

A Study on the Optimum Shoulder Width in the Tunnel Considering Driving Safety

Authors : Somyoung Shin, Donghun Jeong, Yeoil Yun

Abstract : South Korea continuously installed tunnels in consideration of the safety and operation efficiency, and the number of installed tunnels has doubled over the past ten years. The tunnel section is designed based on the guidelines, but the tunnel entrance becomes narrow due to dark adaptation and pressure. In fact, around 13% of traffic in expressways of Japan happens at the entrance, leading to congestion and rear-ends collision accidents. Therefore, this study aims to analyze the stability from the expansion of the shoulder width in the tunnel entrance by applying a virtual reality driving simulator in order to reduce the accidents that happen in the tunnel entrance. To compare the driving stability based on the changes in the width of the right shoulder under the same condition, a virtual reality driving simulator is used to conduct an experiment on 30 subjects in their 20s to 60s and to provide a more practical virtual reality driving environment, and an experiment map is designed based on actual roads as the background to conduct the experiment. The right shoulder is classified into 2.5m and 3.0m based on the design guidelines of the expressways and the road structure installation regulations. The experimenters' experiment order is decided randomly. As a result of analyzing the average speed, it was displayed as 100.73km/h when the shoulder width was 2.5m and 101.69km/h when the shoulder width was 3.0m and as a result of conducting t-test analysis, the p-value appeared as more than 0.05 in the significance level of 95%, so it was statistically insignificant. Also, as a result of analyzing the speed deviation between the average driving speed of the analyzed interval and the average driving speed upon entering the tunnel, it was displayed as 3.06km/h when the shoulder width was 2.5m and 1.87km/h when the shoulder width was 3.0m and as a result of conducting t-test analysis, the p-value appeared as less than 0.05 in the significance level of 95%, so it was statistically significant. This means that when the shoulder width is 3.0m, there is stability in terms of the driving stability compared to when it is 2.5m. Therefore, it is considered that when new roads are constructed in Korea, the right shoulder width should be installed as 3.0m to enhance the driving stability.

Keywords : driving stability, shoulder width, tunnel, virtual reality driving simulator

Conference Title : ICVST 2022 : International Conference on Vehicle Safety and Transportation

Conference Location : Zurich, Switzerland

Conference Dates : January 14-15, 2022