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Method of Providing Safe Technical Condition of Vehicles by Technological Design of Enterprises

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Abstract

The problem of minimization of impact of vehicles' technical condition (V) and technological design of the production base for motor transport enterprises (MTEs) on the road traffic accident rate is investigated in the article. It is shown that the deterministic cycle method, used in practice, possesses low efficiency for small MTEs as well as for service stations maintaining their rolling stock.

Correction of the methodology of technological calculations to ensure the guaranteed performance of works on subsystems and vehicle aggregates having the most influence on the accident rate is substantiated. The normal law of distribution of initial parameters of data for technological design is substantiated. The fundamentals of the methodology for using in calculations not a constant value of the average daily run, but its randomly distributed value are stated. The formulas enabling to determine the distribution parameters of the technical readiness coefficient and volumes of the works performed are proposed.

The quantile of the standard normal distribution used in formulas, the value of which is assumed according to the specified probability of work performance, enables, when determining capacities necessary for technical servicing and repair (TSR) of separate systems, units and aggregates, to specify probability of their performance taking into account the impact on the safety parameters.

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Keywords: technical condition of vehicles; control of technical condition; design of motor transport enterprises; technical readiness coefficient

1. Main text

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Traffic safety (TS) ensuring is defined as the activity aimed at prevention of causes of road traffic accident (RTA) occurrence and decrease in severity of their consequences [State Duma (1995)].

It means that, without substantiation of causes of RTA occurrence, the organization of purposeful actions for their prevention is impossible. One of the ways of search and substantiation of RTA causes is investigation of the mechanisms of production activities at the MTE, detection of a great number of factors influencing the level of the ensured TS and causes of non-observance of the required standards and rules, beginning with the technological design of the MTE. The condition of the road accident rate as to the factor of the technical condition of motor vehicles (MV) has deteriorated dramatically in recent years. For example, for the first 6 months of 2016, due to operation of MVs with technical malfunctions, an increase in a number of RTAs (in comparison with the similar period of 2015) by 122.5% took place in the Russian Federation; the total number of such RTAs amounted to 2103, 371 persons died and 3081 were injured (these indicators increased in comparison with 2015 by 118.2% and 123.6%, respectively) [STSI (2013)].

If we assume that the increase in a number of on-the-road malfunctioning MVs is the main cause of this fact, which is quite probable, it is formally necessary to define the factors contributing to this increase and propose measures for their management on the basis of their analysis.

If we classify MVs according to the form of ownership, the fleet of MVs owned by legal entities is of particular interest as any RTA with their participation leads to both deterioration in the general transport situation and probable human losses, and decrease in functioning efficiency of the MTE in general: increase in total expenditures for transportations and increase in the production cost of its products or services.

The factors contributing to the increase in a number of on-the-road malfunctioning MVs owned by legal entities include the following:

- factor of imperfection of the methodology for technological design of MTEs, related to inconformity of the developed projects of production and technical facilities of MTEs to the requirements of the specific construction of the used MVs;
- factor of MTE scale, increasing unprofitability of application of modern diagnostic devices in small and medium-sized enterprises;
- factor of lack of the available production infrastructure for control of the technical condition of MVs for small and medium-sized MTEs.

Factor of technological design of MTEs. This factor was not investigated in its capacity as a tool of TS ensuring in the Russian Federation, however, there are bases for such investigation [Lavrentyev (2013, 2013[1])].

During the years of reforming the economic structure, the disintegration of large MTEs and formation of a considerable number of small MTEs took place in the Russian Federation. Currently, the average number of cars falling on one MTE across Russia does not exceed 30 units. In particular, the MTE structure by groups and quantity of rolling stock units across Saint Petersburg and the Leningrad Region is shown in table 1 [Keveshov and Sabelnikov (2012)].

Table 1. Number of the on-the-road vehicles in MTE separate groups.

Region	Number of vehicle fleet units				
	Less than 10	11–50	51–100	101–300	More than 300
Saint Petersburg	15,962	1784	250	120	63
Leningrad Region	6272	906	103	23	3
Total:	22,234	2690	353	143	66

The development of optimum technological solutions and organizational conditions providing release of technically sound MVs on the road according to the schedule and at the minimum resources' consumption is provided, as it is known, by MTE technological design [Takhtamyshev (2011)]. At the moment, the technological design (calculation) is developed mainly according to the deterministic cycle method for the majority of MTEs in the Russian Federation. The calculations according to this method are based on the assumption of the constancy of the average daily run, idle time in maintenance and current repairs and so on, although the majority of them have a