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METHODS OF ANALYZING THE STRUCTURE OF THE MODULAR CAR PARK AND THE INTENSITY OF ITS OPERATION

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Abstract:

Full satisfaction of the development needs of the country's economy by road transport is an important task in the field of transport. This task in road transport is achieved through an extensive quantitative increase in the country's car fleet, as well as through intensive and high-quality improvement of the produced vehicles, improving the fleet structure, by increasing the technical readiness of vehicles. The article deals with the analysis of parking lots of vehicles with the aim of solving the problems of the production and technical base of road transport, which are now becoming increasingly important.

Key words: *module, car, pattern, system, technology, innovation.*

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INTRODUCTION:

The efficiency of using a modular car park and the intensity of its operation, based on the example of motor transport enterprises of the Russian Federation, is based on the technical condition. The principles of modularity are widely applied to all types of transport. In trucks, the concept of modularity is already widely used by the development of structural units that allow to build and upgrade automotive structures with minimal time loss (Figure 1).

Figure 1: The concept of a modular truck

At present, the motor transport enterprises of the Russian Federation do not have a high-quality production and technical base for the maintenance and repair of modular vehicles.

Based on this, it becomes necessary to create mathematical models that provide:
- distribution of the base number of modular vehicles into relatively homogeneous classes according to their quantity;
- formation of irregularities in the distribution of the number of considered types of modular vehicles for selected groups with the definition of the necessary statistical data;
- detection of regularities of changes in the age structure of automobile rolling stock of Russian production and the most common brands of other foreign manufacturers,
- the study of patterns that characterize the performance of rolling stock, depending on the number of modular vehicles in the motor transport enterprises (with the allocation of characteristic classes).

MATERIAL AND METHODS:

The distribution according to a numerical indicator on relatively homogeneous groups of the initial set of cars (total, modular cars and others) can be made on the basis of finding from the initial set of random variables (the number of modular cars in enterprises of our country) homogeneous groups with corresponding estimates of the parameters and distribution functions that is the solution of the tasks of the first and second stages (Figure 2).

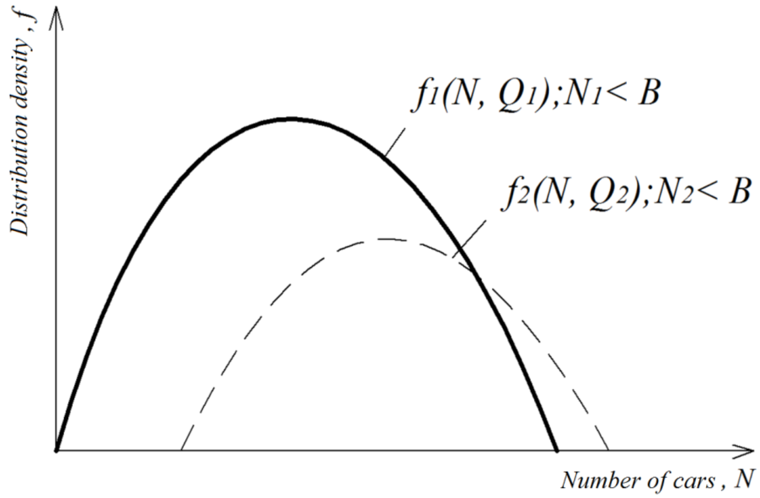

Figure 2: Graphic illustration of the separation of the original set

where B - estimates of the parameters of the distribution of differential functions (density of distributions).
N_1 and N_2- number of vehicles belonging to the original set B (in all motor transport enterprises);

Figure 2 shows in general terms the possibility of dividing the original set N into two subsets (f_1 and f_2), although it is also true for dividing into another number of subsets, provided that the criterion is maximized F_{max}.

RESULTS AND DISCUSSION:

Considering the uneven quantitative structure of the rolling stock in this work, we proceed from the condition of a possible asymmetric distribution of differential functions t (...), for which the Weibull-Gnedenko distribution can be used, allowing, depending on the shape parameter, to fairly accurately describe the patterns of distribution of random variables (in this case, the number of vehicles) in a wide range of coefficients of variation V_{ma}:

$$t(V_{ma}) = \frac{\alpha}{\beta} V_{ma}^{\alpha-1} \exp[-\frac{V_{ma}^{\alpha}}{\beta}] \quad (1)$$

where α - distribution form parameter (tabulated value),
β -reduced mean for set$\{V_{ma}\}$
Wherein α and β have a look:

$$\begin{cases} \alpha = \tau[U_{ar}(V_{ma})] \\ \beta = a^{a} \end{cases} \quad (2)$$

where a - scale parameter for Weibull distribution.
Options α and β otherwise can be determined from expressions of the form:

$$\begin{cases} \beta = \left[\frac{V_{ma}}{b_a}\right]^{a} \\ \alpha \approx 1{,}042U(V_{ma})^{-1{,}0473} \end{cases} \quad (3)$$

where V_{ma}- estimation of the mathematical expectation of the number of vehicles at a motor transport enterprise,
$U(V_{ma})$ – variation coefficient for a set of values$\{V_{ma}\}$,
$b_a = \tau\left(\frac{1}{a}+1\right)$- parameter defined by the gamma function values for ($X = \frac{1}{a} + 1$).
Solving the tasks of the third and fourth stages - identifying patterns of quantitative changes in the age structure $V = t(A)$ rolling stock and its performance Z = T(V) (depending on the number of vehicles at the motor company), which can be based on the use of correlation - regression analysis methods.
Analytical representation of statistical data can be described on the basis of linear, exponential, power, logarithmic, polynomial and other models of the form:

$$\begin{cases} W = t(V = y) \\ V = t(A = y) \end{cases} = \begin{cases} \begin{cases} a + by & or \\ a\exp(by) & or \\ ay^{b} & or \end{cases} \\ \begin{cases} a + b\ln(y) \; or \\ a_0 + a_i y^{i} + a_n y^{n} \; and \; other, \end{cases} \end{cases} \quad (4)$$

where Z- the volume of transport work performed by rolling stock of motor transport enterprises with the number of vehicles in them equal to V,
V - number of cars with age $Y = T_{years}$,
a_0, a_i, a_n, b– partial coefficients of the models under consideration,
Y - a variable taking the values of T (when analyzing the age structure) or N (when analyzing the volume of traffic).
Analytical dependences fairly accurately describe the linear and nonlinear change of the studied variables A

or V. Building models of the connection between the factor A or V under consideration and the resulting attribute V or A, Z = t (V) or V = t (A) is made on the basis of known mathematical principles. statistics. Checking the adequacy of the models is carried out on the basis of a comparison of the calculated (experienced) value of the Fisher criterion. F_{exp} with its tabular value F_{tab}. (condition of adequacy of models - $F_{exp} \geq F_{tab}$), and checking the significance of the coefficients a_0, a_i, a_n, b- with the help of an experienced t_{exp} and tabular t_{tab} Student criterion values (the condition of meeting the requirement of the significance of the coefficients -$t_{exp} \geq t_{tab}$) for given levels of significance and the number of degrees of freedom.

When analyzing the dependencies Z - t (V), in the case of a compact, cluster distribution of the original set of points in a two-dimensional space (on a plane in the coordinates Z; V), the conditions for obtaining, along with the regression analytical dependencies Z = t (A), also distributions $t_i(V)$ and $t_i(Z)$. For the modular-type cars under consideration, with corresponding statistical characteristics, the indicated dependences are reflected in general form in Figure 3. In this case, the construction of the patterns of distributions $t_i(Z)$ and $t_i(V)$ carried out on the basis of the known provisions of the theory of probability and mathematical statistics.

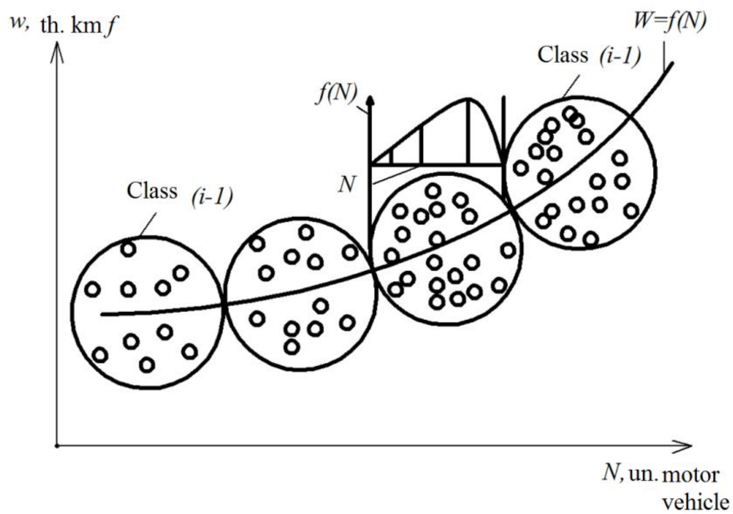

Figure 3: Graphic illustration of the theoretical dependence *W = f (N)* and distributions for homogeneous classes of dependencies of traffic volume and the number of modular vehicles

CONCLUSION:

The demonstrated theoretical studies create the necessary initial conditions for the subsequent development of models for the formation of the structure and network of centers for specialized maintenance and repair of modular trucks in the Russian Federation.

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