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THE INFLUENCE OF WORKING TIME ON CHANGES IN THE QUALITY OF CARS: WORKING CONDITIONS AND PATTERNS OF THEIR CHANGE

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A B S T R A C T

This article presents the development of a comprehensive theoretical framework, consisting of rules, to facilitate the interpretation and modeling of quality change processes in both individual cars and their collective groups. The emphasis is placed on ensuring adequacy in capturing the dynamic nature of these processes. A key feature of the framework is its incorporation of seasonal variations in working conditions and intensity. By considering these factors, the rules aim to enhance the understanding of how the quality of cars evolves over time, providing a valuable foundation for future research and practical applications in the automotive industry.

K E Y W O R D S

Car, quality, specification, production, service, operation, working conditions and intensity.

Introduction

Operating conditions are a set of factors affecting the product during its operation. A factor is understood as an objective characteristic of working conditions. Thus, the operating conditions X represents the set of factors x1, x2, …xn, which is called the factor space. For quantitative characteristics, each mile has indicators that can take different numerical values.

Methodology

The analysis of regulatory and technical documents, as well as scientific and educational literature, led to the following conclusions.

1. Classification of operating conditions is a necessary stage of a systematic approach to the study of the laws of their influence on car quality indicators.

2. Previously developed classifications differ significantly. The same factors often have different names in different sources. For example, the terms "meteorological", "climate", "temperature", "natural-climate", "atmosphere", and "environment" are used to define climatic conditions. In the

classifications made by different authors, the same factors are assigned to different groups. In particular, in some cases, the traffic intensity depends on the road conditions, in others - on the work mode, and thirdly - on the traffic conditions [1].

3. Factors should be classified for further analysis.

Working conditions from the category of working conditions (defined by the type of road surface, terrain and traffic conditions combination), organization of work of rolling stock, natural and climatic conditions, the number of cars serviced and repaired in ATK, technologically compatible vehicles corresponds to the number of groups. It should be noted that this classification has an extended nature, which is related to the compromise between accuracy and ease of practical use.

The classification of factors proposed below is only for ease of analysis. The list of the main factors affecting the realized quality of cars is formed based on the analysis of the above literature sources.

All factors can be divided into two groups. The factors of the first of them determine the quality indicators (potential quality) of cars and include design, materials and production technology. The factors belonging to the second group change the quality indicator during operation, that is, determine the possible quality of cars.

The factors of the second group can be divided into the following subgroups.

Road conditions: type and condition of road surface; road length profile; cross-sectional profile of the road; road plan; traffic conditions (traffic intensity).

Climatic conditions: ambient air temperature; the presence of snow, moisture, and ice on the road; wind speed and direction; air pollination; solar radiation; atmospheric pressure; environmental aggression [2].

Procedure: load capacity utilization (passenger capacity); mileage usage; movement speed (average value and unevenness); Transportation distance; frequency and duration of stops; trailer availability; exploitation intensity.

Ride Quality: the nature of the driving; driver class; driver experience.

Organizational and technological factors: ATK size; rolling stock of different brands; qualification of repair workers; availability of production areas; provision of technological equipment; method of storing rolling stock between shifts; car account and other factors.

It should be noted that some factors belonging to different groups are closely related. For example, road conditions are highly dependent on air temperature and precipitation.

In some sources, seasonal conditions are separated. They are associated with the appearance of several additional factors that affect the intensity of changes in the quality of the car, changes in the ambient temperature, and changes in road conditions by season.

Analyzing the graphs of changes in working conditions, we can divide them into three components:

laws of change of average values of factors;

laws of cyclical (seasonal) changes;

random variable graphs.

For example, the change in air temperature over time is determined by the following formulas:

$$t(\tau) = \overline{t}(\tau) + \psi(\tau) \quad (1)$$

$\bar{t}(\tau)$ - average temperature corresponding to timeτ;

$\psi(\tau)$ - random component corresponding to time;

$$\bar{t}(\tau) = A_0 + \sum_{i=1}^{n} (A_i \cos \omega_i \tau + B_i \sin \omega_i \tau) \quad (2)$$

the mathematical expectation of average annual temperature;
Amplitudes of fluctuations of the mathematical expectation of temperature corresponding to frequency Ai, Bi-i [4].
Random component $\psi(\tau)$ is normally distributed with a mean expectation and standard deviation equal to zero σ_t .
In GOST 16350-80, it is noted that the annual distribution of air temperature differs from the norm in some regions. It is recommended to use the Gram-Charlier law for climate regions with values of asymmetric coefficients greater than minus 0.4 and greater than minus 0.6, which takes into account its effect.
A large number of factors of operating conditions affect the change in the quality of cars. Many factors are interrelated. The most typical example is seasonal conditions resulting from cyclical changes in air temperature and manifested in cyclical changes in road conditions, humidity, dust, etc.
In general, graphs of changes in operating conditions consist of three components:
– graphs of changes in average values of factors;
– laws of cyclical (seasonal) changes; random variable graphs;
– cyclic changes in air temperature are described with sufficient accuracy by the harmonic model;
– the pattern of random changes in air temperature is approximated by a simple law or Charlier distribution;
– in some cases, none of the laws provide a satisfactory approximation.
Operational time - the duration of the object's operation or the amount of operational time means the duration of the product measured in hours or kilometres, in some cases in units of completed work [5].
The degree of change in the quality of the car with an increase in working hours or working hours is determined by reliability. Reliability is the ability of a vehicle to keep on time within specified limits, which includes the values of all parameters describing the ability to perform the required functions in certain modes and conditions of use, maintenance and repair, storage and transportation Reliability is a complex property consisting of 4 properties: failure-free operation, durability, stability and persistence.
Research on the issue under consideration is mainly related to the problem of changing the technical condition of cars. In this case, gradual changes in quality indicators, random indicators that lead to gradual failures and sudden failures are taken into account.
Step-by-step change of parameters of the technical condition, the graph of type 1 are described by ar, while random ones are considered relative to vehicle groups and described by type 3 graphs.
The laws of change of parameters of the technical condition during working time have been studied by many authors on the example of various types of machines and equipment.
Technical condition change issues have attracted the attention of researchers since the beginning of automobile production. Many articles have been published on this topic. For example, in 1936, the

dependence given in the source, which shows the graphs of the change of wear of pistons, cylinders, piston rings, and camshafts according to the working time of automobile engines, corresponds to the classic wear curve.

According to the information presented in many articles, monographs, textbooks and manuals, wear increases to the maximum limit state during the entire journey of the car.

Results and Discussion

Analysis of the results of experiments obtained by various researchers shows that in all cases there are no changes according to the classical curve.

Experimental data obtained by FN Avdonkin also indicate a variety of forms of the dependence of the parameters of the technical condition of cars on the working time: an increase and a decrease in the working time. A parameter can be either linearly variable curvilinearly progressive or regressive.

Note that this case cannot be represented as a general case, since here the wear intensity varies only with the mode and the effect of the operating time on the process variation is not taken into account [14].

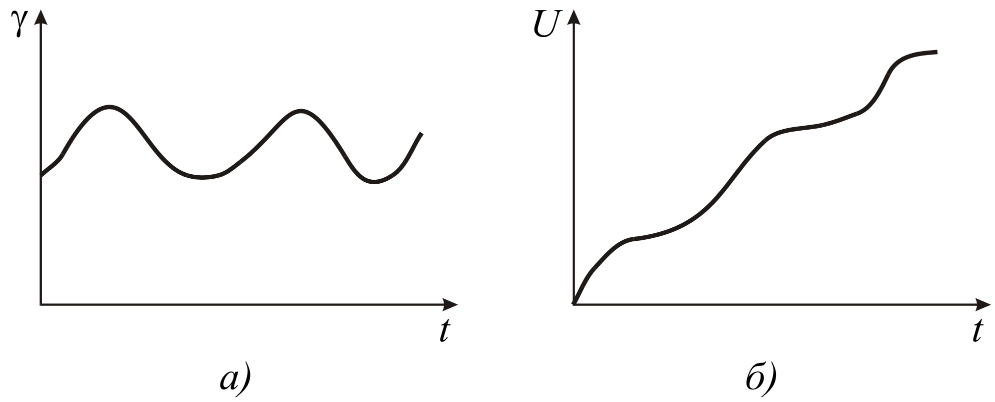

Figure 1. Laws of the flow of stationary wear processes over time [5]

Modelling a car in random changes in the technical condition is much difficult In the case of a single object, the probability of failure R or the probability of failure F operating time L can be estimated:

$$R(L) = \int_{L}^{\infty} f(L) \cdot dL$$

or

$$R(L) = \frac{n - m(L)}{n} = 1 - \frac{m(L)}{n}. \tag{3}$$

m(L) - the number of failed products during operation L;
n- number of products;

$$F(L) = 1 - R(L) = \frac{m(L)}{n}$$

$$F(L) = \int_{-\infty}^{L} f(L) \cdot dL. \tag{4}$$

The scheme of change of failure probability and failure probability by operation time is shown in Fig. 2.

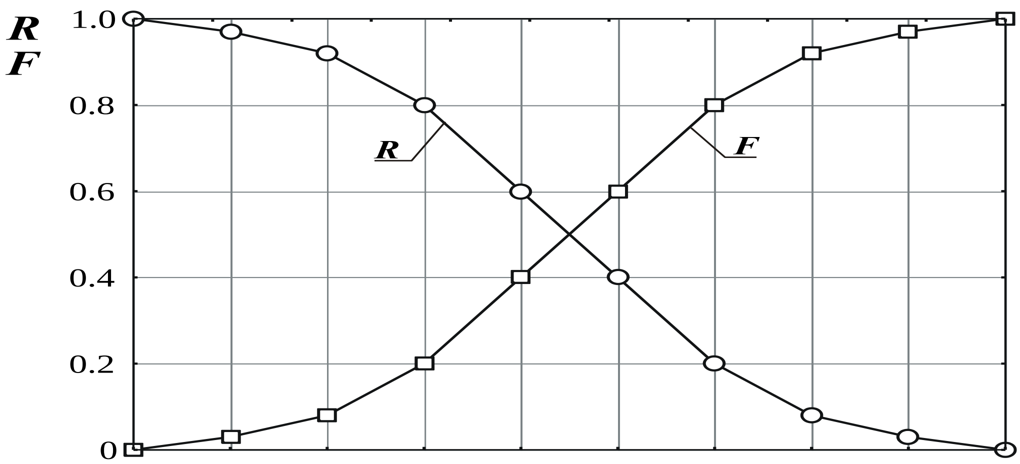

Figure 2. Failure rate R and failure probability F[5]

The change in the technical condition of the working time for a group of vehicles is characterized by the laws of the recovery process. Consideration of these regularities follows from the following axioms.

First, each car is characterized by a random and corresponding function f(L).

Developments are independent for different cars [10].

When troubleshooting a repair industry, it doesn't matter which machine failed or which invoice failed.

The following indicators are used to describe the third type of graph. K-mean time to failure:

$$\bar{L}_k = \bar{L}_1 + \bar{L}_{12} + \ldots + \bar{L}_{k-1,k}, \qquad (5)$$

$\bar{L}_1$ - average time to first failure;

$\bar{L}_{12}$ - the average time between first and second failures, etc.

The average time between (k-1)- and k- failures for N cars:

$$\bar{L}_{k-1,k} = \frac{1}{n}\sum_{i=1}^{n} L_{k-1,k}. \qquad (6)$$

The completeness coefficient of resource recovery describes the possibility of resource reduction after repair:

$$\eta = \frac{\bar{L}_{k-1,k}}{\bar{L}_1}. \qquad (7)$$

The leading function of the failure stream (recovery function) determines the accumulated number of first and subsequent failures of the product up to the operating time L:

$$\Omega(L) = \sum_{k=1}^{\infty} F_k(L). \qquad (8)$$

Failure flow parameters are the density of the probability of failure of a repaired product determined for a certain time or kilometre:

$$\omega(L) = \frac{d\Omega(L)}{dL} = \sum_{k=1}^{\infty} f_k(L). \quad (9)$$

E.S. Kuznetsov et al., when evaluating the reliability of a product, the number of failures usually depends on the start-up, and when evaluating the flow of failures that come to be eliminated, the operating time of the relevant production units. Here are some things to note when considering a change ω another regularity must belong to another species over time. In this work, the change in fault flow, as well as maintenance, and resource replenishment requirements, belong to the 6 types of patterns discussed below [9].

Using the values of the breakdown flow parameter, it is possible to determine the spare parts demand for a given operating time and plan the operation of the supply system. Based on experimental data, the failure rate parameter can be estimated as follows:

$$\omega(L) = \frac{m_2 - m_1}{n(L_2 - L_1)}, \quad (10)$$

mbitta, m2 - total number of failures*n*cars, respectively, for L1 and L2 working hours.

In general, failure rate parameters are not constant because the operating time varies. There are three main modes of its behaviour:

– full recovery of the resource;
– incomplete, but permanent recovery of the resource after the first failure;
– gradual decrease in the completeness of resource recovery.

Rules for changing the technical condition and "age" of cars are established. Thus, the results of the annual technical inspection of passenger cars in Sweden show that after 10 years of operation, they have 3.7 times more failures than after 1-2 years [8].

Type 3 graphs are usually considered as an example of the occurrence of vehicle faults and the process of their elimination. But this is a special case. According to similar graphs, flows of requirements for maintenance, and replenishment of consumables (fuel, engine oil) are formed.

It should be noted that these laws have no practical application and are considered an idealized model of the real process. This is due to the following reasons [7].

First, when considering these processes, the operating time of vehicles is used as a coordinate axis. That is, the process is considered in terms of equal working time of a group of cars. In practice, the mileage of individual cars during the same time period varies significantly. Consequently, the picture taken in the context of equal developments is not actually realized.

Secondly, the elimination of breakdowns and breakdowns, and replenishment of resources is planned and organized based on time, and not based on the working time of vehicles.

Third, working conditions and intensity change cyclically over time, so the level of disruption, and resource consumption is not constant and changes not only due to the increase in working hours but also related to these reasons also has cyclical fluctuations.

Thus, these graphs are realized only when the following conditions are fulfilled [13]:

$$\frac{dX}{dT} = 0; \qquad \frac{dL}{dT} = const. \quad (11)$$

In the process of increasing the operating time, not only the technical condition but also other indicators of the quality of cars change.

Based on the summarization of the data given by various authors, Kuznetsov ES concludes that indicators characterizing productivity and workability change over time, as a rule. The table shows the data reflecting the changes in the operation of a large-class bus depending on the speed of travel [14].

Notes:

– the laws of change of quality indicators by working time are considered as an idealized model of a real process for a situation where working conditions do not change over time and work time increases with constant intensity;

– mathematical models of the idealized process of the change of the parameters of the technical condition during the working time were established;

– a simple summary of the results of previous studies does not allow us to adequately interpret and model the real process of changes in the quality of vehicles during working hours [15].

Conclusions

None of the available practical software packages fully meet the requirements of the processes of development and use of the considered models of laws; excludes the possibility of purchasing them for institutions; unauthorized copies of packages do not work or have an interface in English, which prevents their effective use by uneducated users; in addition, the use of pirated programs is shown to be contrary to the principles of international law.

References

1. Davronzoda, X. D., & Abdubannopov, A. (2023). Analysis of the existing aspects of the problem of processing and use of vehicle tyres. American Journal of Technology and Applied Sciences, 19, 149-155.
2. Ismoilov, A., & Abdubannopov, A. (2023). A machine for continuous planting of tree seedlings. American Journal of Technology and Applied Sciences, 19, 1-6.
3. Ismoilov, A., & Abdubannopov, A. (2023). Development of modern directions of driving training and recommendations for increasing traffic safety. European Journal of Emerging Technology and Discoveries, 1(9), 1-7.
4. Adhamjon o'gli, XMM, & Abdulhaq son, A.A. (2022). Organization of car transportation and operating conditions. Pedagog , 5 (5), 281-284.
5. Adhamjon o' g, XMM, & Abdulhaq son, A.A. (2022). Technology of production of nonmetallic materials. Pedagog , 5 (5), 261-264.
6. Adhamjon o'g, XMM, & Abdulhaq son, A.A. (2022). Operational characteristics of automobile transport vehicles. Pedagog, 5 (5), 252-257.
7. Adhamjon o' g, XMM, & Abdulhaq son, A.A. (2022). Reduction of gas engine thermal load. Pedagog, 5 (5), 273-280.
8. Abdubannopov, A., Kambarov, U.B., Makhmudov , I., & Khametov, Z. (2022). Studying the effect of driver training in modern methods on ensuring traffic safety. Evraziysky zurnal akademicheskikh issledovaniy, 2 (6), 847-851.

9. Fame son, AX, Bahadirjan son , LA, & Abdulhaq son , AA (2022). shipping _ organize reach and of roads importance . Journal of pedagogs, 10 (4), 213-219.
10. Komronbek Grandfather Og, Q., Rakhmonali Khojamkul Og, A., & Abdulhaq son, A.A. (2022). Evaluation of usage of transport vehicles. Galaxy International Journal of Interdisciplinary Research, 10 (3), 344-349.
11. Abdulkhaq son, A.A. USE evaluation». Editorial college , 287.
12. Siddikov , B., Abdubannopov , A., & Khametov , Z. (2022). Gas engine thermal load reduce. Evraziyskiy zurnal akademicheskikh issledovaniy , 2 (6), 388-395 .
13. Abdulhak , AA (2022). Transportation loads and their calculation modes. Galaxy International Interdisciplinary Research Journal , 10 (3), 365-367.
14. Bubb, H. (2011). Traffic safety through driver assistance and intelligence. International Journal of Computational Intelligence Systems, 4(3), 287-296.
15. Xametov, Z., Abdubannopov, A., & Botirov, B. (2021). Yuk avtomobillarini ishlatishda ulardan foydalanish samaradorligini baholash. Scientific progress, 2(2), 262-270.