European Journal of Emerging Technology and Discoveries
ISSN (E): 2938-3617
Volume 1, Issue 4, July, 2023.

THE PROBLEM OF ENSURING THE SAFETY OF VEHICLES IN BRAKING MODES

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Abstract
In this article, taking into account the conditions on the roads of Uzbekistan, the work that needs to be done to ensure the safety of vehicles in braking modes is fully explained. The interaction between the elements of the "Car-Driver-Road-Pedestrian-Environment" system in the modes of simultaneous braking of vehicles, as well as new methods, tools and technologies for diagnosing the braking system using new information technologies considered development processes. Methods of increasing car safety in braking modes based on the developed scientific rules, new methods, technologies for preventing traffic accidents and diagnostics of motor vehicles are widely covered.

Keywords: car, road traffic accident, bicycle, driver.

Introduction

One of the main indicators describing the quality and efficiency of road transport is traffic safety [1,2,3]. Prevention of accidents is becoming one of the most serious socio-economic problems in modern Uzbekistan, characterized by the high intensity of road traffic, which includes tens of millions of people and a large number of vehicles. Not only people's lives and health depend on its successful solution, but also the development of the country's economy [4-7].

This problem, which is characterized by its complexity and diversity, has become particularly acute in the last decade due to the increase in the number of motor vehicles and the growing disparity between the length of the road network.

The Department of Public Safety of the Ministry of Internal Affairs of Uzbekistan, the Road Safety Service, set the task of reducing road traffic accidents and deaths in the country by 15% by 2023 [8-12].

According to the traffic safety service, 9,902 accidents were officially registered in the country last year, which is 99 or 1% less than in 2021 (10,001). The number of accidents ending in

death decreased from 2197 to 2086 - 111 or 5.1%, and the number of people who died as a result of accidents - decreased by 70 people or 2.9% - from 2426 to 2356. Meanwhile, injury-related crashes increased to 7,816 from 7,804 in 2021, an increase of 12, or 0.2%, and the number of injuries increased by 376, or 3.9%, to 9,606 from 9,230.

Last year, there were 27.5 accidents per 100,000 inhabitants and 23.7 accidents per 10,000 vehicles. The number of fatal accidents was 5.8 per 100,000 population, 5 per 10,000 vehicles. The number of accidents involving injuries was 20.7 per 100,000 population and 24.4 per 10,000 vehicles.

Most of those who died in traffic accidents - 91.7% or 2161 people were not wearing seat belts, 8.3% or 195 people who died in accidents were wearing seat belts. 66.9% of those injured in traffic accidents, i.e. 6426 people, were not wearing seat belts, 33.1% or 3180 people were wearing them.

In terms of types of accidents, the most - 44.9% or 4449 collisions with pedestrians, 31.2% or 3093 collisions with cars, 11.5% or 1136 collisions with cyclists. In 4.7% or 467 accidents, the car overturned, 4.3% or 428 collided with an obstacle, 1.1% or 105 collided with stationary vehicles, 2.3% or 224 are conflicts with others.

The largest number of accidents occurred with the participation of passenger cars - 76.1% or 7370. Bicycles - 11.5% or 1136, trucks - 9% or 1047, motorcycles - 1.4% or 142, buses - 1.4% or 141, horse-drawn carriages - 0.4% or 43, scooters - 0.2% or 23 [1, 2].

According to the traffic safety service, the number of traffic accidents has increased in Fergana, Jizzakh and Syrdarya regions.

It is known that ensuring road safety is a complex problem that combines three main factors of the system [13-19].

"Car-Driver-Road". To solve this problem, measures to improve the design of vehicles, construction and reconstruction of highways, improvement of the organization of technical maintenance and repair of rolling stock, training of highly qualified drivers and repair workers, and improvement of the organization of traffic implied [20-24].

Traffic accidents in road transport are determined by the interaction of these factors, there is a very complex relationship between them. The cause of the accident is the incompatibility of one of the system components with the rest.

More than half of the truck fleet consists of vehicle models developed more than 25 years ago, as a result of which they have improved braking efficiency, especially for heavy vehicles, reduced noise levels, seat vibration loading, cabin strength characteristics. new solutions for active and passive safety provided by UNECE regulations in terms of enhancement, external and internal awareness, etc.

At the same time, about half of cars, trucks and buses have been in operation for more than 10-15 years.

A quarter of all traffic accidents are vehicle collisions, of which approximately 35% are pedestrian collisions. Although side-by-side collisions do not take the first place in terms of the number of deaths and injuries, in general, this type of collision is no less serious than other types of collisions. Due to the large number of collisions, this type of collisions is in the first place in terms of material damage.

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According to most scientists, one of the main factors that lead to collisions on high-traffic highways is the sudden braking or intensive reduction of the speed of the vehicle in front. This mode occurs very often and forces the following driver - the leader - to apply intensive response braking [25-29].

But often the attitude of drivers to ensure the minimum safety distance is too late. The problem is that the value of the safety distance cannot be correctly determined, because the driver of the vehicle behind cannot know the possibility of braking at any time and the braking distance of the leader, and additionally the accuracy of braking. The driver's estimate of the current distance is limited. In the modern conditions of the various vehicles participating in the traffic flow on the roads of Uzbekistan, the wide distribution of the total mileage and service life, this task is more complicated.

In order to timely and accurately respond to dangerous situations from the point of view of traffic safety, and to establish compatibility between the uncertainty of the characteristics of AVDS system elements, the system Active Vehicle Safety must match the psychophysiological capabilities of the driver.

According to many researchers [30-36], the distances between vehicles are determined by the traffic flow. In other words, the driver is forced to deliberately violate the safety distance to avoid being placed between his car and the leader of other vehicles. Taking into account that in this mode, a passenger car operates on average 35% of the entire driving time in urban conditions, the braking mode can lead to frequent violations of the safety distance, which is the main reason for collisions. Foreign scientists have found that if drivers who are in a dangerous emergency braking position when passing cars have an additional time reserve equal to one second, then the number of past collisions will decrease by 40-50%, and the number of victims will decrease.

As noted in a number of studies [7,8,9], one of the possible effective ways to create a time reserve for the driver to make a decision can be to increase the information content of the driver. External light signaling of the vehicle through engine braking modes and forward movements, its signaling of the leading vehicle's emergency braking mode. The safety of motor vehicles in braking modes is determined to a lesser extent by the technical condition of their working braking systems. Imperfect design and long service life of an important part of the car park negatively affects its technical condition.

Table 1. Distribution of causes of accidents by vehicle units and systems

Name of Units and Systems	Accident rate, %		
	Republican and regional centers	Cities and regions	Regional and local roads
Braking system	61	53	45
Steering wheel	11	12	13
Lighting devices	11	17	17
Tires	7	8	6
Other	9	10	14

Most often, brake system malfunctions are manifested as an increase in the braking distance of the car (decrease in deceleration) or uneven braking, which causes the car to slide. At the same time, slips and overtakes are one of the most common causes of traffic accidents.

Deterioration of braking efficiency in operation is caused by an increase in the gaps between the drums, the presence of oil, water and dirt on their working surface, a violation of the adjustment of the brake valve, hydraulic vacuum booster or the movement of the brake pedal, mainly the internal fluid flows from the brake cylinder or booster [10]. At the same time, in most cases, adjusting the corresponding block allows to restore the required braking efficiency [11].

The sudden failure of the braking system during movement has particularly serious consequences: breaks in the diaphragms of the brake chambers, hoses, etc. However, these sudden failures develop to a large extent under the influence of certain failures of the brake system units (compressor, pressure regulator, etc.). Timely detection and elimination of their malfunctions, in turn, allows to prevent sudden brake failures.

On average, 25% of accidents involving injuries and deaths are caused by vehicle skidding during braking. The problem of lateral stability of the car during braking was fundamentally solved in the works of E. A. Chudakov [12].

The authors show that the magnitude of the transverse tilt of the vehicle during emergency braking depends mainly on the unevenness of the braking forces along the sides. In these works, a number of influence design parameters, operational factors, various schemes for the appearance of uneven braking torques on the wheels.

The unevenness of the brake linings caused by the difference in friction coefficients is the main reason for the uneven clearances in the right friction pairs μ and brake to the left one mechanisms of the arrow [13].

In this work, V.P. Merinov studied the effect of friction coefficients and gaps between friction pairs of brake mechanisms on the unevenness of their effect and determined the permissible dispersion of friction coefficients. As a result of these studies, the author found that the presence of a difference in the friction coefficients of the friction linings leads to their different wear and, accordingly, a difference in the gaps between the friction elements of the brake. In this case, the mechanisms of one axle of the car, the combined effect of friction coefficients and the difference in clearances lead to uneven movement.

The introduction of automatic gap adjustment devices into the brake system does not fully ensure the constancy of the gaps and does not eliminate their difference in the right and left brake mechanisms. This is primarily due to the fact that automatic devices themselves are not free from adjustment instability and allow the increase of gaps in the process [14].

Thus, the permissible deviations according to GOST R 51709 - 2001 should not exceed 25% of the maximum value of the braking force. However, studies show that deviations for ZIL-130 cars reached 65%. At the same time, by adjusting the brakes on the drum power stand, to reduce unevenness one of the vehicles the braking power of axle wheels is only up to 20%.

Thus, the analysis shows that the main reasons for the uneven effect of brake mechanisms are the difference in the friction coefficients of one axle of the vehicle and the difference in the friction coefficients of the left and right brake mechanisms of one axle of the vehicle. In addition, unevenness appears. Both for new cars and for cars that have traveled a high distance

since the start of work, the unevenness of the movement of the brake mechanisms does not remain constant in the control range. This makes it necessary to control braking mechanisms with a frequency lower than the TO-1 frequency. This problem can be solved on the basis of on-board diagnostics of the uneven effect of braking mechanisms.

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