Bezpieczeństwo, układ hamulcowy, droga hamowania, śmiertelność, ruch drogowy, pojazdy

Dalibor BARTA[1]
Peter TUČNÍK[1]
Juraj SANIGA[1]

EFFECT OF SELECTED PARAMETERS ON VEHICLE SAFETY

This article contains information about the accident frequency and the potential for the affecting of it by technical condition of the vehicle. It discusses the impact of the selected vehicle and surface parameters on the safety.

WPŁYW WYBRANYCH PARAMETRÓW NA BEZPIECZEŃSTWO POJAZDU

Ten artykuł zawiera informacje o częstotliwości wypadków i możliwośći jej wpływu przez stan techniczny pojazdu. Omawia wpływ wybranego pojazdu i parametrów powierzchni na bezpieczeństwo.

1. INTRODUCTION

Movement, the moving from the place to place is the basis of the life. It is natural go on the foot for human. Means of transport that the human society invented to make the movement faster and simpler ultimately do not facilitate the life of many people but make it worse. Sometimes the accidents even murder the people. The consequences of the environmental pollution by vehicles and industries associated with the vehicle production and operation on the health of human society are known to everybody. Their daily effects are so imperceptible that we do not sense the direct influence on the damage of our health. All the more we react on the mortalities or injuries caused by some kind of the traffic accident. Most of them become in the road transport. Car accident is most common cause of the death of 2 -34 years old people, according to the statistic.

Around 26 million people died in traffic accidents since the first recorded traffic accidents in London in 1896 [3]. Currently the number of victims at auto accidents worldwide is approximately 1,2 million people every year (almost 3,000 per day), according to World Health Organization (WHO) estimates. Unfortunately, because of massive development of automotive in China, India, new EU member countries and also other countries worldwide it is expected that this number will increased. Only China increases the number of registered vehicles doubled every 5 years.

[1] University of Zilina, Faculty of Mechanical Engineering, Department of Automotive Technology, Univerzitna 1, Zilina, 010 26, Slovakia, Tel: + 421 41 513-2654, Fax: + 421 41 525-3016
E-mail: dalibor.barta@fstroj.uniza.sk; juraj.saniga@fstroj.uniza.sk; peter.tucnik@fstroj.uniza.sk

Table 1 presents the situation in the field of the safety of road motor vehicle in relative numbers in 2007. There are visible differences in results of the EU countries. 15 EU members proclaimed document called “White book” (WH) which deals with the transport and society and which based on the reduction of fatalities in half to the year 2010. It means that 27 EU countries were intending to reduce number of killed people from 75 426 in 1991 to 53 342 in 2002 and at least 38 875 in 2009 presented in absolute numbers as you can see in fig. 1 [1].

Tab. 1. Fatalities in road transport in 2007

Fatalities					
per million inhabitants		**per 10 billion pkms**		**per million passenger cars**	
MT	29	**UK**	44	**MT**	54
NL	43	**SE**	46	**NL**	97
UK	50	**NL**	47	**UK**	106
SE	51	**MT**	56	**SE**	111
DE	60	**DE**	56	**DE**	120
FI	72	**FI**	59	**LU**	135
DK	74	**FR**	62	**IT**	145
FR	75	**LU**	64	**FR**	148
IE	78	**IT**	64	**FI**	150
AT	83	**DK**	72	**AT**	164
ES	85	**IE**	80	**ES**	179
EU27	86	**EU27**	88	**IE**	182
IT	86	**BE**	94	**EU27**	187
LU	90	**AT**	94	**DK**	199
PT	92	**ES**	108	**BE**	213
BE	100	**SI**	125	**PT**	225
CY	114	**PT**	128	**CY**	227
SK	116	**EL**	158	**CZ**	291
CZ	118	**CY**	158	**SI**	293
HU	123	**CZ**	163	**EL**	338
RO	130	**LT**	187	**EE**	364
BG	131	**EE**	193	**PL**	399
EL	141	**PL**	229	**HU**	413
SI	145	**LV**	234	**SK**	453
EE	146	**SK**	235	**LT**	465
PL	146	**HU**	289	**LV**	485
LV	184	**BG**	289	**BG**	523
LT	219	**RO**	448	**RO**	782

Mentioned reduction has been reached up by giving a lot of effort. There is an area of safety level increase. The main factors creating this increment are the higher quality of the road surfaces, the advanced road signaling system and the transparent and more intuitive crossroads.

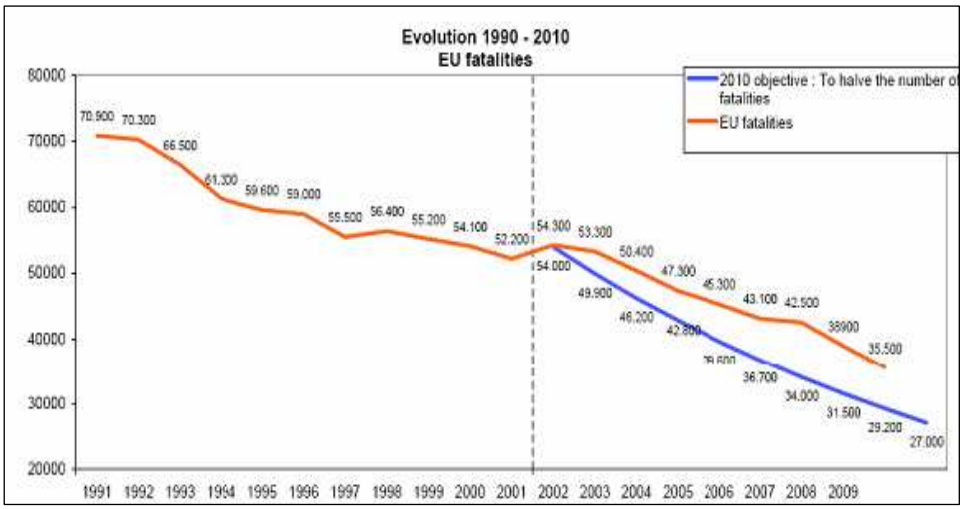

Fig. 1. Progress of fatalities at road accidents in EU

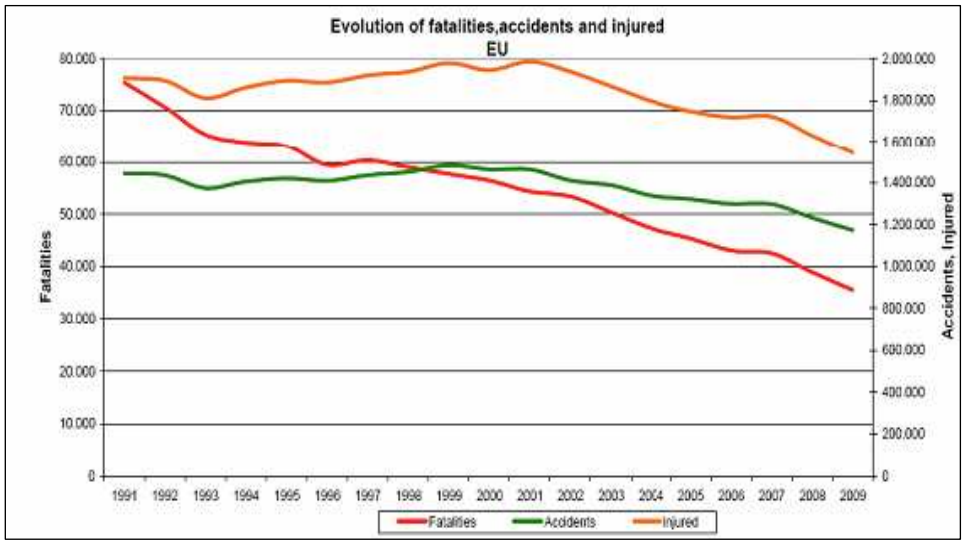

Fig. 2. Road safety progress in EU

As can be seen in fig. 2, the fatality recorded since 1991 constantly falls. Although from 1991 to 2001 the constantly increase in accidents is noticeable, it was reflected only in an increased number of injuries. Just application of the white book principles could be beneficial to safe a continuous decline in mortality. The condition and character of the

road surface and the technical equipment of the vehicle by safety elements are factors that affect the safety of operation.

2. BRAKING

The biggest influence to prevent accidents or dangerous situations has the braking system. The vehicle can be equipped by antiblock braking system ABS. The condition and type of the road surface are important for braking of the vehicle, too. This part of the paper deals with the influence of selected parameters currently popular vehicle category SUV on the safety. Measurements of braking distance on the car with the ABS function turned on and off were realized at various speeds.

The tests ran on the landing runway of the airport at the calm at the two different surface conditions - dry asphalt, wet asphalt and at the temperature of 15°C. The vehicle was fitted with the summer tires Hankoon.

The most important information for common user is the braking distance. The following charts show the differences in the length of braking distances for the vehicle with enabled anti-block braking system and without it on the dry and wet roads.

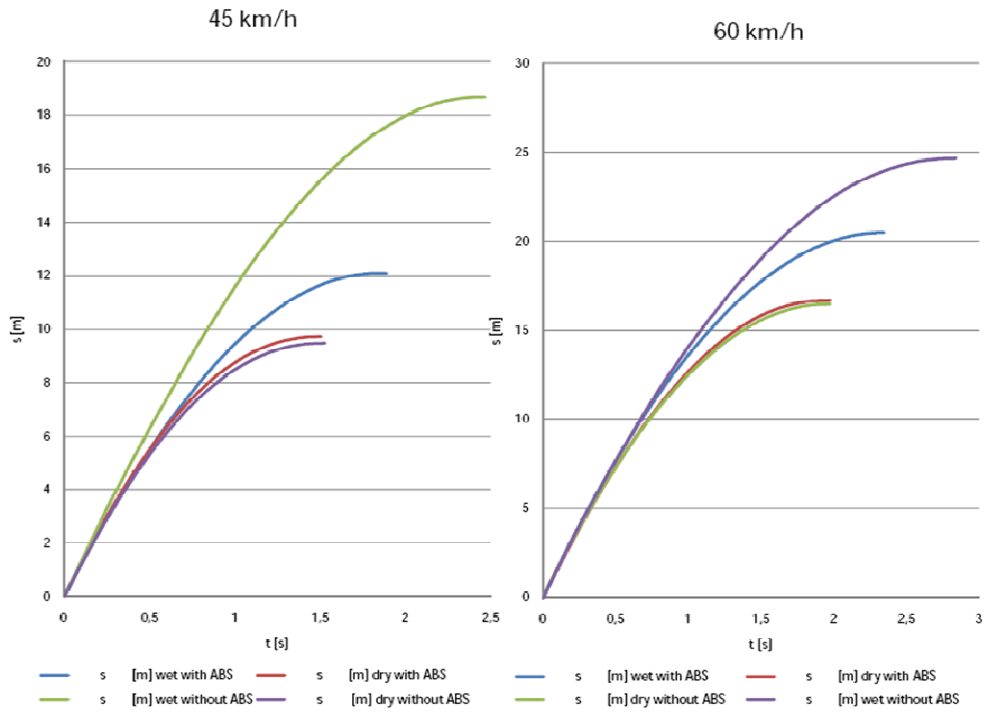

Fig. 3. Braking distances from 45km.h^{-1} and 60km.h^{-1}

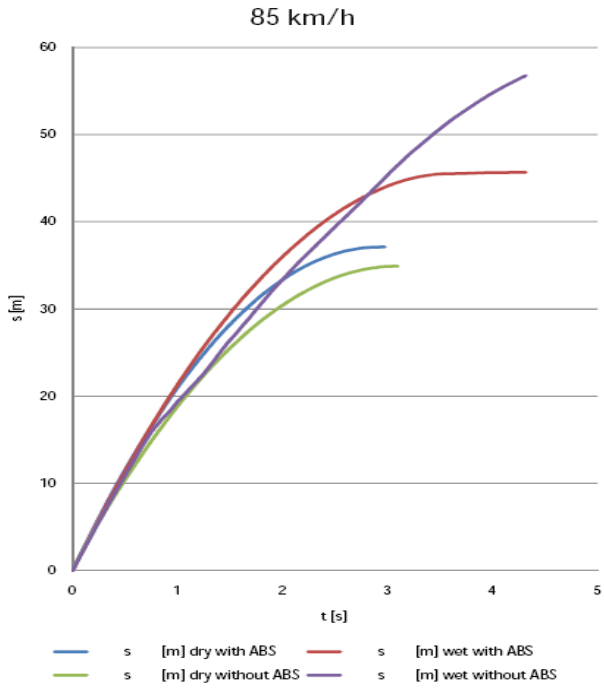

Fig. 4. Braking distance from 85km.h^{-1}

The measurements show that the vehicle had the shortest breaking distance on dry road at all three speeds and with disabled ABS system. The longest breaking distance was recorded on the wet road and disabled ABS system - Fig. 3 and 4. Differences in the length of braking distances on dry roads with and without ABS were minimal. But the breaking distance on the wet road increased in 6,6 meters at 45km.h^{-1} and in 4,2 meters at 60km/h comparing the braking without ABS and with ABS. The measurement of braking distance without ABS from 85km.h^{-1} was not finished because the vehicle began rotate. This could be caused by asymmetric brake action, different road adhesion or by uneven loading of the vehicle. Interesting results of braking distance were recorded at the measurement with under inflated, optimally inflated and over inflated tires on dry and wet roads.

The minimal braking deceleration on the dry road was achieved at the value of the manufacturer recommended tire pressure, as can be seen at the figure 5 [2]. The braking at this pressure on the wet road (fig. 6) was however the most effective. This fact refers to the possibility of the recommended tire pressure optimization in the light of the safety.

Measurement also shows that the lowest value of the braking deceleration during the braking is on the wet road at all speeds in the under-inflated tires. The minimum difference of the deceleration was shown by the manufacturer recommended tire pressure of 220kPa. Low-inflated tires showed the worst braking ability on a wet road. The difference in the deceleration in the comparison with the over-inflated tires was 1m.s^{-2}.

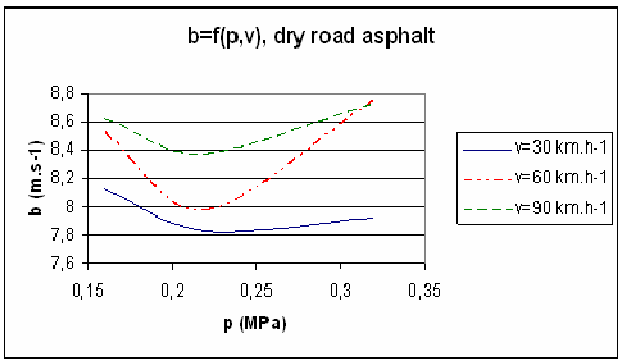

Fig. 5. Braking deceleration dependence on the tire pressure at the various velocities – the dry road

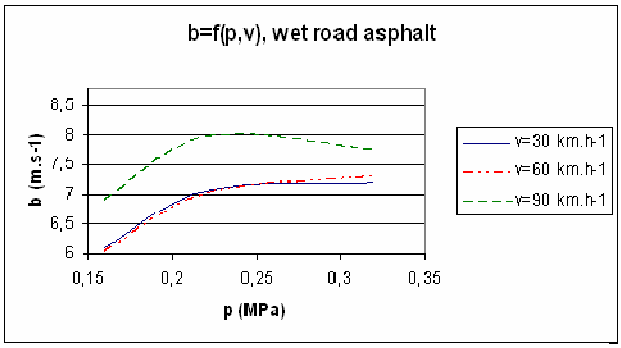

Fig. 6. Braking deceleration dependence on the tire pressure at the various velocities – the wet road

3. AVOIDANCE MANEUVER – MOOSE TEST

Another test which is important for crew safety with regard to the stability of the vehicle is an avoidance maneuver - moose test. This test shows the tilting of the car body at a sharp avoidance maneuver with subsequent return to the original track. SUV are relatively high, have a high center of gravity, what is disadvantageous of vehicle stability. We were interested in lateral acceleration in this measurement. We recorded lateral acceleration in the area of the head of driver and passenger in the backseat. Measurements were made at speeds 30km.h^{-1}, 40km.h^{-1}, 50km.h^{-1}, 60km.h^{-1} a 70km.h^{-1}. As seen from the graphs in fig. 7 the average values of lateral acceleration at the speed 70km.h^{-1} in the position of drivers head and back passenger head and without falling gear were about 9m.s^{-2}. The maximum values were to 13m.s^{-2}. At the same maneuver but at the speed of 50km/h was the max. value in the position of the back passenger head 7m.s^{-2}.

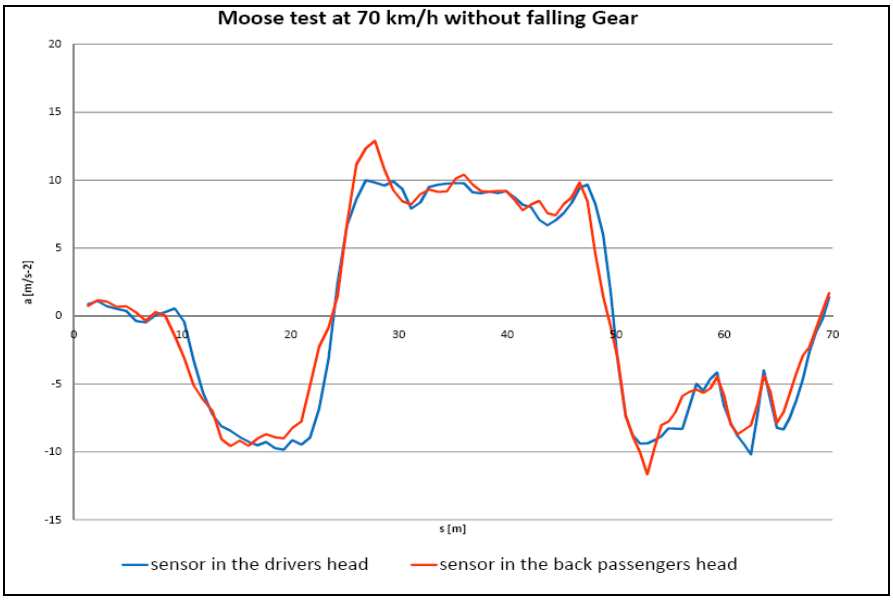

Fig.1. Moose test at 70km.h^{-1} without falling gear

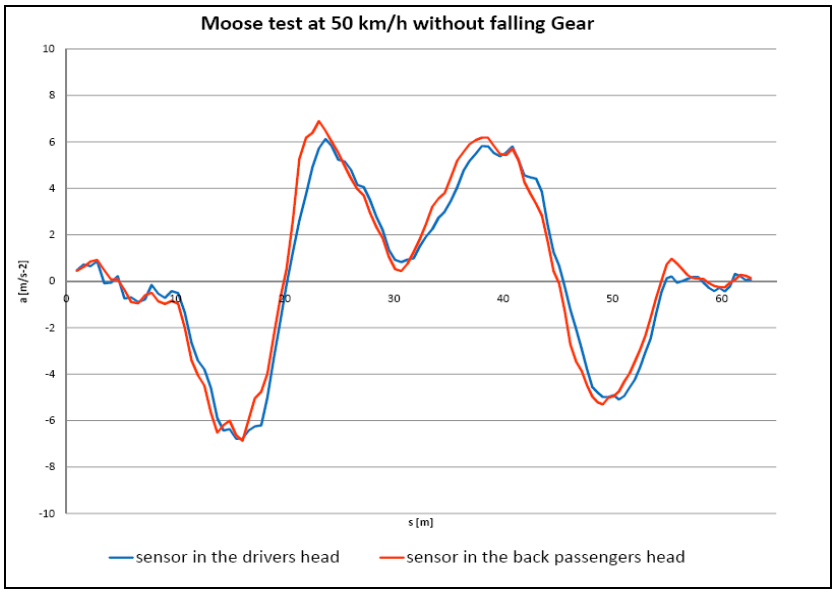

Fig. 2. Moose test at 50km h^{-1} without falling gear

4. CONCLUSION

Road safety depends on many factors. Quality, condition and equipment of the road network and road vehicles are the basic technical factors which, unlike the behavior of the road users, we can assume or influence and by that reduce the number of injuries and deaths in road accidents. Drivers often disregard the importance of tire pressure. However, test results proved significantly changing of the value of deceleration and braking distances depending on the value of the tire pressure and the road surface conditions. Also, the stability of the vehicle in an avoidance maneuver, which is often part of a dangerous situation, is important to know. Lateral acceleration measured during this maneuver reach values that correspond to values of the braking deceleration. This is related to risk of injury or to inducing of the stress situations by freely moving objects in the vehicle.

It can be said, based on the measurements, that the deceleration of the vehicle as the most important safety factor is greatly influenced by two main effects. These effects are the road conditions (wet, dry, snow) and the tire pressure. The measurements were done only with one vehicle and in one category therefore the results of this measurement cannot be generalized.

5. REFERENCES

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