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RESEARCH OF INTENSITY OF TIRES WEAR OF TRUCKS IN THE PROCESS OF THEIR OPERATION

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***Abstract.** The dependences intensity of tires wear on the tire life of trucks are determined on the basis of the system measurements of residual tread depth in the actual operating conditions. The factors which influence the critical rate of tire wear are analyzed.*

***Key words:** tire, truck, tire wear, tire life, tread depth.*

ИССЛЕДОВАНИЕ ИНТЕНСИВНОСТИ ИЗНОСА ШИН ГРУЗОВЫХ АВТОМОБИЛЕЙ В ПРОЦЕССЕ ИХ ЭКСПЛУАТАЦИИ

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***Аннотация.** Определены зависимости интенсивности износа шин от пробега грузовых автомобилей на основе системных измерений остаточной высоты рисунка протектора в фактических условиях эксплуатации. Проанализированы факторы, которые влияют на критическую величину износа шин.*

***Ключевые слова:** шина, грузовой автомобиль, износ, ресурс шин, высота рисунка протектора.*

ДОСЛІДЖЕННЯ ІНТЕНСИВНОСТІ ЗНОСУ ШИН ВАНТАЖНИХ АВТОМОБІЛІВ В ПРОЦЕСІ ЇХ ЕКСПЛУАТАЦІЇ

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***Анотація.** Визначені залежності інтенсивності зносу шин від пробігу вантажних автомобілів на основі системних вимірів залишкової висоти рисунка протектора в фактичних умовах експлуатації. Проаналізовані чинники, які впливають на критичну величину зносу шин.*

***Ключові слова:** шина, вантажний автомобіль, знос, ресурс шин, висота рисунка протектора.*

Introduction

Development of carrying system leads to enhancement of the role of tires during the vehicle and especially truck operation. Observations for the trucking development in Ukraine showed the essential increase in use of the heavy-duty trucks made by the main world's top manufacturers. Maintenance running is increased simultaneously; the quality of utilized trucks is improved; the specific consumption of fuel are reduced as the cargo volume increases; quantity of tires in the tire kits raises. It is topical in the conditions of industrial regions where trucks are used in diffi-

cult conditions of big cities, anthropogenic influence, chemical pollution, difficult operation assignments.

The Analysis of Publications

The problem of checking over the technical state of tires of truck is topical. It is proved in research works [1-3] that the measurement of residual tread depth of the tire of trucks, its documenting and comparison with the previous values is the most expedient method of monitoring of the dynamics of the wear under the operating conditions. The method does not demand the

complicated equipment, the previous influence on the tire, destroying influence on it and tire dismantling. The method allows finding of unevenness of the tire wear, both on the width of the tread cap and on the length of its circle that is almost impossible under the application of the volume and weight valuation methods.

Objective and Problem Statement

The dynamics of wear of tires in the process of exploitation of cars are analyzed. Research objective is the research of laws of intensity and character of the tread wear of truck tires and the development of prediction technique of their actual life.

Experimental Research

The research was done at the enterprises of the Donetsk region. It were Volvo FM 400 8x4, Volvo FM 400 6x4, KAMAZ 6520-61 6x4. The special device [4] to control the residual height of the tread pattern of the tires was used.

The results of the research have shown that the tire has a difficult, nonlinear dependence of the wear on run (fig. 1) which can be observed on the example of many technical objects [5-7]. The wear rate of the tire h_{tr} is measured in percentage ratio (y-axis) and it depends on run of the trucks L_T - it is measured in thousand kilometer of run (x-axis). In terms of the variable intensity of wear the tire life can be divided into three stages: a wearing-in zone, a well-established (stable) wear zone, and a zone of critical wear which are necessary to be researched separately.

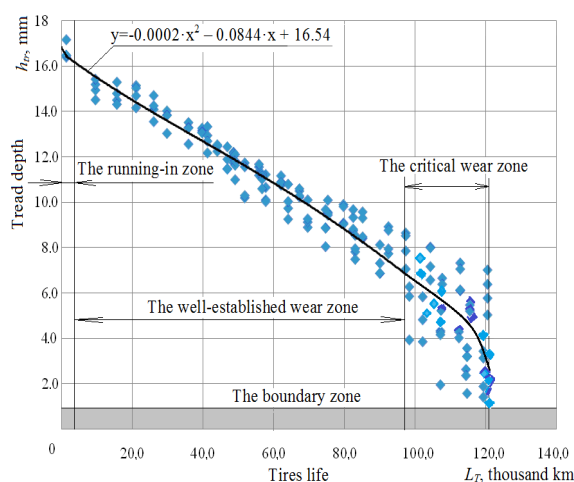


Fig. 1. Tire wear of the make Michelin XZY-2

Consequently, the phases of the running-in and critical wear are the sedate functional dependences of the residual height of the tread pattern on the tire life; it means that they allow changing of the wear intensity with accumulation of the tire life. At the same time the wear has the linear dependence in the constant phase.

The running-in period present at the beginning of the tire operation is extensively conditioned by the tire accommodation to the running-in to specific features of the geometry of the truck chassis and the work of the units of the truck suspension [2, 6]. It is obvious that the truck chassis which were in operation in different and not always favorable conditions have a number of imperfections, such as frame twisting, flexure or misalignment of axles, their one or versatile shift, deformation of the wheel disk and many other things [7].

According to the dependence it is possible to draw a conclusion that the running-in period makes up about 8 thousand km. According to reports of measurements, the value made up 0.377 mm/1000 km at that period and at the first 1500 km reached the value of 1.04 mm/1000 km, and at the first 4000 km of the tire life it had the average value of 0.504 mm/1000 km.

The running-in is established that if tires with the tire life of about 216 thousand km wore out with the intensity of 0.066...0.079 mm/1000 km at the moment of their deducing from the operation, the tires established instead of them having the tire life of 41100 km showed the wear-rate of about 0.14...0.2 mm/1000 km.

The stage of the well-established wear is the longest stage concerning the tire life which makes up about 85 percent of the tire life of large-tonnage trucks. This stage is characterized by the uniform supported due to rather stationary conditions of tire operation and the end of the running-in process. The constant wear is investigated in the full cycle of operation of the tires Michelin XZY-2, the dimension-type 315/80R22.5 which are established on the operated axes of the dump truck Volvo.

On the basis of the positions the up limit of the well-established wear corresponds to the value of the tire life at which the establishment of the

stable average wear rate of the tire tread has taken place.

The transitive zone to the critical wear for the tires (fig. 1) is at 100000 km of the tire life. At this point the swift increase of the divergence between the average remaining-tread depths which smoothly increased to 100000 km is observed.

The stage of critical wear is characterized by the raised average wear intensity and instability of the value. The dispersion of the remaining-tread depths (fig. 1) increases with the tire life that testifies to the variability of the wear intensity which reaches the variation limits at the tire life 120000 km – 0.08...0.2 mm/1000 km for the tires of the steering wheels of the dump trucks and 0.04...0.25 mm/1000 km for the driven wheels.

In terms of economic expediency of the operation the stage of entry of the tire to the phase of the critical wear is the most adverse. Practice shows that more than 80 percent of cases of damages of the tire tread and the carcass of tires which are not subject to repair are exactly connected with the exhaustion of the tire life [8].

As at the motor transportation enterprise is economically interested in the constant operation of the trucks, it is necessary to take tires which have the average remaining-tread depths of about 2 mm out the operation beforehand.

Conclusions

The analysis of statistics indices allows correcting the standard life in rather wide limits. It occurs with taking into account the actual operating conditions of the tires at the particular enterprise, and allows prompt correcting of the appointed standards.

Measuring of the remaining-tread depths and the analysis of the running conditions of trucks can give the information on the share of each factor which influences the tire wear; find out principal reasons of the raised wear rate and failure of the tires and units of the trucks. The information about the character and the wear rate of the tire allows developing recommendations for the reduction of the tire wear of the trucks in actual service and it improves the control of the technical state of the vehicle fleet of the enterprise.

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