

## Development of non-redirective crash cushions for improving the safety of occupants

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### Abstract

The fatal accident was occurred when vehicle collision with road facilities. This research was conducted to prevent collision of pole among facilities on the road. The guideline and manual was reviewed to provide performance criteria to ensure occupant safety. This study was conducted 4 types of simulation to assured the performance of pole protection of the occupant safety. This research was conducted THIV, PHD were used to verified a protection of pole which assured the occupant safety. And then this research proceeded to simulation and on-site test. The results of this study are expected to contribute researches for improving traffic safety.

### Background, Method, Results and Conclusions

In 2016, 232,035 traffic accidents occurred and 32 of them were caused by collision with facilities on the road. The classification according to the type of traffic accident shows that 169,471 (73.0%) of traffic accidents occurred in type of vehicle to vehicle accidents, 50,980 (22.0%) in type of vehicle to human accidents, and 11,579 of traffic accidents occurred in type of vehicle-solo accident. Especially, in vehicle-solo accidents, 2,188 cases (0.9%) have occurred in the case of vehicles colliding with road facilities. These values have been reported to be four times higher than the traffic accidents caused by the rollover (0.2%) and off-roads (0.2%) traffic. Street lights, traffic signs, poles and road sign are representative road facilities. In particular, when comparing with the number of fatalities per 100 traffic accidents, the total fatal rate of traffic accidents in 2016 was 1.94 per 100 person, and the traffic accident fatal rate by facilities was 11.06 per 100 person cases. It is required to reduce the fatalities by improving the occupant safety. In this study, to reduce the severity of accidents, it is important to develop a protection of pole which assured the occupant safety. Particularly, this study was conducted to prevent collision of bridge pole among facilities on the road.

In order to verify the performance of the facilities protection using the guardrail, we reviewed guidelines and manuals in Korea and abroad. THIV (Theoretical Head Impact Velocity) and PHD (Post Head Deceleration) were used as indicators for assuring occupant safety. Simulation was conducted using LS-Dyna Program mainly used for simulating the collision of vehicle. This study was conducted 4 types of simulation to assured the performance of pole protection of the occupant safety. This research was conducted THIV, PHD were used to verified a protection of pole which assured the occupant safety. The simulation were conducted 900kg-head on, 1,300kg-head on, 900kg-1/4 offset, 1,300kg-head on 15°. The simulation result presented that all the types of the collision condition ware passed to the reference value (THIV : under 44km/h , PHD : under 20g).

Table 1. The results of collision simulation.

	<b>Direction of Impact</b>	<b>Vehicle Mass(kg)</b>	<b>THIV(Km/h)</b>	<b>PHD(g)</b>
<b>Type-1</b>	Head-On	900	39.8	17.0
<b>Type-2</b>	Head-On	1300	35.2	14.9
<b>Type-3</b>	1/4 Offset	900	40.3	14.9
<b>Type-4</b>	Head-On 15°	1300	36.1	15.4

And on-site test carried out by performing a real impact test in testbed certified by authorities. The collision test result meets the guideline. It is expected that the results from in this study will be utilized for developing the occupants safety in the field of traffic safety.

### References

NCHRP Report 350, Recommended procedures for the safety performance evaluation of highway features. National Cooperative Highway Research Program, 1993.

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AASHTO, Median barrier guidelines revision of the roadside design guide, 2005.