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Transportation Optimization of Homogeneous Freight in the Transport Systems

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Abstract

There are situations where, due to various circumstances, a large number of direct routes in the freight traffic running (which were traditionally used) can not satisfy transport users. Then there is a need to find new routes for the transportation of freight from departure points to destinations. The authors present an example to solve the transport task by setting of transportation routes in an extensive network, taking into account the specifics of transportation of homogeneous freights on concrete sections of railways. This allows optimizing the plan of transportation for homogeneous freights in the transport systems. This is relevant for the development of new transport routes, especially in modern conditions.

KEY WORDS: *transportation, homogeneous freight, transport task, route*

1. Introduction

An important factor in the political and economic development of countries/territories is the effective operation of transport, transport infrastructures, and transport segments. Their main tasks are transportation – freight, passenger, luggage, tourist [1-3]. A significant part of these transportations is an important component of production processes – both industrial and agricultural. Since their volumes are the basic economic indicators of any state.

When choosing a type of transport, the importance of environmental factors is increasing, in particular, reducing fuel consumption, reducing adverse environmental effects. Therefore, there is a reorientation of a significant part of transportation to the usage of more environmentally friendly modes of transport [4-6].

Currently, transportation is actively carried out by railway and motor transport [7, 8]. However, on long distances of transport routes (above 200 km according to European requirements) there is a decrease in the usage of motor transport [9]. And this is because compared to the motor, railway transport:

- provides a high level: of reliability and safety of traffic, movement of goods, mobility of the population [1, 2];
- requires less allotment of land per ton- and passenger-kilometer [2];
- enhances environmental friendliness and energy efficiency of transport processes [10-12];
- has a reduced adverse effect on climatic changes, workability, and physiological state of a person [2, 9].

Also with the upgrading/modernization of rolling stock units [13-15] and their elements [16, 17], re-equipment of infrastructure facilities [18], railway transport provides accessibility and quality of services.

2. Actuality

In modern conditions, to ensure life, support/development of the economy, and increase competitiveness, also all enterprises require a professional approach to the management of transportation processes. Depending on the placement of production, the transport system is approaching either the places of raw materials extraction (minerals) or the consumers' location.

The organization toward the direction of trade flows by defined routes is a factor in the stability of railways, and the transport component in economic costs is essential. The movement of traffic flows should be carried out on sections and directions that are economically beneficial. Therefore, it is important that the minimum transportation costs have to be provided in the transport service market; to meet the timing of goods delivery, execution of consignor/consignee requests, etc. This should foresee a reduction in the costs of railways for processing and inactivity of cars at stations, the performance of technical and freight operations, running of trains on the sections of railways, maintenance of technical infrastructure and staff costs. This should ensure the concentration of marshaling at stations, reduce the time spent the duration of cars at stations, and increase the degree of usage for the technical means of transport.

But the situations arise when, owing to various circumstances, a large number of direct routes in freight traffic running (which were used traditionally) can not meet the demand and needs of transport users [19]. Then there is a need to find new routes for freight transportation from departure points to destinations. Such routes should also provide the smallest economic costs of transportation – this is a way to reduce the prime cost of transport services and increase the efficiency of transport operational activity of railways.

where $\sum x_{A_i, B_j, C_k}^{depar loc}$ – the sum of all local cars departing from the station; $\sum x_{A_i, B_j, C_k}^{arriv loc}$ – the sum of all local cars arriving to the station; $\sum x_{A_i, B_j, C_k}^{arriv tran}$ – the sum of all transit cars arriving to the station; $\sum x_{A_i, B_j, C_k}^{depar tran}$ – the sum of all transit cars departing from the station; $x_{A_i, B_j, C_k - A_i, B_j, C_k}$ – integers; $x_{A_i, B_j, C_k - A_i, B_j, C_k} \geq 0$.

After the process of searching for solutions is completed, the Table of car flows on the service sections will automatically be filled with numbers. And this is the number of cars running on each section of the route. These figures are the solution to the set task and will provide the lowest financial costs for transportation. It will optimize the freight transportation plan in the transport systems. Due to this, it will be possible to analyze more reasonably the efficiency of routes operation for freights transportation in new conditions.

5. Conclusions

Choosing an optimal route for transportation of homogeneous freights by railways in new conditions was realized with the help of a transport task. When solving the problem, real factors affecting the number of actions in transport systems are taken into account. The presented example to solve the transport task for the setting transportation routes in an extensive network takes into consideration the specifics of transportation on concrete sections of the railway.

The result of solving the transport problem is the best option for transportation of freights from departure stations to destinations that reduces transport costs. This can be used to solve a transport task with any homogeneous freights on the railway in the transport systems. This is relevant to mastering new transport routes, especially in modern conditions.

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