GOVERNMENT STATUS REPORT OF REPUBLIC OF KOREA

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Status of Road Traffic Accidents and Policies

Analysis of Road Traffic Accidents Statistics

The fatalities from road traffic accidents steadily decreased due to the Korean government's continuous efforts and the implementation of policies to reduce traffic accidents, while the number of motor vehicle registrations continued to increase over the past 20 years. The number of motor vehicle registrations increased by four folds in 2017 compared to that in 1997, but the fatalities due to traffic accidents decreased by about one third from 1997 to 2017. The fatalities per 100,000 people also declined to below 10 in 2014 for the first time, decreased steadily to 8.1 in 2017.

Table 1. Total fatalities and fatalities per 100,000 (unit: death)

Year	2011	2012	2013	2014	2015	2016	2017
Total Fatalities	5,229	5,392	5,092	4,762	4,621	4,294	4,185
Fatalities per 100,000	10.5	10.8	10.1	9.4	9.1	8.5	8.1
Number of Vehicle Registration (million unit)	18.44	18.87	19.40	20.12	20.99	21.80	22.53

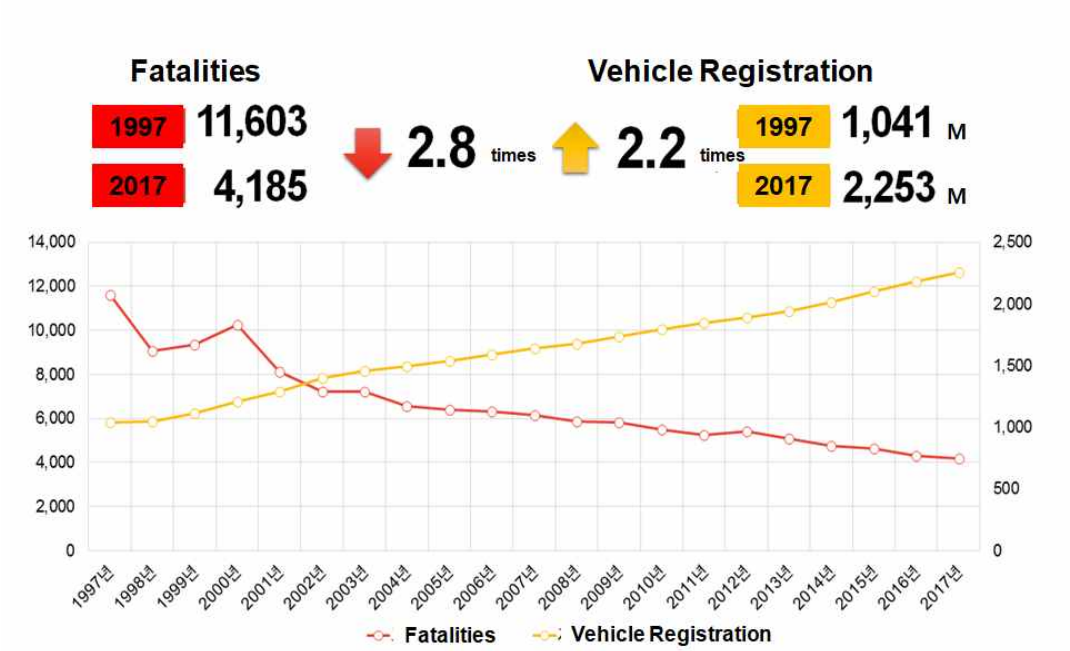

Figure 1. Road traffic fatalities

In order to improve road traffic safety, the Korean government has established a 5-year National Transportation Safety Master Plan every five years. According to the 8th Plan (2017 ~ 2021), the government aims to reduce the fatalities from road traffic accidents to 2,800 or less by 2021 by implementing various measures.

The 2nd Vehicle Policy Framework Plan(2017~2021)

The 2nd Vehicle Policy Framework Plan(2017~2021), established in 2016, sets policy directions for strengthening vehicle safety, strengthening passenger and pedestrian protection from traffic accidents, and implementing vehicle safety and management measures. In particular, regarding the activities for strengthening vehicle safety, the feasibility and implementation studies of international vehicle regulations have been carried out. Regarding international cooperation, Korea has actively participated in the UN ECE WP.29 for the past two years with the aim of strengthening our role in international vehicle regulation legislation.

Activities in International Harmonization of Vehicle Regulations

The Republic Korea is a contracting party to the 1958 Agreement and the 1998 Agreement of UN ECE(United Nations Economic Commission for Europe) WP.29(World Forum for Harmonization of Vehicle Regulations). UN Regulations and UN Global Technical Regulations have been reflected in domestic vehicle regulations.

Researches for International Harmonization of Vehicle Regulations

Since 2006, Korea has introduced international vehicle regulations to domestic vehicle regulations every year based on the feasibility studies to promote international harmonization. From 2017, an annual plan has been established and the feasibility study and implementation of international vehicle regulations have been carried out under the 2nd Vehicle Policy Framework Plan.

In 2019 the studies have been initiated to introduce seven UN Regulations, such as Mechanical coupling(UN Reg 55), the Rollover Stability of Tank Vehicles(UN Reg 111), Superstructure and Seat Strength of a Bus(UN Reg 14, 16, 66, 80, 107).

As of February 2019, about 68% of the domestic vehicle safety regulations were harmonized with international vehicle regulations by introducing 68 UN Regulations and 14 UN Global Technical Regulations. In 2017, 16 items in the domestic vehicle safety regulations were harmonized with UN Regulations including UN Reg 18 and 4 items in the domestic vehicle safety regulations were harmonized with UN Global Technical Regulations including GTR No. 2. Five items in the domestic vehicle safety regulations were harmonized with UN Regulations including UN Reg 77 in 2018.

Table 2 shows the number of items to be revised by year, 16 items of international vehicle regulations to be studied to reflect on domestic vehicle safety regulations, and a total of 43 international vehicle regulations will be reflected on domestic vehicle safety regulations by 2023.

Table 2. Harmonization Rate and Number of Research Items

Category		2019	2020	2021	2022	2023	Total
UN Regulation	to be reflected after study	3	7	4	1	1	16
	to be reflected	10	3	3	2	1	27
UN Global Technical Regulation	to be reflected	4	1	3	-	-	
Number of Items		17	11	10	3	2	43

Activities at UN/ECE WP.29

The Republic of Korea is actively participating in the WP.29 Plenary Meetings and six Expert Meetings(GR) and informal technical group meetings. As of 2019, The Delegate of Korea is serving as Vice-Chairperson of Working Party on Passive Safety(GRSP).

The Delegates of Korea also chair for the informal working group on Panoramic Sunroof Glazing (PSG) to develop an international vehicle regulations to prevent the damage of panorama sunroof and for the informal working group on Deployable Pedestrian Protection System (DPPS) to develop test procedures to mitigate pedestrian injury in pedestrian accidents.
The Delegates of Korea are serving as Vice-Chairperson for the informal working group on 2nd phase Hydrogen and Fuel Cell Vehicles (HFCV) and the informal working group on Vehicle Interior Air Quality (VIAQ) to develop international vehicle regulations in the 2nd phase. The Republic of Korea is actively participating in 13 informal technical working group meetings.
In addition, in order to develop international vehicle regulations for autonomous vehicles, at its February 2018 session, the Inland Transport Committee (ITC) requested WP.29 to consider establishing a dedicated subsidiary Working Party. Following this request, WP.29, at its June 2018 session, decided to convert the Working Party on Brakes and Running Gear (GRRF) into a new Working Party on Automated/Autonomous and Connected Vehicles (GRVA). Five informal technical working group meetings will be operating under GRVA. In response to transition, the Republic of Korea will exercise her full capabilities and participate in the informal technical working group meetings to pursue active roles and activities.

Korean New Car Assessment Program (KNCAP)

The Korean New Car Assessment Program was introduced in 1999 with a full frontal crash test of Hyundai Avante model. Since then, 175 models have been assessed by 2018, and 22 items in the three areas of collision safety, pedestrian safety and accident prevention safety are being evaluated by continuously expanding models and assessment items.
Reflecting technological and social changes such as strengthening the safety of vulnerable road users, cutting-edge automotive technology, and commercialization of autonomous vehicles, the Korean New Car Assessment Program began the evaluation of the collision safety for vulnerable road users such as women drivers and children in 2017. The safety of the accident prevention field was enhanced by including the assessment of ADAS such as AEBS.
To enhance passenger safety in the second row seat the assessment was extended to evaluate the neck injuries of passengers in 2018 and the crash safety of women passengers in 2019. The assessment has been continuously enhanced by evaluating the safety of women and children, whose safety has been somewhat neglected in the program.
In addition, after expanding the number of evaluated ADAS to 13 in 2017 in the accident prevention area, the installation rate of safety devices increased from 57% in 2017 to 66% in 2018 by 9 % points. The Korean New Car Assessment Program played a leading role in enhancing vehicle safety in the accident prevention area.
The second mid to long-term Korean New Car Assessment Program Plan (2019-2023) was established in 2017. The current status of domestic traffic accidents, technological development trends, and overseas NCAP trends were reflected in this Plan according to the 8th National Transportation Safety Master Plan(2017 ~ 2021) and the 2nd Vehicle Policy Framework Plan(2017~2021). In this Plan the following three major strategies and detailed implementations were decided as follows:

A. Strengthening collision protection: Strengthening collision safety of vulnerable occupant such as female passengers in the second row, etc. and strengthening occupant protection in consideration of real world traffic accidents other than typical collision tests.
   1. Safety evaluation of female passengers in the second row seats
   2. Car-to-car collision safety, Far-side passenger safety
   3. Strengthening occupant protection in side impacts
B. Strengthening protection of vulnerable road users: Improving evaluation technology for pedestrian protection with a 40% fatality rate and introducing evaluation for cyclist protection.
   1. Enlargement of pedestrian head impact zone in consideration of vehicle-to-bicycle accidents
   2. A Study on the Improved Pedestrian Leg Model Evaluation Technique
C. Improving accident prevention safety: Encourage the Development and Mandatory Installation of Advanced Emergency Braking System(AEBS), Emergency Steering System (ESF), etc. to cope with

the commercialization of autonomous vehicles in advance.

1. Extending AEBS assessment items to cyclists
2. Research for Evaluation Technology of ESF and Expansion of Evaluation Items
3. Study on the Combined Assessment Scenario of ADAS

Research and Development

Research for the safety assessment technology of autonomous vehicle

The safety assessment technology of autonomous vehicle means a technology for evaluating and verifying the safety of an automobile equipped with autonomous driving technology. As shown in Figure 2, the government's plan to support the commercialization of autonomous driving vehicles focuses on the development of safety assessment technologies and identification of evaluation items that can be applied to level 3 autonomous vehicles safely driven on public highways.

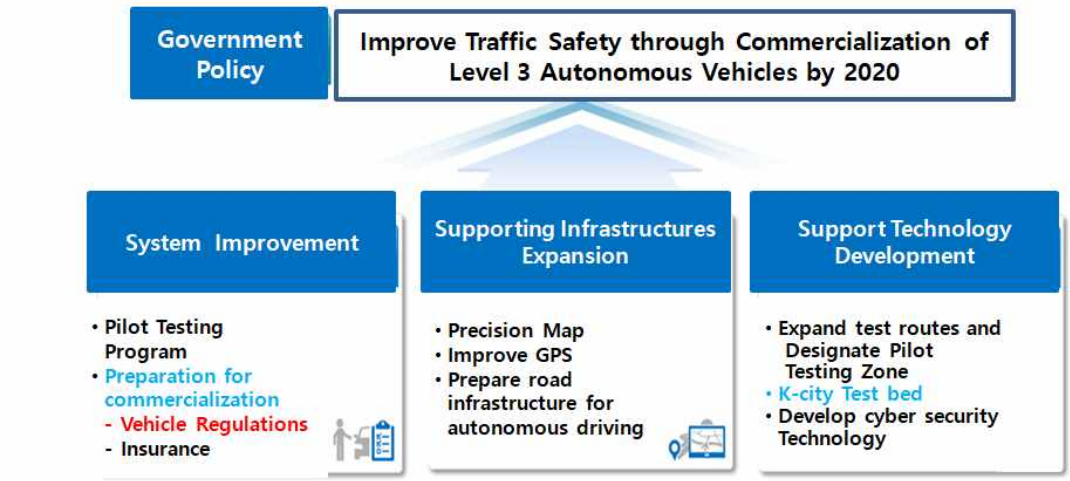

Figure 2. Government Policy for supporting the commercialization of Autonomous Vehicle(5. 2015)

In order to verify and assess the safety of autonomous vehicles the testing environment dedicated to evaluate autonomous driving systems will be established in this study. Also the assessment technology of autonomous driving and fail-safe systems under the normal driving or abnormal situations (including failure conditions) will be developed to assess the safety of the autonomous vehicle. The evaluation technology related to cyber security of autonomous driving systems in the internal and external communication environments will be developed too. Figure 3 shows the overall scope of development processes.

- Establishment of Testing Environment : Establishment of K-City and Evaluation System (e.g. Robo-vehicle) simulating actual roads in order to evaluate autonomous driving systems
- Assessment Technology of Autonomous Driving and Fail-safe Systems: Develop scenario-based evaluation technology to ensure the safe driving of autonomous driving systems in various normal and abnormal conditions such as ODD exit, system failures, emergencies.
- Evaluation Technology of Cyber Security of Autonomous Driving Systems: Conduct a phased study of cyber security of autonomous driving systems in the internal and external communication environments in order to assess the system security against communication disturbances such as jamming radio waves, forgery of communication data and arbitrary collection of operation data.

In order to effectively study and verify these detailed technologies, a consortium of 16 organizations including Hyundai Motors and Seoul National University has been established by the Korea Automobile Testing and Research Institute(KATRI). From June 2016 to June 2019, a total of 21.7 billion wons(roughly 20 million dollars) was funded(including the government fund of 18 billion wons(roughly 16 million dollars)).

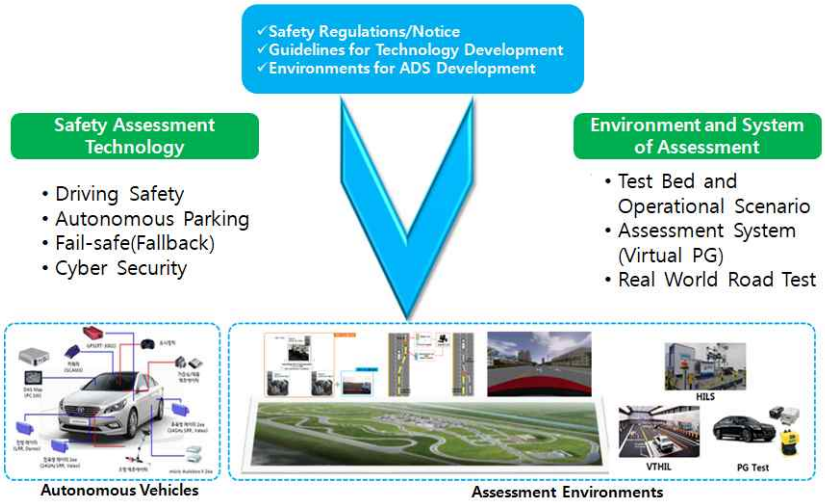

Figure 3. Overview of Assessment Technology Research for Autonomous Vehicle

Based on the research results of this project, the government will amend the existing legal system and present the safety guidelines for of autonomous driving vehicles(motor vehicle safety regulations, NCAP). The government will pave the road for the commercialization of level 3 autonomous driving vehicles on dedicated highways by 2020. Also The government is actively participating in international regulation activities related to autonomous vehicles such as UN/ECE WP29.

Construction of K-City, Test bed for autonomous driving vehicles

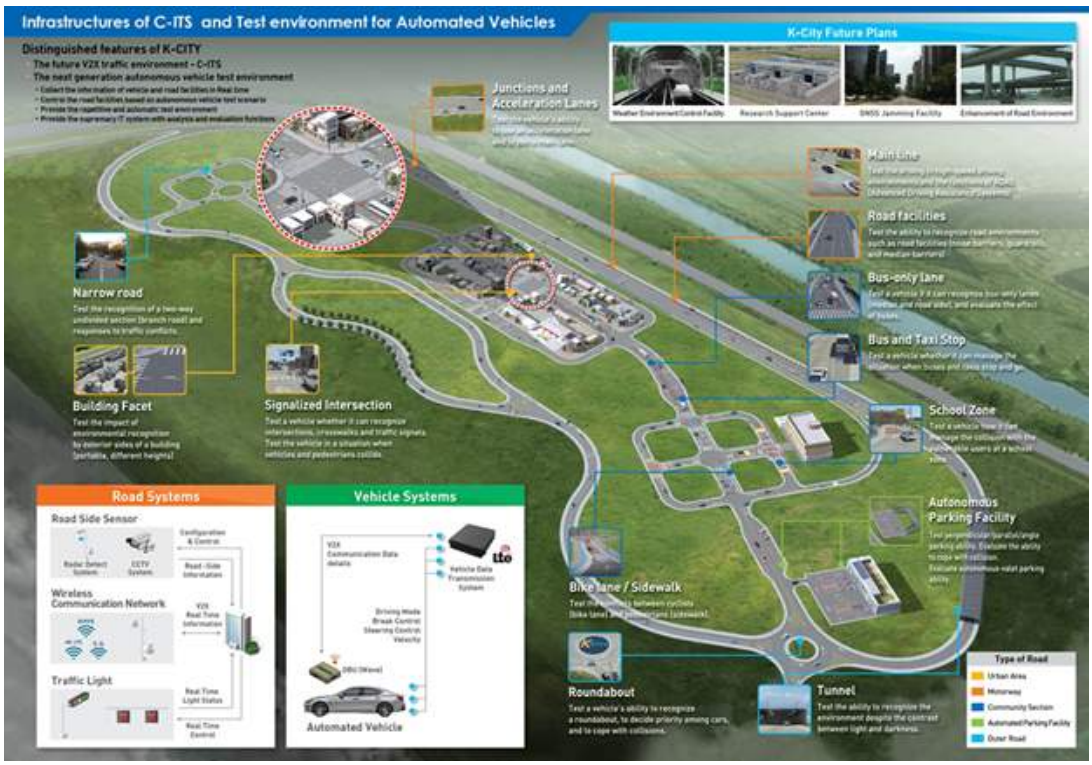

Figure 4. K-City Enhancement Project

- Location : KATRI Proving Ground(Hwaseong city, Gyeonggi-do)
- Composition : motorway, urban area, rural area, residential area(school zone), autonomous parking area
- Size : 3.6 million m2, 5.5km

K-City, a test bed that allows autonomous vehicles to be operated repeatedly and reproducibly in a real world environment, was opened on 10 Dec. 2018. It has been open to small and medium-sized businesses and universities without charges for three months since March to support active development of autonomous driving vehicle technologies.
K-City, shown in Figure 4, provides comprehensive communication environments such as WAVE, LTE and 5G in addition to road infrastructures. It provides 15 virtual service of co-operative Intelligent Transportation Systems (C-ITS) compliant with domestic standards. It is possible to test level 3 or higher autonomous vehicles, too.
In addition, the Ministry of Land, Infrastructure and Transport will build an advanced testing facility that can provide harsh test environments such as weather conditions of rainfall, fog, and communication disturbance like GPS jamming under the K-City Enhancement Project.
It plans to provide an integrated environment for development of autonomous vehicles by adding maintenance centers and data analysis stations in consideration of the characteristics of autonomous vehicles

Autonomous Vehicles DVI

The government aims to establish legal systems to allow the commercialization of level 3 autonomous vehicles(refer to SAE J3016) by 2020 and revise overall systems allow level 5 autonomous vehicles by 2022.
At level 3 of autonomous driving vehicles, the control of the vehicle can be switched between the system and the driver.
In case autonomous driving system experiences a system failure, it needs to develop evaluation technology to verify and ensure the safe transition of vehicle control to a driver.
In addition, this study was conducted to devise measures to promote user acceptance of autonomous vehicles.
DVI research aims to develop elemental technologies to verify the safe transition of vehicle control to a driver and to improve user acceptance in preparation for the commercialization of autonomous driving technology.
In this project there are three main sub-projects as follows; "Development of Evaluation Criteria and Evaluation Platform for Control Transition of Autonomous Driving Vehicles", "In-depth Research and Development of Human Factors and DB in Autonomous Driving Situations", "Improvement of Legal, Ethical, Technical, and Standard Perspectives for Improving Social Acceptance"
KATRI and 21 other agencies are carrying out these projects with a budget of 15.5 billion wons(roughly 13.5 million dollars) from 2017 to 2020. Through this, it is going to ensure the safe transition of vehicle control and present DVI design guidelines. We also expect to resolve distrust and anxiety over autonomous vehicles and protect the lives and property of the people.

Current Status of Amendments to Domestic Safety Regulations

Expansion of Vehicles Categories subject to ESC(14. 11. 2017)

The electronic stability control is a computerized technology that improves a vehicle's stability by detecting and reducing loss of traction. ESC will be applied to all vehicle categories while it was previously applied to passenger vehicles and small trucks with GVW 4.5 tons or less to. Dump trucks and special purpose trucks are exempted.

Safety Regulations for MicroCar(refers to L7 in ECE Regulation) (11. 7. 2018)

Safety regulations for microcars were established on 11. 7. 2018. The criteria for this category are the vehicle weight 600 kg for passenger vehicle, 705 kg for goods, and the maximum speed of 80 km/h. Some Regulations, such as braking, head restraint, esc, seat back, were relaxed. Some Regulations, such as headlamps, braking lamps, etc. were prepared in consideration of vehicle dimensions.

Expansion of Vehicles Categories subject to AEBS and LDWS(11. 7. 2018)

AEBS and LDWS is applied to all buses and trucks and special-purpose trucks with GVW of 3.5 tons or more to prevent vehicle accidents involving heavy vehicles. This requirement was in force from 1. 1. 2019 for buses with a pneumatic service brake, 1. 7. 2021 for other vehicles. Mini-sized buses are exempted.

Relaxation of Ground Clearance and Various Materials for Windows(31. 12. 2018)

The ground clearance regulation was amended from 12 cm to 10 cm to accommodate the dimensions of speed bumps. Various materials are allowed for windows. The direction of an exhaust pipe was relaxed to give more flexibility for vehicle design and performance.

Improvement for Lift Axle and Retro-reflective Markings(31. 12. 2018)

Lift Axles shall be automatically lifted or lowered according to goods weight to prevent serious traffic accidents involving overloaded heavy trucks. Regulations for Retro-reflective Markings was harmonized with UN-R48 and UN-R104 to prevent traffic accidents, such as rear end collision with trucks in the night. Retro-reflective Markings should be fitted on the sides and rear of a truck.

Harmonization of Collision Regulations with International Regulations(31. 12. 2018)

The existing collision regulations similar to US FMVSS were harmonized with UN-R94, UN-R95, UN-R135, UN-R137 in case of off-set frontal collision and pole side impact in consideration of various collision accident types due to changes in the traffic environments.

Conclusion

The Korean government has been making diverse efforts through international cooperation and developing efficient policies to pave the roads in advance for future motor vehicles such as autonomous vehicles and to enhance safety. The Ministry of Land, Infrastructure and Transport has proposed a road map for Korean New Car Assessment Program, which further strengthens vehicle safety even beyond the scope of safety regulations. In addition, the 1st phase of K-City for testing autonomous vehicles was completed so that it provides a place for domestic and overseas vehicle manufacturers to be able to perform the tests of Level 3 autonomous vehicles. Through the K-City Enhancement Project KATRI plans to provide an integrated environment for the development of autonomous vehicles. The Ministry of Land, Infrastructure and Transport strongly promotes the international harmonization of vehicle regulations and will make every effort to build an environment to enhance the safety of future vehicle technology.

REFERENCES

[1] MOLIT, 2017, The 8th Transportation Safety Master Plan
[2] National Police Agency, 2019, "2017 Load Traffic Safety a White Paper
[3] MOLIT, 2016, The 2nd Vehicle Policy Master Plan (2017-2021)
[4] MOLIT, 2018, KNCAP 2023 Roadmap
[5] MOLIT, 2018, Korean Motor Vehicle Safety Standard: KMVSS