THE IMPACT OF SEVERE ROAD AND CLIMATIC CONDITIONS ON THE OPERATION OF AUTOMOBILE TIRES

Sh. B. Asamov
Academy of the Ministry of Emergency
Situations of the Republic of Uzbekistan

Annotation
The article analyzes the operation of tires of fire and rescue vehicles, tire wear from the impact of an aggressive road surface, influx of thermal shock, road class and climatic conditions. Recommendations are given for calculating the service life of tires for fire and rescue equipments.

Keywords: The surface of the road, pavement, cross profiles, carcass, fatigue wears out the tread.

The effect of the road surface on the tire depends on the type and condition of the road surface, its longitudinal and transverse profiles, and the curvature of the road. The rougher and more uneven the road surface, the faster the tread wears out, the faster the tire carcass wears out, and the tire's ability to resist mechanical damage decreases.
The more frequent and steeper the descents, ascents, and turns on the road, the more load is placed on the front, rear, right, or left wheels, and the car has to accelerate and decelerate more often. This increases friction and pressure in the tires, as well as heat generation, accelerating their wear. The more convex the cross-section of the road, the more the tires on the right wheels are loaded and the tires on the left wheels are unloaded. As a result, the tires on the right wear faster. When a car moves in the middle of a narrow asphalt-concrete road with a sharply convex cross-section, the inner dual tires are slightly overloaded, which increases their deflection [1].
A) If the length of the gravel section of the group road is, for example, 35% of the total length, this leads to an increase in the deflection rate of the tires by 30-70%.
In mountainous areas, the profile of the road, that is, the shape of the road, characterized by a large number of steep ascents and descents and small-radius turns, has a significant effect on the deflection of the tires. For example, if the share of the mountain road profile in the route is increased to 25%, the deflection rate of passenger car tires increases by
75-90%. The difference in deflection of truck tires when used on mountainous and flat roads is much smaller, not exceeding 20%.
The increase in the intensity of the tread of light tires in mountainous road conditions is explained by the greater slippage of the tread elements in the contact zone of the tire with the

road as a result of the emergence of forces that cause the wheel to move sideways. The low intensity of the tread of truck tires on mountainous roads is associated with their design features and low vehicle speed.

Figure 1 presents experimental data indicating a very strong influence of the camber angle on the tread of passenger and truck tires. The intensity of the tread increases nonlinearly with increasing camber angle, while it is greater for passenger car tires than for truck tires. Thus, with an increase in the wheel camber angle from 0 to ±2.0°, the intensity of the tread of passenger and truck tires increases by 6 and 10 times, respectively. As the wheel camber angle increases, the tire tread flex intensity increases further [2].

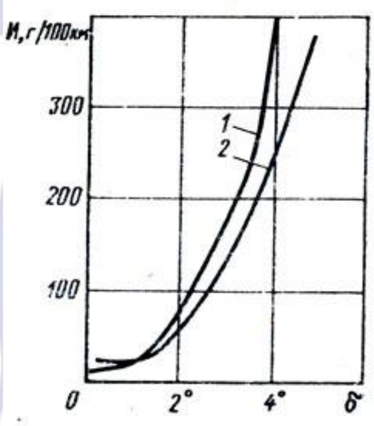

Figure 1. The influence of the wheel exit angle on the bending intensity of the tread of passenger and truck tires: 1 - tire 6.70-15 mod. I-191; 2 -220-508 mod. tire. IYA-112

It is known that when the wheel is lifted during travel, additional lateral contact stresses arise in the contact plane of the tire tread with the road. These stresses are added to the contact stresses acting on the tire, significantly increasing their magnitude. When the wheel is lifted, the contact stresses increase especially in the zone of the tread leaving the contact, which expands the sliding area of the tread relative to the road and increases the intensity of its deflection. At the same time, uneven deflection increases along its width. Measurements of the height of the bumps in the tread pattern showed that at large departure angles (±5°), the deflection of the edges of the tread of light tires relative to the middle is 30-35% higher, and the deflection of truck tires is 20-25%. The relationship between the camber angle of the wheel and the tread wear intensity of passenger and truck tires can be expressed by the following equations [3].

$I_l=6,0+5,858\delta^{3,25}$;

$$I_g=8,5 + 12,48\delta^{2,12},$$

where δ-is the amplitude of the wheel deflection angle when turning to the right and left degrees.

The calculated data obtained by the linear equations differ from the experimental data by an average of ±3 + 5%. The results of the calculations by the given linear equations fully correspond to the experimental data. The conducted special road tests showed that the tire tread deflection intensity on flat-profile roads with improved pavement is approximately 2.5 times lower than on the stand at the operational values of the tire load parameters in the summer season. Therefore, if the values of the linear coefficients of the determined empirical equations are reduced by 2.5 times, then in the first approximation it is possible to estimate the influence of the tire tread on the deflection and road conditions.

Conclusion

Tire wear is greatly influenced by climatic conditions: ambient air and road temperature and humidity. Thus, in winter, tire wear on a hard road surface is approximately 25-30% less than in summer.

The higher the ambient air temperature, the more heat is generated in the tires, the faster the tread wears out, and the service life of the tires is shortened. With increasing ambient air temperature, the tightness of the tire decreases due to increased air diffusion through the walls of the chamber.

Low ambient air temperature reduces the temperature in the tires during operation, which reduces their overall wear. However, even at low temperatures, tires can wear out prematurely due to the loss of rubber elasticity and the appearance of brittleness.

If tires are not placed under tires when parked outdoors for a long time or stored in low temperatures without a garage, they will harden and stick to the ground, and moving the car (especially abruptly) can weaken the tire material and even cause the tread to separate from the tire carcass.

References:

1. 52.006:2009 Guiding document of the Republic of Uzbekistan Standards for operational mileage of automobile tires.

2. Order No. 212 dated July 17, 2021 “On approval of the Regulation on the procedure for the use, repair and write-off of motor vehicles and automobile property in the system of the Ministry”.

3. Order No. 62 dated March 1, 2021 “On approval of the main consumption standards and the procedure for the use of automobile tires and batteries in the system of the Ministry of Emergency Situations”.