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Legislation of Intelligent Connected Vehicles Management and Innovative Practice in Shenzhen

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Abstract: The future development of electric, intelligent, and connected vehicles has become an inevitable trend. Intelligent connected vehicles (ICVs) are accelerating from testing and verification to the eve of commercialization. However, due to the constraints of laws and regulations, ICVs are facing challenges such as lack of legal driving subject status, unable to be legally commercialized, inapplicable accident distribution system, and gaps in safety supervision. Based on an in-depth analysis of the difficulties and priorities in ICVs management, this paper summarizes the legislative experience of Europe, America, and other developed countries geared toward the commercial management of ICVs. Taking the Regulations on the Administration of Intelligent Connected Vehicles of Shenzhen Special Economic Zone, which is the first regulation on the administration of ICVs in China, this paper analyzes the innovative measures for the administration of ICVs in Shenzhen, including granting automatic driving systems the legal status of traffic participant, establishing a local “product access-vehicle registration-transport operation” management system, clarifying the division of liability and compensation rules in separate traffic accident scenarios, and establishing a supervisory mechanism for network security and data information protection. By developing a well-established innovative local management system, Shenzhen is promoting the high-quality development of the ICVs industry. **DOI:** 10.13813/j.cn11-5141/u.2023.0019-en

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0 Introduction

Intelligent connected vehicles (ICVs), commonly known as intelligent vehicles, autonomous vehicles, and self-driving automobile [1], have become a strategic direction for the development of the global automotive industry, an important carrier for driving a new round of economic growth and building a “dual circulation” development pattern, and also a core scientific and technological field of major-country competition. The U.S. federal government has regularly released Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles every year since 2016 to clarify the development route of autonomous vehicles [2]. The European Union released On the Road to Automated Mobility: An EU Strategy for Mobility of the Future in 2018, putting forward the vision of entering society of full automation by 2030 [3]. In Japan, Strategic Innovation Program: Automated Driving for Universal Service (SIP-ADUS) was launched in 2014 to accelerate the research and development of basic technologies related to autonomous driving [4].

However, ICVs, as brand-new traffic participants, have transformed the relationship between vehicles and human beings with their autonomous driving systems. The existing

laws and regulations governing motor vehicles are based on the driver as the main body, and “manned” motor vehicles as the object of management, which are incompatible with ICVs. To solve the legal and regulatory constraints faced by the development and application of autonomous driving technology, developed countries are committed to creating an open and inclusive policy and institution to race to reach the commanding heights of the industry’s development. For example, the UK has taken the lead in establishing an insurance compensation mechanism for self-driving cars, defining the responsibilities of all parties based on the type of accident [5]. Germany has revised its road traffic law to clarify the legal status of autonomous driving and has taken the lead in releasing related codes of ethics and morality [6]. Since 2018, China has released documents on road testing and demonstration application management of ICVs at the national and local levels, but all of them are general normative documents that have a low effectiveness and are unable to fundamentally eliminate the conflict between autonomous driving technology and existing laws and regulations [7].

In 2020, a plan on implementing pilot reforms in Shenzhen to build the city into a demonstration area of socialism with Chinese characteristics in the next five years (2020–2025) issued by General Office of the CPC Central Committee and General Office of the State Council of the People’s Republic

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of China and the list of the first batch of authorized matters proposed that Shenzhen should be supported to take advantage of the legislative power of the special economic zone (SEZ) to broaden the space of the SEZ's legislation, and to give Shenzhen the right to early pilot implementation in emerging fields such as artificial intelligence and self-driving. In August 2022, the Regulations on the Administration of ICVs in Shenzhen Special Economic Zone (hereinafter referred to as the Regulations) came into force. The Regulations is China's first regulation on the management of ICVs and also a milestone in the development of China's ICV industry, providing experience for the revision of laws and regulations at the national level. Based on the technical characteristics of ICVs, this paper analyses the key issues facing the legislation on ICV management, summarizes the legislative process and experience of other countries, and further elaborates Shenzhen's thinking and practice on the innovative management of ICVs, so as to provide reference for the legislation at the national level, and thus to ensure that China can take the leading role in the competition of this industry.

1 Key issues in ICV management in china

During the development of vehicle motorization, countries around the world have established a set of systematic and strict laws and regulations around conventional motor vehicles, covering management links such as automobile production and manufacturing, vehicle register and use, road traffic regulation, and handling and compensation for traffic accident damages. The emergency of ICVs makes the core components of the car change the transmission system to intelligent software system algorithms and processor chips, realizing "software-defined vehicles (SDV)". The vehicle has the autonomy of operation, and people gradually become users, managers and passengers, rather than drivers. Under such a change of rules, ICVs bring multidimensional impact on the existing management system.

Although ICV technology is still in a period of rapid iterative updating, it is not yet possible to fully foresee its final form. But in the face of the current transformation stage from technology testing and verification to large-scale application, there are four key issues that need to be resolved on the management of ICV industry.

(1) Autonomous driving systems do not yet have legal driving subject status

Autonomous driving system is centred on artificial intelligence algorithms, and its essence is that the system gradually replaces human to drive. According to the first paragraph of Article 19 of the *Road Traffic Safety Law of the People's Republic of China*, "Whoever drives a motor vehicle shall have lawfully obtained a motor vehicle driving licence." The first paragraph of Article 19 of the *Regulations on the*

Implementation of the Road Traffic Safety Law of the People's Republic of China stipulates, "Any person satisfying the conditions for driving as prescribed by the public security department of the State Council may file an application to the traffic administrative department of the public security organ for motor vehicle driving licence." In the current provisions of the superior laws, a car's legal driving subject and the main body of responsibility is "a person with a motor vehicle driving licence", and car travelling on the road with autonomous driving systems is not a legal driver, without road driving legality. At the same time, the obligations, requirements and responsibilities for drivers stipulated in the *Road Traffic Safety Law of the People's Republic of China* is no longer applicable to ICVs with high-level autonomous driving.

(2) Restrictions on the legal commercialization of new means of transport

The development of ICV industry is still at the stage of large-scale R&D investment, and the industry can achieve sustainable development only by realizing the application of product commercialization. First, the legalization of ICV products is restricted. Since 1985, China has implemented an access management system for motor vehicle products to enter the market, with the inspection and testing system and safety technology assessment and audit as the core. However, ICVs do not have corresponding access standards, and key components such as LIDAR are missing automotive-grade standards, which do not meet the requirements of the *Measures for the Administration of Road Motor Vehicle Manufacturing Enterprises and Product Access*^[8], so they cannot be listed in the vehicle product content, cannot be sold and registered, and can only be driven in the form of road tests on designated open roads. Second, the legalization of ICV applications is restricted. According to the current transport laws and regulations, both passenger and freight services require a driver who meets the conditions and has a passenger and freight transport business license, while driverless ICVs obviously do not meet the requirements and cannot carry out road transport business activities.

(3) The division of responsibility for accidents and the insurance compensation mechanism are not applicable

The existing road traffic safety laws and regulations for dealing with traffic accidents and violations are based on the premise of human behavior, which assigns responsibility according to the degree of fault of the parties' behavior. With the change of the driver's role, the traffic accident tort liability system centred on the driver's driving behavior is difficult to apply to ICVs. In the absence of a driver, the rules for determining the tort liability of other relevant responsible subjects such as manufacturing enterprises and operating enterprises of ICVs that may be involved in traffic accidents are unclear. In addition, the main body of insurance in the

current compulsory liability insurance of vehicle traffic accident is confined to motor vehicles owner. In the future, the risk structure of vehicles will change from vehicle damage and third-party liability risks to product liability, operational liability, etc. And the conventional insurance risk ratings and analyses, insurance coverage, and compensation mechanisms will face challenges of change ^[9].

(4) Gaps in network and data security regulation

ICVs are highly networked and informationized, and are subject to public security risks such as hacking, system failure, data leakage, and illegal use of data. Since 2017, China has successively enacted *Cybersecurity Law of the People's Republic of China*, *Data Security Law of the People's Republic of China*, and *Personal Information Protection Law of the People's Republic of China* to promote the healthy development of economic and social informatization, filling the gap of monitoring of network and data security. However, these basic laws are not yet able to cope with the multi-dimensional security issues of the vehicle, cloud, road, and mobile terminals that ICVs bring about ^[10]. There are still a large number of legal provisions that need to be further refined and stipulated. The Ministry of Industry and Information Technology (MIIT) published the *Management Guide for Intelligent Connected Vehicle Manufacturing Enterprises and Product Access (Trial)* (exposure draft), which put forward the requirements of cybersecurity assurance capability for ICVs manufacturing enterprises, but the specific implementation details and standards were not yet clear. Additionally, ICVs belong to the emerging product of the fusion of multi-disciplinary fields, and there is no relevant detailed basis to guide the department concerned to monitor network and data security. Therefore, the supervision of emerging security risks of ICVs remains a major challenge.

2 Foreign experiences in ICV management legislation

As early as in the 1980s, the United States as a representative of the developed countries in science and technology has carried out automatic driving technology on the road test ^[10]. To comply with the wave of the new generation of technological revolution and the rapid change of the automotive industry, countries around the world have successively introduced relevant policies and regulations to

solve the conflict between ICVs and existing laws and regulations based on promoting the ICVs industrialization and commercialization.

(1) Clearly defining the legal driving subject status of autonomous driving systems

The United States, Germany, and Japan have all clarify the legal status of autonomous driving systems by amending their previous road traffic laws or enacting new regulations. For example, in 2017, Germany passed the *Anderung des Straßenverkehrsgesetzes (The Road Traffic Act (Eighth Amendment))*, which allowed autonomous vehicle to replace a person under specific conditions, and at the same time contained specific provisions for the right of self-driving vehicles, and for the rights and obligations of the driver in the self-driving mode. Thus the legalization of autonomous vehicle on the road has been achieved ^[6]. It is important to note that the legal driving subject status of the self-driving system is to allow it to pass on the road as transportation ^[4], rather than give it the status of civil law subject.

(2) Promoting the legalization of the production and application of autonomous vehicles

Against the background of uncertain technologies, if we are committed to managing ICVs through the traditional technical standard and regulation model, it will limit the diversified and multi-path development of emerging technologies, and the difficulty and hysteresis in standard establishment will slow down the development of an industry. Developed countries and regions such as the United States ^① and the European Union ^② have not yet established a set of mature and complete safety technology standard system for ICVs. However, for ICVs that are unable to meet the current motor vehicle safety standards because of the adoption of new technologies, new processes, etc., an access channel of exemption from the relevant conditions has been granted, so that the production of ICVs can comply with regulations in the framework of specific quality and safety supervision. Other countries mainly adopt two paths to promote the legal commercialization of ICVs: administrative laws license and special legislation allows. For example, the commercialization of driverless delivery vehicle, self-driving taxi, self-driving trunk transport and other scenarios in the United States have obtained special permission of administrative order by the California Motor Vehicle Administration (CMVA); South Korea has introduced a special bill called the *Act on Promotion and Support of the*

^① According to Article 30113 of Chapter 49 in *United States Code*, Article 555 of Chapter 49 in *Code of Federal Regulations*, and Article 24405 in *Fixing America's Surface Transportation Act (FAST Act)*, vehicles that do not satisfy the Federal Motor Vehicle Safety Standard (FMVSS) due to new technologies, vehicle manufacturer can apply to the management department for exemption of access conditions according to the regulations and corresponding procedures. After obtaining the exemption license, the vehicles for sale and use need to attach the exemption license label on the windshield or side window of the body.

^② According to Guidelines on the Exemption Procedure for the EU Approval of Automated Vehicles Version 4.1, exemption permit can be applied for Level 3 and Level 4 autonomous vehicles planned for mass production, not including Level 5 autonomous vehicles. Applicant needs to follow relevant procedures and requirements in the guide.

Commercialization of Autonomous Vehicles to allow the commercial demonstration of self-driving vehicles.

(3) Constructing relatively complete rules for the liability determination for traffic accidents

Developed countries such as Germany, the United Kingdom, and the United States clarify the traffic accident liability through the revision of the original traffic accident handling system or the corresponding regulations for ICVs, which compliance with the fault liability, product liability and other established systems, and expand the scope of the subject of tort liability from the driver to the manufacturer, the software designer and other subjects, i.e., human drivers are responsible for the operational fault, and automobile manufacturers and system providers are responsible for the product defects. For example, in the UK, in the current liability framework for self-driving car accidents, if an accident occurs in autonomous mode and the owner of the vehicle has no fault, the manufacturer will take full responsibility, and the insurance company will have the right to recover the compensation from it in accordance with the product liability act and other relevant provisions after the compensation is made in advance. While ensuring the victims' rights to claim damages, this will also further promote the production of self-driving cars of acceptable quality by manufacturers.

(4) Establishing a new security risk management system for the whole life cycle

Developed countries and regions have attached great importance to cybersecurity and data protection in Internet of Vehicles, and have focused on regulating the responsibilities and obligations of vehicle manufacturers. For example, the *Self Drive Act* in the US requires manufacturers of ICVs to develop a privacy protection plan as a prerequisite for the sale of self-driving vehicles, based on which it is made clear that manufacturers should protect driver and passenger data, as well as third-party data (e.g., pedestrian data) from privacy risks caused by unauthorized access, collection, use or sharing. The *Key Principles of Cyber Security for Connected and Automated Vehicles* in the UK clarify the manufacturer's responsibility for cyber security throughout the entire lifecycle of the design, development, production and use of automated vehicles, and require manufacturers to develop a cybersecurity plan as a prerequisite for the sale.

3 Innovative practice of ICV management legislation in Shenzhen

Shenzhen has legislative power as both a SEZ and a local region. Legislative power of SEZ authorized by the National People's Congress includes the right of priority, right to create, and right to trial, and also have the initiative of

advancing innovation, expanding opening up, and accelerating development^[11]. Shenzhen bears a significant mission for the national reforms to seek a replicable system sample^[12]. The Regulations were the first exploration of legislating in emerging industry after Shenzhen made full use of the legislative power of the SEZ, and it comprehensively established a local innovative management system to promote the high-quality development of the ICVs industry, centred on the key issues faced by the management of ICVs.

(1) Granting legal status to autonomous driving systems as traffic subjects

The Regulations reasonably stipulate the driving qualifications of automated driving systems of ICVs, giving it the status of "traffic subject", so that ICVs can legally drive on the road. According to the relevant technical requirements in the Taxonomy of driving automation for vehicles (GB/T 40429-2021), the Regulations make it clear that ICVs with conditional driving automation (Level 3) and high driving automation (Level 4) shall be equipped with a driver who do not operate the vehicle in autonomous driving, but has the obligation to take over and be vigilant. ICVs with full driving automation (Level 5) are allowed to be free from drivers, but the vehicles should have the function of adopting effective measures to reduce the risk in abnormal and critical situations.

(2) Creating a local management system—"product access-vehicle registration-transport operation"

China already has a set of mature management system for product access, registration and operation of motor vehicles. On the basis of the traditional management process and rules, the Regulations establish a new local management system for ICVs. The first is local product access management. The Regulations provide for a local access based on local standards for ICVs. ICVs complying with the local product standards are allowed to be sold in Shenzhen after they are listed in Shenzhen's ICVs product catalogue and announced to the public. At the same time, to encourage technological innovations and to meet the urgent needs of the industry and the market, the Regulations encourage related associations, enterprises and organizations to formulate leading and innovative group standards for ICVs. The second is local registration management. According the Article 8 "The state applies a system of registration to motor vehicles. A motor vehicle is not allowed to run on road until it has been registered by the traffic administrative department of the public security organ" in the *Law of the People's Republic of China on Road Traffic Safety*, the Regulations establish a local registration management system, stipulating that ICVs can be driven in Shenzhen after they have been registered by the traffic police department of Shenzhen and have obtained registration certificates, number plates and driving licences. The third is local operation management. On the basis of allowing ICVs to register and be licensed, the Regulations

further clarify that the Shenzhen Municipal Transportation Administration shall grant road transport business licences and road transport permits to eligible enterprises and vehicles, and support the diversified transport services, so as to resolve the problem of ICVs being unable to obtain operating qualifications and carry out road transport business activities.

(3) Clarifying the determination of responsibility and compensation for scenario-based accidents

Due to the characteristics of grading driving automation, the Regulations clarify the attribution of liability for damages and the recovery mechanism in accordance with two types of scenarios with or without a driver in the car. When a traffic violation or accident occurs, the established laws and regulations are applied for ICVs with drivers. But for liable ICVs without drivers, the traffic police department will handle the vehicle owner and manager. If the damages are caused by ICVs' defects, the vehicle owner and manager can request compensation from the manufacturer and the seller according to the law. First, according to the principle of "who benefits, who is responsible", letting the vehicle owner and manager bear the responsibility can urge them to cautiously drive and regularly maintain the vehicle. Second, the establishment of the compensation rule—"pay first, recover later" can avoid long-term failure to uphold the legitimate rights and interests of victims because of prolonged technical appraisals, and can give priority to the protection of the rights and interests of the victims. And the parties involved can legally recover the compensation from the producer and the seller if the accident is indeed caused by technical defects of the vehicle.

(4) Establishing a regulatory mechanism for cyber security and data protection

Drawing on experience of developed countries and regions in cyber security and data protection in the Internet of Vehicles, the Regulations focus on regulating the cyber security, data protection responsibilities and obligations of enterprises related to ICVs, and establish a joint regulatory operation mechanism based on China's existing superior laws. First, it stipulates that related enterprises should obtain security testing certification for critical network devices and specialized cybersecurity products in accordance with the law, and establish cyber security assessment and management mechanisms. Second, it stipulates that relevant enterprises should take measures to prevent the leakage, loss and destruction of users' personal information in accordance with relevant national regulations, and formulate data security and privacy protection programmes. Third, it prohibits the illegal collection, processing and use of personal information, and the illegal collection of data related to national security. Fourth, it is clear that the network and information security departments in collaboration with the transport, public security and industry and information technology

departments will bear the burden of supervising and establishing an emergency management mechanism together, so as to effectively safeguard public security.

4 Conclusions

ICV management legislation is an important cornerstone for improving the management mechanism of new traffic elements and promoting the standardized and orderly development of emerging industries. The Regulations imply a further innovative breakthrough for Shenzhen on the basis of the original management framework. By establishing rules and mechanisms for the management of the whole chain of ICVs, Shenzhen promotes the transformation of the ICV industry from scientific research and testing to application, and from simply capital investment to a virtuous cycle of the industry, which provides a model for China's innovative science and technology in seizing the commanding heights of global development. The Regulations not only protect the legitimate rights and interests of the public, but also have practical significance and demonstration effect in multiple dimensions such as politics, economy and society. This paper summarizes the key issues of ICV management and advanced foreign experience, and rethinks the legislative exploration and practice in the emerging field of Shenzhen, in order to provide useful assistance for the local ICV management policies and regulations, urban intelligent traffic management and other related aspects, and jointly promote the innovative development of the industry.

References

- [1] LI K Q, DAI Y F, LI S B, et al. State-of-the-art and technical trends of Intelligent and Connected Vehicles[J]. *Journal of automotive safety and energy*, 2017, 8(1): 1–14.
- [2] US Department of Transportation. Ensuring American leadership in automated vehicle technologies: automated vehicles 4.0[R/OL].(2016-01-08) [2022-08-05]. <https://www.transportation.gov/av/4>.
- [3] European Commission. On the road to automated mobility: an EU strategy for mobility of the future[R/OL]. 2018[2022-08-05]. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018DC_0283.
- [4] MASAHIRO K. Research on the legal system of realizing autopilot vehicles[J]. YAO W Q, translated. *Police science research*, 2019(6): 59–69.
- [5] CAO J F, ZHANG Y H. Review on UK AEV Act: innovation in insurance and liability rules for autonomous vehicles[J]. *Information security and communications privacy*, 2018(10): 66–73.
- [6] ZHANG T L, JIANG Y Y. Zur Smart Car-Gesetzgebung und nderung des StraBenverkehrsgesetzes in Deutschland [J]. *Deutschland-Studien*, 2017, 32(3): 68–80
- [7] LI S. Research on the legislation of self-driving cars[J]. *Administrative law review*, 2019(2): 104–113.
- [8] CUI J J. Access system for self-driving cars: legitimacy, requirements and strategy[J]. *Administrative law review*, 2019(2): 90–103.
- [9] Institute of Policy and Regulation (Industrial and Information law Service Center) of China Center for Information Industry Development. Policy and law research report of intelligent connected vehicle in 2019[R]. Beijing: China Center for Information Industry Development., 2019.

[10] IOANNOU P A. Development and experimental evaluation of autonomous vehicles for roadway/vehicle cooperative driving[R]. Berkeley: University of California, Berkeley, 1998: 2.
[11] XU P H. A research on the legislation of the special economic zone[D]. Changchun: Jilin University, 2012.

[12] QIAO X Y. Composition, characteristics and content of the socialist legal system with Chinese characteristics [J]. People's Congress of Qinghai, 2012(4): 8-13.

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