

Traffic Safety Subsystem Management at Enterprises Engaged in Road Transport Activities

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Abstract – This article discusses the management of the traffic safety subsystem at enterprises engaged in road transport activities. For the successful functioning of industrial enterprises in modern conditions of economic development, along with the growth of production volumes, fewer costs are required. To this end, in recent years, many enterprises and individual entrepreneurs have refused to outsource transport activities, which have a negative impact on road safety issues. The authors have developed a methodology for assessing the effectiveness of traffic safety based on scientifically based criteria. The technique is based on the application of the method of weights and the first step is to determine the set of factors that have the greatest impact on the final result of the automotive business. To improve the performance of the road safety monitoring subsystem at enterprises operating in the transport sector, the data are calculated for determining the integral indicator which are taken on the basis of annual monitoring of individual indicators, the list of which is set by experts for enterprises and entrepreneurs individually. This method allows you to control the road transport activities of industrial enterprises and individual entrepreneurs in order to develop methods for improving road safety.

Key words — road safety, road transport company, road transport activities, weighting factors method, automobile business

I. INTRODUCTION

For the successful functioning of industrial enterprises in modern conditions of economic development, along with the growth of production volumes, fewer costs are required. To this end, in recent years, many enterprises and individual entrepreneurs have refused to outsource a transport activity, which has a negative impact on road safety issues.

According to Federal State Statistics Service [2], the fleet of motor vehicles in Russia exceeds 50 million units. Moreover, over the past 15 years, more than 81 % of the total rolling stock in the Russian Federation is car (Figure 1).

In the past 15 years, there has been a steady trend towards an increase in the number of vehicles owned by citizens: in 2000, the share of trucks was 35.6 %, and in 2015 – 60.8 %;

the share of buses in 2000 was 29.1 %, and in 2015 – 49.7 %. This indicates that, on average, the fleet of individual entrepreneurs engaged in road transport activities increased by 23.2 %. At the same time, the age structure of the rolling stock fleet (Figure 2–4) significantly reduces the reliability of vehicle operation and, therefore, negatively affects road safety.

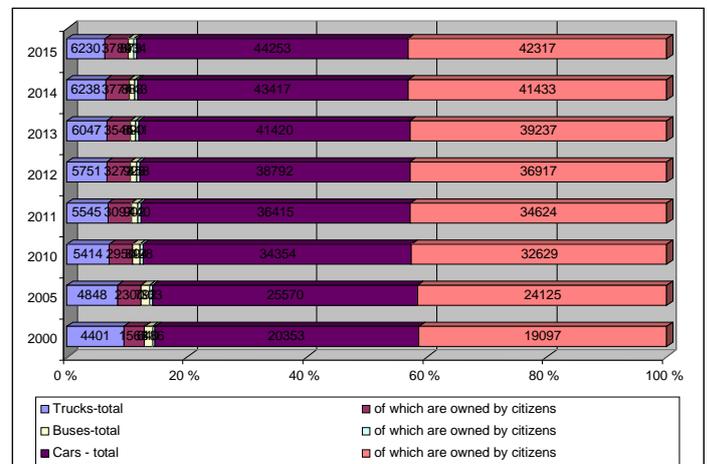


Fig. 1. Park of motor transport in Russia

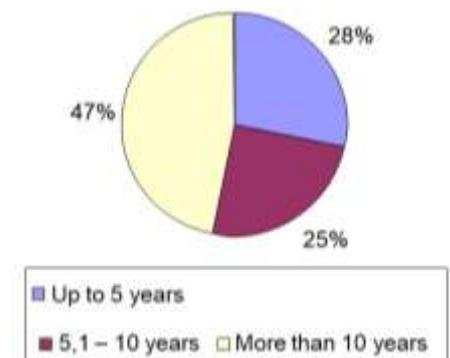


Fig. 2. The age structure of the rolling stock of passenger cars

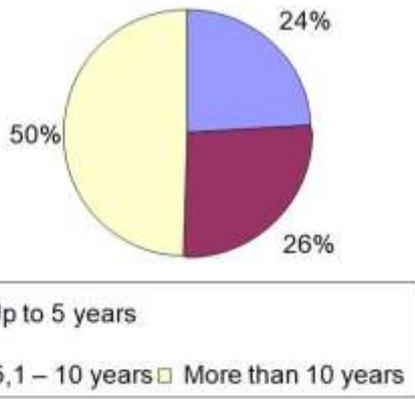


Fig. 3. The age structure of the rolling stock of buses

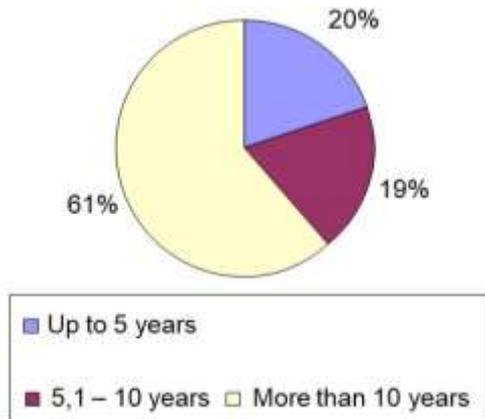


Fig. 4. The age structure of the rolling stock of trucks

We consider the motor transport activities of several positions: on the one hand, the production of enterprises in various sectors of the economy depends on the work of transport, and on the other hand, without the exchange of goods that transport provides, the market cannot function. The structure of the transport process can be represented as a diagram (Figure 5).

To improve the efficiency of the rolling stock and reduce the cost of transportation, it is necessary to apply economic-mathematical methods and calculations.

During the implementation of the transport process, one of the conditions is the development of a system of indicators characterizing the efficiency of transportation. This is due both

to the diversity of goals and methods of performance evaluation, and to the understanding of the term “effectiveness”.

Economic efficiency can be defined as the maximum possible benefits from the use of specific resources.

Economic efficiency is a relative indicator that directly depends on two absolute indicators: profit (effect) and costs used to obtain this profit (effect). Complex economic efficiency cannot be determined without the use of additional analytical indicators, the system of which may differ significantly in various fields of knowledge and branches of the national economy. For example, in transport, such indicators include labor productivity, capital intensity, capital productivity, profitability, etc.

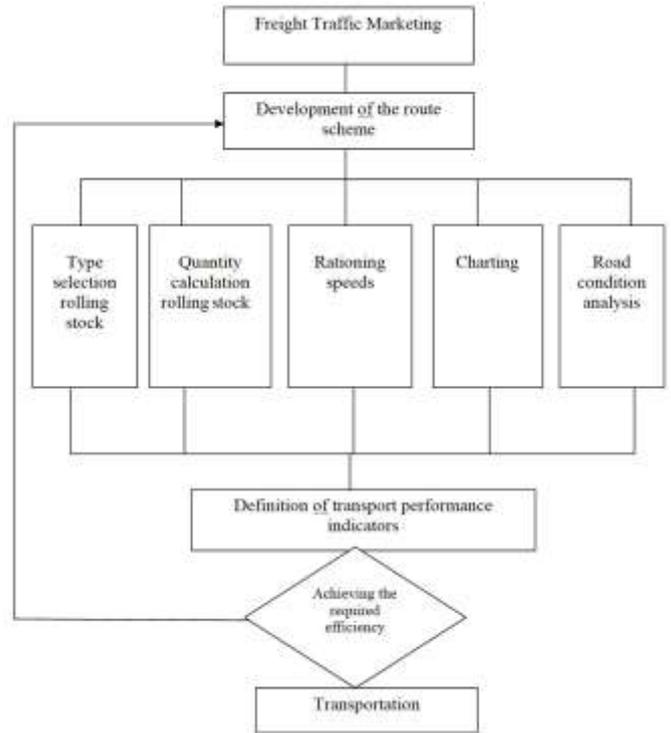


Fig. 5. Structure of the transport process

Significantly performance evaluation indicators may vary at the macro and micro levels. Additional indicators may also be required in evaluating the effectiveness of long-term projects.

TABLE I. RESPONSIBILITIES OF THE SUBJECTS OF ROAD SAFETY ACTIVITIES

Organizational	HR	Technical
Analysis and elimination of the causes of road accidents (RTA) and traffic violations with the participation of their vehicles (C)	Organization of the work of drivers in accordance with the requirements of road safety (road safety)	Ensuring compliance of the technical condition of the vehicle with the requirements of road safety
Ensuring the fulfillment of the statutory obligation to insure the civil liability of vehicle owners	Creation of conditions for advanced training of drivers and other workers who provide road safety	Equipping the vehicle with technical means of control, providing continuous, uncorrectable registration of information on the speed and route of vehicles, on the mode of work and rest of drivers of the vehicle.
Compliance with the established by law regime of work and rest of drivers	Organization of events for improving the skills of first aid to victims of road crash crash by drivers	
Organization of mandatory medical examinations of drivers of vehicles		

Taking into account the above, the efficiency of road transport activities can be quantitatively determined using a system of interrelated indicators characterizing the effectiveness of the main elements of the transport process.

On the territory of the Russian Federation, all enterprises and individual entrepreneurs operating through the operation of vehicles must comply with the requirements of the Federal Law "On Road Safety" [2] (Table 1).

II. ANALYSIS OF SIMULATION RESULTS AND EXPERIMENTAL DATA

One of the most difficult problems in ensuring road safety is staffing. The annual output of specialists in the field of transport operation over the past 10 years has decreased by 9.8 %. Given the growth rate of the rolling stock fleet and the number of enterprises and individual entrepreneurs, the problem of "lack of personnel" significantly affects the reliability of the road safety system.

A key point of the road safety management system in enterprises that do not operate in the transport industry is control over the operation of the system. The authors have developed a methodology for assessing the effectiveness of traffic safety based on scientifically based criteria.

The technique is based on the application of the method of weights and the first step is to determine the set of factors that have the greatest impact on the final result of the automotive business.

At the second stage, the relative importance of each factor is assessed. As a result, a certain "weight" is assigned to each factor. Studies show that it is advisable to single out 4-6 of the most significant factors among a set of factors for evaluation. We suppose that we have identified five such factors, if their total mass should be evaluated as a whole, taking into account the "weight" of the identified factors, each weight factor should be assigned, the value of which should lie in the interval from 0 to 1, and the total amount of weight factors should be 1, while each of the identified factors becomes a criterion for evaluating road transport activities [3].

At the third stage, for each factor, it is determined by the product of its weight and the estimates for each of the compared criteria, and then the total weight of each criterion is calculated.

Methods for evaluating the performance of industrial enterprises and individual entrepreneurs on road safety are necessary not only to assess the quantitative values of the safety level [4], but also to monitor the work of the road safety management subsystem, to identify the advantages and disadvantages of road transport during monitoring, stabilize and increase the former and minimize or eliminate the latter.

The methodology for evaluating the performance of manufacturing enterprises and individual entrepreneurs in the field of road traffic allows solving the problem of increasing the reliability of the production system by managing the road safety subsystem, since motor activity is assessed according to scientific criteria [5].

Thus, the proposed method allows for a comprehensive analysis, as well as operational management and forecasting of enterprises and individual entrepreneurs to ensure road safety, which in turn leads to the possibility of determining the main directions of increasing the level of safety in the managed subsystem.

The diversity of the road safety management subsystem in enterprises operating in the transport sector [6], which is solved using methods, necessitates the use of different weighting algorithms. Since it is impossible to clarify the universal system of criteria and indicators for evaluating the performance of industrial enterprises and individual entrepreneurs to ensure the safety of everyone without exception, in most cases it is the task of expert people with experience in the relevant field [7].

Consider the results of studies of the effectiveness of the system of traffic safety assessment using the example of an enterprise selected as a result of an analysis of a representative sample of 49 enterprises of the agro-industrial complex of the Krasnodar Territory.

The integral indicator (R) is the final indicator of the effectiveness of the use of the system for assessing the quality of road safety in the enterprise based on criteria. Total integral indicator for all criteria:

$$\Sigma R_m = R_1 + R_2 + R_3 + \dots + R_i, \quad (1)$$

The calculation of the complex indicator for each of the criteria was carried out in the following areas of production activity:

- the activities of the administration, public organizations of the enterprise;
- issues common to all services and departments of the enterprise;
- production and technical activities and product quality control;
- operation of fixed assets;
- control and auditing activities.

Each complex indicator (R_i) was calculated using the following formula:

$$R_i = X_1k_1 + X_2k_2 + X_3k_3 + X_4k_4 + \dots + X_jk_j, \quad (2)$$

where X_j – is a particular criterion;

k_j – is a weighting factor.

The value of the particular criterion was taken to be 0, 5, or 10. If the condition required by the criterion is fully met, the value $X_j = 10$, if there is a remark and the criterion is not performed sufficiently qualitatively $X_j = 5$, and $X_j = 0$ if the requirements by criterion are not met.

The weighting factor is selected based on the degree of influence of each criterion on the final result of motor transportation activity. In this case, when road transport activities are not commercial, the level of accidents was used as an end result in order to manage the traffic safety

subsystem. The degree of influence is determined by the method of expert assessments with a sufficient statistical base of the study [9].

The results of the calculation of the integral indicator according to formula 2 are presented in table 2.

TABLE II. THE RESULTS OF THE CALCULATION OF THE INTEGRAL INDICATOR

Indicator number	Name	Value
1	The activities of the administration, public organizations of the enterprise	7,1
2	Questions common to all services and departments of the enterprise	7,8
3	Production and technical activities and product quality control	6,7
4	Operation of fixed assets	7,8
5	Control and auditing activities	8,25

III. CONCLUSION

Based on the data on complex indicators, the value of the integral indicator was 7.43. Further, based on the rating scale, compiled by the method of expert assessments, it was found that the functioning of the traffic safety subsystem can be assessed as satisfactory. When assessing, a three-level scale was applied (positive, satisfactory, negative) [10].

To improve the performance of the road safety monitoring subsystem in enterprises operating in the transport sector, calculated data for determining the integral indicator are taken on the basis of annual monitoring of individual indicators, the list of which is set by experts for enterprises and entrepreneurs individually. This method allows you to control the road transport activities of industrial enterprises and individual

entrepreneurs in order to develop methods for improving road safety.

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