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Organization of truck maintenance

Bulbul Umarova*, Nurbolat Sembayev, Zoltan-Iosif Korka

Abstract. *Increased maintenance performance is able to contribute in growing the profitability of a transport company. Maintenance produces financial costs as well as losses in terms of availability. While the financial costs are a direct economic loss, availability losses causes indirectly an economic loss. Therefore, proper maintenance of trucks leads to high availability, thus increasing short-term profit of a transport company. This paper deals with the development production and technological tasks development of innovative system of vehicle operating in the Republic of Kazakhstan, due to the centralized specialized technical repair organizations or auto services in the context of the specific modifications of trucks together with the manufacturers. It presents a methodology for assessing the operational efficiency of contemporary commercial vehicles from different brands and manufacturers for which there isn't yet a legal framework.*

Keywords: *car, exploitation, efficiency, profit, service.*

1. Introduction

Road transport plays an important role in the transport complex of the Republic of Kazakhstan, regularly servicing millions of enterprises, organizations, and the population. More than 70% of goods are transported by road annually, and more than 65% of passengers are transported by public transport. At the same time, road transport is the main consumer of resources consumed by the transport complex: 66% of fuel is of petroleum origin, 70% of labor resources and 50% of all capital investments [1].

As shown by the study of the existing management system, the least studied tasks were operational planning. It is known from management theory that optimization problems are considered the most difficult and effective of the tasks of this class.

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On the other hand, in Kazakhstan, the fleet of commercial trucks is being intensively updated due to modern Russian, Chinese and other foreign models. At the same time, owners of transport enterprises make a choice of cars, focusing on the prestige of the brand, the availability of certain models on the market, cost, etc. But during operation, it often turns out that such a car has high operating costs compared to competitors, although it meets the requirements of the technological transportation process. In most cases, this is due either to car failures or to the high cost of spare parts, consumables, and lubricants.

2. The purpose of the work

The study of a methodology for evaluating the efficiency of operation of modern commercial vehicles of various manufacturers and brands, for which there is currently no regulatory framework.

The efficiency of the operation of vehicles in the implementation of commercial cargo transportation for the owner of trucks is ultimately determined by the maximum profit received.

The latter depends on the efficiency of using cars and the cost of transporting cargo, which in turn depends on the amount of operating costs.

Managing a complex system with continuously changing parameters of individual elements is quite a difficult task, its solution by standard optimization methods in production conditions in some cases do not give positive results, in others they require large expenditures of funds and resources. Therefore, to solve this problem, we have proposed a method of operational redundancy based on decomposition ideas, which will solve the problem of ensuring a high level of reliability of trucks of various brands at relatively low cost.

Effectively managing a motor transport company and the transportation process in market conditions means fully satisfying the effective demand for transportation and reducing the transport component in the final price of transported goods. All this can be considered a common management goal. To fulfill the purpose of operational management in it, a tree of goals is proposed (Figure 1).

The following symbols were used in Figure 1:

1- increase in profit;

2.1- increase in income;

2.2- reduction of financial costs;

3.1- reducing the cost of own resources

4.1- offering new services

4.2- increase in transportation tariffs

4.3- attracting new customers;

4.4- maintaining income at the planned level;
4.5- reducing the cost of an auto-hour;
4.6- reduction of the cost per man-hour;
4.7- reducing the cost of own resources;
5.1- compliance with the terms of delivery of goods;
5.2- compliance with cargo delivery addresses
5.3- compliance with the conditions of loading according to the nomenclature of goods;
5.4- reducing the cost of car watches;
5.5- reducing the cost of man-hours;
6.1- reduction of the empty mileage coefficient;
6.2- reducing vehicle downtime;
6.3- reducing the labor intensity of the transport company.

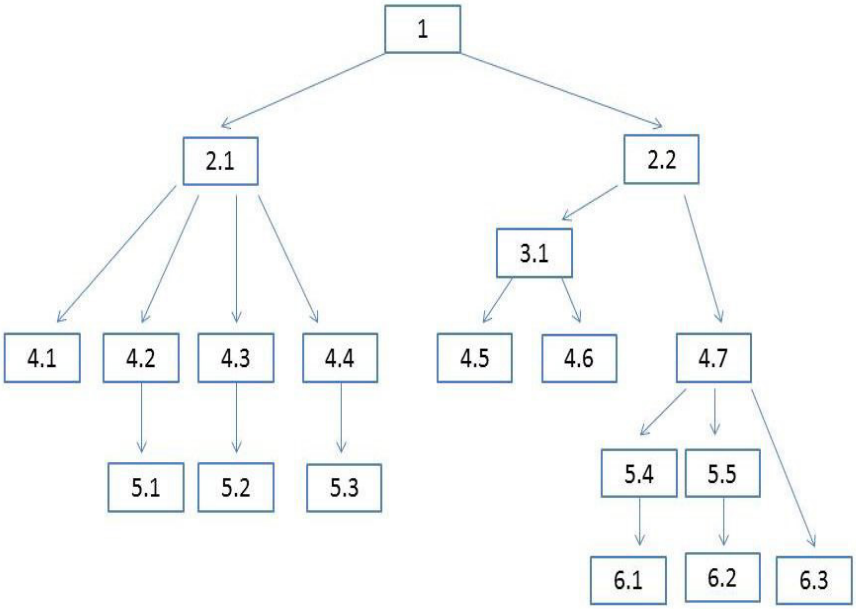

Figure 1. A tree of goals for effective management of road transport enterprises

Components such as maintaining revenues at the planned level; reducing the cost of preparing rolling stock for transportation, repairs and transportation proper belong to both levels of the formulated service facility. Based on the research conducted, it has been established that one of the most important problems facing road transport is to increase the operational reliability of cars. The research used

materials from surveys of motor transport enterprises, regardless of the form of ownership and affiliation, scientific and technical reports on the development and implementation of technological processes and mechanization tools for the maintenance and repair of trucks of various brands and industries, as well as the results of a survey among drivers of heavy-duty vehicles performing intercity and international road transport.

In order to increase operational reliability and reduce maintenance and repair costs, it is necessary, first of all, to improve the design and manufacturing technology of the car. On the one hand, the solution to this problem is provided by the automotive industry through the production of more reliable rolling stock, on the other – by improving the methods of technical operation. Unfortunately, this requires the creation of the necessary base to maintain the rolling stock in good condition, the use of advanced resource-saving technological maintenance processes directly in motor transport enterprises. Since the creation of optimal modes of operation and maintenance will reduce the intensity of changes in the technical condition of the car, which, ultimately, will lead to an increase in the durability of the car, the main indicator of which is the resource.

However, in motor transport enterprises, the insufficiency of their own working capital does not allow for proper investments (investments) for the development and maintenance of the necessary technical base for maintenance and repair, as well as aimed at replacing rolling stock and equipment. The renewal of fixed assets is one of the main factors in the effectiveness of their use, improvement of the quality characteristics of the services provided and, ultimately, economic recovery, sustainable development of the country's industry. Therefore, it is currently necessary to organize specialized enterprises with modern rolling stock and technological equipment for the maintenance and repair of a certain brand of cars.

Specialization is understood as an increase in the services provided, carried out by increasing the investment of resources per unit of production area, equipment, and vehicles.

The main indicator in determining the range of works and services provided is the coefficient of specialization and is calculated according to the formula [2]:

$$K_c = \frac{100}{\Sigma YB(2i-1)} \quad (1)$$

where:

YB - the specific weight of types of services, %;

i – the ordinal number of the specific weight of services in the ranked series;

100 – the sum of the specific weights of services in individual industries.

For this purpose, the analysis of the fleet's activities for all groups of rolling stock together and the types of services provided is carried out. In the analysis, we use such indicators as the total and average daily mileage, car-days at

work, at the enterprise, in repair and other indicators, and the coefficients given in Table 1, as well as the volumes performed by the auxiliary structural units of the motor transport enterprise.

The production program for the operation of a transport company is calculated based on its production capacity and productivity and expressed in operational meters. Calculations are carried out for each car model separately, and then summarized throughout the fleet.

The production capacity of the fleet is determined by the car days at the enterprise. The initial data for its planning is the average number of used cars since the beginning of operation.

Table 1. Fleet performance indicators

№	Indicators
1	Cargo transported, thousand tons
2	Mileage utilization factor
3	Total mileage, thousand km
4	Average daily mileage, km
5	Rolling stock
6	Car-days at the enterprise
7	Car-days at work
8	Car-days in repair
9	Output ratio
10	Technical readiness coefficient
11	Income from car services, thousand tenge.

The calculation of the production program is based on the mileage for the year. To reduce the volume, cars were combined into technologically compatible groups [3].

On the other hand, modern car operating conditions place increased demands on its technical and operational properties. The requirements for increasing savings and improving environmental friendliness when using fuels and lubricants come out on top today. Optimization of measures to improve the work of the maintenance and repair department is one of the main tasks for the development of any motor vehicle enterprise since many times more labor and money are spent on car maintenance than on its production.

Technical service is a complex of works and services for the effective use of equipment and maintaining them in good condition throughout the entire period of operation. The operation of the product includes intended use, storage, maintenance, and repair. The purpose of technical operation of machines is to maintain, preserve and restore serviceability, operability, and resource. It includes the performance of works on refueling machines with fuel and lubricants, cleaning, regulation, replacement of wear-out machine elements, their restoration, checking and diagnosing the condition of machines and components, determining residual life, environmental impact control, restoration of worn parts, modernization of machines in operation.

In conditions of shortage and limited renewal of rolling stock at motor transport enterprises, the importance of repair and maintenance production of car owners and the entire repair and maintenance base increases significantly. However, the increase in the number of cars and the increase in traffic safety and environmental safety requirements create the need to improve the management system of the technical condition of the car fleet.

3. The results of the study

Operational reliability and the level of quality of services provided depend on the rationality and scientific organization of maintenance and repair. Because modern economic conditions objectively change the relationship between consumers and service providers. Motor transport companies, in conditions of intense competition and escalating need for systematic improvement of technological processes, inevitably strive to rationalize and increase the productivity of car maintenance and repair services as much as possible.

When repairing trucks, it is most often necessary to repair the engine, suspension, transmission and electronic systems. It is clear that thousands of miles of mileage can render unusable even such powerful engines that are installed on cars from leading countries of the world. Therefore, it is necessary to increase the operational and technical reliability of cars, by improving the organization and increasing the level of maintenance and repair at specialized motor transport enterprises, for further economic development of the enterprise and increasing its competitiveness. For this purpose, a special technological map of cars is compiled, depending on the technical condition and the amount of work performed. The calculation is carried out in the context of specific car brands [4].

We will determine and adjust the inter-repair mileage before major repairs according to the formula:

$$L_{KP} = L_{KP}^{H} * K_1 * K_2 * K_3 \quad (2)$$

where: L_{KP}^{H}– standard mileage before major repairs, thousand km;
K_1 – mileage correction factor depending on the operating conditions;
K_2– correction factor depending on the modification of the rolling stock;
K_3 – the coefficient of correction depending on natural and climatic conditions.

Trucks have been attracting freight carriers for a long time with their reliability and increased comfort, but even such an automobile giant as Mercedes Benz breaks down sooner or later. In order to repair it in a short time and at minimal cost, you need to know the car service stations where it is produced. After all, the repair of a truck will differ from a passenger car not only in the spare parts used, but also in the repair technology [5-8]. Trucks must have increased reliability and resistance to breakage. This is the main requirement for a machine that is designed for everyday use in the harshest conditions.

4. Conclusions

In order to be sure that a truck after repair will serve faithfully for a long time, it must be repaired in a professional car service center, which has a team of highly qualified specialists who can work at the highest level, have specialized equipment and a modern technological base. In addition, they must conduct a reasonable pricing policy, and a wide range of spare parts must be present in the assortment.

It is necessary and advisable to organize centralized specialized repair and technical enterprises or car service centers in the context of specific modifications of trucks together with manufacturers, depending on their number and market demand levels.

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Addresses:

- PhD. stud. Umarova Bulbul, Toraighyrov University, Kazakhstan, Pavlodar, 64 Lomova Street
  bulbul186@mail.ru
  (**corresponding author*)
- Candidate of Technical Sciences, Assoc. Prof. Nurbolat Sembaev, Toraighyrov University, Kazakhstan, Pavlodar, 64 Lomova Street
  n.sembaev@mail.ru
- Assoc. Prof. PhD. Habil. Eng. Zoltan-Iosif Korka, Department of Engineering Science, Faculty of Engineering, Babeş-Bolyai University Cluj-Napoca, Piaţa Traian Vuia, nr. 1-4, 320085, Reşiţa,
  zoltan.korka@ubbcluj.ro