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Performance Indicators of Vehicle Use in the Transportation Process

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ABSTRACT: In the article, the connection with the complexity of the design of the car, the diversity of some of its properties and design features, as well as their various combinations, different depending on the operating conditions and type of transportation, it is quite difficult to evaluate the car with one general indicator. Therefore, in this article, the recommended car quality is determined by the complex of its most indicative operational properties: capacity using mass, speed, maneuverability, safety, etc.

KEY WORDS: Classification, Data Mining, Machine Learning, Predictive analysis, Social Networking Spam, Spam detection.

I.INTRODUCTION

The key issue of choosing the most rational transport option is to assess the efficiency of the transport process. The choice of efficiency criteria depends on the specific conditions of transportation and the task to be solved. There are local (private) and generalized (complex) performance criteria.

Local performance criteria are applied if the transport options compared differ by one single indicator. Thus, the introduction of hourly transportation schedules eliminates downtime of cars in the queue.

In this case, the effectiveness of the compared transport options can be estimated by one indicator: the duration of vehicle downtime at the points of loading and unloading. It is also possible to use the cost estimation of transport downtime. The introduction of rational routes of transportation provides the decrease in empty runs[1].

II. SIGNIFICANCE OF THE SYSTEM

The difference in the compared options in this case can be estimated by reducing empty car mileage or other indicators related to empty mileage, such as:
• mileage utilization rate;
• total mileage;
*fuel consumption, etc.
Integrated performance indicators are used when several transport process characteristics change simultaneously.
For example, the replacement of rolling stock leads to a change in parameters such as:
• carrying;
• easy under loading and unloading;
• specific fuel consumption;
* depreciation charges, etc.
In this case, a particular criterion is not sufficient.
The following technological parameters of the transport process are used as local performance indicators[2]:
* average transportation distance;
• zero mileage;
• empty run;
• total load capacity of vehicles;
• the average utilization rate of carrying capacity;

• total downtime of vehicles;
• need for cars;

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* ton-hours spent on completing a given volume of traffic;
• the total time for execution of the transportation;
* timely delivery;
• cost of cargo in transit;
• speed of cargo delivery;
• the amount of cargo losses in transit;
• cargo safety.

Among the local indicators of the efficiency of the transport process, and are such as:
• energy intensity;
• materials consumption;
* material intensity of transportation.

III. LITERATURE SURVEY

Literature survey guides or helps the researcher to define/find out/identify a problem. It is something when you look at a literature (publications) in a surface level , or an Ariel view. It includes the survey of place people and publications is context of Research. It is a phase where the researcher tries to know of what are all the literature related to one area of interest. And the relevant literature are short-listed.

Whereas a literature review is going into the depth of the literature surveyed. It is a process of re-examining, evaluating or assessing the short-listed literature [literature survey phase]. Review of literature gives a clarity & better understanding of the research/project.

Objectives:
• Gaining an understanding on the fundamentals and state-of-the art of the area.
• Learning the definitions of the concepts.
• Access to latest approaches, methods and theories.
• Discovering research topics based on the existing research
• Concentrate on your own field of expertise– Even if another field uses the same words, they usually mean completely different thing.
• It improves the quality of the literature survey to exclude sidetracks– Remember to explicate what is excluded.

IV. METHODOLOGY

The efficiency of using cars is determined by technical and operational indicators. When analyzing the efficiency of the transportation process, the main indicator is the performance of the rolling stock. Productivity is formed based on several technical and operational indicators that characterize different aspects of road transport. Each of these indicators is influenced by various factors (organizational, economic, technical, etc.), which can affect the indicators themselves, and therefore the performance of cars (Fig.1).

The efficiency of using a car depends on its quality. Quality - a set of properties that determine the degree of suitability of the car to perform specified functions when used for its intended purpose. The degree of suitability of the vehicle during operation varies[3].

Due to the complexity of the car's design, the variety of some of its properties and structural features, as well as various combinations of them, different depending on the operating conditions and type of transportation, it is quite difficult to evaluate the car with one generalizing indicator. Therefore, the quality of the car is determined by the complex of its most significant operational properties: capacity, mass, speed, cross-country ability, safety, etc.

The efficiency of using cars is described by a system of indicators that can be divided into private and generalizing ones.

Private ones are technical and operational indicators (TEP), which include[1]:
- average number of vehicles;
- composition of vehicles by type, make and number of days of operation of the rolling stock;
- time in the outfit;
- working mileage of the vehicle;
- driving time of vehicles on the route;
- technical readiness coefficient;
- vehicle fleet utilization rates, working hours, and mileage.

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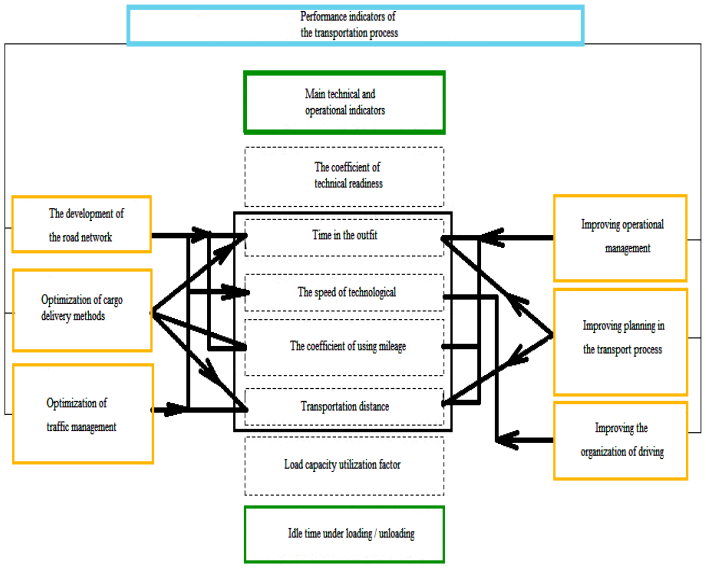

Figure 1-Factors affecting the performance of the transportation process

Generalizing indicators characterize the influence of many factors in the aggregate on the efficiency of car use. The system of these indicators includes:

- ✓ technical and operational indicators (traffic volume, passenger turnover, vehicle fleet performance);
- ✓ economic (cost of transportation, profit and profitability).

Vehicle efficiency refers to the level of performance and the degree of use of vehicles. Car performance indicators include:

- o daily and annual output per 1 vehicle;
- o number of days worked;
- o time when vehicles are in gear and in motion;
- o Park utilization rate in dress and movement;
- o fleet utilization rate on the line;
- o the utilization factors of the mileage.

These indicators are applicable for evaluating current and annual vehicle usage estimates[4].

The main technical and operational indicators (TEP) of vehicle operation are: technical readiness of the rolling stock(PS), production on the line, use of the rolling stock (PS) and the duration of its operation, etc.

Analysis of the performance of freight and passenger transport shows that the greatest impact on performance is the time in the outfit and the average speed of the car.

V. EXPERIMENTAL RESULTS

The factors affecting the performance of the car

For freight transport:

$$Q = \frac{q\gamma T_H \beta V_T}{l_{eg} + \beta V_T t_{pr}} (1)$$

$$T_H = t_{dv} + t_{pr} (2)$$

$$V = \frac{L}{t_{dv}} (3)$$

For passenger transport:

$$P_p = T_H V_e \beta g_v \gamma_v A_{sp} \alpha_v Д_к (4)$$

$$T_H = T_m + T_o (5)$$

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$$V_e = \frac{L_{sut}}{T_H} \quad (6)$$

The time the car is in the vehicle's attire ($T_н$) is determined by the number of hours from the moment the car leaves the motor transport company (ATP) until it returns to the Parking lot, except for the time of rest and lunch for the driver.

$$T_н = T_{дв} + t_{пр} = T_м + t_0; \quad (7)$$

where T_{DV} is the driving time of the car;
$T_{пр}$ – idle time of the vehicle under loading/unloading;
T_M – vehicle operating time on the route;
T– time zero of the run.
Vehicle speeds are divided into technical, operational, and message speeds.
Technical vehicle speed (VT) includes all short temporary stops associated with traffic:

$$V_T = \frac{L}{T_{dv}} \quad (8)$$

where L is the distance traveled.

The operating speed of a vehicle (Ve) is the conditional speed of the vehicle during its stay on the line:

$$V_T = \frac{L}{T_m} = \frac{L}{T_{dv} + t_{pr} + T_{pt}} \quad (9)$$

where T_{PT} is the downtime of the vehicle for technical reasons.

Based on the above formulas for Q and P, you can increase the efficiency of vehicle use by increasing the mileage and load capacity utilization factors, increasing the load capacity, and increasing the average daily mileage of the vehicle, which depends on the technical speed of the vehicle and the downtime during loading and unloading.

As a result of the analysis of technical and operational indicators of the transportation process, those indicators that mainly depend on the parameters of the road, traffic flow and affect the performance of the car are highlighted.

The efficiency of the transportation process depends on the speed of delivery. The cost of cargo transportation and the amount of inertia in the transportation process is affected by changes in the technical speed of the vehicle. The inertia of the transportation process is a mismatch between the transportation capacity of the transportation complex and the existing amount of cargo flow. The costs that appear in connection with the identification of the inertia of the transport process can be determined[2]:

$$R = \left[1 - \frac{1 + \frac{l_{sg}}{t_{pr} V_T \beta_e}}{1 + \frac{l_{sg}}{t_{pr} V_{Tf} \beta_e}}\right] \quad (10)$$

Due to the increased costs of the transportation process, it is necessary to consider the impact of indicators of the road network on the speed of cargo transportation.
The main indicators that assess the traffic congestion of the road network (UDS) are the speed, density and intensity of traffic flow. The relationship between the density and speed of traffic flow is expressed in the Greenshieldsmodel[3]:

$$V = V_o\left(1 - \frac{k}{k_c}\right) \quad (11)$$

Where V – is the maximum possible speed on the road;
V_0 – speed of free movement of cars in the stream;
k – flux density;
k_c – maximum flow density that causes all cars in the stream to stop completely.
In mathematical form, the relationship between the intensity and speed of traffic flow is represented by the following models[3]:

$$N = k_c V\left(1 - \frac{V}{V_o}\right) \quad (12)$$

Where N – the intensity of the traffic.

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$$N = V_o k(1 - \frac{k}{k_c})(13)$$

In this mathematical model, the traffic load of the road network is shown as k/k_c. These models allow you to estimate the intensity and speed of traffic flow in any city, both on main roads and on roads with low traffic intensity.

The efficiency of the transport process includes the performance of the transport process and traffic safety. A comprehensive indicator for evaluating the efficiency of the transport process should be measurable in real conditions of traffic flow and have a cost expression.

VI. CONCLUSION AND FUTURE WORK

The transport process management system uses a whole set of different indicators that can be of crucial and secondary importance[5]:

- capacity of the road network (UDS);
- parameters of the road network (UDS);
- the intensity of the traffic flow;
- transport delays;
- your average speed;
- travel time;
- number of vehicle stops;
- the length of the queues in front of intersections;
- the number and severity of road accidents(accidents); the degree of pollution of the environment;
- the level of noise generated by vehicles (vehicles).

The above indicators are related, but the type of dependencies among most of them is not defined. Some of the indicators are determined by collecting and analyzing statistical data[1,4].

The calculation of certain indicators is made based on the purpose of the assessment. Many of the indicators are determined in the aggregate. When calculating economic efficiency, many indicators are taken into account in monetary terms. When setting the optimization problem, it is usually sufficient to determine a small number of indicators, since it is known that minimizing one parameter that affects the efficiency of the transportation process affects others. For example, when traffic delays are reduced, the speed of traffic flow increases, and traffic time, gas pollution, and noise are reduced accordingly.

When analyzing the car's performance indicators, you must select the leading one. The effectiveness of the transport system is most clearly shown by the work of intersections on the road network (UDS). The throughput of intersections can be crucial in determining the performance of the transport system as a whole.

The main indicators that need to be determined when analyzing the performance of intersections are the average delay time of vehicles and the average service time of the intersection. When determining transport delays, you can use one of the many known techniques. You can also calculate the vehicle delay time (TC) in monetary terms.

There is an indirect relationship between the value of the average transport delay and the degree of traffic safety, since reducing the number and duration of vehicle delays on the route leads to a decrease in the psychological fatigue of drivers, which leads to a decrease in the probability of road accidents[6].

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