FUNDAMENTALS OF TRANSPORT SYSTEM ORGANIZATION IN NORTHERN REGIONS

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ABSTRACT

Transport is considered as a single object of management (industry), which is part of the general transport complex of the Northern region. The coordinated development and organization of interaction of the sector of freight transportation by road transport with other modes of transport make the transport complex of the region not just the sum of individual industries but a single complex providing for interaction of water, rail, road and air transport (sea, railways, roads and aviation) and providing users of transport services with an additional systemic effect. Management of such a complex can be ensured through logistics centers, which are large operators that organize the work of carriers of goods by road in the context of a common transport-logistics system.

Keywords: transport, management, logistics, terminal, northern regions, cargo, transportation services.

Background. *The complexity of implementation of plans for delivery of goods to the northern regions is substantiated by considerable transportation distances, complex transportation technology, a wide range of goods transported and limited time.*

To equip the undeveloped territories, building materials, fuel, machinery, equipment, food and other goods are needed in considerable quantities. In these conditions, transport (including all its types) becomes one of the decisive factors for successful development of productive forces, exploration, extraction and export of minerals. The transport network in the territory basically remains seasonal (waterways, ice roads). The share of river and sea transport in the turnover of goods, for example, the Republic of Sakha (Yakutia) reaches 80 %, Irkutsk region – 60 %. The duration of navigation on the rivers is 110–160 days. A significant volume of traffic is carried out along ice roads, the operating time of which varies depending on natural and climatic conditions within 120–210 days. At the same time the terms of the river and sea navigation do not coincide, there are large breaks between the closure of navigation and the beginning of the work of ice roads [1].

Objective. *The objective of the authors is to consider fundamentals of transport system organization in Northern regions of Russia.*

Methods. *The authors use general scientific methods, statistical method, mathematical apparatus, scientific description, comparative method, analytical method.*

Results.

1.

The structure of the transport network includes main and local networks, transport nodes and end points of consumption. The transport hub connects the main transport routes of various modes of transport, and transport transshipment points are adjacent to the transport routes.

The development of logistics technologies for delivery of goods significantly expanded the functions performed by transport reloading points. In connection with the active use of terminal technologies for cargo transportation, it became necessary to create transport terminal-logistics complexes in which concentration and distribution of small-batch shipments take place [2].

Traditionally, transport systems are divided into four main components: transport network, mobile vehicles, labor resources and management systems. However, such a model of the structure does not reflect the features of interaction of structural components in multilevel transport systems and formation of systemic effects accompanying this interaction.

To implement inter-regional transport links X_s between the correspondent transport regions A^m and A^n, inter-district communications A^m and A^n are organized, which are carried out by the inter-district transport system N^y using the inter-regional transport network R^y, which includes the communication routes r^y and network nodes. Network nodes are the place of connection between inter-district and local transport networks. Two types of network nodes are distinguished: a road junction b^y – a junction of inter-district and local transport communications (crossroads); transport node (terminal) B^y – the place where there is a change in the mode of transport or rolling stock. The B^y nodes can perform the functions of road nodes b^y.

Inter-district transport communications g^{min} ($g^{min} \in G^{min}$) can be represented as a chain $g^{\min} = \{g_y^m, g_{mn}^y, g_y^n\}$. The communications $g_y^m = \{g_y^m \in G_y^m\}$ and $g_y^n = \{g_y^n \in G_y^n\}$ are carried out respectively on local networks R^m and R^n, and the communications G_y^{mn} – on the inter-district network R^y. The communications G_y^m and G_y^n are concentrated in the so-called terminal points $\varphi_i^y (i = 1,...z; z \geq s)$ of the transport areas, in which local, R^m, R^n and inter-regional R^y networks connect. Limit points φ_i^y are located in network nodes b^y and B^y.

Unlike the node b^y, passing through which parameters of transport communications do not change, in the node B^y parameters are converted: $g_y^m \times B^y \rightarrow g_{mn}^y$ etc. When converting transport communications in the nodes B^y the following conditions are generally fulfilled: $g_y^m \succ g_{mn}^y; g_{mn}^y \prec g_y^n$. The functional purpose of the inter-district network R^y is to integrate transport communications G^{mn} between districts A^m and A^n of the set t. The integration function in the inter-district transport network $J(R^y)$ in the set-theoretical interpretation can be defined as a mapping $J(R^y): \{G_y^m, G_y^n\} \times R^y \rightarrow G_{mn}^y$.

Structuring of transport links, formation of transport areas and organization of inter-district networks lead to formation of new functional levels in the transport system (transport subsystems), the functional purpose of which is to integrate inter-district transport communications. The main means of integration are the elements of the transport network (communication routes paths and network nodes) [3].

2.

As a result of an ill-conceived market position, the regions of the Far North do not receive the necessary financial support, as a result of which they found themselves in a difficult social and economic situation, and consequently the question of survival of people in harsh climatic conditions arose [4].

When analyzing the existing route of cargo delivery to the Northern region, it was revealed that seasonality is a characteristic feature of the situation.

The material and technical basis of transport for the supply of goods includes transportation and handling facilities, equipment for departure and destination points of goods and transshipment bases [5].

Significantly, the fact remains that the development of related modes of transport in the northern regions faces

many problems both in the construction of transport main lines and in their operation. At the same time, in recent years there has been a slowdown in the rate of growth in the carrying capacity of river transport. For all the variety of reasons that caused this situation, one can distinguish the unpreparedness of river ports to increase the volumes of traffic [6].

The solution of these problems is mainly connected with the following tasks:

1. Improving the organization of transportation process in large water-transport nodes.

2. Improving the coordination of operation of all modes of transport in river (sea) transshipment ports.

3. Introduction of advanced technologies for transportation of goods in a mixed traffic.

On the basis of the analysis, it was revealed that navigation along the Northern Sea Route is favorable in the sphere of Lena cabotage and is explained by the influence of the heat flow of the Lena and Yana rivers, which volume exceeds 50 % of the heat flow of all rivers from Khatanga to Chukotka, and also Yansk and Novosibirsk ice massifs, which are relatively easy to overcome by sea vessels, while in the west direction there are the impassable Taymyrsky, and on the east – the Ionian massifs [7].

The network of roads of the Northeast consists of constantly operating (30 %) and seasonal (70 %) roads. As a result of this transportation is carried out irregularly. The fuel required for the heating season comes only during the period of possible traffic along rivers and roads.

Automobile roads in the North-East are built, as a rule, in stages: first, a seasonal, and subsequently – a road of constant operation of the corresponding category (Taksimo–Bodaibo) is created. The density of traffic along the roads of the region varies and depends on the capacity of industrial and agricultural enterprises, as well as on the population number.

Based on the overall analytical picture, the creation of a developed transport infrastructure through the construction and reconstruction of highways that provide interregional transport corridors, intra-district and inter-district communications, seems to be the real option that promises the desired favorable conditions for the progress of the mining and forestry sectors of the northern territories of the region. The efforts to establish navigation in the Yenisei water basin and the operation of the Northern Sea Route are equally necessary.

In its most general form, if we approach from abstractions to organizing actions, a set of program activities aimed at developing the transport complex should include:

- *creation of an effective regional delivery management system;*
- *provision of sustainable operation of local air lines, which is consistent with the growing needs;*
- *creation and development of multimodal transport nodes;*
- *provision of necessary conditions for navigation, in particular – safety standards for waterway maintenance;*
- *provision of conditions for the operation of the Northern Sea Route;*
- *creation of a competitive environment for rail transport;*
- *construction and reconstruction of highways serving interregional transport corridors;*
- *construction and reconstruction of roads providing inter-district and intra-district communications;*
- *construction of bridge crossings across the northern rivers.*

Conclusion. *Thus, the development of a year-round network of highways, the expansion of railway communication opportunities, and the attraction of other modes of transport to more active activities are today one of the most important factors for increasing the efficiency of the system of supplying goods and providing life support to the population of the northern regions.*

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Article received 06.07.2016, accepted 19.09.2016.