

INFORMATION ON RESEARCH  
CONCERNING ACTIVATION OF BRAKE LIGHTING  
IN CASE OF APPLICATION OF VEHICLE AUXILIARY BRAKES

Note: The present document was prepared in accordance with the decision of GRRF (TRANS/WP.29/GRRF/58, para. 6).

INTRODUCTION

As the statistics, the number of road collisions, in which two vehicles and more participate, is 4-5 times higher, than the number of accidents with participation of one vehicle. 70 percent of group collisions are rear impacts. And, that is rather characteristic, only 10 percent of such cases are connected to wrong realization of the decision made by the driver of the back vehicle or malfunction of braking system. The majority of collisions occurs because of the unnoticed information coming from ahead moving vehicle (49 percent), or incorrect estimation of such information (41 percent).

RESEARCH CARRIED OUT IN RUSSIAN FEDERATION

The research shown that the threshold of delay of the information, at which rear impact becomes inevitable, is reduced considerably more intensive, than the distance between vehicles. At 2 times reduction of a distance - the threshold of probable delay of the information about deceleration, which could result inevitability of collision is reduced in 3.5 times.

This implies on the obvious necessity of informing the following driver in a flow or in a column not only about pressing a brake pedal, but also about reaching the certain level of deceleration (operation threshold). And as in a flow each vehicle simultaneously both leading and conducted, for informing drivers it is proposed to equip vehicles by the device automatically activating the brake signals in the moment, when the deceleration exceeds the certain value.

The deceleration sensor has been developed in the design bureau «Diamond» specially for vehicles of common purpose assigned for movement in a column. But at present dense traffic flows the sensor is irreplaceable and in all cases. The design is protected by the patent of Russian Federation.

One of the main reasons of collisions with rear impact is imperfection of sensors activating braking signals: the signal from the brake pedal lights braking signals. At other modes of braking, for example, at use of the engine, the signals are not lit.

In this connection, the objective was to develop an auxiliary braking sensor depending on reached certain deceleration level regardless actuation of braking pedal. For the moment of beginning of actuation of the auxiliary sensor the moment of occurrence of negative acceleration (deceleration) was accepted.

A number of devices, which distinguish deceleration and activation of vehicle braking signals was developed. Depending on a principle of distinguishing of deceleration these devices can be divided into three classes: mechanic, electro-mechanic and electronic.

At the research the device realizing a principle of frequency-pulse distinguishing of deceleration was proposed. At reduction) of a vehicle speed, i.e., at occurrence of deceleration, the faltering signal on lamps of braking signals automatically follows. The driver of the back vehicle receives the information on probable braking of the leader on 0.5 – 1.0 second earlier beginning of braking, when the lamps of braking signals are lit constantly. That is equivalent to reduction of the stopping distance on 8-17 meters.

The automatic braking sensor developed by the Pilyugin Research Center is also protected by the patent of Russian Federation. The sensor has the sensitivity of less than  $0.2 \text{ m/s}^2$ , adjustable threshold of operation from  $0.7$  up to  $2.2 \text{ m/s}^2$ , delay of activation of additional braking signals, which excludes false operations from peak accelerations due to roughness of a road, and also delay of deactivation of additional braking signals reducing repeated, false operations and improving informing of a back vehicle driver.

The sensor works on a principle of two pendula located on one horizontal axis of rotation and having different factors of damping, which excludes influence of inclinations of a road profile. At deceleration appropriate to the operation threshold, the sensor the help of a photocell located on one pendulum commands to activate the braking signals. For adaptation of the gauge to any kind of vehicles levels of delays of activation and deactivation of braking signals are adjusted.

The gauge has passed the road tests with positive results. The set operation threshold about  $1 \text{ m/s}^2$ , absence of response of the sensor on curvatures, at transition to slopes, at switching the gear in the manual transmission, and taking off the leg from the accelerator pedal on a horizontal road have been confirmed. At motion on slopes without deceleration operation of the sensor was not recorded.

The gauge also has passed the tests checking the ability to operate at lowered (down to  $-40 \text{ }^{\circ}\text{C}$ ) and raised (up to  $+50 \text{ }^{\circ}\text{C}$ ) temperatures, relative humidity up to 90 percent at the temperature of  $+40 \text{ }^{\circ}\text{C}$ , vibrations from 50 up to 250 Hz with vibrating loading up to 5g, repeated shock loadings up to 10 g, at change of voltage of onboard electricity in set levels, and also test for electromagnetic compatibility.

-----