval in particular.	/	IDT

Table 24: Comparison of Part 1 and Part 2 and differences with R79

Function		GB		EU	Remarks
		Part 1: Single-lane manoeuvre	Part 2: Multi-lane manoeuvre	UN R79	
Performance requirements	Time for lane change	/	M vehicle system shall complete lane change preparation within 3-5 seconds after being activated by the driver and complete lane change execution within 5 seconds; N vehicle system shall complete lane change preparation within 3-5 seconds after being activated by the driver and complete lane change execution within 10 seconds.	**5.6.4.6** The lateral movement of the vehicle towards the intended lane shall not start earlier than 1 second after the start of the lane change procedure. The lane change manoeuvre shall not be initiated before a period of 3 seconds and not later than 5 seconds after the deliberate action of the driver. The lane change manoeuvre shall be completed in less than: (a) 5 seconds for M1, N1 vehicles; (b) 10 seconds for M2, M3, N2, N3 vehicles.	IDT

Table 24: Comparison of Part 1 and Part 2 and differences with R79

Function		GB		EU	Remarks
		Part 1: Single-lane manoeuvre	Part 2: Multi-lane manoeuvre	UN R79	
Test requirements	Time for lane change	**Four tests:** **6.5** Straight single-lane manoeuvre test **6.6** Hands-off warning test **6.7** Maximum lateral acceleration test **6.8** Detection coverage test	**Ten tests:** **6.2.1** Self-check function and failure warning test **6.2.2** Lane change test of inactivated single-lane function **6.2.3** Lane change test **6.2.4** Curve lane change test of activated single-lane function **6.2.5** Driver intervention performance test **6.2.6** Test of subject vehicle changing to the target vehicle **6.2.7** System state transition test **6.2.8** Warning time and system response test after disengagement **6.2.9** Backward safe distance test **6.2.10** Forward safe distance test	Test of ACSF of Category B1: • Lane keeping test • Maximum lateral acceleration test • Overriding force test • Hands-off test Test of ACSF of Category C: • Lane change function test • Minimum activation speed test • Overriding force test • Lane change prevention test • Sensor performance test • Sensor failure test • Engine start/stop activation conditions test	Based on the single-lane function test, the multi-lane function test focuses more on the lane change and vehicle following section. The UN R79 also emphasises the sensor and engine test in this section.

The Technical Requirements and Testing Methods for Combined Driver Assistance System of Intelligent and Connected Vehicles contains two parts, i.e. Part 1: Single-lane manoeuvre and Part 2: Multi-lane manoeuvre.

In terms of general requirements, the two parts are very close on the requirements for self-check, failure detection, warning signal and functional safety, while Part 2 sets stricter activation and execution conditions. With regard to performance requirements, Part 2 sets stricter limits for the variation of lateral acceleration and specifies the minimum activation speed, longitudinal deceleration, variation of longitudinal deceleration and safe time interval in particular. Moreover, Part 2 also lays down detailed rules on the time for lane change. In terms of test requirements, the two parts vary in test requirements due to different scenarios, but both set out hands-off warning and driver intervention performance tests.

Compared to UN R79 ACSF (B1, C), the Chinese standard basically adopts the provisions of R79 for identical contents.

3.1.9.3 Type approval

Both the Chinese standard and UN regulation are at the comments stage without type approval requirements, and it is very likely that the access test requirements for ICV products (driver assistance) will be incorporated.

3.1.9.4 Summary

The Technical Requirements and Testing Methods for Combined Driver Assistance System of Intelligent and Connected Vehicles contains two parts, i.e. Part 1: Single-lane manoeuvre and Part 2: Multi-lane manoeuvre, laying down detailed requirements for lateral and longitudinal manoeuvre functions such as following, cruise control and lane change. This standard has no UN regulation that is completely equivalent.

In terms of type approval and access, the Technical Requirements and Testing Methods for Combined Driver Assistance System of Intelligent and Connected Vehicles is still at the comments stage, there is no requirement for type approval.

3.1.10 Field testing methods and requirements for automated driving Functions

3.1.10.1 Regulation/standard briefing

With regard to field testing for automated driving functions, the German and EU regulations have no formal standards in place. In China, GB/T 41798-2022 Intelligent and Connected Vehicles – Field Testing Methods and Requirements for Automated Driving Functions was released on 14 October 2022 and was implemented on 1 May 2023. Its time for approval is not decided.

3.1.10.2 Analysis of key points

The key points contained in the Intelligent and Connected Vehicles – Field Testing Methods and Requirements for Automated Driving Functions are shown below.

Table 25: Analysis of key points

GB/T 41798-2022		Description
Article	**Content**	
1	**Scope** This standard shall apply to M and N vehicles, automotive trains and articulated buses with automated driving functions subject to field testing, and has reference value for other vehicles.	**Note:** this standard will apply to L3 and above automated driving vehicles.
6	Test items	List of 32 test items: No. Test items **1** Speed limit sign **2** Lane marking **3** Parking & give-way sign **4** Motor vehicle traffic signal light at intersection **5** Direction guide signal light **6** Express way signal light **7** Tunnel **8** Circular intersection **9** Ramp **10** Toll station **11** Traffic conflict at unsignalized intersection **12** Right-turn traffic conflict at unsignalized intersection **13** Left-turn traffic conflict at unsignalized intersection **14** Normal obstacle **15** Stationary vehicle occupying part of lane **16** Pedestrian crossing crosswalks **17** Pedestrian walking along the road **18** Bicycle riding along the road **19** Motorcycle riding along the road **20** Pedestrians walking across the road **21** Bicycle riding across the road **22** Forward vehicle cut-in **23** Forward vehicle cut-out **24** Opposite vehicle lending lane **25** Target vehicle stop-and-go **26** Stationary vehicle in front of the following vehicle **27** Forward vehicle brakes sharply **28** Parking at designated place **29** Entering bus bay **30** Entering normal bus stop **31** Dynamic driving task intervention **32** Risk mitigations
Annex A	Test methods for night and special weather scenarios	/

Table 25: Analysis of key points

GB/T 41798-2022		Description
Article	**Content**	
Annex B	Classification and selection of test items	1. Driving areas can be classified into highways, expressways, urban roads and suburban roads according to the operational design conditions of automated driving systems. 2. Subject vehicle shall identify one or more driving areas according to the operational design conditions, and complete test items in these areas. The 32 test items mentioned above, and those in the driving areas of highways, expressways, urban roads and suburban roads shall be illustrated.

3.1.10.3 Summary

GB/T 41798-2022 Intelligent and Connected Vehicles – Field Testing Methods and Requirements for Automated Driving Functions is a recommended Chinese national standard that was formulated by the Automated Driving Working Group of the ICV sub-committee under NTCAS. The standard lays down rules on closed field tests and bolsters the state regulation.

According to Annex 3: Test Requirements for the Access of Intelligent and Connected Vehicle Products of the Guideline for the Administration of the Access of Intelligent and Connected Vehicle Manufacturers and Products (for Trial Implementation) issued by MIIT in April 2021, test requirements for product admission specify that ICV products applying for admission shall fulfil at least a simulation test, closed field test, real-world road test, vehicle cybersecurity test, software upgrading test and data storage test requirements.

Released by MIIT in July 2017, the Opinions on Strengthening the Administration of the Access of Intelligent and Connected Vehicle Producers and Products stipulates that security management of products with automated driving functions must be strengthened. According to Article 7, automated driving product producers shall ensure that the following requirements are met: '4. process protection requirements of functional safety, SOTIF and cybersecurity, as well as test requirements for simulation, enclosed field, real-world roads, cybersecurity, software upgrade and data recording, in order to avoid foreseeable and preventative safety accidents under the operational design conditions.' At present, the guideline is still soliciting public comment and its method of implementation is not yet specified.

In light of the present circumstances in China, the guideline will be further advanced in order to standardise the access test for automakers and products based on the underlying national standards.

3.2 Data recorder system

3.2.1 Event data recorder

3.2.1.1 Regulation/standard briefing

GB 39732-2020 Event Data Recorder (EDR) and the UN/ECE World Forum for Harmonization of Vehicle Regulations (WP.29) are corresponding pieces of legislation. The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type-approval of motor vehicles with regard to Event Data Recorder (draft for comments) specifies that onboard EDR shall meet both the technical requirements of UNR160 and the requirements for data security in Article 3, data retrieval in Article 4 and road trafficability in Article 5. It complements GSR regulation 2019R2144 and makes up for E5 in Part E. Reference to UN ECE R160 is equivalent to implementing UN R160 with regard to EDR.

The Chinese national standard GB 39732-2020 and EU regulation draft were formulated with reference to US CFR-49-563 concerning EDR, and hence show many similarities.

According to No. 2 Amendment to GB 7258-2017 Technical Specifications for Safety of Power-driven Vehicles Operating on Roads, as of 1 January 2022, newly produced M1 passenger cars shall be equipped with EDR, or alternatively with a DVR, as stipulated by GB/T 38892-2020.

The EU regulation set the requirements later than its Chinese counterpart, establishing that as from 6 July 2022, M1 and N1 vehicles shall be equipped with an EDR, and from 7 July 2022, M1, M2, M3, N1, N2 and N3 vehicles shall install an EDR.

3.2.1.2 Analysis of main similarities and differences

A comparison of standards and regulations concerning EDR from home and abroad is shown in Table 26.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
1	This standard specifies terms and definitions, technical requirements, test methods and requirements, appearance and identification, extension of approval of the vehicle type, and manual of event data recorder for M1 vehicles. This standard shall apply to M1 vehicles installed with an event data recorder. Other vehicles could take it as reference.	**3 LEGAL ELEMENTS OF THE DELEGATED ACT & Art. 1 Scope**	The Act establishes technical requirements and testing procedures for vehicle type-approval with regard to EDR, as well as type-approval for EDR as a separate technical unit (STU). This regulation shall apply to vehicle categories M1 and N1, as defined in Article 4 of Regulation (EU) 2018/858 of the European Parliament and of the Council	EU scope of application and effective date: M1 and N1 vehicles fitted with EDR; Chinese national standard scope of application and effective date: M1 vehicles equipped with EDR. EU regulation sets requirements for type approval of STU as for vehicles.
3.4	Lateral acceleration is the Y-component of the vector acceleration for a point in the vehicle. **Note:** lateral acceleration is positive from left to right from the perspec-tive of the driver when seated in the vehicle facing the direction of forward vehicle travel, see Figure 1.	**UN R160: 2.1.6**	'Lateral acceleration' means the component of the vector acceleration of a point in the vehicle in the y-direction. Lateral acceleration is positive from left to right from the perspective of the driver when seated in the vehicle facing the direction of forward vehicle travel.	With regard to coordinates, the EU regulation and Chinese national standard specify the same, that the downward right-hand rule is adopted, i.e. downward as positive, rightward as positive and forward as positive. Subsequent trigger conditions, locking conditions, data elements and format are thereby secured.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
4.1.1	**4.1.1** Trigger threshold **4.1.1.1** When a vehicle reaches the following trigger threshold conditions, the event shall be recorded: • For vehicles that record 'delta-V, longitudinal' only, trigger threshold means a change in vehicle velocity in the X-axis direction that is not less than 8km/h within a 150ms interval. • For vehicles that also record 'delta-V, lateral', trigger threshold means a change in vehicle velocity in either the X-axis or Y-axis direction that is not less than 8km/h within a 150ms interval. **4.1.1.2** For both the above cases, if the event is less than 150ms in duration, when a change in vehicle velocity is not less than 8km/h, that is, the trigger threshold is reached. **4.1.1.3** When the manufacturer sets other trigger thresholds, the requirements of 4.1.1.1 and 4.1.1.2 shall also be met.	**UN R160: 5.3.1**	**Conditions for triggering recording of data** An event shall be recorded by the EDR if one of the following threshold values is met or exceeded: **5.3.1.1** Change in longitudinal vehicle velocity more than 8 km/h within a 150 ms or less interval. **5.3.1.2** Change in lateral vehicle velocity more than 8 km/h within a 150 ms or less interval. **5.3.1.3.** Activation of non-eversible occupant restraint system. **5.3.1.4** Activation of vulnerable road user secondary safety system If a vehicle is not fitted with any Vulnerable Road User (VRU) secondary safety system, this document requires neither recording of data nor fitting of such systems. However, if the vehicle is fitted with such a system, then it is mandatory to record the event data following activation of this system.	**Trigger threshold:** EU regulation on lateral and longitudinal velocity: 150ms 8km/h. The first comer shall prevail. The Chinese national standard specifies 8km/h and other thresholds developed by suppliers with high flexibility. The EU regulation states requirements for a secondary safety system for vulnerable road users (VRU), whereas the Chinese counterpart does not specify this system.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
4.1.2	**4.1.2** Locking condition **4.1.2.1** EDR shall choose either of the following as the locking condition, and the event data shall not be overwritten by a subsequent event: • non-reversible restraint deployment; • the vehicle velocity change in X-axis direction is not less than 25km/h within 150ms interval. **4.1.2.2** In the case of a rear impact, it is permissable to adopt the locking condition of the control algorithm at the discretion of the manufacturer as the locking condition. In the case of a lateral impact, it is necessary to take deployment of the lateral non-reversible restraint as the locking condition. If the vehicle is not configured with a lateral non-reversible restraint, the vehicle manufacturer shall determine whether to lock. **4.1.2.3** If the manufacturer sets other locking conditions, the requirements of 4.1.2.1 and 4.1.2.2 shall also be met.	**UN R160: 5.3.2**	**Conditions for triggering locking of data** In the circumstances provided below, the memory for the event shall be locked to prevent any future over-writing of the data by a subsequent event. **5.3.2.1** In all the cases where a non-reversible occupant restraint system is deployed. **5.3.2.2** In the case of a frontal impact, if the vehicle is not fitted with a non-reversible restraint system for front impact, when the vehicle's change of velocity in the x-axis direction exceeds 25 km/h within 150ms interval or less. **5.3.2.3** Activation of vulnerable road user secondary safety system.	**Locking conditions:** the EU regulation and Chinese national standard both stipulate non-reversible restraint deployment as the locking condition of the EDR system, and the vehicle's change of velocity in the x-axis direction shall be no less than 25 km/h within 150ms for front impact. The EU regulation states requirement of a secondary safety system for vulnerable road users, whereas the Chinese counterpart does not specify this system. In accordance with the Chinese national standard, in the case of a rear impact, it is permissable to adopt the control algorithm at the discretion of the manufacturer as the locking condition. In the case of a lateral impact, it is necessary to take deployment of the lateral non-reversible restraint as the locking condition. If the vehicle is not configured with a lateral non-reversible restraint, the vehicle manufacturer shall determine whether to lock.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
4.1.3	**4.1.3** Beginning of impact event The beginning of an impact event (time zero T0) shall meet any of the following requirements, as shown in Figure 2: **a)** For systems with 'wake-up' occupant protection control algorithms, T0 is the time at which the occupant protection control algorithm is activated. **b)** For systems with 'continuously running' occupant protection control algorithms, T0 is the time when the cumulative delta-V of not less than 0.8km/h is reached within a 20ms interval in the longitudinal direction for a frontal/rear event; or the cumulative delta-V of not less than 0.8km/h is reached within a 5ms interval in the lateral direction for a lateral impact event. This is shown in Table 1. **c)** A deployment starting time of a non-reversible restraint. **d)** If EDR function is not realised through airbag controller, then clause b) shall be taken as the beginning of an impact event.	**UN R160: 5.3.3**	**Conditions for establishment of time zero** Time zero is established at the time when any of the following first occurs: **5.3.3.1** For systems with 'wake-up' airbag control systems, the time at which the occupant restraint control algorithm is activated; or **5.3.3.2** For continuously running algorithms; **5.3.3.2.1** The first point in the interval where a longitudinal, cumulative delta-V of over 0.8 km/h is reached within a 20 ms time period; or **5.3.3.2.2** For vehicles that record 'delta-V, lateral.' the first point in the interval where a lateral, cumulative delta-V of over 0.8 km/h is reached within a 5 ms time period; or **5.3.3.3** Deployment of a non-reversible deployable restraint or activation of VRU secondary safety protection system.	Beginning and ending of impact event Beginning conditions–similaties: For systems with 'wake-up' airbag control systems, the time at which the occupant restraint control algorithm is activated. For continuously running algorithms, the first point in the interval where a longitudinal, cumulative delta-V of over 0.8 km/h is reached within a 20 ms time period; or for vehicles that record 'delta-V, lateral,' the first point in the interval where a lateral, cumulative delta-V of over 0.8 km/h is reached within a 5 ms time period; or deployment of a non reversible deployable restraint. The event is triggered at the time when any of the above conditions are met. The EU regulation specifies the activation of a secondary safety protection system for VRUs as the beginning of an impact event, whereas the Chinese counterpart does not specify this system.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
4.1.3	**e)** The second stage (or higher stage) firing of airbag shall not be taken as the beginning of an impact event, and shall not trigger another EDR record. **f)** If clause c) is adapted as the beginning of impact event, impact event data before the deployment of a non-reversible restraint shall be collected and recorded as well. "Wake-up" occupant protection control algorithm refers to that occupant protection control algorithm starts to operate after satisfaction of certain conditions and activation; "continuously running" occupant protection control algorithm refers to start of operation after power-on of occupant protection control algorithm.	**UN R160: 5.3.3**		The Chinese standard specifies that if the EDR function is not realised through an airbag controller, then clause **b)** shall be taken as the beginning of an impact event, and that the second stage (or higher stage) firing of the airbag shall not be taken as the beginning of an impact event and shall not trigger another EDR record. The EU regulation does not specify the ending time, whereas the Chinese standard does.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
4.2	**4.2** Data record requirements **4.2.1** The EDR record data elements are divided into two levels according to the following requirements: • Level A data element: data that shall be recorded when vehicles are equipped with an EDR system. See name of Level A data element, minimum recording interval, minimum recording frequency and definition as per Table 2. • Level B data element: data shall be recorded when vehicles equipped with an EDR system and equipped with a relevant device or have relevant function. See name of Level B data element, minimum recording interval, minimum recording frequency and definition as per Table 3.	**UN R160: 5.1**	**5.1** Data elements **5.1.1** Each vehicle fitted with an EDR shall record the data elements specified as mandatory and those required under specified minimum conditions during the interval/time and at the sample rate specified in Annex 4, Table 1.	As regards data elements, the Chinese standard entails 60 elements which are divided into two level: a) Level A data that shall be recorded by all M1 vehicles; Level B data that shall be recorded when vehicles are equipped with a relevant device or have a relevant function (unnecessary to record when without relevant device or function). The EU regulation entails 41 elements, including 34 compulsory ones. The Chinese standard has added the event time, preevent synctiming time, VIN mark and EDR number, and removed the elements of airbag deployment status, seat position, passenger size & position and number of events.
4.3.3	Requirements on number of storage events The EDR system shall record data for at least three consecutive impact events. After the test is carried out according to 5.3.3, the test requirements shall be met.	**UN R160: 5.3**	The EDR non-volatile memory buffer shall accommodate the data related to at least two different events.	Number of storage events: the Chinese standard specifies at least three events, whereas the EU regulation stipulates at least two events.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
4.3.5	**Power-off storage requirements** During the collision process, if the power supply circuit in the car cannot be powered normally due to the collision time, the EDR system itself should have the power supply capability. This power supply capacity should meet the situation of collision in a single direction, when all relevant ignition circuits (if equipped) are fully deployed within (150±10) ms after power failure, the EDR system should at least meet the needs for recording all data before T0 and data from T0 to (150±10)ms after power failure, and meet the test requirements of 5.3.5.	**UN R160: 5.3.5**	**Power failure** Data recorded in non-volatile memory is retained after loss of power.	**Storage capacity** in case of power failure: the EU regulation makes requirements but does not specify specific events, whereas the Chinese standard stipulates that in case of power failure due to collision, all data before T0 and those from T0 to power failure (150±10)ms shall be recorded at least.
4.4	**4.4** Requirements on data retrieval **4.4.1** General requirements **4.4.2** Requirements on data retrieval port **4.4.3** Requirements on data retieval protocol **4.4.4** Requirements on data retrieval identifier **4.4.5** Data translating requirements **4.4.6** Storage time limit requirements **4.4.7** Other data retrieval requirements	**UN R160**	**1.** Crash-related data recorded by the event data recorders shall be made available for retrieval through the serial data port on the standardised data link connector referred to in Article 2.9 of Annex X to Regulation (EU) 2018/858. Where the serial data port is no longer functional after a collision, the data shall be retrievable by a direct connection to the event data recorder.	**Data retrieval tools** UN R160 calls for local requirements to be observed. The Chinese standard also makes requirements about data retrieval protocol in addition to data retrieval port, and specifies data communication protocol, data retrieval symbols and data translating formats.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	Content	Article No.	Content	
4.4		UN R160	**2.** The vehicle manufacturer shall provide the type-approval authority and, at their request, any interested manufacturer or repairer of components, diagnostic tools or test equipment with information about how the event data can be accessed, retrieved and interpreted. **3.** Vehicles and their event data recorders shall be designed in a way that enables a data retrieval tool to produce event reports that contain the following data elements: **(a)** each of the mandatory data elements, as required under the 01 Series of Amendments to UN Regulation No 160; **(b)** the precise vehicle type, variant and version (including the fitted active safety and accident avoidance systems) of the vehicle hosting the event data recorder. The data referred to in point (b) above, shall also be available at the completion of the crash test referred to in paragraph 5.4.3 of the 01 Series of Amendments to UN Regulation No 160. **4.** The data recorded by the event data recorder shall not be available for retrieval over interfaces accessible without the need to unlock the vehicle or to use tools, or over vehicle interfaces for wireless connections. **5.** The event data recorder's data made available pursuant to paragraph 1: **(a)** shall be available in a machine-readable format; **(b)** shall not include or be made available together with any information that permits those data to be related to a natural person.	The EU regulation specifies data retrieval port and format requirements, but does not give specific requirements.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
/	Data security related: N/A	**Art.3**	**1.** The crash-related data recorded and stored by the event data recorder shall be protected against manipulation by compliance with the relevant technical requirements and transitional provisions of UN Regulation No 1556, the original series or any later series of amend-ments thereof. **2.** Software updates performed on the event data recorder shall be protected to reasonably prevent them from being compromised and reasonably prevent invalid updates.	The EU regulation has additional requirements on data retrieval, privacy and security. According to Article 3, data shall be protected by compliance with the relevant provisions of UN R1556, and software updates performed on the event data recorder shall be protected to prevent them from being compromised and prevent invalid updates.
		UN R160: 1.3	The following data elements are excluded from the scope: VIN, associated vehicle details, location/positioning data, information of the driver, and date and time of an event.	Compared to the EU regulation, the Standardization Administration records VIN code and time of occurrence, and predicts GDPR constraints.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
5	This national standard specifies test methods and requirements.	**R160: 3.2.1**	**3.2.1** A description of the vehicle type with regard to the items specified in paragraph 5 below, in particular relating to the location of the EDR in the vehicle, the triggering parameters, storage capacity and the resistance to high deceleration and mechanical stress of a severe impact.	Protection performance: the Chinese standard specifies that with regard to the location of the EDR in the vehicle, the protection performance of the EDR shall meet the functional requirements by GB/T 30038. The EU regulation does not make any requirements.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
8	**8.1** For vehicles fitted with EDR, their product manual shall at least include: a) a declaration such as 'this vehicle is fitted with EDR'; b) an explanation of the meaning and possible purpose of items of EDR recorded data; c) an explanation of the supplier and accessible path for the EDR data retrieval tool; d) a description of the method for extracting data from the EDR controller; e) an explanation for the data source of vehicle velocity in Level A data elements f) a description of an unlocked event storage overwrite mechanism and event types that can be overwritten; g) a declaration of the realisation method for intelligent control functions and related data elements. **8.2** It is deemed to be satisfactory if d) ~ g) in Article 8.1 can be obtained by other publicly available methods (such as a maintenance manual or official website).	/	/	Product manual: the Chinese standard incorporates a product manual.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
5	**5** Test methods and requirements **5.1** Impact test **5.2** Driving operation data test **5.3** Bench test	**5.4**	Crash test performance and survivability **5.4.1** Each vehicle subject to the requirements of national or regional frontal crash test regulations shall conform with the specifications in paragraph 5.4.3. **5.4.2** Each vehicle subject to the requirements of national or regional side impact crash test regulations shall conform with the specifications of paragraph 5.4.3. **5.4.3** The data elements required by paragraph 5.1 shall be recorded in the format specified by paragraph 5.2, exist at the completion of the crash test, and the complete data recorded element shall read 'yes' after the test. Elements that are not operating normally in crash tests (e.g., those relating to engine operation, braking, etc.) are not required to meet the accuracy or resolution requirements in these crash tests. The data shall be retrievable even after an impact of a severity level set by UN Regulations Nos.94, 95 or 137.	Test methods: the EU regulation adopts the impact test, whereas the Chinese standard adopts the impact test, driving operation data test and bench test.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
7	**7** Extension of approval of vehicle type **7.1** General For vehicle models that have passed type inspection as per this standard, the results can be extended to other vehicle models conforming to the determination condition of 7.2. After extension is granted to vehicle model, the extension vehicle model shall not be extended further to other vehicle models. **7.2** Determinant condition	/	/	Extension of type approval: the Chinese standard stipulates the extension of approval for different vehicle types on the premise of fulfilment of administrative requirements for product approval, in order to minimise manufacturer's costs and increase efficiency. Same vehicle manufacturer, EDR controller manufacturer, EDR controller specification and model are essential conditions for type approval extension.
/	Vehicle manufacturer information and controller manufacturer information (mark abbreviation or logo), specification and model, and unique number of ECU recording EDR data shall be marked on surface of EDR controller by means of nameplate, label, punching or mould, logo is clear and easy to see, durable and difficult to replace.	/	/	Exterior

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
/	/	**Art. 5**	**Provisions for roadworthiness testing** For the purpose of periodic roadworthiness tests on vehicles, it shall be possible to verify the following features of the event data recorder system: (1) its correct operational status, by visible observation of the failure warning signal status following activation of the vehicle master control switch and any bulb check. Where the failure warning signal is displayed in a common space (the area on which two or more information functions/symbols may be displayed, but not simultaneously), it must be checked first that the common space is functional prior to the failure warning signal status check; (2) its correct functionality and software integrity, by means of an electronic vehicle interface, such as the one laid down in Section I, point (14), of Annex III to Directive 2014/45/EU of the European Parliament and of the Council, where the technical characteristics of the vehicle allow for it and the necessary data is made available. Manufacturers shall ensure that technical information for using the electronic vehicle interface is made available in accordance with Article 6 of Commission Implementing Regulation (EU) 2019/621.	The EU regulation makes requirements on roadworthiness test.

Table 26: EDR standard & regulation comparison

GB 39732-2020 Event Data Recorder		The EC Regulation draft 2021RXXXX on specific test procedures and technical requirements for the type approval of motor vehicles with regard to Event Data Recorder (draft for comments) & UN R160		Remarks
Article No.	**Content**	**Article No.**	**Content**	
9	From 1 January 2022, the vehicles that newly apply for type approval shall meet the requirements other than those on Level B data elements and Article 4.4. From 1 January 2024, vehicles that newly apply for type approval shall meet all requirements contained in this standard. Vehicles that were type-approved before 1 January 2022 thereafter need only to record the data ele-ments below: Longitudinal delta-V, maximum recorded longitudinal delta-V, time to maximum recorded longitudinal delta-V, service brake on and off (position of brake pedal), vehicle velocity & vehicle identification number, longitudinal acceleration as an alternative to longitudinal delta-V, and passing impact test (5.1), driving operation data test (5.2) and bench test (5.3).	**EU regulation:**	Regulation (EU) 2019/2144 of the European Parliament and of the Council mandates motor vehicles of categories M1 and N1 to be equipped with event data recorders (EDR) from 6 July 2022 for new vehicle types and from 7 July 2024 for all new vehicles.	Effective date: the Chinese standard states that from 1 Jan. 2022, Level B data elements may not be recorded, but from 1 Jan. 2024, all requirements shall be met. The EU regulation started later than Chinese counterpart, and stipulates as such: from 6 July 2022, M1 and N1 new vehicles shall be equipped with qualified EDRs; from 7 July 2024, M1, M2, M3, N1, N2 and N3 new vehicles shall be equipped with qualified EDRs.

3.2.1.3 Type approval

Table 27: Type approval

Standard	Approval	Implementation content	Time
GB 39732-2020 Event Data Recorder	Incorporated	Passenger cars should be equipped with an event data recording system (EDR) in accordance with GB 39732; if a vehicle is equipped with an on-board video driving recording system that complies with GB/T 38892, it shall be deemed to meet the requirements; other buses with a length of less than 6m shall be equipped with a driving recorder or an event data recording system (EDR) that complies with the provisions of GB/T 19056 and GB 7258	18 July 2022 (CNCA Announcement No. 9 of 2022)
Regulation (EU) 2021xxxxx	Incorporated	M1 M2 M3 N1 N2 N3 STU	B D D B D D B

3.2.1.4 Summary

The Chinese standard and EU regulation remain consistent in terms of overall framework, but differ on scope of application, trigger threshold, locking conditions, number of records, data elements, data retrieval, protection requirements and test methods. As regards implementation date, both were put into force by stages, and the Chinese standard were implemented earlier.

3.3 Requirements for cybersecurity and software updates

In the automotive cybersecurity field, both China and Germany (Europe) are formulating and promoting the implementation of relevant regulations, standards and administrative measures, with EU countries progressing faster than China.

On the European side, UNECE WP.29 issued and implemented UNECE Cybersecurity R155 Regulation on 22 January 2021. As the first international regulation concerning vehicle cybersecurity governance, this regulation is applicable in 54 countries as Parties to the 1958 Agreement, including EU countries and Japan. Firstly, it proposes requirements for a cybersecurity management system as to vehicle manufacturers, as well as proposing technical requirements for cybersecurity for vehicle types that have been type-approved, requiring vehicle manufacturers to apply for type approval of new vehicles to the regulatory department only after obtaining a compliance certificate for a cybersecurity management system. The regulation also specifies the responsible parties, implementation process and timeline of implementation.

Relevant standards and documents include explanatory documents to UNECE R155, which provide a detailed explanation and exemplification for part of the R155 regulation. ISO/SAE 21434 Road Vehicles – Cybersecurity Engineering provides reference for the construction of cybersecurity system on the part of vehicle manufacturers. ISO PAS 5112 Road Vehicles – Guidelines for Auditing Cybersecurity Engineering and the VDA's Automotive Cybersecurity Management System Audit provide reference for auditing the cybersecurity management system of vehicle manufacturers.

On the Chinese side, MIIT issued the Guideline for the Administration of the Access of Intelligent and Connected Vehicle Manufacturers and Products (for Trial Implementation) in April 2021, which is similar to UNECE R155. The guideline establishes cybersecurity system requirements for Intelligent and Connected Vehicle manufacturers, and cybersecurity technical requirements for Intelligent and Connected Vehicle products. However, MIIT is still soliciting comments and details of how it will be put it in place remain unknown. With regard to Chinese standards, NTCAS, the National Technical Committee 485 on Communication of Standardization Administration of China and the National Information Security Standardization Technical Committee have been formulating and releasing relevant national standards with the Working Group on Information Security of the ICV sub-committee under NTCAS in particular. The working group is formulating the Technical Requirements for Vehicle Cybersecurity, a compulsory national standard that strengthens cybersecurity requirements for vehicles, and will provide a standards framework for national supervision.

Additionally, recommended national standards such as Technical Requirements and Test Methods for Cybersecurity of Vehicle Gateway and Technical Requirements and Test Methods for Cybersecurity of On-board Information Interactive System outline cybersecurity requirements applicable to auto parts. In light of the current circumstance, the guideline will be further promoted to standardise the cybersecurity of vehicle manufacturers and products in China with the support of relevant national standards.

To compare automotive cybersecurity standards in China and Germany, the Technical Requirements for Vehicle Cybersecurity, which is now being formulated by NTCAS as a compulsory national standard, benchmarks with Germany's (the EU's) current UNECE R155 Cyber Security and Cyber Security Management System. Another important NTCAS standard under development is Road Vehicles – Cybersecurity Engineering, which benchmarks with ISO/SAE 21434 Road Vehicles – Cybersecurity Engineering.

In addition, NTCAS has several other recommended national standards concerning auto parts or cybersecurity functions and services released or under development, and relevant standards on a cybersecurity management system audit are also being prepared for approval.

3.3.1 Technical requirements for vehicle cybersecurity

3.3.1.1 Regulation/standard briefing

The Technical Requirements for Vehicle Cybersecurity (standard drafting stage) is a mandatory national standard, initiated in November 2019. In March 2021, it became a compulsory standard for project approval, its content having been extended from technical requirements to benchmarking with R155, since the issuance and implementation of UNECE R155 made Chinese departments aware of the importance and compulsory nature of vehicle cybersecurity and of the need to attune domestic vehicle cybersecurity standards to EU R155.

R155 makes requirements for vehicle cybersecurity type approval by laying out rules and an appendix, whereas NTCAS's Technical Requirements for Vehicle Cybersecurity contains three parts, namely system requirements, technical specifications and test methods.

In terms of the differences in type approval between China and EU, the Technical Requirements for Vehicle Cybersecurity abandons R155's provisions on type approval application and endorsement, retains management requirements for the cybersecurity management system and vehicle types of domestic vehicle enterprises, in line with the industry status in China, and makes adjustments in line with conditions in China.

3.3.1.2 Analysis of main similarities and differences

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
5.1.1	The vehicle manufacturer shall establish a cybersecurity management system throughout the full lifecycle of the vehicle. Vehicle lifecycle includes development phase, production phase and post-production phase.	**7.2.2.1**	The vehicle manufacturer shall demonstrate to an Approval Authority or Technical Service that their cybersecurity management system shall apply to the following phases: **a)** development phase; **b)** production phase; **c)** post-production phase.	R155 is implemented by type approval organisations or technical service providers.

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
5.1.2	The cybersecurity management system shall set essential processes with full consideration of security risks: **1)** the processes used within the manufacturer's organisation to manage cybersecurity; **2)** the processes used for the identification of risks to vehicle types; **3)** the processes used for the assessment, categorisation and treatment of the risks identified; **4)** the processes in place to verify that the risks identified are appropriately managed; **5)** the processes used for testing the cybersecurity of a vehicle type; **6)** the processes used for ensuring that risk assessment is kept current; **7)** the processes used to monitor and respond to cyberat-tacks, cyber threats and vulnerabilities on vehicle types; **8)** the processes used to assess whether the cybersecurity measures implemented are still effective in the light of new cyber threats and vulnerabilities that have been identified; **9)** the processes used to provide relevant data to support analysis of attempted or successful cyberattacks.	**7.2.2.2**	The vehicle manufacturer shall demonstrate that the processes used within their cybersecurity management system ensure security is adequately considered, including risks and mitigations listed in Annex 5. This shall include: **a)** The processes used within the manufacturer's organisation to manage cybersecurity. **b)** The processes used for the identification of risks to vehicle types. Within these processes, the threats in Annex 5, Part A, and other relevant threats shall be considered. **c)** The processes used for the assessment, categorisation and treatment of the risks identified. **d)** The processes in place to verify that the risks identified are appropriately managed. **e)** The processes used for testing the cybersecurity of a vehicle type; **f)** The processes used for ensuring that the risk assessment is kept current;	The GB simplifies the R156 requirement to user's confirmation.

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
5.1.2		**7.2.2.2**	**g)** The processes used to monitor for, detect and respond to cyberattacks, cyber threats and vulnerabilities on vehicle types and the processes used to assess whether the cybersecurity measures implemented are still ef-fective in the light of new cyber threats and vulnerabilities that have been identified. **h)** The processes used to provide relevant data to support analysis of at-tempted or successful cyberattacks.	
5.1.3	The vehicle manufacturer shall ensure that the identified cyber threats and vulnerabilities are responded to within a reasonable timeframe.	**7.2.2.3**	The vehicle manufacturer shall demonstrate that the processes used within their cybersecurity management system will ensure that, based on categorisation referred to in paragraph 7.2.2.2 (c) and 7.2.2.2 (g), cyber threats and vulnerabilities which require a response from the vehicle manufacturer shall be mitigated within a reasonable timeframe.	R155's requirements for risk mitigation within a reasonable timeframe is mentioned in Article 5.1.4 of the Chinese standard.

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
5.1.4	The vehicle manufacturer shall ensure that the cyber threats and vulnerabilities required to be responded to are mitigated within a reasonable timeframe, and that monitoring against and response to cyberattacks, cyber threats and vehicle vulnerabilities are continual. This shall include vehicles after first registration in the monitoring; include the capability to analyse and detect cyber threats, vulnerabilities and cyberattacks from vehicle data and vehicle logs.	**7.2.2.4**	The vehicle manufacturer shall demonstrate that the processes used within their cybersecurity management system will ensure that the monitoring referred to in paragraph 7.2.2.2 (g) shall be continual. This shall: **a)** include vehicles after first registration in the monitoring; **b)** include the capability to analyse and detect cyber threats, vulnerabilities and cyberattacks from vehicle data and vehicle logs. This capability shall respect paragraph 1.3. and the privacy rights of car owners or drivers, particularly with respect to consent.	R155 also includes conforming to requirements concerning personal privacy rights.
5.1.5	The vehicle manufacturer shall specify and manage dependencies that may exist between the cybersecurity management system and the contracted suppliers, service providers or manufacturer's sub-organisations in relation to security processes.	**7.2.2.5**	The vehicle manufacturer shall be required to demonstrate how their cybersecurity management system will manage dependencies that may exist with contracted suppliers, service providers or manufacturer's sub-organisations with regard to the requirements of paragraph 7.2.2.2.	IDT

3.3.1.3 Comparison of vehicle type management requirements

Technical Requirements for Vehicle Cybersecurity		UNECE Regulation No.155		Remarks
Article No.	Content	Article No.	Content	
6.1.1	The vehicle manufacturer shall comply with the requirements of the cybersecurity management system during the product development process.	7.3.1	The manufacturer shall have a valid Certificate of Compliance for the cybersecurity management system relevant to the vehicle type being approved.	IDT
6.1.2	The vehicle manufacturer shall identify and manage supplier-related risks for the vehicle type being approved.	7.3.2	The vehicle manufacturer shall identify and manage, for the vehicle type being approved, supplierrelated risks.	IDT
6.1.3	The vehicle manufacturer shall identify the critical elements of the vehicle type and perform an exhaustive risk assessment, and shall treat/manage the identified risks appropriately.	7.3.3	The vehicle manufacturer shall identify the critical elements of the vehicle type and perform an exhaustive risk assessment for the vehicle type and shall treat/manage the identified risks appropriately. The risk assessment shall consider the individual elements of the vehicle type and their interactions. The risk assessment shall further consider interactions with any external systems. While assessing the risks, the vehicle manufacturer shall consider the risks related to all the threats referred to in Annex 5, Part A, as well as any other relevant risk.	The risks mentioned in R155 are listed in Annex 5.

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
6.1.4	The vehicle manufacturer shall protect the vehicle type against risks identified in the risk assessment in accordance with the technical requirements. If a mitigation referred to in the technical requirements is not relevant or not sufficient for the risk identified, the vehicle manufacturer shall ensure that another appropriate mitigation is implemented.	**7.3.4**	The vehicle manufacturer shall protect the vehicle type against risks identified in the vehicle manufacturer's risk assessment. Proportionate mitigations shall be implemented to protect the vehicle type. The mitigations implemented shall include all mitigations referred to in Annex 5, Part B and C which are relevant for the risks identified. However, if a mitigation referred to in Annex 5, Part B or C, is not relevant or not sufficient for the risk identified, the vehicle manufacturer shall ensure that another appropriate mitigation is implemented.	The risks and mitigations contained in R155 are listed in Annex 5.
6.1.5	The vehicle manufacturer shall take appropriate measures to secure dedicated environments on the vehicle type for the storage and execution of aftermarket software, services, applications or data.	**7.3.5**	The vehicle manufacturer shall put in place appropriate and proportionate measures to secure dedicated environments on the vehicle type (if provided) for the storage and execution of aftermarket software, services, applications or data.	IDT
6.1.6	The vehicle manufacturer shall perform appropriate and sufficient testing to verify the effectiveness of the security measures implemented.	**7.3.6**	The vehicle manufacturer shall perform, prior to type approval, appropriate and sufficient testing to verify the effectiveness of the security measures implemented	IDT

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
6.1.7	The vehicle manufacturer shall implement measures for the vehicle type to detect and prevent cyberattacks against vehicles of the vehicle type, support the monitoring capability of the vehicle manufacturer with regards to detecting threats, vulnerabilities and cyberattacks relevant to the vehicle type, and provide data forensic capability to enable analysis of attempted or successful cyberattacks.	**7.3.7**	The vehicle manufacturer shall implement measures for the vehicle type to: **a)** detect and prevent cyberattacks against vehicles of the vehicle type; **b)** support the monitoring capability of the vehicle manufacturer with regards to detecting threats, vulnerabilities and cyberattacks relevant to the vehicle type; **c)** provide data forensic capability to enable analysis of attempted or successful cyberattacks.	IDT
6.1.8	If the cryptographic modules used are not in line with international or national standards, then the vehicle manufacturer shall justify their use.	**7.3.7.8**	Cryptographic modules used for the purpose of this Regulation shall be in line with consensus standards. If the cryptographic modules used are not in line with consensus standards, then the vehicle manufacturer shall justify their use.	R155 incorporates conformity requirements of the cryptographic standard.

As regards technical requirements and test methods, Technical Requirements for Vehicle Cybersecurity analyses and converts risks, summarises typical attack scenarios with reference to the seven risks and mitigations contained in the Annex 5 of R155, proposes standard vehicle cybersecurity technical requirements and develops test methods accordingly in the light of the current situation of Chinese automakers.

3.3.1.4 Technical requirements for vehicle cybersecurity

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
7	Security requirements for external connectivity	**4.3.5**	Threats to vehicles regarding their external	IDT
7.1	Security requirements for remote control system	**16**	Manipulation of the connectivity of vehicle functions enables a cyberattack, this can include telematics; systems that permit remote operations; and systems using short range wireless communications.	R155 involves systems using short range wireless communication.
7.1.1	Systems with remote control functions	**16.1**	Manipulation of functions designed to remotely operate systems, such as remote key, immobiliser and charging pile.	The GB details the security technical requirements and audit requirements for remote control functions.
7.1.1.1	The authenticity and integrity of the command information for remote control shall be verified.			
7.1.1.2	Remote control functions include remote keys. These shall be able to deal with the verification failure (if any) of authenticity and integrity of the command information.	**16.2**	Manipulation of vehicle telematics (e.g. manipulate temperature measurement of sensitive goods, remotely unlock cargo doors)	
7.1.1.3	Access control shall be set; the use of remote control commands outside the control to manipulate the system shall be prohibited.			
7.1.1.4	Security audit functions shall be included, of which the audit records shall include the remote control command date, time, sending subject, and whether the operation is successful or not, etc.			
7.1.1.5	Audit records shall be protected from unanticipated deletion, modification or overwriting, etc.			
7.1.1.6	Audit records shall be protected from unauthorised interruptions.			
7.1.1.7	Integrity verification shall be performed on the programs and data of systems with remote control functions.			

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
7.1.2	Short range wireless communication and sensors	**16.3**	Interference with short range wireless systems or sensors.	The GB details the technical requirements for electro-magnetic interference security.
7.1.2.1	Electromagnetic interference shielding shall be applied to sensors.			
7.1.2.2	Short range wireless systems shall be detected for failures arising from electromagnetic interference attacks.	**16.1**		
7.2	Security requirements for third-party applications (environment).	**17.1**	Corrupted applications, or those with poor software security, used as a method to attack vehicle systems.	The GB details the security requirements for third-party applications.
7.2.1	The authenticity and integrity of the third-party application shall be tested.			
7.2.2	The access resources of the t hird-party application shall be controlled; applications that illegally use resources outside the control shall be prohibited from being installed or operated.			
7.3	Security requirements for external interfaces.	**18**	Devices connected to external interfaces e.g. USB ports, OBD port, used as a means to attack vehicle systems.	R155 involves examples of external interfaces.
7.3.1	Access control shall be performed on files in devices connected to USB ports, allowing only media files to be read and written or application software with specified signatures to be installed or executed.	**18.1**	External interfaces such as USB or other ports used as a point of attack, for example through code injection.	The GB details the technical requirements for access security control of external interfaces.
7.3.2	Access control shall be protected for Jtag interface and other debugging interface access; unauthorised user access is prohibited.			

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
16.27.3.3	The system shall be able to resist virus programs and virus-carrying media files/applications in the USB port access device.	**18.2**	Interference with short range wireless systems or sensors.	The GB contains more specific requirements for the USB port access device.
7.3.4	Security strategies such as authentication and access control shall be implemented when sending write requests through the OBD interface.	**18.3**		The GB details the technical requirements for OBD port access security.
8	Security requirements for communication channels.	**4.3.2**		IDT
8.1	The vehicle receives spoofing of messages or data.	**4**	Spoofing of messages or data received by the vehicle.	IDT
8.1.1	The vehicle shall verify the authenticity and integrity of received messages to prevent spoofing by counterfeit messages.	**4.1**	Spoofing of messages (e.g. 802.11p V2X during platooning, GNSS messages, etc.) by impersonation.	The GB details the technical requirements for external messages received by the vehicle.
8.1.1.1	The vehicle's communication with vehicles, roadside units, service platforms, etc., shall go through identity authentication.			
8.1.1.2	Integrity protection and verification mechanisms shall be adopted to prevent messages received by the vehicle from being tampered with or forged.			

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
8.1.2	Security control of stored keys shall be implemented to prevent Sybil (spoofing other vehicles) attacks.	**4.2**	Sybil attack (in order to spoof other vehicles as if there are many vehicles on the road)	The GB translates the Sybil attack security requirements in R155 into technical requirements for vehicle key security.
8.1.2.1	The identity key of the vehicle shall be stored with security.			
8.1.2.2	Access control shall be performed on the use of keys.		Communication channels used to conduct unauthorised manipulation, deletion or other amendments to vehicle held code/data.	IDT
8.2	Communication channels shall not be used to conduct unauthorised manipulation with vehicle held code/data.	**5**	Communications channels permit code injection, for example tampered software binary might be injected into the communication stream	The GB details the technical requirements for external messages received by the vehicle.
8.2.1	Integrity protection and verification mechanisms shall be employed to prevent the injection of tampered code into the vehicle held data/code through the communication channels.	**5.1**		
8.2.2	The internal network of the vehicle shall be divided into security zones, of which the boundaries shall be protected, thus forming a logical isolation between physical devices that do not need to communicate.			

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
8.1.3	Access control and related technologies shall be used to prevent illegal manipulation, overwriting, erasure or introduction of illegal data or codes by messages from external channels to the vehicle data/code.	**5.2** **5.3** **5.4** **5.5**	Communications channels permit manipulation of vehicle held data/code. Communications channels permit overwrite of vehicle held data/code. Communications channels permit erasure of vehicle held data/code. Communications channels permit introduction of data/code to the vehicle (write data code).	The GB combines the security requirements for data and code.
8.3	Authenticity and validity requirements for communication messages.	**6**	Communication channels permit untrusted/unreliable messages to be accepted or are vulnerable to session hijacking/replay attacks.	The GB summarises R155 requirements as authenticity and validity.
8.3.1	The vehicle shall verify the authenticity of the received messages to prevent receiving information from unreliable or untrusted sources.	**6.1**	Accepting information from an unreliable or untrusted source.	The GB proposes to verify the authenticity of the received messages.
8.3.2	The vehicle shall verify the authenticity of the received messages to prevent attack/session hijacking from man in the middle.	**6.2**	Man in the middle attack/session hijacking.	The GB proposes to verify the authenticity of the received messages.

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
8.3.3	The vehicle shall verify the validity or uniqueness of the received messages to protect against replay attacks.	**6.3**	Replay attack, for example an attack against a communication gateway, allows the attacker to downgrade software of an ECU or firmware of the gateway.	The GB proposes to verify the authenticity and uniqueness of the received messages.
8.4	Information leakage shall be prevented.	**7**	Information can be readily disclosed, for example through eavesdropping on communications or allowing unauthorised access to sensitive files or folders.	R155 contains examples of information leakage.
8.4.1	Confidential data transmitted to or from the vehicle shall be protected against leakage of sensitive information due to interception of communication information from the vehicle, interfering radiations or communication monitoring, by establishing appropriate confidentiality protection mechanism.	**7.1**	Interception of information / interfering radiations / monitoring communications.	The GB details security technical requirements for the vehicle communication process.
8.4.2	Unauthorised access to personal or system-critical data or files shall be prevented through access control and related technologies.	**7.2**	Gaining unauthorised access to files or data.	The GB puts forward security technical requirements for access control.
8.5	Denial of service attacks via communication channels to disrupt vehicle functions shall be prevented.	**8**	Denial of service attacks via communication channels to disrupt vehicle functions.	IDT

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
8.5.1	Actions shall be taken to detect denial of service attacks and recover from such attacks, so as to prevent a large number of garbage data from being sent to the vehicle information system, which makes it unable to provide services in the normal manner.	**8.1**	Sending a large number of garbage data to the vehicle information system, so that it is unable to provide services in the normal manner.	The GB proposes detection and recovery from denial of service attacks.
8.5.2	Actions shall be taken to detect and recover from black hole attacks.	**8.2**	Black hole attack, disruption of communication between vehicles by blocking the transfer of messages to other vehicles.	The GB proposes recovery from black hole attacks.
8.6	Unprivileged users shall be prevented from gaining privileged access to vehicle systems.	**9**	An unprivileged user is able to gain privileged access to vehicle systems.	IDT
8.6.1	Actions shall be taken to detect and prevent unprivileged users gaining privileged access to vehicle systems.	**9.1**	An unprivileged user is able to gain privileged access, for example root access.	IDT
8.7	Viruses embedded in communication media shall be prevented from infecting vehicle systems.	**10**	Viruses embedded in communication media are able to infect vehicle systems.	IDT
8.7.1	Actions shall be taken to prevent viruses/malware embedded in communication media from infecting vehicle systems.	**10.1**	Virus embedded in communication media infects vehicle systems.	IDT
8.8	Messages containing malicious content received by the vehicle or transmitted within it shall be prevented.	**11**	Messages received by the vehicle (for example X2V or diagnostic messages), or transmitted within it, contain malicious content.	The GB deletes examples of X2V and diagnostic messages.

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
	Actions shall be considered to detect malicious internal messages.	**11.1**	Malicious internal (e.g. CAN) messages.	IDT
8.8.2	The vehicle shall verify the authenticity and integrity of received massages to identify malicious V2X messages, malicious diagnostic messages, malicious proprietary messages, etc., and protective measures shall be taken to prevent the vehicle from being attacked by malicious messages.	**11.2**	Malicious V2X messages, e.g. infrastructure to vehicle or vehicle-vehicle messages (e.g. CAM, DENM).	The GB combines a number of R155 articles.
		11.3	Black hole attack, disruption of communication between vehicles by blocking the transfer of messages to other vehicles.	
		11.4	Malicious proprietary messages (e.g. those normally sent from OEM or component/system/function supplier).	
9	Security requirements for software update.		4.3.3. Threats to vehicles regarding their update procedures.	IDT
9.1	Security requirements for TA security update.	**12**	An unprivileged user is able to gain privileged access, for example root access.	The GB details the technical requirements for the security of software OTA update.
9.1.1	The vehicle side and the OTA software update servers shall verify each other's authenticity.			
9.1.2	The vehicle side shall verify the authenticity and integrity of the update package.	**12.1**	Compromise of over-the-air software update procedures. This includes fabricating the system update program or firmware.	
9.1.3	The vehicle-side software update program shall log the failure events that occur during the OTA software update process.			

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
9.1.4	The vehicle-side master update procedures shall be equipped with the functions of safe boot, trusted root, Bootloader program and system firmware, which shall not be tampered with or else normal boot may be unavailable.	**12.1**	Compromise of over-the-air software update procedures. This includes fabricating the system update program or firmware.	The GB details the technical requirements for the security of software OTA update.
9.2	Security requirements for local update.	**12.2**	Compromise of local/physical software update procedures. This includes fabricating the system update program or firmware.	The GB proposes to authenticate the flash identity.
9.2.1	The vehicle side shall authenticate the flash access end and verify the authenticity of its identity.			
9.2.2	The vehicle side shall verify the integrity of the update package.			
9.3	The in-vehicle software update system shall verify the authenticity and integrity of the acquired update package.	**12.3**	The software is manipulated before the update process (and is therefore corrupted), although the update process is intact.	The GB proposes to verify the authenticity and integrity of the update package.
10	Security requirements for external servers, unintentional and potential vulnerabilities.	**1**	Back-end servers used as a means to attack a vehicle or extract data.	The GB combines contents about back-end servers, unintentional behaviours and potential vulnerabilities.
10.1	External servers.	**2**	Services from back-end server being disrupted, affecting the operation of a vehicle.	IDT

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
10.1.1	In the event the vehicle loses communication with back-end servers or when the back-end services are not available, the normal basic functions related to vehicle driving shall be guaranteed, or corresponding measures shall be taken to ensure driving safety.	**2.1**	Attack on back-end server stops it functioning, for example, it prevents it from interacting with vehicles and providing services they rely on.	The GB puts forward security requirements to guarantee the normal basic functions of vehicle driving.
10.1.2	When back-end data on which the vehicle relies is lost, the normal basic functions related to vehicle driving shall be guaranteed, or corresponding measures shall be taken to ensure driving safety.	**3.2**	Loss of information in the cloud. Sensitive data may be lost due to attacks or accidents when data is stored by third-party cloud service providers.	The GB puts forward the security requirements to guarantee the normal basic functions of vehicle driving.
10.1.3	Secure identity authentication shall be im-plemented before the vehicle communicates with the back-end server.	**3.5**	Information breach by unintended sharing of data (e.g. admin errors).	The GB proposes to verify the identity.
10.2	Threats triggered by unintentional behaviours to the vehicle.	**15**	Legitimate actors are able to take actions that would unwittingly facilitate a cyberattack.	The GB summarises this part as threats to the vehicle triggered by unintentional behaviours.
		15.1	Innocent victim (e.g. owner, operator or maintenance engineer) being tricked into taking an action to unintentionally load malware or enable an attack.	

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
10.2.1	The default security settings shall be adopted for the vehicle.	**15.2**	Defined security procedures are not followed.	The GB refines the R155 requirements to personnel and users.
10.2.2	Users shall be informed of the necessary cybersecurity precautions.	**2.1**		
10.2.3	Maintenance personnel shall follow cybersecurity procedures.			
10.3	Potential vulnerabilities and general protection requirements.	**4.3.7**	Potential vulnerabilities that could be exploited if not sufficiently protected or hardened.	The GB involves general protection requirements.
10.3.1	Cryptographic technologies might be compromised or are insufficiently applied.	**26**	Cryptographic technologies can be compromised or are insufficiently applied.	IDT
10.3.1.1	Encryption keys of appropriate length and period of validity shall be defined based on different encryption algorithms and scenarios.	**26.1**	Combination of short encryption keys and long period of validity enables attacker to break encryption.	IDT
10.3.1.2	Open, published cryptographic algorithms shall be used, with appropriate parameters and options selected.	**26.2**	Insufficient use of cryptographic algorithms to protect sensitive systems.	IDT
10.3.1.3	Effective cryptographic algorithms shall be used and checked periodically to take appropriate action.	**26.3**	Using already or soon to be deprecated cryptographic algorithms.	IDT

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
10.3.2	Parts or supplies could be compromised to permit vehicles to be attacked.	**27**	Parts or supplies could be compromised to permit vehicles to be attacked.	
10.3.2.1	Necessary actions shall be taken to identify and collect security vulnerabilities of parts and supplies, and the identified security vulnerabilities shall be promptly fixed or addressed after assessing possible impacts.	**27.1**	Hardware or software, engineered to enable an attack or fails to meet design criteria to stop an attack.	The GB proposes to fix hardware and software vulnerabilities.
10.3.2.2	Security measures shall be taken for parts to protect the security of hardware, software and the system.			
10.3.3	Software or hardware development permits vulnerabilities.	**28**	Potential vulnerabilities that could be exploited if not sufficiently protected or hardened.	Software or hardware development permits vulnerabilities.
10.3.3.1	Necessary measures shall be taken to reduce software bugs.	**28.1**	Software bugs. The presence of software bugs can be a basis for potential exploitable vulnerabilities. This is particularly true if software has not been tested to verify that known bad code/ bugs is not present and reduce the risk of unknown bad code/ bugs being present.	IDT
10.3.3.2	The vehicle shall take security measures for the debug ports after mass production based on the risk assessment results; for high-risk parts, the debug ports shall be closed or disabled, or secure access control mechanisms shall be set up.	**28.2**	Using remainders from development (e.g. debug ports, JTAG ports, microprocessors, development certificates, developer passwords, ...) can permit access to ECUs or permit attackers to gain higher privileges.	The GB breaks down R155 requirements into two articles, one for debugging ports, the other for system privileges.
10.3.3.3	For high-risk parts, measures shall be taken to prohibit direct login by the most privileged users.			

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
10.3.4	Network design introduces vulnerabilities.	**29**	Network design introduces vulnerabilities.	The GB proposes to fix hardware and software vulnerabilities.
10.3.4.1	Unnecessary network ports shall be closed.	**29.1**		
10.3.4.2	Measures shall be taken for vehicle communications to isolate the internal communication network from the external.	**29.2**	Superfluous internet ports left open, providing access to network systems.	
10.3.4.3	The in-vehicle network shall be isolated according to functional needs, and access control shall be performed on cross-domain requests, of which the list shall follow the default denial principle and minimal authorisation principle.		Circumvent network separation to gain control. Specific example is the use of unprotected gateways, or access points (such as truck-trailer gateways), to circumvent protections and gain access to other network segments to perform malicious acts, such as sending arbitrary CAN bus messages.	Software or hardware development permits vulnerabilities.
10.3.5	Necessary measures shall be taken to reduce software bugs.	**31**	Unintended transfer of data can occur.	IDT
10.3.5.1	For vehicle resale, rental or scrapping, personal information erasure and anti-recovery mechanism shall be available.	**31.1**	Information breach. Personal data may be leaked when the car changes user (e.g. is sold or is used as hire vehicle with new hirers).	IDT
10.3.6	Physical manipulation of systems can enable an attack.	**32**	Physical manipulation of systems can enable an attack.	IDT

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
10.3.6.1	There shall be an identity authentication mechanism for parts that communicate with the external world.	**32.1**	Manipulation of electronic hardware, e.g. unauthorised electronic hardware added to a vehicle to enable 'man-in-the-middle' attack. Replacement of authorised electronic hardware (e.g. sensors) with unauthorised electronic hardware. Manipulation of the information collected by a sensor (for example, using a magnet to tamper with the Hall effect sensor connected to the gearbox).	The GB translates R155 requirements into an identification requirement for external parts.
11	Data/code security.	**4.3.6**	Threats to vehicle data/code.	IDT
11.1	Safety requirements for extraction of vehicle data/code.	**19**	Extraction of vehicle data/code.	IDT
11.1.1	Anti-extraction of copyright or proprietary software (product piracy/stolen software) shall be adopted in the vehicle system to strengthen the defence mechanism.	**19.1**	Extraction of copyright or proprietary software from vehicle systems (product piracy).	IDT
11.1.2	Unauthorised access to sensitive personal information shall be prevented and such information shall be encrypted.	**19.2**	Unauthorised access to the owner's privacy information, such as personal identity, payment account information, address book information, location information, vehicle's electronic ID, etc.	IDT
11.1.3	The vehicle shall store cryptographic keys securely to prevent unauthorised access.	**19.3**	Extraction of cryptographic keys.	IDT
11.2	Anti-tampering for data/code.	**20**	Manipulation of vehicle data/code.	IDT

Table 28: Comparison of requirements for vehicle cybersecurity management systems

Technical Requirements for Vehicle Cybersecurity (Draft Stage)		UNECE Regulation No.155		Remarks
Article No.	**Content**	**Article No.**	**Content**	
11.2.1	The vehicle shall ensure that unique vehicle ID and data for identification stored in the vehicle are not tampered with.	**20.1** **20.2**	Illegal/unauthorised changes to vehicle's electronic ID. Identity fraud. For example, if a user wants to display another identity when communicating with toll systems, manufacturer backend.	The GB combines the two R155 requirements as one.
11.2.2	The vehicle shall ensure that the critical data stored in the vehicle is not tampered with.	**20.3** **20.4** **20.5**	Action to circumvent monitoring systems (e.g. hacking/ tampering/ blocking of messages such as ODR Tracker data, or number of runs). Data manipulation to falsify vehicle's driving data (e.g. mileage, driving speed, driving directions, etc.). Unauthorised changes to system diagnostic data.	The GB combines the three types of data stated in R155 as critical data in the vehicle.
11.5	The vehicle shall be able to monitor and record denial of service attacks.	**24** **24.1**	Disruption of systems or operations. Denial of service, for example this may be triggered on the internal network by flooding a CAN bus, or by provoking faults on an ECU via a high rate of messaging.	The GB proposes to monitor and record denial of service attacks.
11.6	The vehicle shall securely store vehicle configuration parameters to prevent their unauthorised deletion and modification.	**25** **25.1** **25.2**	Manipulation of vehicle parameters. Unauthorised access to falsify the configuration parameters of vehicle's key functions, such as brake data, airbag deployed threshold, etc. Unauthorised access to falsify the charging parameters, such as charging voltage, charging power, battery temperature, etc.	The GB summarises R155 requirements as prevention of unauthorised deletion and modification of vehicle configuration parameters.

3.3.1.5 Type approval

Not involved.

3.3.2 Cybersecurity engineering

3.3.2.1 Regulation/standard briefing

ISO/SAE 21434 Road Vehicles – Cybersecurity Engineering was officially released in August 2021. It put forward requirements for vehicle manufacturers and auto parts suppliers in respect of building an automotive information security system, while offering them guidance, and has supported systemic construction of the UNECE R155 Regulation.

The National Technical Committee of Auto Standardization (NTCAS) in China was also involved in compilating the standard and at an early stage NTCAS proposed transforming the international standard into a national one to apply to the national situation. To date, NTCAS has established the recommended national standard Road Vehicles – Cybersecurity Engineering, equivalent to ISO/SAE 21434, which is precisely translated and adapted to the industrial situation in China, and may be used as a supporting standard for systemic construction of the national mandatory standard Technical Requirements for Vehicle Cybersecurity.

3.3.2.2 Analysis of main similarities and differences

To adopt IDT method.

3.3.2.2 Type approval

Not involved.

3.3.3 Cyber security standard for auto parts

3.3.3.1 Regulation/standard briefing

Germany and the EU have not yet issued any formal standard on cybersecurity for auto parts, but there are three recommended national standards officially released by the NTCAS at present in China. These are: GB/T 40855-2021 Technical Requirements and Test Methods for Cybersecurity of Remote Service and Management System for Electric Vehicles; GB/T 40856-2021 Technical Requirements and Test Methods for Cybersecurity of On-board Information Interactive System; and GB/T 40857-2021 Technical Requirements and Test Methods for Cybersecurity of Vehicle Gateway.

GB/T 40855-2021 Technical Requirements and Test Methods for Cybersecurity of Remote Service and Management System for Electric Vehicles, as a recommended national standard, stipulates information security-related requirements and corresponding test methods for data communication between the on-board terminal, the vehicle company's platform and public platform of pure electric vehicles, plug-in hybrid electric vehicles and fuel cell electric vehicles in the Chinese market.

GB/T 40856-2021 Technical Requirements and Test Methods for Cybersecurity of On-board Information Interactive System, as a recommended national standard, puts forward technical requirements and corresponding test methods for information security protection of hardware, communication protocol and interface, operating system, application software and on-board terminal (T-Box) data, and the in-vehicle infotainment (IVI) system.

It can be used as a guidance for vehicle manufacturers, auto parts suppliers, software suppliers, etc., to design, develop, verify and produce information security technologies for on-board information interactive systems.

GB/T 40857-2021 Technical Requirements and Test Methods for Cybersecurity of Vehicle Gateway, as a recommended national standard, stipulates information security-related requirements and corresponding test methods for hardware, communication, firmware and data of automotive gateway products, applicable to the design and realisation of vehicle gateway information security, as well as the testing, evaluation and management of automotive gateway products.

3.3.4 Automotive software update standards

3.3.4.1 Regulation/standard briefing

With regard to automotive software updates, the regulation that is mainly used currently in the international community is UNECE R156, which was officially released and implemented on 22 January 2021 (Software Update and Software Update Management System), which applies to 54 contracting parties, including the EU, Japan and other member countries of the UNECE 1958 Agreement.

Similar to the R155 Regulation, the R156 Regulation also requires vehicle manufacturers to obtain software update management system certification before they can apply for software update type approval of the models.

The regulation includes software update management system requirements for auto manufacturers, type approval process requirements and functional and technical requirements for software update.

In China, it was quickly recognised that automotive software updates and information security were equally important; taking into account the alignment of Chinese standards and international regulations, and in order to ensure consistency in compliance of Chinese vehicle manufacturers in applying the Chinese automotive software update standard with the EU R156 Regulation, the NTCAS has set up as a mandatory national standard the General Technical Requirements for Software Update of Vehicles.

This is the Chinese version adapted from the R156 Regulation based on the Chinese auto market, including vehicle requirements, test methods and the software update management system (SUMS).

3.3.4.2 Analysis of main similarities and differences

Table 29: Differences in technical requirements for auto software updates

General Technical Requirements for Software Update of Vehicles (Draft for Comments)		UNECE Regulation No.156		Remarks
Article No.	**Content**	**Article No.**	**Content**	
5.1.2	Vehicles shall be capable of updating the software identifier or software version (set).	**7.2.1.2.1**	Each RXSWIN shall be uniquely identifiable. When type approval relevant software is modified by the vehicle manufacturer, the RXSWIN shall be updated if it leads to a type approval extension or to a new type approval.	The GB converts the RXSWIN requirement in R156 into a requirement for software identifier or version set update.
5.1.3	Each software identifier shall be easily readable in a standardised manner through an electronic communication interface, or at least through a standard interface (OBD port).	**7.2.1.2.2**	Each RXSWIN shall be easily readable in a standardised way via the use of an electronic communication interface, at least by the standard interface (OBD port).	The GB proposes compatibility provisions for vehicles not using a software identifier.
5.1.4	If the software identifier is not used on the vehicle, the software version (set) associated with the type approval shall be easily readable in a standardised manner through a standard interface (OBD port).			
5.2.2	Confirmation shall be available prior to execution of the update.	**7.2.1.1**	The authenticity and integrity of software updates shall be protected to reasonably prevent their compromise and reasonably prevent invalid updates.	The GB simplifies the R156 requirement to user's confirmation.
1.2.7	During the update process, the user in the vehicle shall not be prohibited from unlocking the door.	**–**	–	The GB adds the requirement about door locking status during the update process, in addition to the R156 requirement.

Table 29: Differences in technical requirements for auto software updates

General Technical Requirements for Software Update of Vehicles (Draft for Comments)		UNECE Regulation No.156		Remarks
Article No.	**Content**	**Article No.**	**Content**	
1.2.8	After the execution of an update: **a)** the vehicle user is able to be informed of the success (or failure) of the update; **b)** the vehicle user is able to be informed about the changes implemented and any related updates to the user manual (if applicable); **c)** the vehicle user is able to be informed about the failure of the update and relevant suggestions.	**7.2.2.4**	After the execution of an update the vehicle manufacturer shall demonstrate how the following will be implemented: **a)** the vehicle user is able to be informed of the success (or failure) of the update; **b)** the vehicle user is able to be informed about the changes implemented and any related updates to the user manual (if applicable).	The GB adds the requirement to inform the user of the suggested solution if the update fails, in addition to the R156 requirement.
1.2.9	The vehicle manufacturer shall ensure that the vehicle is able to restore systems to their previous version in case of a failed or interrupted update, or that the vehicle can be placed into a safe state.	**7.2.2.1.1**	The vehicle manufacturer shall ensure that the vehicle is able to restore systems to their previous version in case of a failed or interrupted update or that the vehicle can be placed into a safe state after a failed or interrupted update.	IDT

3.3.4.3 Type approval

Not involved.

3.3.5 Summary

Cybersecurity and software update of vehicles are products of the development trend of automobiles being more electrified, intelligent, connected and shared; both are new auto technologies, since they are based on the concept of software-defined automobiles, in which software is of strong relevance.

Both China and Germany (Europe) are keeping a close eye on the development of relevant technologies in these two fields, while formulating relevant regulations, standards and administrative measures. In addition, these two key areas of technology, closely related to vehicle safety performance and a driver's personal and property safety, are highly valued by both countries.

At present, China's standardisation organisations represented by the NTCAS mainly follow and transform UNECE regulations and relevant ISO standards in terms of developing standards and rules on vehicle cybersecurity and software updates.

These include: Technical Requirements Vehicle Cybersecurity, which corresponds to UNECE Regulation R155 Cyber security and cyber security management system – this not only puts forward information security management system requirements for OEMs, but also proposes cybersecurity technology baseline requirements for vehicle products concerning the seven major risk items for auto cybersecurity; General Technical Requirements for Software Update of Vehicles, the mandatory national standard corresponding to the UNECE Regulation R156 Software update and software update management system – this puts forward management system requirements for vehicle software update and process technical requirements for vehicle products; Road Vehicles – Cybersecurity Engineering, the recommended national standard, corresponds to ISO/SAE 21434 Road vehicles – Cybersecurity engineering – this can be equally adopted as the ISO standard to impose system construction requirements on the cybersecurity management systems of OEMs.

In the access management of ICVs, the EU's UNECE R155 and R156 are mandatory regulations, putting forward mandatory requirements in management system certification for German OEMs, along with regular re-examination and mandatory requirements for type approval of auto products.

MIIT in China has released the Guideline for the Administration of the Access of Intelligent and Connected Vehicle Manufacturers and Products (Trial) as a guiding document, in which system and product requirements are made for information security and software update, but it is still under discussion as to the specific approach to implementing the guidelines together with the mandatory and recommended national standards.

3.4 Functional safety and SOTIF testing

3.4.1 Vehicle functional safety standard

3.4.1.1 Regulation/standard briefing

ISO 26262, based on IEC 61508, was compiled to meet the specific needs of electrical/electronic systems in road vehicles. GB/T 34590, a modified version of ISO 26262, applies to all activities in the safety lifecycle of safety-related systems consisting of electronic, electrical and software components in road vehicles.

Safety is one of the key issues regarding the development of road vehicles. With the development of automobile functions and growth of integration complexity, the demand for functional safety is growing day by day.

As technologies upgrade and more software and mechatronic applications emerge, an increasing number of risks relating to systemic and random hardware failures are appearing, which are all within the scope of functional safety.

GB/T 34590 reduces the risks by providing appropriate requirements and processes.

To achieve functional safety, ISO 26262 and GB/T 34590-XXXX (all):

a) provide a reference for the automotive safety lifecycle (development, production, operation, service, scrapping) and support the tailoring of the activities executed within these stages across the lifecycle;

b) provide an automotive-specific risk-based analysis methodology to determine Automotive Safety Integrity Levels (ASIL);

c) use ASIL levels to define applicable requirements in ISO 26262 and GB/T 34590, so as to avoid unreasonable residual risks;

d) propose requirements for functional safety management, design, implementation, verification, validation and approval measures; and

e) set forth requirements for customer-supplier relations.

ISO 26262 and GB/T 34590 address the functional safety of electrical/electronic systems through safety measures (including safety mechanisms). They also provide a framework within which safety-related systems based on other technologies (e.g. mechanical, hydraulic, pneumatic) can be considered.

The realisation of functional safety is influenced by the development process (e.g. including requirement specification, design, implementation, integration, verification, validation, and configuration), along with the production, service and management processes. Safety issues are interrelated with regular function-oriented and quality-oriented activities and working achievements. ISO 26262 and GB/T 34590 address safety-related development activities and working achievements.

Scope: this standard applies to safety-related systems containing one or more electrical/electronic systems installed in mass-produced road vehicles other than motorbikes.

This standard does not apply to specific electrical/electronic systems installed in special purpose vehicles, e.g. vehicles designed for drivers with disabilities.

Systems and their components that have been released or those under development prior to the date of publication of this standard are not applicable. When changes are made to systems and their components that were released prior to publication of this standard, this standard shall tailor safety lifecycle activities based on these changes. When systems not developed in accordance with this standard are integrated with those developed so, safety lifecycle tailoring is then required in accordance with this standard.

This standard focuses on possible hazards caused by abnormal functional performance of safety-related electrical/electronic systems, including possible hazards caused by the interaction of these systems. This standard does not

address hazards related to electric shock, fire, smoke, heat, radiation, toxicity, flammability, reactivity, corrosiveness, energy release, etc., unless the hazards are directly caused by the abnormal functional performance of safety-related electrical/electronic systems.

This standard proposes a framework for functional safety development of safety-related electrical/electronic systems, which is designed to integrate functional safety activities into an enterprise-specific development framework.

It also specifies the technical development requirements to achieve the product functional safety, and also stipulates the development process requirements that an organisation shall be equipped with appropriate functional safety capabilities.

3.4.1.2 Analysis of main similarities and differences

Table 30: Differences in functional safety for road vehicles (vocabulary)

GB/T34590.1-XXXX Road Vehicles – Functional Safety – Part 1: Vocabulary (Draft for Comments)		ISO 26262:1-2018 Road Vehicles – Functional Safety – Part 1: Vocabulary		Remarks
Article No.	**Content**	**Article No.**	**Content**	
3.14	**Bus**: Commercial vehicle which, because of its design and technical characteristics, is intended for carrying persons and their accompanied luggage, and which has more than nine seating places, including the driving seat. A bus may have one or two decks and may also tow a trailer (3.171).	**3.14**	**Bus:** Motor vehicle which, because of its design and appointments, is intended for carrying persons and luggage, and which has more than nine seating places, including the driving seat **Note 1 to entry:** a bus may have one or two decks and may also tow a trailer.	ISO definitions are modified to be consistent with those in GB/T GB/T 3730.1-2001 Motor Vehicles and Trailers – Types – Terms and Definitions.
3.107	**Passenger car:** Vehicle designed and constructed primarily for the carriage of persons and their accompanied luggage/or their goods, having not more than a seating capacity of nine, including the driving seat. A passenger car may also tow a centre axle trailer.	**3.107**	**Passenger car:** Vehicle designed and constructed primarily for the carriage of persons and their luggage, their goods, or both, having not more than a seating capacity of eight, in addition to the driver, and without space for standing passengers.	ISO definitions are modified to be consistent with those in GB/T GB/T 3730.1-2001 Motor Vehicles and Trailers – Types – Terms and Definitions.
3.151	**Semi-trailer:** Trailer (3.171) that is equipped with a coupling device that can transmit horizontal or vertical forces to the tractor (3.170), and the axle is placed behind the trailer's center of gravity (when it is uniformly loaded).	**3.151**	**Semi-trailer:** Trailer that is designed to be towed by means of a kingpin coupled to a tractor that imposes a substantial vertical load on the towing vehicle.	ISO definitions are modi-fied to be consistent with those in GB/T GB/T 3730.1-2001 Motor Vehicles and Trailers – Types – Terms and Definitions.
3.171	**Trailer:** Road vehicle, not powered, which is designed to be towed, because of its design and technical characteristics, so that it can be used properly, for: – transporting of persons and/or goods; – special purposes.	**3.171**	**Trailer:** Road vehicle which is designed to be towed, such that no substantial part of the total weight is supported by the towing vehicle.Note 1 to entry: a trailer can be designed to transport goods, equipment or persons.	ISO definitions are modified to be consistent with those in GB/T GB/T 3730.1-2001 Motor Vehicles and Trailers – Types – Terms and Definitions.

Table 30: Differences in functional safety for road vehicles (vocabulary)

GB/T34590.1-XXXX Road Vehicles – Functional Safety – Part 1: Vocabulary (Draft for Comments)		ISO 26262:1-2018 Road Vehicles – Functional Safety – Part 1: Vocabulary		Remarks
Article No.	**Content**	**Article No.**	**Content**	
3.93	**Motorcycle:** Two-wheeled or three-wheeled motor-driven road vehicle, whose maxi-mum design speed is greater than 50 km/h, or meets one of the following conditions: • with an internal combustion engine, the displacement is greater than 50 ml; • with an electric motor, the total max-imum continuous rated power of the motor is greater than 4 kW; **The following are not included:** • motorised wheelchair vehicle designed for people with disabilities, whose maxi-mum design speed, unladen weight, overall dimensions and other indicators are all in line with relevant national standards and regulations.	3.93	**Motorcycle**: Two-wheeled motor-driven vehicle, or three-wheeled motor-driven vehicle, whose unladen weight does not exceed 800 kg, excluding mopeds as defined in ISO 3833.	ISO definitions are modified to be consistent with those in GB/T 5359.1-2019 Term for Motorcycles and Mopeds.

Table 31: Differences in functional safety for road vehicles (management of functional safety)

GB/T34590.2-XXXX Road Vehicles – Functional Safety – Part 2: Management of Functional Safety (Draft for Comments)		ISO 26262-2:2018 Road vehicles – Functional Safety –Part 2: Management of Functional Safety		Remarks
Article No.	**Content**	**Article No.**	**Content**	
5.4.2.3	The organisation shall institute and maintain effective communication channels between functional safety, SOTIF, cybersecurity, and other disciplines that are related to the achievement of functional safety. Example 1: establish communication channels between functional safety and SOTIF to facilitate the interaction of relevant information between the two (e.g. functional safety activities and SOTIF activities are conducted in parallel during product development and need to be assessed for possible mutual effects.).	**5.4.2.3**	The organisation shall institute and maintain effective communication channels between functional safety, cybersecurity and other disciplines that are related to the achievement of functional safety.	Article 5.4.2.3 in GBT34590 adds instructions on SOTIF and other disciplines related to safety, along with Example 1.

Table 31: Differences in functional safety for road vehicles (management of functional safety)

GB/T34590.3-XXXX Road Vehicles – Functional Safety – Part 3: Concept Phase (Draft for Comments)		Remarks
Article No.	**Content**	
Annex B Table B.2	Table B.2 Class of probability of exposure in operational situations	In GBT34590 Annex B Table B.2 adds a new road type example of 'urban road' under E4 class to suit the road scenario in China.

Class of Probability of Exposure in Operational Situations (See Table 2)	**E1**	**E2**	**E3**	**E4**
Description	Very low probability	Low probability	Medium probability	High probability
Duration (% of average operation time)	Not specified	<1% of average operating time	1% to 10% of average operating time	> 10% of average operation time
Examples for road layout	–	Country road intersection; Highway exit	One-way street (city street)	• Highway; • Country road; • Urban road.
Examples for road surface	–	• Snow and ice on road; • Slippery leaves on road.	Wet road	–
Examples for vehicle stationary state	• Vehicle during jump start; • In repair garage.	Trailer attached; Roof rack attached; Vehicle being refuelled.	Vehicle on a hill (hill hold)	–
Examples for manoeuvre	Driving downhill with engine off (mountain pass)	Driving in reverse; Overtaking; Parking (with trailer attached) Heavy traffic (stop and go)	- Heavy traffic (stop and go)	Accelerating; Decelerating; Stopping at traffic light (city street); Lane change (highway).

Table 31: Differences in functional safety for road vehicles (management of functional safety)

ISO 26262-3:2018 Road Vehicles – Functional safety – Part 3: Concept Phase					Remarks
Article No.	**Content**				
Annex B Table B.2A					In GBT34590 Annex B Table B.2 adds a new road type example of 'urban road' under E4 class to suit the road scenario in China.
Class of Probability of Exposure in Operational Situations (See Table 2)	**E1**	**E2**	**E3**	**E4**	
Description	Very low probability	Low probability	Medium probability	High probability	
Duration (% of average operation time)	Not specified	<1% of average operating time	1% to 10% of average operating time	> 10% of average operation time	
Examples for road layout	–	Country road intersection; Highway exit	One-way street (city street)	• Highway; • Country road; • Urban road.	
Examples for road surface	–	• Snow and ice on road; • Slippery leaves on road.	Wet road	–	
Examples for vehicle stationary state	• Vehicle during jump start; • In repair garage.	Trailer attached; Roof rack attached; Vehicle being refuelled.	Vehicle on a hill (hill hold)	–	
Examples for manoeuvre	Driving downhill with engine off (mountain pass)	Driving in reverse; Overtaking; Parking (with trailer attached) Heavy traffic (stop and go)	- Heavy traffic (stop and go)	Accelerating; Decelerating; Stopping at traffic light (city street); Lane change (highway).	

Table 32: Differences in functional safety for road vehicles (supporting processes)

GB/T34590.3-XXXX Road vehicles – Functional Safety – Part 8: Supporting Processes		ISO 26262-8:2018 Road vehicles – Functional Safety – Part 8: Supporting Processes		Remarks
Article No.	**Content**	**Article No.**	**Content**	
11.2	The tool may pre-exist or be developed upon request, based on the tool user requirements. Example 2: software development tools, requirement management tools, system design tools, testing tools, static analysis tools, etc.	**11.2**	General The tool may preexist or be developed upon request, based on the tool user requirements.	GBT34590 Article 11.2 adds examples of tools based on tool user requirements.

3.4.1.3 Type approval

At present, there are no mandatory requirements concerning ISO 26262 or GB/T34590 Road Vehicles – Functional Safety in either China or Europe, but there are requirements of specific standards for certain systems, e.g. GB17675-2021 Steering System of Motor Vehicles – Basic Requirements Annex B, ECE R79 Uniform provisions concerning the approval of vehicles with regard to steering equipment and its Annex 6.

In addition, in August 2021, the Ministry of Industry and Information Technology of China issued Opinions on Strengthening the Management of Connected Vehicles (Intelligent Networked Vehicles) Manufacturers and Product Access, clearly stating that: 'enterprises shall assume their entity responsibilities to strengthen the management of vehicle functional safety and SOTIF, ensure product quality and production consistency, promote the high-quality development of the ICV industry' and '(VII) strengthen product safety management related to automated driving. Manufacturers producing automobiles with automated driving function shall meet process security requirements regarding functional safety and SOTIF, so as to avoid predictable and preventable safety accidents within the operational design condition of the vehicles.

3.4.1.4 Summary

Technically, GB/T34590-XXXX is a modified version of ISO 26262-2018, containing basically consistent requirements, except for some terms and examples that have been changed to better suit China's situation.

With regard to type approval and access, ISO 26262 is not mandatory in the EU, nor is GB/T34590 Road Vehicles – Functional Safety in China. However, the Opinions on Strengthening the Management of Connected Vehicles (Intelligent Networked Vehicles) Manufacturers and Product Access, issued in China in August 2021, clearly states that enterprises shall strengthen the management of functional safety and SOTIF, meeting corresponding process guarantee requirements. It has not yet been decided when the Opinions will be implemented.

3.4.2 ASIL determination method for vehicle electronic and electrical systems

3.4.2.1 Regulation/standard briefing

1. Road Vehicles – ASIL Determination Guidelines for Electrical and Electronic System

GB/Z-XXXX Road Vehicles – ASIL Determination Guidelines for Electrical and Electronic Systems (Planned No. 20201791-Z-339) is the guiding technical document for standardisation in this field in China.

Scope: This standard proposes a method for determining the ASIL (Automotive Safety Integrity Level) of electrical and electronic systems of road vehicles. The determination of electronic and electrical system ASIL is required in GB/T 34590.3-XXXX.

GB/Z-XXXX Road Vehicles – ASIL Determination Guidelines for Electrical and Electronic Systems (Planned No. 20201791-Z-339) applies to the safety of mass-produced road vehicles, other than mopeds, that contain one or more electrical/electronic systems.

2. SAE J2980:2018 Considerations for ISO 26262 ASIL Hazard Classification

Scope: This SAE Recommended Practice presents a method and example results for determining the Automotive Safety Integrity Level (ASIL) for automotive electrical and electronic (E/E) systems. This activity is required by ISO 26262-3:2011 [1], and it is intended that the process and results herein are consistent with ISO 26262:2011 [1]. The technical focus of this document is on vehicle motion control systems, as the hazards they may generate typically have a higher ASIL rating than those that may be generated by non-motion control systems.

Therefore, the SAE Functional Safety Committee decided to give motion control systems a higher priority and focus only on these in the SAE J2980 Recommended Practice. ISO 26262:2011 [1] has a wider scope than SAE J2980, covering other functions and accidents (not just motion control or collisions, as in SAE J2980). SAE J2980:2018 Considerations for ISO 26262 ASIL Hazard Classification is limited to passenger cars weighing up to 3.5 metric tons. Furthermore, the scope of this recommended practice is limited to collision-related hazards.

3.4.2.2 Analysis of main similarities and differences

Table 33: Differences in determining ASIL of electronic and electrical systems

GB/Z-XXXX Road Vehicles – ASIL Determination Guidelines for Electrical and Electronic Systems		SAE J2980: 2018		Remarks
Article No.	**Content**	**Article No.**	**Content**	
1	Scope	**1**	Scope	The scope of application of GBZ is consistent with that of GB/T34590-XXXX; SAE J2980 is applicable to passenger cars weighing up to 3.5 metric tons.
2	Normative references	**2**	References	While only GB/T34590-XXXX (all parts) is cited as the normative reference in GBZ, its reference documents are basically the same as those of SAE J2980.
3	Terms and definitions	**3**	Definitions and acronyms	There is no separate list of terms and definitions in GBZ which adopts the terms and definitions in GB/T 34590.1-XXXX; SAE J2980' definitions and acronyms are consistent with ISO 26262: 2011.

3.4.2.3 Type approval

Not applicable.

3.4.2.4 Summary

This standard is a guiding technical document for standardisation, designed to provide guidelines or information on standardisation in the process of technological development (such as fast-changing technology fields), for the reference of professionals engaged in scientific research, design, production, use and management. It is not mandatory or administratively binding.

3.4.3 Functional safety requirements for vehicle steering systems

3.4.3.1 Regulation/standard briefing

GB 17675-2021 Steering System of Motor Vehicles – Basic Requirements – Annex B (normative annex) Functional Safety Requirements

Scope: Annex 6 of this standard specifies the requirements for the documentation, safety strategy and verification and validation of functional safety of the steering electronic control system. This annex does not address the nominal performance of steering electronic control systems, nor does it serve as specific guidance for the development of functional safety of steering electronic control systems.

Rather, it specifies the methods to be followed during the design process and the information to be available during system verification and validation, to demonstrate that the system is capable of achieving the functional concept and functional safety concept in both normal and fault conditions, and meet all applicable performance requirements as specified in this standard.

The main body of this standard applies to vehicles in Category M, N and O, as specified in GB/T 15089.

UN Regulation No. R79 – Uniform provisions concerning the approval of vehicles with regard to steering equipment Annex 6 Special requirements to be applied to the safety aspects of electronic control systems.

Scope: Annex 6 of this regulation specifies special requirements for documentation, failure strategy and verification of safety aspects of complex vehicle electronic control systems. Performance criteria for the systems are not specified, but methods applied to the design process and information that must be disclosed to the technical service provider for the purposes of type approval are covered herein.

The information to be disclosed shall demonstrate that the system complies with all appropriate performance requirements specified elsewhere in this regulation, under both normal and fault conditions

This regulation applies to vehicles in Category M, N and O.

3.4.3.2 Analysis of main similarities and differences

Table 34: Differences in functional safety requirements for vehicle steering systems

GB 17675-2021 Steering System of Motor Vehicles – Basic Requirements		UN Regulation No. R79 – Annex 6		Remarks
Article No.	**Content**	**Article No.**	**Content**	
3.2	Functional safety terms	/	No equivalence	GB 17675-2021 specifically introduces functional safety terms, including functional safety concepts, safety strategies, safety objectives, safety metrics, safety measures, controllability, etc., which are not mentioned in UN Regulation No. R7.
4.1.9	Functional safety requirements for steering electronic control systems shall be developed in accordance with GB/T34590 (all parts) and meet the requirements in Annex B.	/	No equivalence	GB 17675-2021 contains explicit requirements for functional safety in its main body text, while UN Regulation No. R79 does not.
B2.2.2	The scope of the steering electronic control system shall be defined, specifying the subsystems and elements and identifying external systems or elements with which it interacts.	**2.7**	'Range of control' refers to an output variable and defines the range over which the system is likely to exercise control.	GB 17675-2021 states that subsystems and elements shall be clarified, while UN Regulation No. R79 does not.

Table 34: Differences in functional safety requirements for vehicle steering systems

GB 17675-2021 Steering System of Motor Vehicles – Basic Requirements		UN Regulation No. R79 – Annex 6		Remarks
Article No.	**Content**	**Article No.**	**Content**	
B2.4	Hazard analysis and risk assessment Functional failures of the steering electronic control system shall be analysed and categorised. Potential hazards shall be analysed and the corresponding ASIL shall be defined according to the target use scenarios and target users of the vehicle; see GB/T34590.3. Safety targets shall be defined and categorised for potential hazards.	/	No equivalence	Hazard analysis and risk assessment are specified in GB 17675-2021, and are required to be submitted as a document as part of its functional safety requirements, which is not specified in UN Regulation No. R79.

Table 34: Differences in functional safety requirements for vehicle steering systems

GB 17675-2021 Steering System of Motor Vehicles – Basic Requirements		UN Regulation No. R79 – Annex 6		Remarks
Article No.	**Content**	**Article No.**	**Content**	
B2.5.1	It shall be guaranteed that the safety strategy selected to achieve the safety objectives does not affect the safe operation of the vehicle under both fault conditions and non-fault conditions. Safety requirements.	**3.4.1**	The manufacturer shall provide a statement which affirms that the strategy chosen to achieve 'the system' objectives will not, under non-fault conditions, prejudice the safe operation of systems that are subject to the prescriptions of this Regulation.	GB 17675-2021 states safety requirements, safety objectives, ASILs, vehicle hazards, etc. relating to steering electronic control systems, while UN Regulation No. R79 does not.

Table B.1 Safety Requirements for Hazards Associated with the Steering Control System

No.	Vehicle Hazards	ASIL	Safety Objectives
1	Unintended lateral motion	**D**	Unintended lateral movement of the vehicle shall meet the safety metrics of unintended lateral motion.*
2	Unintended loss of lateral motion control	**D**	The driver's ability to control the lateral motion of the vehicle shall be ensured, and the corresponding steering force shall meet the safety metrics of unintended loss of steering control.
3	Heavy steering in case of loss of assist	**QM or A**	The steering force shall meet the safety metrics of heavy steering.

Table 34: Differences in functional safety requirements for vehicle steering systems

GB 17675-2021 Steering System of Motor Vehicles – Basic Requirements		UN Regulation No. R79 – Annex 6		Remarks
Article No.	**Content**	**Article No.**	**Content**	
B2.6	Safety analysis It shall be stated through safety analysis that hazards and failures affecting vehicle motion control and safety objectives have been effectively identified and addressed, so as to support the above-mentioned document. Safety analysis shall include, but not be limited to, safety analysis at the vehicle level, safety analysis at the system level, and examination of the validation plan and results. In addition, corresponding measures to be taken shall be defined when system performance is affected by environmental conditions.	/	This may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) or any similar process appropriate to system safety considerations. The chosen analytical approach(es) shall be established and maintained by the Manufacturer and shall be made open for inspection by the technical service at the time of the type approval.	GB 17675-2021 defines the content of safety analysis (vehicle level, system level and validation plan), and a summary report of safety analysis at the vehicle level and another one at the system level are required to be submitted. Measures to be taken under certain environmental conditions are also specified. UN Regulation No. R79 does not specify the safety analysis at the vehicle level or the system level.
B3.3	Verification and validation of functional safety concepts Verification and validation shall be performed for controllability under fault and non-fault conditions, as well as human-machine interaction (HMI) in B 2.5.1.	/	No equivalence	The verification and validation methods of functional safety concepts are specified in GB 17675-2021, yet not proposed in UN Regulation No. R79.

3.4.3.3 Type approval

The main body of GB 17675-2021 Steering System of Motor Vehicles – Basic Requirements and its Annex B Functional Safety Requirements (Normative Annex) both put forward requirements for functional safety. These have been mandatory since 1 January 2022 and have been included in type approval. UN Regulation No. R79 Uniform provisions concerning the approval of vehicles with regard to steeering equipment does not include a specific section on functional safety, but part of its Annex 6 Special requirements to be applied to the safety aspects is about functional safety. The main body of UN Regulation No. R79 is already executed in a mandatory manner in the EU, but implementation of the annex is not yet harmonised.

3.4.3.4 Summary

Technically, GB17675-2021 refers to UN Regulation No. R79, but contains more detailed requirements for functional safety. GB 17675-2021 Steering System of Motor Vehicles – Basic Requirements specifies clearly that 'functional safety requirements for steering electronic control systems shall be developed in accordance with GB/T34590 (all parts) and meet the requirements in Annex B', while the UN regulation does not contain an equivalence.

GB 17675-2021 Annex B Functional Safety Requirements (Normative Annex) provides a detailed description of hazard analysis and risk assessment, functional safety concepts, safety analysis, verification and validation of steering electronic control systems. The test procedures for its functional safety requirements specify the documentation to be submitted, including system description (system scope, boundaries, interface operational conditions and constraints, system layout, component list, system connections, signal flow and priority), hazard analysis and risk assessment, safety measures, software architecture, safety analysis, validation plan and report at the vehicle and system level, and have been implemented by force.

UN Regulation No. R79 Uniform provisions concerning the approval of vehicles with regard to steering equipment does not include a specific section on functional safety, but part of its Annex 6 Special requirements to be applied to the safety aspects is about functional safety, implementation of which is not yet harmonised.

3.4.4 Functional safety requirements and testing methods for passenger car steering systems

3.4.4.1 Regulation/standard briefing

National Standard Plan – Functional Safety Requirements and Test Methods for Passenger Car Steering Systems (20171042-T-339)

Scope: This standard specifies the functional safety requirements and testing methods for passenger car steering systems.

This standard applies to electronic and electrical systems that control the lateral movement of vehicles. Examples include electric power steering (EPS), active rear steering (ARS) and systems that work in conjunction with the steering system to complete vehicle steering, e.g. advanced driver assistance systems (lane keeping assist (LKA) and automatic parking assist (APA)). The standard can serve as a reference for design of systems that achieve lateral vehicle movement control by applying asymmetric braking forces, such as electronic stability control (ESC).

3.4.4.2 Standard content

Table 35: Functional safety requirements for passenger car steering systems

20171042-T-339 Functional Safety Requirements and Testing Methods for Passenger Car Steering Systems		No equivalent European standard		Remarks
Article No.	**Content**	**Article No.**	**Content**	
1	The main body covers the definition of functions and related items, hazard analysis and risk assessment, safety requirements, safety verification, safety validation and assessment.	/	/	20171042-T-339 covers the definition of functions and related items, hazard analysis and risk assessment, safety requirements, safety verification, safety validation and assessment.
2	Annex A (informative) Methods for Deriving Hazard Identification and Safety Requirements	/	/	20171042-T-339 Annex A includes hazard and operability analysis, single element failure analysis, and systems theory-based process analysis.
3	Annex B (informative) Definitions of Risk Assessment and Safety Objectives for Steering-Related Hazards	/	/	20171042-T-339 Annex B contains definitions of risk assessment and safety objectives for steering-related hazards.
4	Annex C (informative) EPS Functional Safety Concept Examples	/	/	20171042-T-339 Annex C contains a method of functional safety concept development, with examples of safety mechanisms/requirements derived from safety objectives.
5	Annex D (normative) Steering System safety requirements	/	/	20171042-T-339 Annex D contains examples of typical safety mechanisms or safety requirements.

Table 35: Functional safety requirements for passenger car steering systems

20171042-T-339 Functional Safety Requirements and Testing Methods for Passenger Car Steering Systems		No equivalent European standard		Remarks
Article No.	**Content**	**Article No.**	**Content**	
6	Annex E (informative) Application of Safety Analysis and Related Failure Analysis at the Software Architecture Level	/	/	20171042-T-339 Annex E includes possible application of safety analysis and related failure analysis at the software architecture level.
7	Annex F (informative) Test Methods and Examples of Steering System Functional Safety Verification	/	/	20171042-T-339 Annex F contains test methods and examples of relevant system functional safety at the system level.
8	Annex G (normative) Test Methods of Steering System Functional Safety Validation	/	/	20171042-T-339 Annex G includes examples of conducting safety validation tests to validate steering system safety objectives at the vehicle level.
9	Annex H (informative) Examples of Functional Safety Assessment Reports for Steering Systems	/	/	20171042-T-339 Annex H provides examples of functional safety assessment reports for steering systems, including system functional descriptions, safety objectives and safety concepts, validation test results for safety objectives, as well as assessment comments.
10	Annex I (informative) Examples of Determination Methods for Fault Tolerant Time Interval (FTTI)	/	/	20171042-T-339 Annex I provides a reference to the analysis methods relating to the fault tolerance time interval and does not take a preference for a specific analysis method.

3.4.4.3 Type approval

20171042-T-339 Functional Safety Requirements and Testing Methods for Passenger Car Steering Systems is still under development, not involving type approval, and is expected to be used in the future as the support for the implementation of GB 17675-2021 Steering System of Motor Vehicles – Basic Requirements. There is no corresponding UN Regulation standard.

3.4.4.4 Summary

20171042-T-339 Functional Safety Requirements and Testing Methods for Passenger Car Steering Systems specifies functional safety requirements and test methods for passenger car steering systems, and covers in its annexes the definition of functions and related items, hazard analysis and risk assessment, safety requirements, safety verification, safety validation and assessment, functional safety concept development, examples of safety mechanisms or safety requirements, safety analysis and related failure analysis, test methods of system functional safety at the system level, etc.

The task of compiling this standard was assigned in 2017 and it is currently being drafted, expected to be used in the future as support for implementing GB 17675-2021 Steering System of Motor Vehicles – Basic Requirements. The standard applies also to advanced driver assistance systems (Lane Keeping Assist (LKA), Automatic Parking Assist (APA)).There is no corresponding UN regulation.

3.4.5 Special requirements for safety of passenger car braking systems

3.4.5.1 Regulation/standard briefing

1. GB 21670-2008 Technical Requirements and Testing Methods for Passenger Car Braking Systems – Annex D (Normative Annex) Special Requirements for the Safety Aspects of Complex Electronic Vehicle Control Systems

   Scope: This standard applies to vehicles of Category M1, as specified in GB/T15089.

   This annex defines the special requirements for documentation, fault strategy and verification with respect to the safety aspects of complex electronic vehicle control systems. The annex can also apply to safety-related functions controlled by electronic systems based on the corresponding provisions contained in this standard. This annex does not specify the performance criteria for the system, but covers the methodology applied to the design process and the information that must be disclosed to the technical service provider for type approval purposes. This information shall show that the system respects, under fault and non-fault conditions, all appropriate performance requirements specified in this standard.

2. UN Regulation No. R13-H Uniform provisions concerning the approval of passenger cars with regard to braking – Annex 8 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems.

Scope: This standard applies to vehicles of Category M1.

This annex defines the special requirements for documentation, fault strategy and verification with respect to the safety aspects of complex electronic vehicle control systems as far as this regulation is concerned. This annex does not specify the performance criteria for the system, but covers the methodology applied to the design process and the information that must be disclosed to the technical service provider for type approval purposes.

This information shall show that the system respects, under normal and fault conditions, all appropriate performance requirements specified elsewhere in this regulation.

3.4.5.2 Analysis of main similarities and differences

Table 36: Differences in technical requirements for passenger car braking systems

GB 21670-2008 Technical Requirements and Testing Methods for Passenger Car Braking Systems		UN Regulation No. R13-H Annex 8		Remarks
Article No.	**Content**	**Article No.**	**Content**	
D.2	This defines requirements for documentation and system function instructions, system layout and schematic drawings, as well as the manufacturer's safety concept.	**3**	The manufacturer shall provide a documentation package which gives access to the basic design of 'the system' and the means by which it is linked to other vehicle systems or by which it directly controls output variables.	
D.3	System function and safety concept shall be validated as required by D.2.	**4**	The functional operation of 'the system', as laid out in the documents required in paragraph 3, shall be tested.	Annex D of GB 21670-2008 shares basically the same content with UN Regulation No. R13-H Annex 8.

3.4.5.3 Type approval

GB 21670-2008 Technical Requirements and Testing Methods for Passenger Car Braking Systems – Annex D Special Requirements for the Safety Aspects of Complex Electronic Vehicle Control Systems came into force in May 2021. UN Regulation No. R13-H – Uniform provisions concerning the approval of passenger cars with regard to braking does not include a specific section on functional safety, but part of its Annex 8 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems is about functional safety, implementation of which is not yet harmonised.

3.4.5.4 Summary

Technically speaking, GB 21670-2008 Technical Requirements and Testing Methods for Passenger Car Braking Systems – Annex D Special Requirements for the Safety Aspects of Complex Electronic Vehicle Control Systems refers to UN Regulation No. R13-H Uniform provisions concerning the approval of passenger cars with regard to braking – Annex 8 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems came into force in May 2021.

3.4.6 Special requirements for the safety of commercial vehicle and trailer braking systems

3.4.6.1 Regulation/standard briefing

GB 12676-2014 Technical Requirements and Testing Methods for Commercial Vehicle and Trailer Braking Systems Annex H (normative annex) Special Requirements for the Safety Aspects of Complex Electronic Vehicle Control Systems

Scope: This standard applies to vehicles of Category M2, M3 and N, as well as trailers of Category O, as specified in GB/T15089.

This annex defines the special requirements for documentation, fault strategy and verification with respect to the safety aspects of complex electronic vehicle control systems. The annex can also apply to safety-related functions controlled by electronic systems, based on the corresponding provisions contained in this standard. This annex does not specify the performance criteria for the system but covers the methodology applied to the design process and the information that must be disclosed to the technical service provider for test purposes.

UN Regulation No. R13 Uniform provisions concerning the approval of vehicles of categories M, N and O with regard to braking – Annex 18 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems.

Scope: This standard applies to vehicles of Category M2, M3 and N, as well as trailers of Category O. This annex defines the special requirements for documentation, fault strategy and verification with respect to the safety aspects of complex electronic vehicle control systems as far as this regulation is concerned. This annex does not specify performance criteria for the system, but covers the methodology applied to the design process and the information that must be disclosed to the technical service provider for type approval purposes. This information shall show that the system respects, under normal and fault conditions, all the appropriate performance requirements specified elsewhere in this regulation.

3.4.6.2 Analysis of main similarities and differences

Table 37: Differences in technical requirements for commercial vehicle and trailer braking systems

GB 12676-2014 Technical Requirements and Testing Methods for Commercial Vehicle and Trailer Braking Systems		UN Regulation No. R13 Annex 18		Remarks
Article No.	**Content**	**Article No.**	**Content**	
H.2	This defines requirements for documentation and system function instructions, system layout and schematic drawing, as well as the manufacturer's safety concept.	**3**	The manufacturer shall provide a documentation package which gives access to the basic design of 'the system' and the means by which it is linked to other vehicle systems or by which it directly controls output variables.	Annex H of GB 12676-2014 shares basically the same content with UN Regulation No. R13 Annex18.
H.3	System function and safety concept shall be validated as required by H.2.	**4**	The functional operation of 'the system', as laid out in the documents required in paragraph 3, shall be tested.	Annex H of GB 12676-2014 shares basically the same content with UN Regulation No. R13 Annex 18.

3.4.6.3 Type approval

GB 12676-2014 Technical Requirements and Testing Methods for Commercial Vehicle and Trailer Braking Systems – Annex H (normative annex) Special Requirements for the Safety Aspects of Complex Electronic Vehicle Control Systems is not yet implemented in China, while execution of UN Regulation No. R13 Uniform provisions concerning the approval of vehicles of categories M, N and O with regard to braking – Annex 18 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems is not harmonised.

3.4.6.4 Summary

Technically, GB 12676-2014 Technical Requirements and Testing Methods for Commercial Vehicle and Trailer Braking Systems – Annex H Special Requirements for the Safety Aspects of Complex Electronic Vehicle Control Systems shares basically the same content with UN Regulation No. R13 Uniform provisions concerning the approval of vehicles of categories M, N and O with regard to braking – Annex 18 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems.

3.4.7 Functional safety requirements for Advanced Emergency Braking Systems (AEBS) for commercial vehicless

3.4.7.1 Regulation/standard briefing

GB/T 38186-2019 Performance Requirements and Test Methods for Advanced Emergency Braking System (AEBS) of Commercial Vehicles – Annex A (Normative Annex) Functional Safety Requirements

Scope: This standard applies to vehicles of Category M2, M3 and N, equipped with Advanced Emergency Braking Systems (AEBS).

Annex A defines the special requirements for documentation, fault strategy and verification with respect to the functional safety aspects of AEBS for commercial vehicles.

This annex specifies the methodology applied to the design process and the information to be available during system verification and validation to demonstrate that the system is capable of achieving the functional concept and functional safety concept in both normal and fault conditions and meet all applicable performance requirements as specified in this standard.

UN Regulation No. R131 Uniform provisions concerning the approval of motor vehicles with regard to Advanced Emergency Braking Systems (AEBS) – Annex 4 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems.

Scope: This standard applies to vehicles of Category M2, M3, N2 and N3, equipped with AEBS, under highway conditions.

This annex defines the special requirements for documentation, fault strategy and verification with respect to the safety aspects of complex electronic vehicle control systems as far as this regulation is concerned.

This annex does not specify the performance criteria for the system but covers the methodology applied to the design process and the information which must be disclosed to the technical service provider, for type approval purposes. This information shall show that the system respects, under normal and fault conditions, all the appropriate performance requirements specified elsewhere in this regulation.

3.4.7.2 Analysis of main similarities and differences

Table 38: Differences in AEBS performance requirements for commercial vehicles

GB/T 38186-2019 Annex A		UN Regulation No. R131 Annex 4		Remarks
Article No.	**Content**	**Article No.**	**Content**	
4.1.3	**4.** Technical requirements **4.1** General requirements **4.1.3** AEBS functional safety shall meet the requirements in Annex A.	**5.1.3**	Conformity with the safety aspects of complex electronic control systems shall be shown by meeting the requirements of Annex 4.	Technical requirements in GB/T 38186-2019 state that 'AEBS functional safety shall meet the requirements in Annex A'. UN Regulation No. R131 does not include a separate section on functional safety, but its Annex 4 contains something about functional safety, and states in the main body that 'conformity with the safety aspects of complex electronic control systems shall be shown by meeting the requirements of Annex 4'.

Table 38: Differences in AEBS performance requirements for commercial vehicles

GB/T 38186-2019 Annex A		UN Regulation No. R131 Annex 4		Remarks
Article No.	**Content**	**Article No.**	**Content**	
A2.1	Requirements There shall be appropriate documentation to describe the functional concept and functional safety concept of the AEBS, meeting the following requirements: **a)** Describe the functional concept, internal and external interfaces, potential failures, risks and safety measures of AEBS. **b)** Demonstrate that AEBS design takes into account potential sources of failure, including random hardware failures and systemic failures, and applies engineering practices in related fields. See GB/T34590.5-2017. **c)** Describe how AEBS working conditions are examined under normal and failure conditions, in order to support the validation test.	**Annex 4. 3.**	Documentation The manufacturer shall provide a documentation package which gives access to the basic design of 'the system' and the means by which it is linked to other vehicle systems or by which it directly controls output variables. The function(s) of 'the system' and the safety concept, as laid down by the manufacturer, shall be explained.	GB/T 38186-2019 provides specific requirements for documentation, including the functional concept, internal and external interfaces, potential failures, risks and safety measures, as well as the potential sources of failure. UN Regulation No. R131 Annex 4 states that the documentation must contain system function and safety concept, but the rest is not mentioned.
/	/	**Annex 3. 3.1.1**	Documentation shall be made available in 2 parts	UN Regulation No. R131 Annex 4 refers to the location of different types of documentation, while GB/T 38186-2019 does not

Table 38: Differences in AEBS performance requirements for commercial vehicles

GB/T 38186-2019 Annex A		UN Regulation No. R131 Annex 4		Remarks
Article No.	**Content**	**Article No.**	**Content**	
A2.4	Functional safety concept The safety measures (including external measures) taken during design to ensure that AEBS meets relevant safety objectives in the event of failure shall be described.	**Annex 4 3.4**	Safety concept of the manufacturer	GB/T 38186-2019 provides specific requirements for documentation, including the functional concept, internal and external interfaces, potential failures, risks and safety measures, as well as the potential sources of failure. UN Regulation No. R131 Annex 4 states that the documentation must contain system function and safety concept, but the rest is not mentioned.
A2.5	Safety analysis FMEA, FTA, or other appropriate safety analysis methods may be used to demonstrate that faults or groups of faults affecting safety objectives of the system are effectively identified and addressed.	**Annex 4 3.4.4**	The documentation shall be supported by an analysis which shows, in overall terms, how the system will behave should any one of those specified faults with a bearing on vehicle control performance or safety occur. This may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) or any similar process appropriate to system safety considerations.	Both propose to conduct safety analysis, using FMEA, FTA or other appropriate approaches.
A3	Validation and test The function and safety concept of AEBS shall be validated as described in relevant documents in A.2.	**Annex 4 4**	Verification and test **4.1.1** Verification of the function of 'the system' **4.1.2** Verification of the safety concept of paragraph 3.4.	Both propose to conduct testing to verify the adequateness of the safety concept and execution under both normal and fault conditions.

3.4.7.3 Type approval

GB 12676-2014 Technical Requirements and TestAccording to the requirements of CNCA Announcement No. 9 of 2022, road buses and tourist vehicles with a length greater than 11m should be equipped with automatic emergency braking systems that meet the requirements of GB/T 38186-2019 Performance Requirements and Test Methods for Automatic Emergency Braking Systems (AEBS) for Commercial Vehicles, and the functional safety requirements of Annex A (Normative Annex) cannot be exempted.

UN Regulation No. R131 Uniform provisions concerning the approval of motor vehicles with regard to the Advanced Emergency Braking Systems (AEBS) was implemented in 2020, but the implementation of Annex 4 has not been harmonised.

3.4.7.4 Summary

GB/T 38186-2019 Performance Requirements and Test Methods for Advanced Emergency Braking System (AEBS) for Commercial Vehicles – Annex A (Normative Annex) Functional Safety Requirements applies to vehicles of Category M2, M3 and N, equipped with AEBS. Annex A defines special requirements for documentation, fault strategy and verification with respect to the functional safety aspects of AEBS in commercial vehicles. At present, according to the requirements of CNCA Announcement No. 9 of 2022, some models have been involved in type approval.

UN Regulation No. R131 Uniform provisions concerning the approval of motor vehicles with regard to the Advanced Emergency Braking Systems (AEBS) – Annex 4 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems applies to vehicles of Category M2, M3, N2 and N3, equipped with AEBS, under highway conditions. There is no specific section on functional safety, but Annex 4 mainly concerns functional safety requirements, including special requirements for documentation, fault strategy and verification with respect to the safety aspects of complex electronic vehicle control systems. The regulation was implemented in 2020, but the implementation of Annex 4 has not been harmonised.

3.4.8 Functional safety requirements for Advanced Emergency Brakingsystem of passenger cars

3.4.8.1 Regulation/standard briefing

GB/T 39901 - 2021 Advanced Emergency Braking System (AEBS) for Passenger Cars and Annex A (Normative Annex) Functional Safety Requirements

Scope: This standard applies to vehicles of Category M1 equipped with AEBS.

This annex defines the special requirements for documentation, fault strategy and verification with respect to the functional safety aspects of AEBS in passenger vehicles. This annex does not address the nominal performance of AEBS, nor does it serve as specific guidance for the development of functional safety for steering electronic control systems.

Rather, it specifies the methods to be followed during the design process and the information to be available during system verification and validation, to demonstrate that the system is capable of achieving the functional concept and functional safety concept in both normal and fault conditions, and meet all applicable performance requirements as specified in this standard.

UN Regulation No. R152 Uniform provisions concerning the approval of motor vehicles with regard to the Advanced Emergency Braking System (AEBS) for M1 and N1 vehicles – Annex 3 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems.
Scope: This regulation applies to vehicles of Category M1 and N1 equipped with AEBS in urban driving conditions.

This annex defines the special requirements for documentation, fault strategy and verification with respect to the safety aspects of complex electronic vehicle control systems as far as this regulation is concerned. This annex does not specify performance criteria for the system but covers the methodology applied to the design process and the information which must be disclosed to the technical service provider for type approval purposes. This information shall show that the system respects, under non-fault and fault conditions, all the appropriate performance requirements specified elsewhere in this regulation.

3.4.8.2 Analysis of main similarities and differences

Table 39: Differences in functional safety requirements for advanced emergency braking systems for passenger cars

GB/T 39901—2021 Annex A		UN Regulation No. R152 Annex 3		Remarks
Article No.	**Content**	**Article No.**	**Content**	
4.1.3	AEBS functional safety shall meet the requirements in Annex A.	**5.1.3**	Conformity with the safety aspects of electronic control systems shall be shown by meeting the requirements of Annex 3.	Technical requirements in GB/T 39901–2021 state that 'AEBS functional safety shall meet the requirements in Annex A'. UN Regulation No. R152 does not include a separate section on functional safety, but its Annex 3 contains some details about functional safety, and in the main body it is stated that 'conformity with the safety aspects of electronic control systems shall be shown by meeting the requirements of Annex 3'.

Table 39: Differences in functional safety requirements for advanced emergency braking systems for passenger cars

GB/T 39901—2021 Annex A		UN Regulation No. R152 Annex 3		Remarks
Article No.	**Content**	**Article No.**	**Content**	
A2.1	Requirements There shall be appropriate documentation to describe the functional concept and functional safety concept of the AEBS, in compliance with the following requirements: **d)** Documentation must describe the functional concept, internal and external interfaces, potential failures, risks and safety measures of AEBS. **e)** Documentation must demonstrate that AEBS design takes into account potential sources of failure, including random hardware failures and systemic failures, and applies engineering practices in related fields. See GB/T34590.5-2017. **f)** Documentation must describe how AEBS working conditions are examined under normal and failure conditions, in order to support the validation test.	**Annex 3 3.1**	Documentation requirements The manufacturer shall provide a documentation package which gives access to the basic design of 'the system' and the means by which it is linked to other vehicle systems or by which it directly controls output variables. The function(s) of 'the system' and the safety concept, as laid down by the manufacturer, shall be explained. The Technical Service shall assess the documentation package to show that 'the system': **(a)** is designed to operate, under non-fault and fault conditions, in such a way that it does not induce safety critical risks: **(b)** respects, under non-fault and fault conditions, all the appropriate performance requirements specified elsewhere in this regulation; and **(c)** was developed according to the development process/method declared by the manufacturer.	GB/T 39901–2021 provides specific requirements for documentation, including the functional concept, internal and external interfaces, potential failures, risks and safety measures, as well as the potential sources of failure. UN Regulation No. R152 Annex 3 states that the documentation must contain the system function and safety concept, but the rest is not mentioned. UN Regulation No. R152 Annex 3 clearly states that the Technical Service shall assess the documentation package to show that 'the system': **(a)** is designed to operate under non-fault and fault conditions in such a way that it does not induce safety critical risks; **(b)** respects, under non-fault and fault conditions, all the appropriate performance requirements specified elsewhere in this regulation; and **(c)** was developed according to the development process/method declared by the manufacturer, which is not mentioned in GB/T 39901–2021.

Table 39: Differences in functional safety requirements for advanced emergency braking systems for passenger cars

GB/T 39901—2021 Annex A		UN Regulation No. R152 Annex 3		Remarks
Article No.	**Content**	**Article No.**	**Content**	
/	/	**3.1.1**	Documentation shall be made available in two parts. The Technical Service shall ensure that this documentation package remains available for a period determined in agreement with the Approval Authority. This period shall be at least 10 years from the time when production of the vehicle is definitively discontinued.	UN Regulation No. R152 Annex 3 explicitly proposes requirements for documentation saving, including location and time, which is not mentioned in GB/T 39901—2021.
A2.2	Definition of related items **A2.2.1** The functional concept of related items shall be described, providing a list of functional descriptions. **A2.2.2** The scope of related items shall be defined, specifying the systems and elements that are part of the related items. **A2.2.3** The operational conditions and constraints of the related items shall be defined. **A2.2.4** Schematic drawings shall be provided to illustrate the architecture of the related items and their internal and external interfaces. **A2.2.5** Identifiers shall be used to clearly recognise each component of the related items.	**Annex3** **3.2** **3.3**	**3.2** Description of the functions of 'the system' **3.3** System layout and schematics	The scope of GB/T 39901—2021 is 'related items' and that of UN Regulation No. R152 Annex 3 is 'the system'; other requirements are basically the same, including the description of functions, operational conditions, constraints, scope, architecture, interfaces, etc.

Table 39: Differences in functional safety requirements for advanced emergency braking systems for passenger cars

GB/T 39901—2021 Annex A		UN Regulation No. R152 Annex 3		Remarks
Article No.	**Content**	**Article No.**	**Content**	
A2.3	Hazard analysis and risk assessment Functional failures of the related items shall be analysed and categorised. The list of potential hazards shall be provided and the corresponding ASIL shall be defined according to the target use scenarios and target users of the vehicle. Safety targets shall be clarified and categorised for potential hazards.	/	/	Hazard analysis and risk assessment are specified in GB/T 39901–2021, and are required to be submitted as a document as part of its functional safety requirements. This is not specified in UN Regulation No. R152.
A2.4	Functional safety concept The safety measures (including external measures) taken during design to ensure that AEBS meets relevant safety objectives in the event of failure shall be described.	**Annex 3 3.4**	Safety concept of the manufacturer	GB/T 39901–2021 clarifies that this section is required with regard to the functional safety concept, while the title of UN Regulation No. R152 Annex 3 3.4 is broader in scope. However, its content is mainly about functional safety requirements, including that 'the manufacturer shall provide a design specification for the system to operate safely even under fault conditions'.

Table 39: Differences in functional safety requirements for advanced emergency braking systems for passenger cars

GB/T 39901—2021 Annex A		UN Regulation No. R152 Annex 3		Remarks
Article No.	**Content**	**Article No.**	**Content**	
A2.5	**Safety analysis** FMEA, FTA or other appropriate safety analysis methods may be used to demonstrate that faults or groups of faults affecting safety objectives of the system are effectively identified and addressed.	**Annex 3 3.4.4**	Inspection of the validation plans and results. This validation shall use, for example, Hardware in the Loop (HIL) testing, vehicle on-road operational testing, or any means appropriate for validation.	Both propose to conduct safety analysis, using FMEA, FTA or other appropriate approaches. The methods of validation (HIL, vehicle road operation test, etc.) are mentioned in UN Regulation No. R152 with respect to examination of the validation plan and results, but not in GB/T 39901–2021.
A3	**Validation and test** The function and safety concept of AEBS shall be validated as described in relevant documents in A.2.	**Annex 3 4**	**Verification and test** **4.1.1** Verification of the function of 'the system' **4.1.2** Verification of the safety concept of paragraph 3.4.	Both propose to conduct tests to verify adequateness of the safety concept and execution under both normal and fault conditions.

3.4.8.3 Type approval

GB/T 39901 – 2021 Advanced Emergency Braking System (AEBS) for Passenger Cars and Annex A (Normative Annex) Functional Safety Requirements does not yet involve type approval.

UN Regulation No. R152 Uniform provisions concerning the approval of motor vehicles with regard to the Advanced Emergency Braking System (AEBS) for M1 and N1 vehicles – Annex 3 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems is implemented in July 2022.

3.4.8.4 Summary

GB/T 39901 – 2021 Advanced Emergency Braking System (AEBS) for Passenger Cars and Annex A (Normative Annex) Functional Safety Requirements applies to vehicles of Category M1 equipped with AEBS. Annex A defines the special requirements for documentation, fault strategy and verification with respect to the functional safety aspects of AEBS in commercial vehicles, and does not yet involve type approval.

UN Regulation No. R152 Uniform provisions concerning the approval of motor vehicles with regard to the Advanced Emergency Braking Systems (AEBS) Annex 3 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems applies to vehicles of Category M1 and N1, equipped with AEBS, under urban driving conditions.

There is no specific section on functional safety, but Annex 3 is mainly about functional safety requirements, including special requirements for documentation, fault strategy and verification with respect to the safety aspects of complex electronic vehicle control systems. The regulation is implemented in July 2022.

3.4.9 Functional requirements for Lane Keeping Assist (LKA) Systems for passenger cars

3.4.9.1 Regulation/standard briefing

GB/T 39323-2020 Performance Requirements and Testing Methods for Lane Keeping Assist (LKA) Systems for Passenger Cars and Annex B (normative annex) Functional Safety Requirements.

This standard applies to vehicles of Category M1 equipped with a Lane Keeping Assist (LKA) system, which can also be referred to by other vehicles. There is no European standard which fully corresponds to this.The annex defines the special requirements for documentation, fault strategy and verification with respect to the safety aspects of LKA systems.

3.4.9.2 Type approval

GB/T 39323-2020 Performance Requirements and Testing Methods for Lane Keeping Assist (LKA) Systems for Passenger Cars and its Annex B (Normative Annex) Functional Safety Requirements do not yet involve type approval.

3.4.9.3 Summary

GB/T 39323-2020 Performance Requirements and Testing Methods for Lane Keeping Assist (LKA) Systems for Passenger Cars and its Annex B (Normative Annex) Functional Safety Requirements apply to vehicles of Category M1 equipped with a Lane Keeping Assist (LKA) system, which can also be referred to by other vehicles. There is no European standard corresponding to this.

This standard stipulates that functional safety requirements of the system shall be made in accordance with GB/T 34590 (all parts) and meet the requirements as stated in Annex B, i.e. the special requirements for documentation, fault strategy and verification with respect to the safety aspects of the LKA system.

It does not yet involve type approval. verification with respect to the safety aspects of complex electronic vehicle control systems. The regulation is implemented in July 2022.

3.4.10 UN Regulation No. R157 Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems

3.4.10.1 Regulation/standard briefing

UN Regulation No. R157 Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems – Annex 4 Special requirements to be applied to the safety aspects of electronic control systems and Audit.
Scope: This regulation applies to vehicles of Category M1 with regard to ALKS.

This annex is intended to ensure that the manufacturer performs an acceptably thorough consideration of functional and operational safety for the automated system that provides the function(s) regulated by the ALKS regulation during the design and development processes and continues to do so throughout the vehicle type lifecycle (design, development, production, field operation, decommissioning).

It covers the documentation which must be disclosed by the manufacturer to the type-approval authority or the technical service acting on its behalf (hereafter referred to as type-approval authority), for type approval purposes. This documentation shall demonstrate that the automated lane keeping system meets the performance requirements specified in this UN regulation, and that it is designed and developed to operate in such a way as to be free of unreasonable safety risks[1] to the driver, passengers and other road users.

The type approval authority granting the approval shall verify through targeted spot checks and tests that the argumentation provided by the documentation is strong enough and that the design and processes described in the documentation are actually implemented by the manufacturer.

Based on the documentation provided, the evidence conducted and the process review/product evaluation, the assessed level of residual risk for the automated lane keeping system is deemed to be acceptable. In line with the requirements of this Regulation, overall vehicle safety during the service life of an automatic lane-keeping system remains the responsibility of the manufacturer applying for type approval.

[1] Unreasonable safety risks: according to the current safety concept, the rixsk is judged to be unacceptable in a certain environment.

3.4.10.2 Analysis of main similarities and differences

Table 40: UN Regulation No. R157 Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping

No Corresponding GB		UN Regulation No. R157 Annex 4		Remarks
Article No.	**Content**	**Article No.**	**Content**	**Safety Concept**
/	/	**5**	System safety and fail-safe response Fulfilment of the provisions of this paragraph shall be demonstrated by the manufacturer to the technical service during the inspection of the safety approach as part of the assessment to Annex 4 (in particular for conditions not tested under Annex 5) and in accordance with the relevant tests in Annex 5.	Fulfilment of the provisions of this paragraph shall be demonstrated by the manufacturer to the technical service during the inspection of the safety approach as part of the assessment to Annex 4 (in particular for conditions not tested under Annex 5) and in accordance with the relevant tests in Annex 5.
/	/	**Annex 4 3.1.1**	The type approval authority shall ensure that this documentation package remains available for a period of at least 10 years from the time when production of the vehicle type is definitively discontinued.	The requirements for documentation storage shall be proposed, including the saving location and time.
/	/	**Annex4 3.2 3.3**	**3.2** Description of the functions of 'the system' **3.3** System layout and schematics	Describes the functions, operational conditions, constraints, scope, architecture, interfaces, etc.
/	/	**Annex 4 3.4**	Safety concept of the manufacturer	The manufacturer shall provide the type approval authority with a description of the system design to ensure functional and operational safety.

Table 40: UN Regulation No. R157 Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping

No Corresponding GB		UN Regulation No. R157 Annex 4		Remarks
Article No.	**Con-tent**	**Article No.**	**Content**	**Safety Concept**
/	/	**Annex 4 3.4.4**	The type approval authority shall perform an assessment of the application of the analytical approach. The type approval authority shall perform or require performance of tests as specified in paragraph 4 to verify the safety concept.	The type approval authority shall perform an assessment of the application of the analytical approach, including checking the manufacturer's vehicle -level safety analysis based on hazard/risk analysis, which may use methods such as FMEA, FTA, STPA, etc. and checking the verification/validation plan and results, including appropriate acceptance criteria. The type approval authority shall perform or require performance tof ests as specified in paragraph 4 to verify the safety concept.
/	/	**Annex 4 3.5**	Safety management system (process audit)	Safety management system (process audit) In respect of software and hard-ware employed in 'the system', the manufacturer shall demon-strate to the type approval authority in terms of a safety management system that ef-fective processes, methodolo-gies and tools are in place, up to date and being followed within the organisation to manage the safety and continued compli-ance throughout the product lifecycle (design, development, production, operation including in respect of traffic rules, and decommissioning).

Table 40: UN Regulation No. R157 Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping

No Corresponding GB		UN Regulation No. R157 Annex 4		Remarks
Article No.	**Content**	**Article No.**	**Content**	**Safety Concept**
/	/	**Annex 4 4.1.2**	Verification of the safety concept of paragraph 3.4. The reaction of 'the system' shall be checked under the influence of faults in any individual unit by applying corresponding output signals to electrical units or mechanical elements in order to simulate the effects of internal failure within the unit. The type approval authority shall conduct this check for at least one individual unit, but shall not check the reaction of 'the system' to multiple simultaneous failures of individual units. The type approval authority shall verify that these tests include aspects that may have an impact on vehicle controllability and user information (HMI aspects e.g. transition scenarios).	Apply corresponding output signals to electrical units or mechanical elements, in order to simulate the effects of internal failure within the unit. The type approval authority shall conduct this check for at least one individual unit, but shall not check the reaction of 'the system' to multiple simultaneous failures of individual units. The type approval authority shall verify that these tests include aspects that may have an impact on vehicle controllability and user information (HMI aspects e.g., transition scenarios).
/	/	**Annex 4 4.1.2.2**	The verification results shall correspond with the documented summary of the hazard analysis to a level of overall effect, such that the safety concept and execution are confirmed as being adequate and in compliance with the requirements of this regulation.	The verification results shall correspond with the documented summary of the hazard analysis to a level of overall effect, such that the safety concept and execution are confirmed as being adequate.
/	/	**Annex 4 4.2**	Simulation tool and mathematical models for verification of the safety concept may be used in accordance with Schedule 8 of Revision 3 of the 1958 Agreement, in particular for scenarios that are difficult on a test track or in real driving conditions.	Simulation tool and mathematical models for verification of the safety concept may be used, in particular for scenarios that are difficult in real driving conditions.

Table 40: UN Regulation No. R157 Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping

No Corresponding GB		UN Regulation No. R157 Annex 4		Remarks
Article No.	Con-tent	Article No.	Content	Safety Concept
/	/	Annex 4 7	**Competence of the auditors/ assessors** The assessments under this annex shall only be conducted by auditors/assessors with the technical and administrative knowledge necessary for such purposes. They shall in particular be competent as auditors/asses-sors for ISO 26262-2018 (Functional Safety – Road Vehicles), and ISO/ PAS 21448 (Safety of the Intended Functionality of Road Vehicles);	**Competence of the auditors/ assessors** The assessments under this annex shall only be conducted by auditors/assessors with the technical and administrative knowledge necessary for such purposes. They shall in particu-lar be competent as auditors/ assessors for ISO 26262-2018 (Functional Safety – Road Vehicles), and ISO/PAS 21448 (Safety of the Intended Func-tionality of Road Vehicles).

3.4.10.3 Type approval

UN Regulation No. R157 Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems – Annex 4 Special requirements to be applied to the safety aspects of electronic control systems and Audit was implemented in Europe in July 2022.

3.4.10.4 Summary

UN Regulation No. R157 Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems – Annex 4 Special requirements to be applied to the safety aspects of electronic control systems and Audit contains no specific section on functional safety, but Annex 4 includes requirements for functional safety and SOTIF, involving safety concepts, safety analysis, functional safety management system audits, testing and verification, and competence requirements for audit assessors.

The regulation is expected to be implemented in Europe in July 2022. There is as yet no GB that fully corresponds to this regulation.

3.4.11 Summary

This chapter has presented standards and regulations that relate to functional safety and SOTIF testing in both China and abroad, involving functional safety, ASIL determination, functional safety requirements for vehicle steering systems, functional safety requirements and test methods for steering systems, technical requirements and test methods for braking systems, performance requirements and test methods for AEBS, functional safety requirements for AEBS, performance requirements and test methods for LKA systems, etc.

The main similarities and differences between these standards and regulations have been analysed, along with the summary of type approval for each standard/regulation.

4. Recommendations for development

4.1 Recommendations for management systems and regulations

4.1.1 General recommendations

China and Germany should strengthen bilateral communication and exchanges, share with each other the legislative challenges and relevant experience related to ICV development, especially with the respect to the right of way of autonomous vehicles (dual mode of 'manual operation – autonomous driving' and 'unmanned operation mode'), and discuss their respective specific plans for ADAS access.

Based on the current status of publication and maturity of ICV-related standards in China and Germany respectively, it is recommended that both sides select functions that significantly enhance safety with a high level of technical maturity and a high adoption rate, as well as relevant standards to conduct studies on access. At the practical level, while maintaining the convergence of legal requirements, China and Germany should expand their exchanges on the formulation of relevant administrative regulations and technical standards, with communication concerning specialised technologies carried out on a regular basis.

4.1.2 Recommendations for road tests

As real road testing plays an important part in the research, development and certification of ICVs, Article 5.4 in Annex 5 of UN R157 puts forward requirements for actual road tests (in Germany, the Eighth Act amending the Road Traffic Act in 2017 endowed autonomous vehicles with the right to use public roads, and made it possible for them to be part of road testing – both of which helped to facilitate the development of autonomous driving technologies in the country). On the other hand, China's current road environment for testing is not yet sufficiently open, and there are proposals for restrictions in existing regulations on road tests for some intelligent driving scenarios to be gradually removed.

4.1.3 Recommendations data security

China requires new vehicles of Class M1 to be equipped with vehicle data recording systems from 1 January 2022, slightly earlier than 6 July 2022 required by the EU regulations; Chinese regulations in this respect apply to M1 vehicles, and can be referred to by other vehicles, while the EU regulations set a timeline for other vehicles. For this reason, it is recommended that China and Germany strengthen communication on implementing auto data recording systems, so as to ensure that imported and exported vehicles will meet the corresponding requirements.

On the other hand, an initial legal and regulatory framework relating to automotive data security in China has now been established; the challenge for automakers is to meet these requirements in a pragmatic way. Opinions on ICV access management in China also propose strengthening data security management requirements in order to formulate and implement the corresponding standards and plans for corporate data collection. GDPR in Europe sets out the requirements for data security, but there is not yet any specific regulation for the auto industry. Both China and Europe should value data security-related laws and regulations. More specifically, it is recommended that management rules should be implemented and regulations on ICV data application and security refined at a faster pace, facilitating the synergy of laws and regulations in the field of data security.

4.1.4 Recommendations data for cybersecurity

At present, all governments around the world attach great importance to the strategic deployment of automotive cybersecurity and more

substantial work is being done. Mandatory standards for cybersecurity protection in China will soon be released and the relevant Chinese authorities already have a clear timetable for the regulation of automotive information security. The recommendation is therefore to establish a certification and access system for auto information security and fully integrate the information security of OEMs, automotive products, V2X service providers, auto parts and their manufacturers into the realm of national regulation.

At the same time, there needs to be analysis of differences in the way the laws and regulations are implemented, based on the existing legal framework in China and Germany, as well as of the differentiated certification systems and national conditions in the two countries. Mutual recognition and trust of standards and regulations in auto information security should be promoted between China and other countries and regions around the world.

On the prerequisite of establishing a complete auto information security certification system domestically, China should fully align with international standards and regulations such as UN R155, establish a system of mutual recognition and trust for information security of auto products with other countries and regions, and advance the cross-border trade of automobiles.

For China and Germany alike, ICV development involves a number of industries and their competent authorities. The corresponding policies and regulations need to be designed at the top level as national strategies. Consequently, the proposal is to formulate a strategic plan for ICV cybersecurity that provides unified and effective guidelines for coordination and standardisation in the sector, so that relevant corporate behaviours can be coordinated through strategic planning. Guidance can be issued for enterprises to continuously enhance their cybersecurity performance, led by the competent departments within the auto industry and combined with efforts from parties including industry associations.

There are also proposals to launch a specific roadmap and timetable for automotive cybersecurity technology research, standards development, policy guidance implementation, etc.

4.1.5 Recommendations for functional safety

The importance of functional safety has become increasingly prominent with the technological advancement of ICVs and growing number of electronic components with which vehicles are equipped. At present, only mandatory standards for braking and steering incorporate functional safety requirements as access requirements. It is not clear how functional safety will be systematically managed in the future, particularly with regard to automated driving-related functional safety.

China and Europe could have more in-depth research activities or joint programs in the field of functional safety. The recommendation is to re-evaluate existing transport laws and regulations so as to remove legal barriers to the testing and deployment of autonomous driving technologies, provide institutional safeguards for the testing and application of new safety technologies, further refine the responsibilities of regulatory authorities at all levels and better coordinate vehicle safety requirements.

4.2 Recommendations for management systems and regulations

4.2.1 General recommendations

In view of global technical difficulties in verifying the safety and reliability of autonomous driving technologies, China and Germany should intensify their exchanges on standardisation of the industry and conduct more online technical expert meetings to share difficulties encountered by both in practical applications. In this way, the two countries can jointly improve the coordination, applicability and operability of technical standards in both countries, reduce compliance costs and promote global exchange and cooperation in the field of autonomous driving technologies, thereby helping the industry to grow and improving

protection for consumers and all road traffic participants with regard to personal and property safety.

4.2.2 Recommendations for road tests

Standards for driver assistance systems, e.g. (EU) 2021/1958, put forward mileage requirements for robustness road tests for intelligent speed assistance systems, and such tests can at present only be conducted in Europe, which increases type approval costs for Chinese enterprises. It is proposed that some of the mileage of road tests performed in China is used to support the robustness requirements.

As real road testing plays an important part in the research, development and certification of ICVs, Article 5.4 in Annex 5 of UN R157 puts forward requirements for actual road tests. On the other hand, China's current road environment is not yet sufficiently open, and it is recommended that restrictions in existing regulations on road testing for some intelligent driving scenarios should be gradually removed.

4.2.3 Recommendations for data

The EU's EDR-related regulations take into consideration data security requirements; the Chinese GB national standards need to do the same and improve content later when they are revised.

Based on the analysis of similarities and differences in Article 3.2, it is recommended that Chinese and German auto companies should compare the corresponding technical parameters. Since the Chinese GB standards do not use the state of the VRU protection system device as the basis for determining the trigger threshold, locking condition, event starting point, etc., functional verification should be conducted on exported vehicles. Meanwhile, Europe should improve the EDR functional requirements and protective performance, as well as the corresponding test methods.

With regard to data elements, it is recommended that Chinese and European standards be integrated to take into account the standardised scope of EDR records and ensure data comprehensiveness.

Finally, for the follow-up to similar data recording standards, both China and Europe are currently drafting their respective DSSAD standards, for instance, and there is sufficient time and opportunity to harness synergies in data formats, protocol reading, data security measures and function realisation forms, to facilitate better support for access management in the future.

4.2.4 Recommendations for cybersecurity

It is essential to establish a cybersecurity standards system suitable for the development of China's automotive industry. Relevant technical measures will gradually be implemented, along with the development of national and industrial standards. Such a system will provide comprehensive guidance and technical support for the promotion of automotive cybersecurity, with a view to clarifying the existing standards framework and the name and scope of specific standard items, formulating research plans and work implementation plans for standard items, and providing support for the formulation of relevant national policies for the automotive industry.

It is also necessary to establish clarity on the current status of China's existing automotive cybersecurity standards, which are divided into three different levels – mandatory standards, recommended standards and group standards – in line with the scope and objectives of specific standards, thus giving full play to their role in safety protection, industry management, market leadership and technology innovation.

The recommendation is to accelerate the formulation of basic and general information security standards for the automotive industry, such as the protection standards involving different auto cybersecurity levels. For the automotive information security standards that are widely used and urgently needed, it is essential to establish standards drafting teams and set up a green channel for standards formulation. It is necessary for China to fully participate in the drafting and coordination of international automotive cybersecurity standards and regulations, draw on the advanced experience of other countries,

encourage the transformation of Chinese standards into international ones, and contribute Chinese wisdom to the international community.

4.2.5 Recommendations for functional safety

China and Germany differ significantly with regard to functional safety standards for road vehicles. In recent years, China has carried out a series of standard formulation and revision measures concerning the implementation of functional safety.

These have focused mainly on general methods, ADAS systems and key chassis execution systems, with the release of Road Vehicles – Functional Safety Audit and Assessment Methods and Functional Safety Requirements and Testing Methods for Passenger Car Steering Systems, both of which apply only to the industrial situation in China; these documents also specify relevant functional safety requirements for ADAS systems and key chassis actuators in the annexes.

Out of all the UN standards, there is no standard specifically drafted as yet for functional safety, and most of the safety-related content in the annexes involves special requirements for the safety of electronic control systems, with no highlighting of the concept of functional safety. In addition, China and Germany differ significantly in the implementation of standards and review of these documents, causing some difficulties for both sides to interpret each other's standards and enter the other's market.

It is therefore recommended that the two sides strengthen communication in this regard, and discuss jointly how to help companies improve the functional safety of autonomous vehicles from the level of standards and regulations without adding too many additional barriers to entry.

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