

THE DEVELOPMENT OF ASSESSMENT TECHNOLOGIES FOR ADVANCED SAFETY VEHICLES

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ABSTRACT

Like many industrialized countries, the Republic of Korea (ROK) has implemented policy and research aimed at reducing the number of casualties caused by traffic accidents. For example, ROK launched the project titled "Reduce traffic casualties by half in 10 years" in 2008, Sweden introduced the Vision Zero Policy in the late 1990s, and other European Union members have launched similar projects aimed at reducing traffic accident fatalities by between 30 to 50 percent.

To reduce the number of casualties from road accidents requires improvements to vehicles, road and traffic managements systems. To expedite this process Intelligent Transport System has been adapted and implemented to the vehicles and road systems.

Vehicles with advanced safety features will be expected to reduce or prevent accidents which drivers cannot respond to or perceive.

To date, there has been insignificant research into the effective performance of vehicles with advanced safety features. The lack of assessment procedures has impeded the public acceptance of vehicles with advanced safety features.

The Development of Assessment Technologies for Advanced Safety Vehicles has been introduced for the promotion of advanced safety vehicles. The project involves the development of assessment technologies for advanced safety vehicles.

This paper shows the development of assessment methods for passive and active safety technologies. These technologies primarily address active protection for pedestrians, rear passenger safety, lane keeping assistance system, and automatic emergency braking system.

INTRODUCTION

Industrialized countries around the world, including the Republic of Korea (ROK), have implemented policies and research aimed at reducing traffic casualties. The goal has been to reduce traffic casualties by between 30 to 50 percent within ten years through policies that include ROK's "Reduce Traffic Casualties by Half" campaign and Europe's "Vision Zero" policy.

To attain such goals, it is necessary to complement and improve road and traffic systems including automobiles. Technologies utilizing Intelligent Transport System (ITS) in automobiles and road systems are actively being studied and disseminated as a way to expedite such improvements to road and traffic systems.

It is expected that the prevention of traffic accidents and improvements to traffic flow can be achieved by strengthening traffic infrastructure on roads that will enable communication between a vehicle and a road or between vehicles. In addition, vehicles themselves can be fitted with advanced safety features through convergence with IT technology, which can contribute to reducing traffic accidents through avoiding or preventing possible accidents by perceiving, assessing and responding to accident situations or by minimizing damage in the event of an unavoidable accident.

These state-of-the-art safety features can help prevent or reduce accidents by effectively responding to traffic situations to which a driver is unable to respond or perceive. For this reason, it is critical to develop and disseminate advanced safety features to reduce the number and severity of road traffic accidents.

However, it is not easy to disseminate and promote either advanced safety features or automobiles with advanced safety vehicles. This is because there has been insufficient research into the effective safety performance of those cutting-edge safety features and no technology has yet been developed to assess their safety performance.

Accordingly, this paper will assess the Advanced Safety Vehicle Project (hereinafter referred to as ASV Project), which aims to secure the safety performance of advanced safety vehicles. This research is thus designed to encourage the dissemination of advanced safety vehicles by providing independent justification for the development and application of advanced vehicle safety technologies.

ABOUT THE PROJECT

Implementation System

The ASV Project is a project funded by the Ministry of Land, Infrastructure and Transport and the Korea Agency for Infrastructure Technology Advancement. The lead research institute of the project is the Korea Automobile Testing and Research Institute under the Korea Transportation Safety Authority, and thirteen co-research institutes include Hyundai MOBIS and Seoul National University (Figure1).



Figure1. Roadmap for the development of assessment technologies for advanced safety vehicles

The total project duration is eight years from December 2009 to July 2017 and consists of three phases (Phase I - 3 years, Phase II - 3 years, and Phase III - 2 years). The total research budget is 28.9 billion dollars. At present, the project is in the third year of Phase II, and Phase II research is scheduled to end in June, 2015.

Research Roadmap

The research area of the ASV Project is largely divided into three parts: crash safety technology, preventive safety technology and base technology. Research on crash safety technology is dedicated to examining the technologies required to improve the safety performance of passive safety technologies for pedestrians, as well as vehicle occupants in the event of a road traffic accident. By contrast, research into preventive safety technology is designed to develop the assessment technologies required to verify the safety performance of advanced safety features equipped with various active safety technologies to prevent traffic accidents. Lastly, research into base technology is designed to conduct research on the technologies required to support the development of passive and active safety technologies.

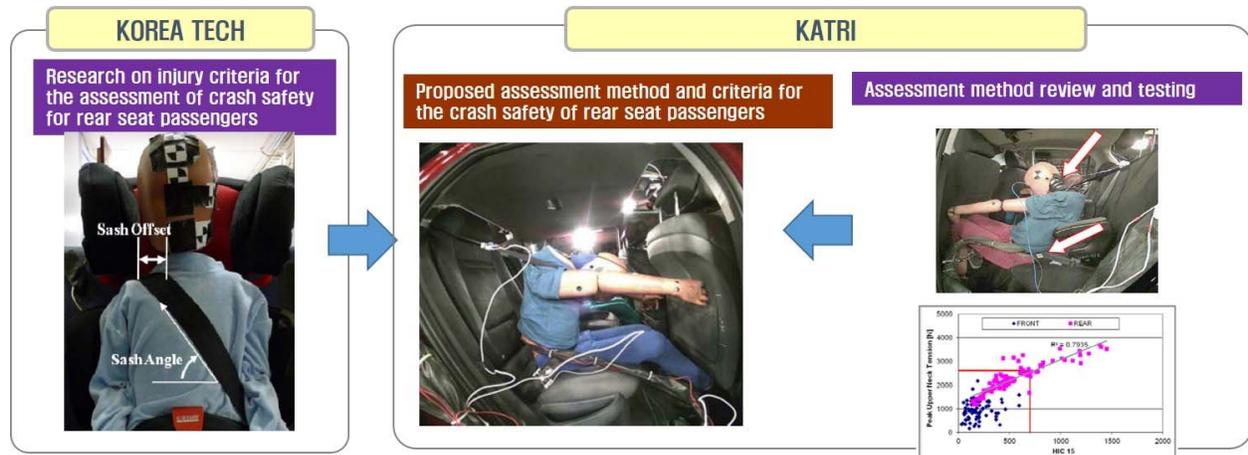
The following is a brief introduction to the main assessment technologies, starting with the Phase II research currently in progress.

SPECIFIC SAFETY ASSESSMENT TECHNOLOGIES

Protection of Rear Seat Passengers

The development of technologies for rear seat passenger protection involves the development of assessment technologies designed to improve the performance of crash safety for rear seat passengers, regardless of whether children or adults, in the event of a road traffic accident.

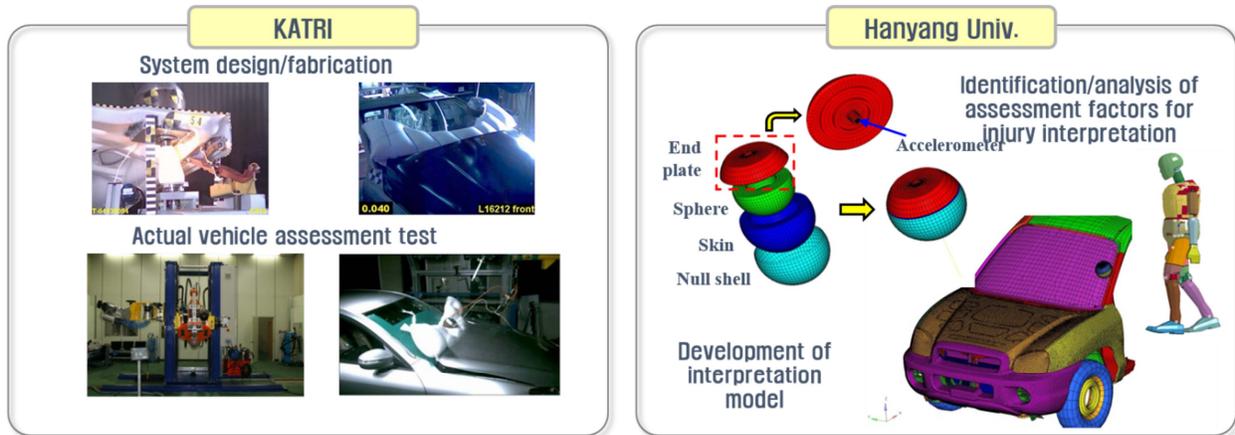
To this end, research is ongoing into the impact on rear seat passengers of road traffic accidents, through data analysis of the mechanism of injuries on children and adult passengers in the rear seats and the strengthening of rear seat passenger crash safety assessment methodology. The proposed criteria for assessment of crash safety for rear seat passengers are based on this analysis.



Active Pedestrian Protection

The development of technologies for active pedestrian protection assessment involves the development of assessment technologies for active hoods and pedestrian airbags, as well as technologies designed to reduce the casualties caused by traffic accidents, particularly given the relatively high frequency of pedestrian injuries in Korea that are caused by road traffic accidents.

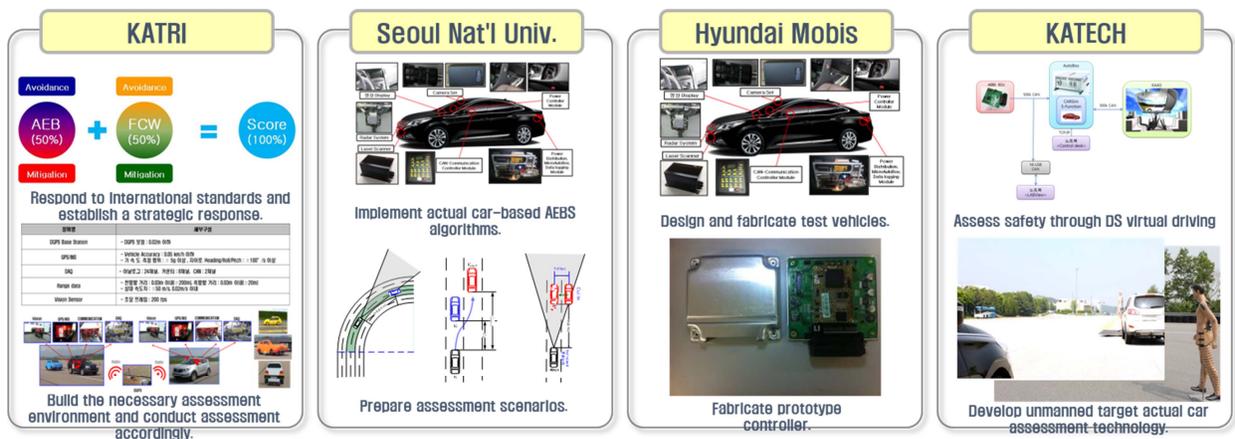
To this end, there is ongoing design and fabrication work for safety systems that can be fitted to passenger cars and SUVs, with testing carried out using actual vehicles. Related interpretation models have been developed to support the establishment of proposed criteria for the assessment of crash safety for pedestrians.



AEBS for Passenger Cars

Development of Advanced Emergency Braking System (AEBS) for passenger cars aims to develop technologies for safety assessment of AEBS, a technology designed to prevent or minimize traffic accidents when a driver is unable to perceive front traffic situations or properly brake the vehicle in emergency.

For this, this research develops assessment technologies for AEBS for passenger cars by studying international automotive criteria, implementing AEBS algorithm based on actual vehicles, developing assessment scenarios and fabricating vehicles for AEBS assessment and prototypes.

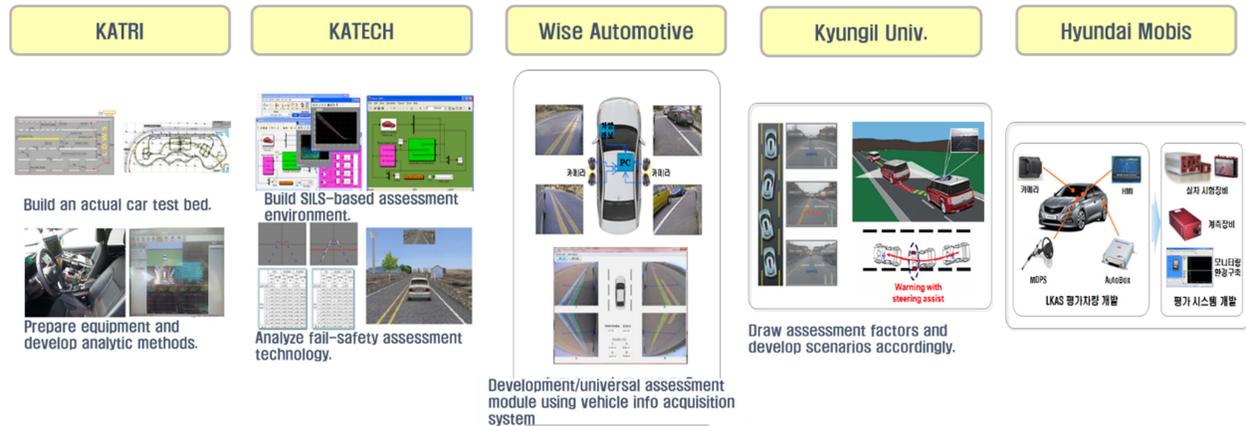


Development of Assessment Technologies for the Safety Performance of LKAS for Passenger Cars

The development of Lane Keeping Assistance System (LKAS) for passenger cars involves the development of technologies to assess the Lane Keeping Assistance System. LKAS is used to prevent possible accidents by

automatically operating the vehicle's steering system to keep the vehicle in the correct lane in the event of possible driver error or carelessness causing it to otherwise veer into another lane or off the road.

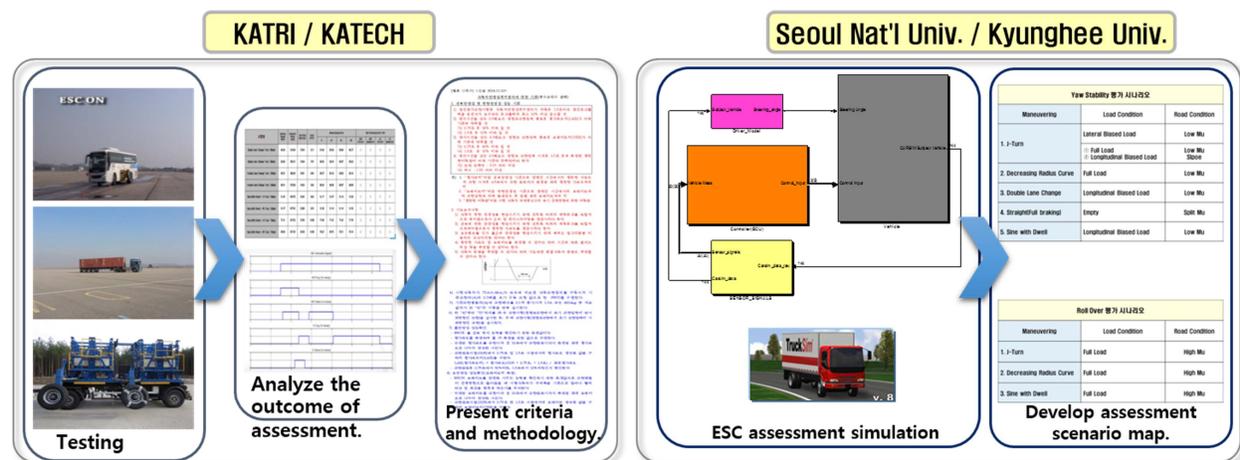
This research includes establishing a proper environment for LKAS assessment, analyzing and developing technologies for fail-safety assessment, developing universal LKAS assessment modules, identifying LKAS assessment factors and developing assessment scenarios.



Development of Assessment Technologies for the Safety Performance of ESC for Commercial Vehicles

The development of assessment technologies for the safety performance of ESC for commercial vehicles involves the development of assessment technologies for the safety performance of Electronic Stability Control (ESC) equipped to vans and trucks to prevent rollover or slipping accidents.

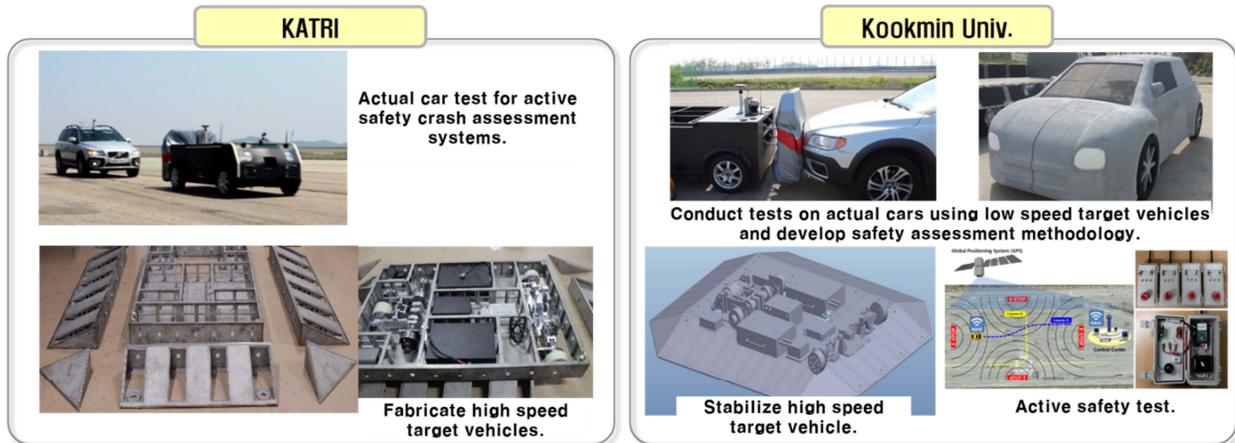
This research includes verifying the assessment of the safety performance of the ESC of commercial vehicles (vans and trucks), developing simulation models and algorithms, analyzing assessment technologies for the performance of ESC and developing technologies for fail-safe assessment.



Development of Active Safety Crash Assessment Systems

This involves the development of systems for assessing the safety of vehicles equipped with advanced safety features such as Advanced Emergency Braking System (AEBS) and Electronic Stability Control (ESC).

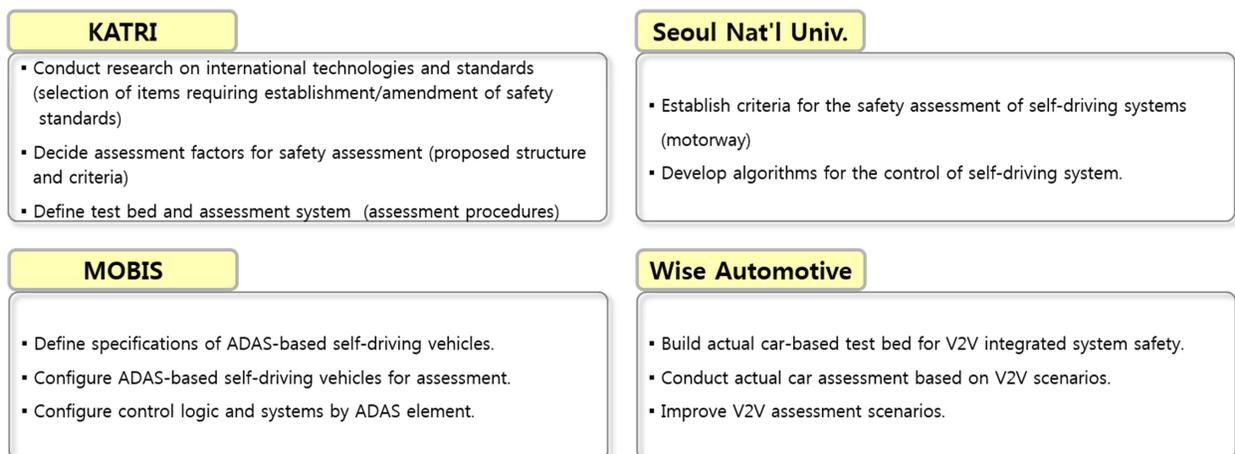
This includes fabricating target vehicles for low/high speed driving, stabilizing them, and developing operating software.



Self-driving Vehicles

The development of assessment technologies for the safety performance of self-driving vehicles involves the development of technologies for assessing the safety performance of self-driving vehicles equipped with sensor-based Advanced Driver Assistance System (ADAS).

This includes building self-driving assessment systems and test beds by integrating ADAS element technologies, developing algorithms for self-driving assessment systems, and conducting studies on the assessment criteria for the structural safety and driving safety of self-driving vehicles equipped with ADAS.



CONCLUSIONS

This paper presented an introduction to the project for the Development of Assessment Technologies for Advanced Technology Vehicles, which is funded by the Ministry of Land, Infrastructure and Transport and the Korea Agency for Infrastructure Technology Advancement and conducted by the Korea Automobile Testing and Research Institute under the Korea Transportation Safety Authority and other partner research institutes.

The goal of this research is to develop the assessment technologies required to verify the safety performance of both advanced safety features utilizing IT convergence technology as well as advanced safety vehicles utilizing such features to reduce casualties from traffic accidents. More specifically, it involves the development of assessment technologies for the fields of crash safety technologies, preventive safety technologies and relevant supporting technologies.

The subjects for each phase of the project were selected by comprehensively taking into account the technology level, market environment and accident reduction effects of element technologies. Research on them is currently being conducted in three different phases.

This paper has introduced the high-level outline and detailed contents of the research on specific safety assessment technologies conducted in the Phase II research project (2012-2015).

The safety performance of vehicles around the world can be improved if automotive safety standards and New Car Assessment Program (NCAP) are updated to reflect the safety assessment technologies developed by the ASV Project. This research project, by contributing to the establishment and amendment of international vehicle safety standards, will also help to raise the prestige of Korea. Moreover, it is expected that the international technical and market competitiveness of carmakers and parts makers can be improved through the more rigorous assessment of both advanced safety features and the vehicles equipped with such features.

ACKNOWLEDGMENTS

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