# 특수차량

# IIHS 부분 정면 충돌 시험의 2열 인체모형 평가에 대한 연구

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# Study on 2nd Row Dummy Evaluation of IIHS Moderate Overlap Frontal Testing

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**Key Words :** IIHS(미국 고속도로 안전 보험 협회), Moderate overlap frontal testing(부분 정면 충돌 시험), Hybrid III(정면 충돌 인체모형)

## ABSTRACT

In the exist IIHS moderate overlap frontal crash testing, a vehicle is driven at 64.4 mph against a barrier with deformable sides in the shape of an aluminum honeycomb, and a Hybrid III dummy representing an average-sized male is placed in the driver's seat. Forty percent of the vehicle's overall width hits the barrier on the driver's side, and the forces exerted in the test are similar to those generated in a head-on collision between two vehicles of equal weight, each traveling less than 64.4 kilometers per hour. When the test first began in 1995, most vehicles received a “poor” or “acceptable” rating. Today, all vehicles receive a “good” rating, but there is still much room for improvement. Recent IIHS research on real-world crashes has shown that in many cases, rear seat occupants suffer more serious injuries than front seat occupants. To address the growing gap in protecting front and rear seat occupants, the IIHS is updating its longest-running crash test, the "moderate overlap frontal overlap testing assessment.

This paper describes the injury assessment methodology and injury calculation process for the new 2023 two-row dummy. CAE and test results are expressed as a percentage of the IIHS injury requirements to represent a measure of severity for each test.

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# 군 수송작전을 위한 비포장도로 특성 분석 및 자율주행 시뮬레이션 검증

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# Analysis of Unpaved Road Characteristics and Validation of Autonomous Driving Simulation for Military Transport Operations

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**Key Words :** Unpaved Road Characteristics(비포장도로 특성), Military Transport Operations(군 수송 작전), Autonomous Driving Simulation(자율주행 시뮬레이션), Path tracking(경로 추종)

## ABSTRACT

ROK(Republic of Korea) Armed forces are trying to replace the sharp decline in conscription manpower for military transport operation with autonomous driving technology. Autonomous driving technology has been widely developed based on the civilian road conditions. However, since unpaved roads have unique characteristics different from civilian roads with smooth surfaces and clear lane marking, the application of civilian autonomous driving technology to military without considering unpaved road condition is not appropriate This paper present analysis of unpaved road environment characteristics and validation of autonomous driving simulation essential for military transport operations. Matlab/Simulink and TruckSim is used to simulate and validate the performance and safety of military vehicle on a generated unpaved road profile. Simulation results can be used to support important decision-making by commanders and staff during the planning, preparation of the operations process, and are expected to contribute to the success of military transport operations and mission complete.

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# 자율주행 트랙터-트레일러의 경로 추종을 위한 선형 공간 모델 예측 제어

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# Tractor-Trailer Steering Control for Path Tracking with Linear Spatial Model Predictive Control

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**Key Words :** Linear Model Predictive Control(선형 모델 예측 제어), Spatial Model Predictive Control(공간 모델 예측 제어), Path Tracking(경로 추종), Tractor-Trailer(트랙터-트레일러)

## ABSTRACT

In the realm of Tractor-Trailer control, the Nonlinear Model Predictive Controller (NMPC) has demonstrated superior performance in tackling complex driving scenarios. However, it comes with a substantial calculation time burden. This paper introduces a Linear Spatial Model Predictive Control (LSMPC) designed to reduce runtime while ensuring performance. Our focus lies on steering control to position the tractor and trailer's rear wheel along the desired path. This article presents the implementation of LSMPC using CVXGEN. Furthermore, it offers an analysis of the calculation time and tracking accuracy in order to verify our controller within the 'TruckSim' simulation environment. Our findings indicate that while LSMPC slightly lags behind NMPC in tracking accuracy, it excels in convergence speed due to its reduced runtime.

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# 이동식 크레인의 기계 제어 시스템(MCS) 안전 요구사항 및 설계를 위한 기계 성능 수준(MPL)결정 모델 개발

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# Development of a Machine Performance Level Determination Model for Safety Requirements and Design of Machine Control Systems for Mobile Crane

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**Key Words :** Mobile Crane(이동식 크레인), Functional Safety(기능 안전), Machine Control System(기계 제어 시스템), Machine Performance Level(기계 성능 수준), Safety Control System(안전 제어 시스템)

## ABSTRACT

In the past, the construction equipment industry developed around improving hardware performance, but the recent emergence of smart construction technology has brought about a paradigm shift in research direction. Smart construction technology refers to technology that improves productivity, safety, and quality by applying cutting-edge technologies such as information and communication technology (ICT), artificial intelligence (AI), and big data analysis to construction technology.

In relation to this, safety inspection technology must also be modernized, but for reasons such as the relative speed of technological development and the absence of standardized inspection procedures and legal regulations, only traditional safety inspection technology is still available. To ensure the safety of construction equipment incorporating these smart construction technologies, reliability in both software and hardware safety inspection techniques is required. Moreover, to prevent major accidents caused by sudden functional failures, research focused on ensuring safety based on functional safety is necessary.

This study analyzed the safety requirements for the machine control system (MCS) of mobile cranes using ISO19014, an international standard related to functional safety, and analyzed the risk of malfunction types of each machine control system function. If there was a risk when a malfunction occurred in the analyzed control system function, a risk assessment was conducted for the function and a study was conducted to determine the machine performance level (MPL) for the malfunction type. This research is expected to be useful in the safety design of control algorithms when applying smart construction technologies such as automation to mobile cranes in the future.

**후기**

이 연구는 국토교통부/국토교통과학기술진흥원이 시행하고 대한건설기계안전관리원이 총괄하는 “고위험 건설기계 안전성 평가 및 관리 기술개발 사업(과제번호 RS-2023-00244879)”의 지원으로 수행하였습니다.

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# 지게차 휠의 결함에 의한 사고 사례 분석

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# A Case Study of Accidents of Forklift Truck Caused by Damage to Wheel

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**Key Words :** Accident(사고), Forklift truck(지게차), Wheel defect(휠 결함)


## ABSTRACT

Forklift truck accidents are caused by human factors, defective body factors, and environmental factors. In this case, around march 2023, while the forklift truck was moving backwards in an empty state after loading a metal coil onto the floor of a cargo ship, the left rear wheel tire of the forklift exploded and broke away from the wheel, and the wheel ring surrounding the wheel was thrown away, causing the victim. it is an accident that resulted in injury.

The forklift showed traces of work to remove rust from the surface of the wheel of the detached tire, and oil was also observed throughout.

This accident was caused by various fators such as corrosion and corrosion removal work on the left rear wheel of the forklift and application of anti-corrosion oil to the surface of the wheel, causing the wheel ring to bounce an the tire to come off.

Looking at the accident prevention measures at the head office, it seems that the accident could have been prevented if the damaged wheel on the forklift trucks had been completely repaired or change.

If minor risks such as this one are overlooked, major accidents can occur, and it is considered a good example of how a minor risk can cause a major accident.


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# 대형 화물차 롤 전복 안전성 시험 평가 방법 연구

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# Evaluation Method of Rollover Safety Test for Heavy Vehicles

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**Key Words :** Heavy Vehicle(대형 화물차), Simulation(시뮬레이션), Rollover(차량 전복), Driving Stability(주행 안정성), Static Roll Threshold(정적 롤 임계값)

The domestic truck market, demands for relaxation of truck safety standards continue to be raised. The current truck rollover safety standard is based on the maximum safe tilt angle of 35 degrees established in 1962. The standard requires that an empty vehicle be fixed on a tread and the vehicle must be tilted at a tread angle of 35 degrees to prevent the vehicle from overturning. Truck and special purpose vehicle manufacturing companies are complaining about the harshness of the standards, citing examples such as decreased fuel efficiency and increased unit costs as the load increases by attaching unnecessary weights to the bottom of the vehicle to meet the standards, and are calling for improvements to the outdated standards. They are asking for it. In overseas countries, unlike domestic standards, standards such as 23 to 4 degrees or critical lateral acceleration of 0.4g for vehicles in a loaded state are implemented. In this paper, we implement domestic roads using simulation, analyze the gap between the standards and actual driving through simulated driving, and seek improvements appropriate for actual driving situations.

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