

## Estimation of PIEV (Perception-Identification-Emotion-Volition) on Unlit Highway by Driving Simulator

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### 1. Introduction

In designing the horizontal alignment of a highway, the stopping sight distance (hereafter SSD) is an important element to determine the curve radius. The calculation of SSD is based on Perception-Identification-Emotion-Volition (hereafter PIEV) time. The PIEV time includes the durations which drivers watch, recognize, and react to step on the brake for avoiding objects on the roads. The PIEV time of highway alignment design is 2.5 seconds which belongs to the 95%-tile of the experimental implementation. However, related studies show that the PIEV time appeared to be about 1.0 second. This means that there is a difference value between highway design and actual driving SSD by sudden appearance of the animals on the highway. Therefore, on this paper, the PIEV time was estimated by using drive simulator and the calculating method of the SSD was proposed in urgent situation specially unlit roads.

### 2. PTEV Experiment

#### 2.1. Scenarios

The scenarios of simulator, UC-WIN ROAD, FORUM8, were consist of day time and night time and speed limits composed as 80kph and 100kph. The PIEV time was estimated five times in a scenario which highway contains straight and curve alignments. When drivers were running on the highway, the large objects suddenly fell in front of vehicle and the difference time between the appearance and driver's braking was estimated as following figure 1. The data storage time was 1/100 seconds and total participants were fifteen persons including five women. The participants age were composed 30 to 60 years old and they had over 10 years driving experience.

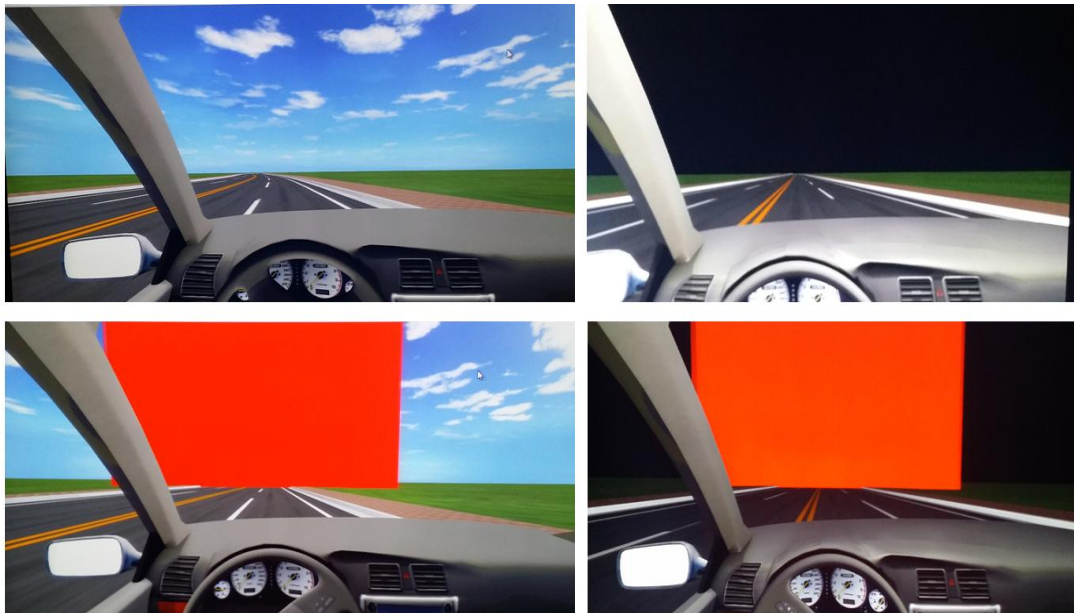


Figure 1. View of Daytime and Nighttime Driving Simulator

**2.2. Results**

As the result of the speed limit 80kph, the 85%-tile PIEV of the daytime scenario was 0.46 second and the nighttime was 0.57 second. In speed limit 100kph, the daytime was 0.57 and the nighttime was 0.58. The PIEV time of the nighttime scenario was larger than the daytime. As a result of paired-T test, the daytime and the nighttime were significantly different, but there was no significant difference between speed limits. The following table 1 describes the 85%-tile PIVE time and statistic results.

[Table 1] 85%-time PIEV time of Daytime and Nighttime

Contents	Daytime	Nighttime	Paired-T test
Speed Limit 80km/h	0.46	0.57	Rejected
Speed Limit 100km/h	0.48	0.58	Rejected
Paired-T test	Not Rejected	Not Rejected	-

**3. SSD of Urgent Situation**

The Korea Transportation Safety Authority provides braking distances at a travel speed 100kph on the market models which include 56 passenger cars, SUV, and vans 28. The average braking distance of 84 vehicles was 47.97m and the 85%-tile braking distance was 51.10m. Using the 85%-tile braking distance and the PIEV time which resulted on unlit highway, vehicle’s deceleration could be calculated as equation 1 that is generally utilized to calculate the SSD. As the result, the deceleration was calculated as 7.6m/sec<sup>2</sup>

**4. Conclusion**

This study is to estimate drivers’ PIEV time when a sudden event occurs in the nighttime. The result showed that 0.58 second and the SSD calculating equation was suggested on unlit roads. These proposed method is able to use as the fundamental criteria of designing the horizontal alignment of unlit roads..

**5. Acknowledgements**

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**6. Reference**

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