PASSENGER TRANSPORTATION AND OPTIMIZATION OF THE URBAN ROUTE NETWORK

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ABSTRACT

The authors propose measures to optimize the urban route network of passenger transport. In accordance with the tasks of optimization, a program and methodology for the survey of passenger flows, a more rational scheme for the route network, a transport macro model for the city, a passenger navigation system for the GLONASS or GLONASS/GPS monitoring system, security monitoring systems and mobile objects management were developed.

Keywords: public transport, urban route network, passenger transportation, optimization, monitoring, GLONASS, macro model, passenger flows.

Background. *In each road transport enterprise of the city, the main task of organizing and planning production invariably is the rational combination and use of all resources to perform the maximum transport work and improve the quality of passenger service by the passenger transportation. At the same time, naturally, in the conditions of a city like Kasimov, there is also a question of optimizing the city's route network, the search for organizational solutions and ways of their implementation begins.*

Objective. *The objective of the authors is to consider passenger transportation and optimization of the urban route network.*

Methods. *The authors use general scientific methods, comparative analysis, and evaluation approach.*

Results. *The first stage, as experience shows, is conducting a survey of passenger flows on public road transport: study of existing passenger flows on routes in the direction of bus traffic, on time of day, on different days of the week; determination of the indices of occupancy of passenger buses on the direction of traffic, on the time of day, on different days of the week. Then there are processing of the results of a survey of passenger flows on the route, the development of measures to optimize the route network [1].*

When planning and obtaining the final result, it is necessary to ensure that all routes and stops meet the requirements of both road safety, and profitability and cost-effectiveness. Since the problem under consideration is multicriteria, the following optimization criteria are proposed [2, 3]:

– an optimized route scheme should be based on the existing stopping network, if possible, use existing reversal circles, if necessary, new turn points;

– the existing route network can be changed within reasonable limits to minimize the discontent of citizens who use public transport daily;

– in order to improve the quality of service to the population, the bulk of passengers should be transported by transport of a larger capacity;

– the principle of the least duplication of routes should be used, their zonal planning is designed to ensure a direct passage from any zone to any one;

– it is advisable to reduce the number of routes in the city due to the greater share of passengers transported by medium and large capacity transport, including using new-generation fixed-route taxis in certain directions;

– the pendulum migration, typical for the city in the morning and in the evening, should be smoothed by dispatching based on GLONASS/GPS technologies, which are not yet used in Kasimov [4].

In accordance with the established criteria, the optimal scheme of the public transport route network was developed on the basis of the study of the correspondence of passenger flows and the information model of the city's transport system [5]. Simultaneously, a transport macro model was created using software, while its parameters are configured to perform purely practical tasks [6].

As one of the main in the process of implementing the macro model was the criterion of economic expediency of routes and stops. Therefore, the system rejected those routes and stops that did not meet the requirements of profitability, and in this sense the created optimal scheme of public transport is idealistic, since it takes little account of political and social factors. For example, near hospitals and kindergartens, there is often no large passenger flow, but the presence of public transport stop and laying of the route through the transport area where these socially important objects are located may be absolutely necessary from the point of view of the city administration [7].

For better provision of public services, it is proposed to introduce the GLONASS or GLONASS/GPS navigation monitoring system, as well as the security monitoring and management system for mobile objects (Locatrans) in the sphere of passenger transportation.

As part of the implementation of the navigation monitoring system, it is assumed:

– to establish a central dispatching service for regulating the movement of public transport, such as the Regional Navigation and Information Center (RNIC), whose purpose is to provide information and navigation support for the activities of any road transport, control the movement of vehicles; increasing the level of safety of passenger transportation, special, dangerous, heavy and bulky cargo; implementation of control and supervisory powers in the transport sector;

– to equip all vehicles with an «alarm button» to provide additional security for transportation of passengers;

– to create an Internet portal, which will display in real time all vehicles involved in the organization of transportation on a particular route, with the possibility of predicting their arrival at a certain stopping point;

– in places of location of social facilities at stops, to place electronic information boards predicting the arrival of passenger route transport in real time.

It should be noted that monitoring results provide:

– wide informing of citizens about the current changes;

– fixing the reserves of vehicles of different capacities;

– constant information on the state of urban public transport;

– assistance in organizing the work of the central dispatching service for regulating the movement of public transport;

– assistance in calculating the effectiveness of price regulation and the environmental friendliness of public transport [8].

The monitoring system for security and management of mobile objects (Locatrans) allows to have centralized control over the relevant area of transport, including:

– to determine the location of mobile objects and display them on an electronic map;

– to display the parameters of movement of objects: speed, direction, distance traveled, places and duration of stops;

– to monitor the status of sensors, remotely control the executive devices installed on the mobile site;

– to observe the traffic route, to receive timely notification of entering or exiting from the specified geographical areas;

– to use built-in standard reports;

– to generate reports on various indicators for any period, as well as archives on the movement of objects and events that occurred with them.

Using the Locatrans system, it is possible to stimulate the growth of traffic volumes and the number of services provided, to reduce accidents, to extend the life of vehicles, to increase the discipline of personnel, to eliminate misuse of transport, to optimize fuel consumption, and to reduce the number of idle runs of transport [9].

Particular attention should be paid to ensuring the safety of passenger transport by buses. The main tasks in this area in terms of optimizing the route network are:

– compliance with the requirements set by regulatory legal acts to the level of qualifications, health status, working and rest regimes of bus drivers;

– the availability of serviceable roads with the necessary arrangement;

–rational organization of traffic with the provision in priority cases of priority to public road transport;

– the maintenance of buses in a technically sound condition, the prevention of failures and malfunctions when operating them on the line;

– ensuring safe road conditions on the bus routes;

– replacement of rolling stock for a more spacious and meeting all modern requirements for the safety of passenger transportation;

– organization of the transportation process using technology that provides safe conditions for passengers [10].

Conclusions. *All the measures described in the article to optimize the city route network will have a positive impact on the development of Kasimov. This work is carried out jointly with LLC PFP Kvanteks, which is developing a program for the integrated development of the transport infrastructure of the municipal entity – the urban district the city of Kasimov until 2030 [11]. Preliminary results are as follows, the proposed replacement of the rolling stock involved in transportation of passengers will reduce the total number of vehicles used by 16,5 %, thereby improving not only the capacity of the road network, but also the ecology of the city.*

In addition, due to the optimization were received:

– reduction in the number of routes;

– a significant increase in the share of a more capacious transport in passenger transportation;

– increase in the total capacity of vehicles by about 10 %;

– realization of the possibility of direct transportation by means of transport between actively corresponding areas of the city;

– a decrease in the load of the street road network by a third and the duplication of routes –an average of 15 %.

It should be noted that the maximum result can be achieved only by an experienced way – to carry out similar studies for a number of years: to study the transport system and to correct it in a timely manner. The city administration, on the basis of research and taking into account socio-economic conditions, determines the basic mode of transport and the supporting network. The latter is adjusted accordingly through the number of vehicles on the route, the ratio of modes of transport (municipal, commercial) and the intervals of their movement. The created scheme of public transport is constantly monitored and researched by specialists, it is constantly being changed.

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