



## METHODOLOGY OF DEVELOPMENT OF TRANSPORT AND RAILWAY NETWORKS

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### ANNOTATION

In this article, the problems of development of surface-vehicle and railway transport network, optimal flow distribution in the network are studied. Foreign experiences on the application of the intelligent transport system in the optimization and management of transport flow are presented.

**Keywords:** multimodal, perspective, transport network, step-by-step development, reconstruction, expansion, optimal, throughput, low cost, problem, solution, cargo and passenger flow, surface transport, intelligent transport, management.

### INTRODUCTION

Transport is the most important for the country's economy. The state of the transport system, which provides communication between each region of the region, is closely related to the stable development of the national economy. Reliable and high-tech transport infrastructure allows to meet the growing demand of the society in the transportation of goods and passengers. In this case, the "optimal distribution" of load flows for each transport type network gives only the "local optimum" within this transport. The real essence of the problem is to achieve the "global optimum" based on the optimal distribution of transportation to different transport networks. Therefore, it is desirable to jointly and comprehensively study the road and railway transport networks of the region.

### THE MAIN PART

The transport network of the economic region should be continuously developed: options for expansion, reconstruction and construction of new links of the existing transport network are envisaged. There may be a need to add new sections of various



transport modes to the existing transport network in the region. In general, any type of transport section can enter the regional transport network as a new link with a specific transport cost. It should only be determined based on this cost.

The timely delivery of materials, raw materials and finished products creates favorable conditions for the effective operation of the economy of the region, the production of goods and the distribution system, and allows reducing the amount of stocks in warehouses of enterprises. This ensures efficient operation of not only transportation, but also the entire logistics system.

As a result of the improvement of the population and the standard of living, the increase in the exchange of goods and passengers between regions, the number of vehicles on the roads of our country is increasing. It is known that in big cities and highways with high traffic flow, the probability of an accident is high. Although modern vehicles are equipped with super modern technologies, driving is still as dangerous as ever. This system depends on a large number of elements, and if nothing is done in this regard, it will be difficult to prevent unpleasant situations. Nevertheless, there is always an opportunity for positive changes, that is, it will be possible to get out of risky situations and minimize negative effects. However, this is a short-term, quantitative solution to the problem, which means that it will not be possible to completely eliminate it, as the number of cars on the road increases.

The analysis of the literature devoted to the development of multimodal transport networks, the organization of multimodal cargo transportation, it was shown that researchers use three main levels in their planning work, that is, strategic, tactical and operational levels, that the issues of the tactical level are widely studied, and the issues of the strategic and operational levels are in the next place [1]. Despite the great attention paid to the above-mentioned issues, there are many problems and issues that await their solution in this regard.

In particular, optimization of transport flows and transport network and setting the issue of their optimal development in the future, substantiation of mathematical model and development or selection of solving methods are the current issues of today [2]. Also, with the introduction of the intelligent transport system, the opportunities for the development of the regional multimodal transport network and the effective use of the network will expand.

Several methods have been recommended by experts to solve the above [3]:

- construction of extensive road infrastructure;
- use of intelligent transport system (ITT) in intensive, traffic flow optimization and management.

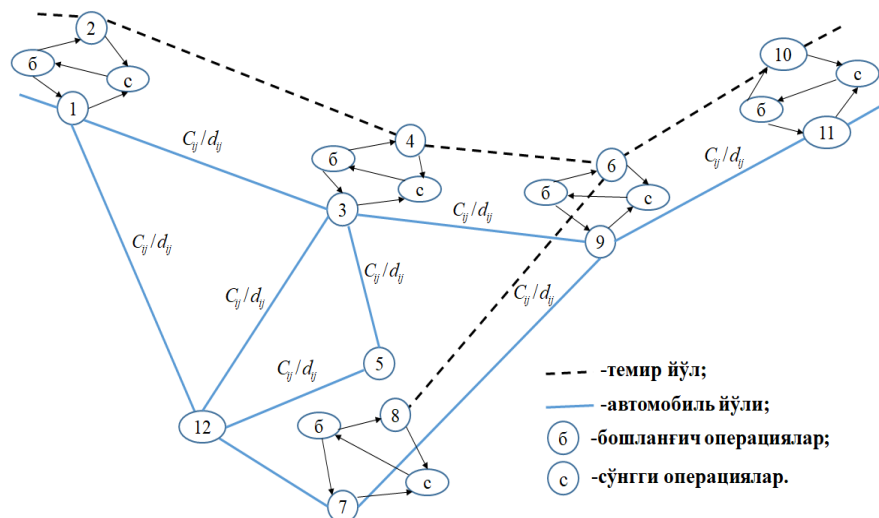
According to the opinion of many authors [4] on the construction of extensive, i.e., road infrastructure, such an infrastructure of the modern stage of development of the transport services market is a multimodal transport network, taking into account international transport corridors.

Multimodal transportation is transportation within the country with at least two modes of transportation [5].

The main characteristic of the transport system is its provision on the territory of the country. The level of provision of transport types is determined by the preference of the geographical location of the region (district, city or corridor) compared to the general regions [6]. Due to the fact that the territory of our republic consists mainly of land, the level of provision of road, automobile and railway transport in our country is high. The joint development of these types of transport and the formation of a low-cost transport network is an important issue.

Destinations where different modes of transport are connected, i.e. points where it is possible to reload from one mode of transport to another, are represented as multiple destinations respectively. They are connected by arcs that determine the economic indicators of costs arising from initial-final operations (Pic. 1).

As a result of the distribution of cargo flows in the arcs of the network, the total volume of transportation for all types of cargo is determined. After each iteration, the load current carrying capacity of the arc is analyzed. The cost characteristic of transportation is recalculated depending on the level of utilization of the capacity of the cargo flow. In this case, the option of developing the transport network for the volume of transport planned for a specific period is considered.



**Picture 1. Road network scheme of the researched area**



The general scheme for solving this problem is based on the multi-network method widely used in the optimization of load flows in the transport network [4,7,8], in this method, the problems of optimization of load flows in the network and development of the transport network are simultaneously solved. The problem is solved in the order of several successive approaches to the real situation. Possible options for development (expansion), reconstruction and new construction of each existing link are defined in the given area. The necessary level of development of the network section determines the demand for the ability to pass the load (transport) flow. This, in turn, depends on the size of the cargo (transport) flow.

Based on this method, convenient road networks are identified and a plan for gradually increasing their development levels is determined. The development of the transport network is mainly carried out in turn based on the transport operational condition of the roads. This ensures the rational distribution of capital funds allocated for the development of the transport network of the region. As a result, convenient transport connections between districts in the region will be formed and the cost of delivering cargo and passenger flows will be reduced. It also allows us to increase our transit capacity.

Application of the intelligent transport system in the optimization and management of the traffic flow is based on the maximum use of the transport network, increasing the efficiency and safety of the transport process, improving the level of comfort for transport users and drivers, and providing quick access to emergency medical care. It also provides an opportunity to reduce the cost of road infrastructure construction. As a result, consumers are provided with a large amount of information and security, and it allows to increase the quality of the level of interaction of the participants of the movement. In developed countries such as the United States of America, Japan, Germany, France, and China, these technologies were widely used in traffic management 20-30 years ago.

The introduction of intelligent transport into practice will allow a comprehensive improvement of socio-economic benefits in several areas, including its advantages [9]:

- the time of movement on the road is saved, the labor resources of drivers and traffic jams are reduced;
- environmental protection is carried out;
- the cost of road infrastructure construction will decrease;
- the development of the industry provides the opportunity to provide employment to the majority of workers.



Intelligent transportation system (ITT, English intelligent transportation system) is a complex engineering structure, which is an innovative approach to transportation system modeling and traffic flow management.

The process of designing a multimodal transport system (that is, with the application of an intelligent transport system) is complex and multivariate. There are many problems that need to be foreseen. [10] addressed some of the issues in the article:

- related to the organization of the design process;
- related to multimodal transport system modeling and their future development.

## CONCLUSION

In this case, the problems of choosing a convenient route for the transport flow of the sending and receiving points in the mastering of the future volume of cargo and passengers, choosing the type of transport for some objects and creating an opportunity for the development of the selected type of transport, distribution of the transport flow according to the types of transport and multimodal transport network. Taking into account the above, in our Republic, based on the training of mature specialists in the field of the European standard, it is possible to widely introduce intelligent transport systems in the territory of our country, to fully use the opportunities and reserves of the country's potential for increasing the export and transit of motor transport services, and to minimize and target the costs of building transport networks.

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