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## 수동안전 II



## 파노라믹 윈도우 PBV 탑승자 이탈 방지 시스템

강승규\* · 박은묵\* · 류성웅\*

### Ejection Mitigation System in the Panoramic Window PBV

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**Key Words** : PBV(목적기반모빌리티), Panoramic Window(파노라마 창), Ejection Mitigation(이탈 저감), CAB(커튼에어백)

#### ABSTRACT

Innovative changes in the automobile industry are underway due to the 4th industrial revolution and strengthening of environmental regulations. In these changes, autonomous driving technology is an important factor that will lead the future automobile industry along with eco-friendly vehicles, and large-scale investments are being made. Along with the development of fully autonomous driving technology, the development of PBV (Purpose Built Vehicle), a multi-purpose mobility based on this, is being actively carried out. In PBV, the steering wheel disappears and the interior environment is very different from that of conventional vehicles. As a result, the paradigm inside the vehicle will also change, and customers will perceive the car as a place of rest. It is the application of the panoramic window that has the advantage of openness and visibility of the interior that can best satisfy the needs of customers for a space where they can rest comfortably. Panoramic window was applied to the PBV for this reason.

Despite the advantages of openness and good visibility, the panoramic window has a disadvantage that the window may be broken in the event of an accident and the occupant may leave the vehicle. In the existing side window system vehicle, the window itself has a low height and the height of the body and trim is high, so the SAB is supported by the trim and the CAB supports only the head area of the passenger. However, in the case of a panoramic window, since there is no structure that can support the SAB due to the low trim height, the passenger restraint reaction force is insufficient, and excessive passenger departure load is applied to the CAB, making it impossible to restrain the passenger with the current structure. So the issue of the risk of occupant departure is emerging, technology development so far is at a low level, and in order to expand the application of the panoramic window structure in future vehicles, it is essential to develop a countermeasure to the problem. Accordingly, we started to develop a technology that can eliminate side effects such as passenger departure while applying an open interior structure such as a panoramic window.

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## 제동감을 위한 복합재 브레이크 전용 친환경 마찰재의 마찰계수 안정화에 관한 연구

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### A Study on Friction Coefficient Stabilization of Eco-friendly Friction Materials for Composite Brake for Braking Feeling

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**Key Words** : Eco-friendly Friction Material(친환경 마찰재), Composite Brake System(복합재 브레이크 시스템), Friction Coefficient(마찰 계수), Braking Effect(제동 효과), Fade(페이드)

#### ABSTRACT

Eco-friendly friction material for composite brake was presented by previously research paper. And it was verified through a variety of tests such as braking effect, fade and wear performance. Although there were many advantages for composite brake performance like them, high friction coefficient is still a burden to apply to vehicles. It is because too high friction coefficient could lead to deterioration of braking feeling. This research attempts to present a new eco-friendly friction material with braking stability. To do this, ingredients of previously developed friction material are changed such as binder material, abrasive material, lubricant material and reinforcement material. And it is also verified through a variety of tests as the same methods to assure objectivity. Finally, we hope that this study contributes to linear braking feeling for high performance and eco-friendly vehicles equipped with composite brake.

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## 자율주행자동차를 위한 시트 모델 개념 연구

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### Concept Study on Seat Model for Autonomous Vehicle

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**Key Words** : Seat foam(시트 폼), Comfort(안락성), Seat frame(시트 프레임), Structural analysis(구조해석), Topology optimization(위상 최적화), Autonomous vehicle(자율주행자동차)

#### ABSTRACT

In the development of automated driving, interest in the interior parts of vehicle is to become more significant in terms of the occupant safety and comfort. This study proposed an optimal design of front seat according to the design requirements for frame stiffness and seat comfort. For the seat comfort, the appropriate foam thickness was obtained using the structural analysis under reclined occupant loadings. While the strength and stiffness analyses were performed to evaluate the seat frame structure. Topology optimization was carried out based on the simulation results and the derived optimal model and baseline seat design was updated. The conceptual seat design for the autonomous vehicle in this study showed that the model development process is appropriate for the design parameters in both frame stiffness and seat comfort.

#### 후기

본 연구는 ‘자율주행기술개발혁신사업, 주행 및 충돌상황 대응 안전성 평가기술 개발’의 연구결과로서 국토교통부와 국토교통과학기술진흥원의 지원 하에 수행되었으며, 이에 관계자 여러분께 감사드립니다.

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## 측면충돌 대차 유형에 따른 대형버스 고압가스용기의 심각도 고찰

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### The Fuel System Severity for the Heavy-duty-bus with High Pressure Vessels According to the Type of Side Impact Test

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**Key Words :** Heavy-duty-bus(대형버스), High pressure vessels(고압가스용기), Moving deformable barrier(MDB, 구동 변형벽충돌대차), Hydrogen fuel system(수소연료시스템), Side impact(측면충돌), Acceleration(가속도),

#### ABSTRACT

Efforts to reduce carbon emissions around the world are being carried out from various devisions. To use hydrogen fuel as an energy source is also underway in the same reasons. In Korea, the development of vehicles using hydrogen fuel system has progressed in earnest, and the hydrogen vehicle, NEXO, and hydrogen fuel low-floor buses and special hydrogen fuel system vehicles are currently in operation. In this study, the test results were presented to review the safety in the event of a side impact tests. As the hydrogen fuel bus was operated with a 700 bar high-pressure container installed, so safety should be secured in the event of a traffic accident. In the case of the current hydrogen fuel bus, a 700 bar hydrogen container is mounted on the loop, so in case of a side impact testing, a bus equipped with a CNG container in the lower floor was used to check the severity.

Test No. 1 is a bus-to-bus side impact test at a collision speed of 30 km/h, Test No. 2 is a side impact test with a 950 kg MDB at a speed of 50 km/h described in UN R No. 94, Test No. 3 is a side impact test with 1100 kg MRB side impact test at 50 km/h speed described in UN R No. 34. and test 4 was performed with 1350 kg MDB side impact test at 54 km/h speed described in FMVSS 301, respectively. For the bus, a 2002 CNG used bus was conducted in the test.

As a result of the test, all four types of side impacts was directly contacted the CNG fuel system. Except for the No.2 test, all CNG fuel leaks occurred. However, there was no CNG vessle damage, and it was caused by damage to the CNG fuel valve and piping. The collision acceleration in the width direction of the vehicle body at the center of the fuel tank was also measured in the range of 10~15g except for the vehicle against the MRB(Moving Rigged Barrier). It can be seen that this is a higher value than the sled acceleration 5g in the Article 91 (6) of the current vehicle safety regulation. As a result of the analysis, in the case of a side collision, the impact of the vehicle body deformation is greater than the impact acceleration of the fuel system, In particular, it was confirmed that the deformation of the side guard and side sill was significantly affected rather than the deformation of the filler.

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## CCTV 영상에서 차량 속도 추정 시 정확도 검증

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### Accuracy Verification when Estimating Vehicle Speed through a Driving Experiment

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**Key Words** : Curved road(곡선 길), Forensic video(법 영상), Speed(차량 속도), Pixel(화소),

#### ABSTRACT

Korea has seen that the installation of CCTVs is becoming more common to control over-speeding vehicles, track fugitive vehicles, analyze accidents, and prevent crime. As CCTV becomes cheaper and its need is increasing to maintain public order and security, it is now widely distributed.

When estimating a vehicle's speed through CCTV images, a vehicle's driving distance is measured by using road lanes or surrounding structures. The speed is then calculated by analyzing travel time.

Furthermore, if there is no lane or structure in the section where vehicle speed is to be estimated, it is difficult to measure driving distance. Thus, estimating speed becomes difficult. Likewise, speed is estimated by using the cross-ratio method.

However, when estimating vehicle speed by using cross-ratio in CCTV images, lens distortion and curve-section errors occur. Since it is difficult to use the cross-ratio method when the front and rear wheels are not visible at the same time in the video, this study is proposing a new method.

The method of estimating vehicle speed as presented in this study is to estimate the speed of an accident vehicle by comparing the location and time of the accident vehicle and the test vehicle in the CCTV image after filming the test vehicle with CCTV at the accident site, while driving the test vehicle at the same trajectory as the accident vehicle at a constant speed. Since this method has been verified to accuracy, it is expected to be used in actual events.

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## 자동차 충돌안전 수리와 정비공장 인증 프로그램

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### A Study on the Automotive Crash Safety Repair and Repair Shop Certification Program

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**Key Words** : Collision Repair Safety(충돌안전수리), Repair Techniques(수리기술), Repair Shop Certification(수리공장인증제)

#### ABSTRACT

The purpose of this study is to survey the repair process and repair techniques at a repair shop for damaged cars due to traffic accidents through interviews with automotive repair shop experts. In addition, a domestic repair shop certification model is proposed by reviewing the accident repair shop certification system for collision repair safety implemented abroad.

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