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THE METHOD OF CHOOSING THE OPTIMAL VEHICLE FROM A SET OF ALTERNATIVES

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Abstract- Most of the problems of optimizing to choice the vehicles are related to the necessity of their solutions to some extent uncertainty. Formalization of uncertainty in mathematical models of systems and processes considered in this article which provides the means of improving the adequacy of these models and, as a consequence, the validity and effectiveness real decisions based on their method of selecting the optimum vehicle.

Keywords: Vehicle Transport Process, Logistics Method, Uncertainty, Fuzzy Logic, Transportation Process.

I. INTRODUCTION

In connection with the transition to a market economy, an important character becomes the problem of modeling and optimization of road transport logistics. The researches conducted by the author found that the decision complex problems of transport process necessitates integration planning and logistics management, modeling and decision-making methods taking into account the characteristics of the object and the conditions of their functioning.

The past experience solving oriented priorities planned economy, now requires a thorough analysis and review. If fundamental condition was earlier position of the maximum load all productive resources, today it is the first necessary considered as: a high level of compliance with delivery schedules; low stocks; minimum cost of shipping supplies.

In modern conditions of effective logistics activities depends primarily on ensuring the efficient interaction of all elements connecting them. Transport task as part of the distribution system and the link in the logistic system is providing guaranteed delivery of goods to the necessary extent and in a timely manner.

Currently road runs more than 75% of freight and growth trend of this share, aided by the benefits of such vehicles as mobility, flexibility, delivery of cargo "door to door" low fares in comparison with other modes of transport. Despite the advantages of road transport, the current state of vehicle fleets is problematic. In transport companies more than 60% of trucks (GA) operated beyond the rated life, which leads to increased downtime for maintenance and repair (TOR). In addition, the structure of the car park and on-duty for body type does not match the demand of transport services market. State fleets requires urgent renovation of PS.

One of the important issues related to improving the quality of road transport is the selection of vehicles for transportation of goods. Justification of rational types and models of rolling stock provides an opportunity to carrier selection, effective use of the car park, reduce the amount of resources involved for the performance of transport and, consequently, reduce the total cost of production and distribution of products.

Today for transport and other enterprises engaged in transportation of goods, as well as organizations using their services, urgent problem is the following: under what conditions the use of some variety of ATS would be the most effective. Each type of rolling road transport has advantages and disadvantages that are caused by certain values of its technical and operational parameters and design features. These parameters and characteristics influence the outcomes of the transport process and the use of the entire fleet of ATS.

In some circumstances, the use of a type of rolling stock may be appropriate, while in others - no, but it shows that when transporting cargo specific for each vehicle there is a certain range (area) rational use. Then, in turn, raises questions: what factor exists to assess this range? What methods or ways you can define it? How accurately reflects the real character of the transport and process?

Road transport is one of the first sectors of the economy that have adopted mathematical planning methods. Real life provides a very wide variety of scheduling problems in road freight transport.

Effectiveness of the organization of the transportation process more fully reflect the cost criteria. They can be economically correct to express often conflicting natural criteria. However, the solution to the problem of choosing the optimal cargo vehicle by calculating the economic efficiency and reduced costs requires the expenditure of considerable time, which is unacceptable in operational planning.

II. STATEMENT OF THE PROBLEM

Currently, a number of reasons road transport fully meets the needs of suppliers and consumers. This is due to many reasons, including:

• lack of a systematic approach, and one agreed delivery technology goods, leading to inconsistent goals and objectives of the models used; refusal to solve the problems of decision-making, are mathematically ill formalized [2].

Selection in the formation of SS park ATP requires a robust and reliable technique techno-economic evaluation. The analysis shows that the known methods do not allow an objective assessment purchased and selection of trucks, which limits their application in practice.

Due to the fact that the complex technical and economic problem of choosing the MS is not completely solved, an article devoted to the development of procedures for the selection of trucks for ATP, is relevant.

The main features of multicriteria problems in the presence of clearly defined criteria are:

a) the existence of a set of alternatives;

b) the existence of a set of constraints that must be considered when selecting alternative solutions;

c) the existence of a function of preference, putting each alternative in line win / loss, which will be obtained when choosing this alternative.

Operational management controllers used intuitive selection of good alternatives, as the analysis, it is often poor even in the sense of a specific quantitative indicator. The goal is to accurately assess the quality of decision making in situations of a certain type, when you know the type of cargo volume and distance traffic.

Determination of the set of feasible alternative vehicles is carried out by analyzing the practical situations together specific restrictions taking into account individual characteristics of the rolling stock, as well as opportunities for loading and unloading points. Therefore, the task at hand concerns only those alternatives that satisfy a certain number of organizational and technological constraints. Selected alternatives characterized by a number of signs (indicators).

Formation of selection criteria through a simple, quantitative characteristics of ATS and transportation process. Fixing the decision criteria can go to the selection. Note that we now have the concepts of "good" or "bad" will not operate at the level of intuition, and by comparing the values of well-defined quantitative indicators.

III. METHOD

Today the market is filled with many similar models of trucks domestic and foreign production. Before motor transport enterprises (ATP) is often a problem of choosing the type of MS, because decision to acquire differently SS without proper justification is often ineffective.

In [1] the problem of choosing the optimal rolling solved on the basis of a modified branch and bound method using graph theory. In [2] conducted studies have found that exposure to a broad and diverse road and climatic conditions on the road surface, it was found that the speed of the vehicle can be integrally estimated coefficients of rolling resistance and grip.

Solution of the problem possible by applying the theory of fuzzy sets; were analyzed by traditional statistical, technical and fundamental approaches to planning elements trucking logistics, was shown that a number of methods do not meet the requirements of today. To solve the problem in the first place determined by the set of feasible alternatives and criteria for choosing the best option.

Transportation planning is mainly based on the experience of the dispatch group, which is currently not able to properly cope with this problem, because of the increasing volume of traffic and complicating conditions. More efficient use of vehicles (ATS) achieved improved transport organization with the help of mathematical methods for solving problems.

Effectiveness of the organization of the transportation process more fully reflect the cost criteria. They can be economically correct dropped often conflicting natural criteria. However, the solution to the problem of choosing the optimal cargo vehicle by calculating the economic efficiency and reduced costs requires the expenditure of considerable time, which is unacceptable in operational planning.

In operational decision problems related to the choice alternatives, sometimes you have to take on the basis of vague and limited information. Even in the specific situation, i.e. for known values of all variables, we can not immediately specify your decision, as there is a danger to get a bad grade, poorly chosen alternative.

The essence of the idea of the method of choice perfect vehicle of a possible set of alternatives is to use a set of indicators that the links between them with some precision reflect the real situation and provides optimal decision. The general approach to solving the problem is as follows: To solve the problem in the first place determined by the set of feasible alternatives and criteria for choosing the best option.

A specific feature of fuzzy tasks is also the symmetry of objectives and constraints, which eliminates the differences between them in terms of their contribution to the formulation and solution of problems [5]. Thus, the mathematical model of choice-making is constructed. There are plenty of alternatives X, and each alternative is characterized by several features. Now the choice of the best alternative is reduced to a mathematical problem. Let known mass planned to shipping between points A and B, the distance between which is eAB.

Transportation may be carried out in a plurality of alternative vehicles. Each alternative has a number of indicators that can be used as a comparative m selection criteria. Want to expand the problem of choosing the optimal vehicle with a set of criteria.

Given that the PBX have different load and speed that will be different amount of time to perform one haul, and the total volume of traffic. Thus, there will different and operating costs. It should be noted that some criteria dominate, while some others can be considered a subsidiary. Integrality conditions of the rider to determine the necessary number of alternatives for each is, $z_i = [Q / gHI]$. Knowing the number of rider can determine the required mileage for each alternative provided export cargo. Here we assume that the path is laden with cargo.

$$L_i = l_{er} / \beta_e z_i \tag{1}$$

Time spent on the delivery of all cargo volume, determined by the formula

$$T_{gi} = (t_g b_i + t_{n-p_i}) z_i \qquad (2)$$

where $t_g b_i$ is the time spent on the ith motion for PBX haul; t_{n-p_i} is runtime-handling operations for the ith haul PBX.

Now we can define the cost of fuel Z_T to perform loading and unloading operations Z_{n-p_i} and payroll driver

$$Z_{T_i} = L_i \cdot H'_{T_i}$$
$$Z_{n-p_i} = C^{1T}_{n-p_i} \cdot g_{H_i} \gamma_{Ci} \cdot z_i \qquad (3)$$
$$Z_{b_i} = T_{g_i} \cdot C'_{ri}$$

where H'_{T_i} is fuel ith vehicle to overcome the 1 km, $C^{1T}_{n-p_i}$ is the cost of loading and unloading 1 ton of cargo, and C'_{ri} is driver's hourly rate of i-PBX.

Selection of the optimal-PBX based on the entire complex design parameters and operating costs

$$W = f\left(g_H,\ v_t,\ R_{\Pi},\ t_{TOP},\ N_{\text{уд}},\ \text{З}_T,\ \text{З}_{n-p},\ \text{З}_b,\ T_g,\ T_{n-p}\right) \qquad (4)$$

The following problem is:

There are 5 alternative ATS $\{a_1, a_2, a_3, a_4, a_5\}$ for the implementation of the transportation process, where a_1 is ZIL 130, a_2 is MAZ 500A, a_3 is KAM AZ 5320, a_4 is KR AZ 257B1, and a_5 is KR AZ 255B (combination).

- Multi-criteria decision-making model [4] can be represented as a set of elements. The article presented as a set of 13 indicators

Each alternative is characterized by 13 parameters $\{C_1, C_2, ..., \text{C13}\}$, where C_1 is carrying capacity (t); C_2 is maximum speed (km/h); C_3 is turning radius (m); C_4 is fuel consumption at v = 40 km/h, (l/100 km); C_5 is the length of the vehicle (m); C_6 is specific power (lc/t); odds. curb weight; dynamic factor of adhesion, at = 0.4; C_9 is the time it takes to perform loading and unloading operations (hour); C_{10} is the time it takes to perform loading and unloading operations (hour); C_{11} is total mileage associated with the performance of a given volume of traffic (km); C_{12} is the cost of fuel and lubricants (Manants, Azerbaijani currencies about equals to Euro); and C_{13} is the cost of vehicles (million Manats).

The problem is to determine the alternative of $\{a_1, a_2, ..., a_5\}$, which is better than the other alternatives in terms of criteria for all $i=\overline{1,13}$.

This problem is, the problem of choosing an alternative in the face of uncertainty, which may be more appropriately characterized as a fuzzy uncertainty. This is due to the fact that the compliance of an alternative to the ith criterion can be assessed subjectively in particular by peer review. It is known that this problem can be solved using the method of

$$D = C_1 \cap C_2 \cap .... \cap C_n \qquad (5)$$

As previously indicated, the evaluation of alternatives by can be expressed through $\mu_{c_i}(a_i) \le [0,1]$ i.e. in terms of the reliability with regard to (1), the problem reduces to determining:

$$\mu_D(a^*) = \max_{j=1,5} \min_{i=1,13} \mu_{c_i}(a_j) \qquad (6)$$

where a^* is the optimal alternative.

Finding effective solutions is impossible without accurate, high-quality information about the preferences of different criteria. As the complexity of the situation, the role of such inaccurate information quality increases [3].

After determining the extent to which each alternative a_i=1.5 k criteria, C_i, $i=\overline{1,13}$.

We can obtain the following fuzzy sets as Equation (7):

$$C_1 = \left\{\mu_{c_1}(a_1)/a_1, \mu_{c_1}(a_2)/a_2, \mu_{c_1}(a_3)/a_3, \mu_{c_1}(a_4)/a_4, \mu_{c_1}(a_5)/a_5\right\}$$
$$C_2 = \left\{\mu_{c_2}(a_1)/a_1, \mu_{c_2}(a_2)/a_2, \mu_{c_2}(a_3)/a_3, \mu_{c_2}(a_4)/a_4, \mu_{c_2}(a_5)/a_5\right\}$$
$$C_3 = \left\{\mu_{c_3}(a_1)/a_1, \mu_{c_3}(a_2)/a_2, \mu_{c_3}(a_3)/a_3, \mu_{c_3}(a_4)/a_4, \mu_{c_3}(a_5)/a_5\right\}$$
$$C_4 = \left\{\mu_{c_4}(a_1)/a_1, \mu_{c_4}(a_2)/a_2, \mu_{c_4}(a_3)/a_3, \mu_{c_4}(a_4)/a_4, \mu_{c_4}(a_5)/a_5\right\}$$
$$C_5 = \left\{\mu_{c_5}(a_1)/a_1, \mu_{c_5}(a_2)/a_2, \mu_{c_5}(a_3)/a_3, \mu_{c_5}(a_4)/a_4, \mu_{c_5}(a_5)/a_5\right\}$$
$$C_6 = \left\{\mu_{c_6}(a_1)/a_1, \mu_{c_6}(a_2)/a_2, \mu_{c_6}(a_3)/a_3, \mu_{c_6}(a_4)/a_4, \mu_{c_6}(a_5)/a_5\right\}$$
$$C_7 = \left\{\mu_{c_7}(a_1)/a_1, \mu_{c_7}(a_2)/a_2, \mu_{c_7}(a_3)/a_3, \mu_{c_7}(a_4)/a_4, \mu_{c_7}(a_5)/a_5\right\} \qquad (7)$$
$$C_8 = \left\{\mu_{c_8}(a_1)/a_1, \mu_{c_8}(a_2)/a_2, \mu_{c_8}(a_3)/a_3, \mu_{c_8}(a_4)/a_4, \mu_{c_8}(a_5)/a_5\right\}$$
$$C_9 = \left\{\mu_{c_9}(a_1)/a_1, \mu_{c_9}(a_2)/a_2, \mu_{c_9}(a_3)/a_3, \mu_{c_9}(a_4)/a_4, \mu_{c_9}(a_5)/a_5\right\}$$
$$C_{10} = \left\{\mu_{c_{10}}(a_1)/a_1, \mu_{c_{10}}(a_2)/a_2, \mu_{c_{10}}(a_3)/a_3, \mu_{c_{10}}(a_4)/a_4, \mu_{c_{10}}(a_5)/a_5\right\}$$
$$C_{11} = \left\{\mu_{c_{11}}(a_1)/a_1, \mu_{c_{11}}(a_2)/a_2, \mu_{c_{11}}(a_3)/a_3, \mu_{c_{11}}(a_4)/a_4, \mu_{c_{11}}(a_5)/a_5\right\}$$
$$C_{12} = \left\{\mu_{c_{12}}(a_1)/a_1, \mu_{c_{12}}(a_2)/a_2, \mu_{c_{12}}(a_3)/a_3, \mu_{c_{12}}(a_4)/a_4, \mu_{c_{12}}(a_5)/a_5\right\}$$
$$C_{13} = \left\{\mu_{c_{13}}(a_1)/a_1, \mu_{c_{13}}(a_2)/a_2, \mu_{c_{13}}(a_3)/a_3, \mu_{c_{13}}(a_4)/a_4, \mu_{c_{13}}(a_5)/a_5\right\}$$

IV. RESULTS

The extent to which alternatives to the criteria presented in Table 1. In view of Table 1 we obtain the following fuzzy sets as Equation (8).

Table 1. The alternatives criteria

ZIL 130	0.25	1	1	0.69	1	1	0.95	0.395	0.5	0.25	0.23	1	0.29
MAZ 500A	0.4	0.94	0.91	0.96	0.95	0.77	0.988	0.526	0.56	0.38	0.73	0.522	0.27
KAM AZ 5320	0.4	0.88	1	0.86	0.90	0.87	0.92	0.503	0.56	0.37	0.71	0.246	0.29
KR AZ 25B1	0.6	0.75	0.59	1	0.69	0.67	0.95	0.673	0.72	0.6	0.71	0.341	0.32
KR AZ 255B c p/p	1	0.68	0.58	0.82	0.46	0.67	1	1	1	1	1	0.208	0.15

$$
\begin{aligned}
&C_1=\{0.25/a_1, 0.4/a_2, 0.4/a_3, 0.6/a_4, 1/a_5\}\\
&C_2=\{1/a_1, 0.94/a_2, 0.88/a_3, 0.75/a_4, 0.68/a_5\}\\
&C_3=\{1/a_1, 0.91/a_2, 1/a_3, 0.585/a_4, 0.585/a_5\}\\
&C_4=\{0.688/a_1, 0.955/a_2, 0.864/a_3, 1/a_4, 0.82/a_5\}\\
&C_5=\{1/a_1, 0.935/a_2, 0.902/a_3, 0.692/a_4, 0.46/a_5\}\\
&C_6=\{1/a_1, 0.771/a_2, 0.871/a_3, 0.674/a_4, 0.674/a_5\}\\
&C_7=\{0.948/a_1, 0.988/a_2, 0.921/a_3, 0.951/a_4, 1/a_5\} \quad (8)\\
&C_8=\{0.395/a_1, 0.526/a_2, 0.503/a_3, 0.673/a_4, 1/a_5\}\\
&C_9=\{0.5/a_1, 0.563/a_2, 0.563/a_3, 0.72/a_4, 1/a_5\}\\
&C_{10}=\{0.25/a_1, 0.375/a_2, 0.375/a_3, 0.6/a_4, 1/a_5\}\\
&C_{11}=\{0.233/a_1, 0.734/a_2, 0.705/a_3, 0.705/a_4, 1.0/a_5\}\\
&C_{12}=\{1/a_1, 0.522/a_2, 0.246/a_3, 0.341/a_4, 0.208/a_5\}\\
&C_{13}=\{0.292/a_1, 0.27/a_2, 0.286/a_3, 0.3184/a_4, 0.1472/a_5\}
\end{aligned}
$$

Using Equation (7) we obtain

$$
\begin{aligned}
&\mu_D(a^*)=\Big\{\max\Big[\min(\mu_{c_1}(a_1), \mu_{c_2}(a_1), \mu_{c_3}(a_1), \mu_{c_4}(a_1),\\
&, \mu_{c_5}(a_1), \mu_{c_6}(a_1), \mu_{c_7}(a_1), \mu_{c_8}(a_1), \mu_{c_9}(a_1), \mu_{c_{10}}(a_1), \mu_{c_{11}}(a_1),\\
&, \mu_{c_{12}}(a_1), \mu_{c_{13}}(a_1)\Big]/a_1, \min\Big(\mu_{c_1}(a_2), \mu_{c_2}(a_2), \mu_{c_3}(a_2),\\
&, \mu_{c_4}(a_2), \mu_{c_5}(a_2), \mu_{c_6}(a_2), \mu_{c_7}(a_2), \mu_{c_8}(a_2), \mu_{c_9}(a_2),\\
&, \mu_{c_{10}}(a_2), \mu_{c_{11}}(a_2), \mu_{c_{12}}(a_2), \mu_{c_{13}}(a_2)\Big)/a_2, \min\Big(\mu_{c_1}(a_3),\\
&, \mu_{c_2}(a_3), \mu_{c_3}(a_3), \mu_{c_4}(a_3), \mu_{c_5}(a_3), \mu_{c_6}(a_3), \mu_{c_7}(a_3), \mu_{c_8}(a_3),\\
&, \mu_{c_9}(a_3), \mu_{c_{10}}(a_3), \mu_{c_{11}}(a_3), \mu_{c_{12}}(a_3), \mu_{c_{13}}(a_3)\Big)/a_3, \qquad (9)\\
&\min\Big(\mu_{c_1}(a_4), \mu_{c_2}(a_4), \mu_{c_3}(a_4)\mu_{c_4}(a_4), \mu_{c_5}(a_4), \mu_{c_6}(a_4), \mu_{c_7}(a_4),\\
&, \mu_{c_8}(a_4), \mu_{c_9}(a_4), \mu_{c_{10}}(a_4), \mu_{c_{11}}(a_4), \mu_{c_{12}}(a_4), \mu_{c_{13}}(a_4)\Big)/a_4,\\
&, \min\Big(\mu_{c_1}(a_5), \mu_{c_2}(a_5), \mu_{c_3}(a_5), \mu_{c_4}(a_5), \mu_{c_5}(a_5), \mu_{c_6}(a_5),\\
&, \mu_{c_7}(a_5), \mu_{c_8}(a_5), \mu_{c_9}(a_5), \mu_{c_{10}}(a_5),, \mu_{c_{11}}(a_5), \mu_{c_{12}}(a_5),\\
&, \mu_{c_{13}}(a_5)\Big)/a_5\Big]\Big\}=\max\left[\mu/a_1, \mu/a_2, \mu/a_3, \mu/a_4, \mu/a_5\right]
\end{aligned}
$$

$$
\begin{aligned}
&\big[\min\big(0.4, 0.94, 0.91, 0.955, 0.935, 0.771, 0.988, 0.526,\\
&, 0.563, 0.375, 0.734, 0.522, 0.27\big)/a_2\big], \big[\min(0.4, 0.88, 1,\\
&, 0.864, 0.902, 0.871, 0.921, 0.503, 0.563, 0.375, 0.705,\\
&, 0.246, 0.286\big)/a_3\big], \big[\min(0.4, 0.88, 1, 0.864, 1, 0.68, 0.585,\\
&, 0.82, 0.46, 0.674, 1, 1, 1, 1, 0.208, 0.1472\big)/a_5\big]\big\}= \qquad (10)\\
&=\sqrt{\ }\max\big[\min(0.233/a_1, 0.27/a_2, 0.246/a_3,\\
&, 0.3184/a_4, 0.1472/a_5\big]=\{0.3184/a_4\}
\end{aligned}
$$

It should be noted that the importance of the criteria in this problem was taken equivalent. When the difference between the importance of C_i, the problem can be solved with the Equation (7) as follows

$$
\begin{aligned}
&C_1^{\alpha_2}=\left\{\left(\mu_{c_1}^{(a_1)}\right)^{\alpha_1}/a_1, \left(\mu_{c_1}^{(a_2)}\right)^{\alpha_1}/a_2, \left(\mu_{c_1}^{(a_3)}\right)^{\alpha_1}/a_3, \left(\mu_{c_1}^{(a_4)}\right)^{\alpha_1}/a_4, \left(\mu_{c_1}^{(a_5)}\right)^{\alpha_1}/a_5\right\}\\
&C_2^{\alpha_2}=\left\{\left(\mu_{c_2}^{(a_1)}\right)^{\alpha_2}/a_1, \left(\mu_{c_2}^{(a_2)}\right)^{\alpha_2}/a_2, \left(\mu_{c_2}^{(a_3)}\right)^{\alpha_2}/a_3, \left(\mu_{c_2}^{(a_4)}\right)^{\alpha_2}/a_4, \left(\mu_{c_2}^{(a_5)}\right)^{\alpha_2}/a_5\right\}\\
&C_3^{\alpha_3}=\left\{\left(\mu_{c_3}^{(a_1)}\right)^{\alpha_3}/a_1, \left(\mu_{c_3}^{(a_2)}\right)^{\alpha_3}/a_2, \left(\mu_{c_3}^{(a_3)}\right)^{\alpha_3}/a_3, \left(\mu_{c_3}^{(a_4)}\right)^{\alpha_3}/a_4, \left(\mu_{c_3}^{(a_5)}\right)^{\alpha_3}/a_5\right\}\\
&C_4^{\alpha_4}=\left\{\left(\mu_{c_4}^{(a_1)}\right)^{\alpha_4}/a_1, \left(\mu_{c_4}^{(a_2)}\right)^{\alpha_4}/a_2, \left(\mu_{c_4}^{(a_3)}\right)^{\alpha_4}/a_3, \left(\mu_{c_4}^{(a_4)}\right)^{\alpha_4}/a_4, \left(\mu_{c_4}^{(a_5)}\right)^{\alpha_4}/a_5\right\}\\
&C_5^{\alpha_5}=\left\{\left(\mu_{c_5}^{(a_1)}\right)^{\alpha_5}/a_1, \left(\mu_{c_5}^{(a_2)}\right)^{\alpha_5}/a_2, \left(\mu_{c_5}^{(a_3)}\right)^{\alpha_5}/a_3, \left(\mu_{c_5}^{(a_4)}\right)^{\alpha_5}/a_4, \left(\mu_{c_5}^{(a_5)}\right)^{\alpha_5}/a_5\right\}\\
&C_6^{\alpha_6}=\left\{\left(\mu_{c_6}^{(a_1)}\right)^{\alpha_6}/a_1, \left(\mu_{c_6}^{(a_2)}\right)^{\alpha_6}/a_2, \left(\mu_{c_6}^{(a_3)}\right)^{\alpha_6}/a_3, \left(\mu_{c_6}^{(a_4)}\right)^{\alpha_6}/a_4, \left(\mu_{c_6}^{(a_5)}\right)^{\alpha_6}/a_5\right\}\\
&C_7^{\alpha_7}=\left\{\left(\mu_{c_7}^{(a_1)}\right)^{\alpha_7}/a_1, \left(\mu_{c_7}^{(a_2)}\right)^{\alpha_7}/a_2, \left(\mu_{c_7}^{(a_3)}\right)^{\alpha_7}/a_3, \left(\mu_{c_7}^{(a_4)}\right)^{\alpha_7}/a_4, \left(\mu_{c_7}^{(a_5)}\right)^{\alpha_7}/a_5\right\}\\
&C_8^{\alpha_8}=\left\{\left(\mu_{c_8}^{(a_1)}\right)^{\alpha_8}/a_1, \left(\mu_{c_8}^{(a_2)}\right)^{\alpha_8}/a_2, \left(\mu_{c_8}^{(a_3)}\right)^{\alpha_8}/a_3, \left(\mu_{c_8}^{(a_4)}\right)^{\alpha_8}/a_4, \left(\mu_{c_8}^{(a_5)}\right)^{\alpha_8}/a_5\right\} \quad (11)\\
&C_9^{\alpha_9}=\left\{\left(\mu_{c_9}^{(a_1)}\right)^{\alpha_9}/a_1, \left(\mu_{c_9}^{(a_2)}\right)^{\alpha_9}/a_2, \left(\mu_{c_9}^{(a_3)}\right)^{\alpha_9}/a_3, \left(\mu_{c_9}^{(a_4)}\right)^{\alpha_9}/a_4, \left(\mu_{c_9}^{(a_5)}\right)^{\alpha_9}/a_5\right\}\\
&C_{10}^{\alpha_{20}}=\left\{\left(\mu_{c_{10}}^{(a_1)}\right)^{\alpha_{10}}/a_1, \left(\mu_{c_{10}}^{(a_2)}\right)^{\alpha_{10}}/a_2, \left(\mu_{c_{10}}^{(a_3)}\right)^{\alpha_{10}}/a_3, \left(\mu_{c_{10}}^{(a_4)}\right)^{\alpha_{10}}/a_4, \left(\mu_{c_{10}}^{(a_5)}\right)^{\alpha_{10}}/a_5\right\}\\
&C_{11}^{\alpha_{21}}=\left\{\left(\mu_{c_{11}}^{(a_1)}\right)^{\alpha_{11}}/a_1, \left(\mu_{c_{11}}^{(a_2)}\right)^{\alpha_{11}}/a_2, \left(\mu_{c_{11}}^{(a_3)}\right)^{\alpha_{11}}/a_3, \left(\mu_{c_{11}}^{(a_4)}\right)^{\alpha_{11}}/a_4, \left(\mu_{c_{11}}^{(a_5)}\right)^{\alpha_{11}}/a_5\right\}\\
&C_{12}^{\alpha_{22}}=\left\{\left(\mu_{c_{12}}^{(a_1)}\right)^{\alpha_{12}}/a_1, \left(\mu_{c_{12}}^{(a_2)}\right)^{\alpha_{12}}/a_2, \left(\mu_{c_{12}}^{(a_3)}\right)^{\alpha_{12}}/a_3, \left(\mu_{c_{12}}^{(a_4)}\right)^{\alpha_{12}}/a_4, \left(\mu_{c_{12}}^{(a_5)}\right)^{\alpha_{12}}/a_5\right\}\\
&C_{13}^{\alpha_{23}}=\left\{\left(\mu_{c_{13}}^{(a_1)}\right)^{\alpha_{13}}/a_1, \left(\mu_{c_{13}}^{(a_2)}\right)^{\alpha_{13}}/a_2, \left(\mu_{c_{13}}^{(a_3)}\right)^{\alpha_{13}}/a_3, \left(\mu_{c_{13}}^{(a_4)}\right)^{\alpha_{13}}/a_4, \left(\mu_{c_{13}}^{(a_5)}\right)^{\alpha_{13}}/a_5\right\}
\end{aligned}
$$

Thus, the best alternative would be a_4, i.e.KP AZ 257B1.

V. CONCLUSIONS

1. Operational tasks used in controllers control intuitive choice of good alternatives on the basis of vague and limited information, as the analysis, it is often unsuccessful in the sense even specific quantitative indicator.

2. Established the need for a fundamentally different approach to the solution of the problem in a certain type of situations when you know the type of cargo volume and distance traffic. Based on the discrete nature of the transport process, the theory of hierarchical models of motor systems and their functioning.

3. Selection method: The basic idea is as follows: the carriage can be performed a plurality of alternative vehicle X, and each has a number of alternative parameters which may be used as a comparative selection criteria.

4. The problem of solving the problem boils down to choosing the optimal of the vehicle with a set of criteria. This article discusses five alternative rolling stock. Each alternative is characterized by 13 indicators. After determining the extent to which each alternative a_i = 1.5 k criteria, C_i, $i=\overline{1,13}$. We can get a set of fuzzy sets.

5. Problem of selecting an alternative in the real world, which can more adequately qualify as fuzzy uncertainty.

6. Problem lies in determining an alternative of $\{a_1, a_2, ..., a_5\}$, which is better than the other alternatives in terms of the criteria $i=\overline{1,13}$.

7. Experimental verification techniques confirmed with scientific and practical points of view of the effectiveness of the developed principles for selecting optimal rolling stock for the given operating conditions. Right solution of these tasks will improve the performance of vehicles, reduce the amount of costs associated with the delivery of goods.

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BIOGRAPHY

Afiq Allahkverdi Allahverdiyev was born in Azerbaijan, in 1937. He received the M.Sc. degree in the field of Road Transport Operation as a Mechanical Engineer from the Polytechnic Institute of Azerbaijan, Baku, Azerbaijan in 1960. He completed his doctoral thesis on "Development of methods and models for optimizing trucking logistics" and graduated in Ph.D. degree in Automation of the Experimental Study from Faculty Retraining Discounts for New, Promising Areas of Science and Technology in Moscow Car and Road Institute, Russian Academy of Sciences, Moscow, Russia in 1985. Currently, he is an Associate Professor in the field of Road Transport and Traffic Safety in Azerbaijan Technical University, Baku, Azerbaijan. He is the author of 163 scientific papers. His research interests lie in the road transport articles large-management, developing methods and models for the optimization of road transport and logistics automation and process control and production.