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The Effect of Sun Glare: Concept, Characteristics, Classification

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Abstract

Investigations have been carried out to determine the types of the driver's sun glare in order to fully take into account all the factors affecting the handling of the vehicle under the effect of sun glare (ESG). The results of studies on the change in the average speed of the vehicles in the "sun glare danger" areas and the results of drivers' testing have been provided. The description of specialized programs to determine the "sun glare danger" areas on the road is given. The characteristics of ESG are provided: its area and force of impact, period and duration. The classification of the ESG by its duration and the location of the sun is suggested.

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1. Introduction

Concept of sun glare effect. The sun glare adversely affects the perception of road conditions leading to faster fatigue and reduction of driver's performance. Sun glare leads to distortion of the road conditions, and in some cases the driver is so blinded by the sunlight that he or she does not perceive the objects located ahead. As a result, the driver does not have time to adequately take into account all the factors on the road, which leads to road traffic accidents (RTA). The experimental evaluation of the influence of the effect of sun glare (ESG) on the drivers showed significant changes in their psycho-physiological qualities and as a result – a reduction in vehicle speed.

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During the days of intense manifestation of the ESG on the roads the running speed is significantly reduced, and road transport companies are suffering losses. Because of this factor, the annual value of lost time in some regions of Russia comes to 268 hours, or about 33 job orders. According to preliminary calculations, the annual loss of the national economy from the negative effects of the ESG is around 25 billion rubles [Pegin (2010)].

The analysis of accidents on the motorways in the Far East region showed that more than 25 people are killed or injured in the sun glare danger areas annually. By the severity level, the accidents are classified as very dangerous. On average one accident accounts for 3.9% of participants; 59.4% are wounded and 2.8% are killed [Pegin (2015)].

The sun glare during daytime (Fig. 1) has been little studied as a natural phenomenon that adversely affects the safety.

The sun glare has a dual impact: physiological and psychological. The physiological impact reduces the sensation of contrasts, sharpness and speed of perception. The psychological impact of the ESG is manifested in the increased nervousness, anxiety and stress, reducing the switching of attention, changing the focus [Vasilyev (1976), Romanov and Pegin (2006)].

The sun glare primarily affects the visual perception of the driver: visibility distance and sight are reduced, temporary blindness occurs, etc [Pegin (2002)].

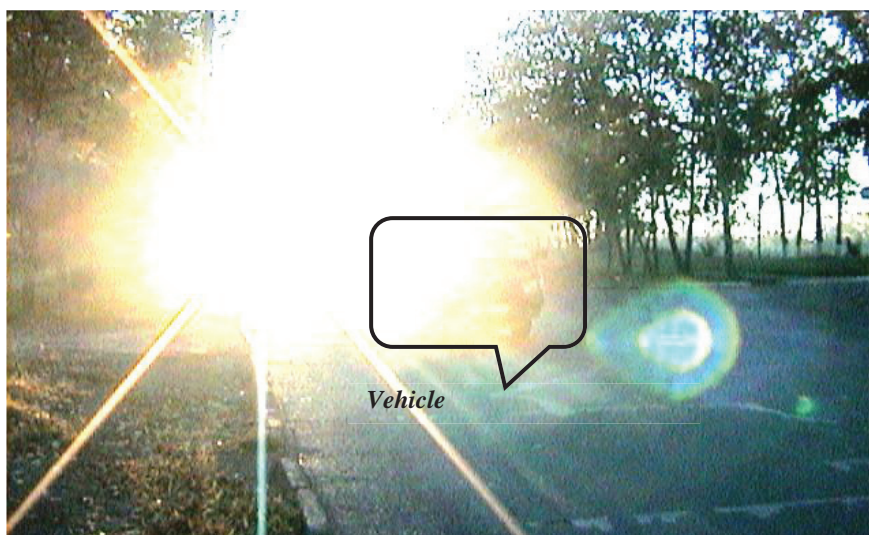


Fig. 1. Effect of Sun Glare.

The short-term feeling of discomfort in the process of adaptation of the eyes to bright light is normal (light adaptation), although on a very bright sunny day the adaptation may take up to 5 minutes.

2. Main part

The effect of solar glare is a psycho physiological process reducing over a period of time required for the transition to a new level of adaptation due to the abrupt change in the brightness level of the road conditions experienced by the driver. It happens due to the impaired visual perception and the deterioration of the emotional state of the driver.

Even total blindness, which can sometimes occur after a look at the sun, is nothing more than a false visual perception. A vehicle driver feels pain from the unexpected and bright sunlight, the cause of which in such cases is not the brightness of the light, but something like a shock that a person experiences in case of a sudden change in light intensity. In this situation, you need to soothe and relax the eyes to the light.

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