УДК 656.072

STRUCTURAL AND LOGICAL SCHEME FOR IMPROVING THE QUALITY OF PASSENGER TRANSPORT SERVICES IN THE CONDITIONS OF IMPLEMENTATION OF THE UPT PRIORITY TRAFFIC

Pidlubnyi S.Yu., Postgraduate Student
Kharkiv National Automobile and Highway University, Ukraine

Improving the efficiency of city passenger transport requires an analysis of the state and prospects for solving the city's transport problems. The city of Kharkiv has a developed complex network of city passenger transport, which allows providing high-quality and efficient services to the population. At the same time, it can be noted that there are a number of problems in the organization of urban passenger transport that require detailed analysis and determination of strategic directions for their solution [1].

Effective urban passenger transport is a condition for ensuring a high level of transport mobility of the population. Increasing the level of efficiency in the management of public urban transport is a necessary condition for ensuring its competitive properties under conditions of rapid growth of the private car fleet. Urban passenger transport, which operates in specially designated traffic lanes, can successfully compete with private transport during peak hours by reducing unproductive idle time in traffic jams.

The street and road network of Ukrainian cities was created for decades, and its change requires time and significant investments. The structure and length of the transport network of cities was created taking into account the general development plans, oriented to a certain level of motorization. For a long time in our country, the priority in the development of transport services was given to public passenger transport, and 60 cars were taken as the estimated level of motorization. per 1000 people. [2]. It was for this level of motorization that the entire transport infrastructure of cities and the traffic management system were created. Its main disadvantages are: low specific density of main streets and insufficient development of the network of local streets; low capacity of streets and intersections; combined traffic of public passenger transport, especially trolleybuses in the middle of the carriageway, cars, trucks and special purpose vehicles; application of outdated methods and technical means for traffic regulation; lack of a system of information provision of urban traffic; lack of the required number of parking lots and car parking spaces [3].

Currently, the transport situation in most modern large cities of Ukraine can be classified as unfavorable and extremely unstable. The main reason for this is the discrepancy between the capacity of the network and the rapid motorization of cities and the preference of personal transport over public transport. Unsatisfactory traffic conditions of urban passenger transport, moving in the general intensive flow of vehicles, leads to a decrease in the quality of service to the population, due to high costs of travel time, associated with low speed of passenger transport and violation of the regularity of its movement. It negatively affects the movement of public transport and the presence of personal transport on a significant number of streets.

When driving on dedicated lanes and in the absence of traffic obstructions, the MPT is able to provide higher speeds of communication than when driving in the general city traffic flow, including during rush hours. It is necessary to create conditions under which the use of public passenger transport would be more profitable and convenient than the use of a car [2].

The task of increasing the speed and safety of the public expressway with the increase in the intensity of traffic flows becomes particularly urgent and at the same time difficult to solve. Solving this task requires providing certain advantages of urban passenger transport over other means of transport provided:

- relevant provisions of the Traffic Rules, special signs and technical means of regulation;
- introduction of priority in the cycle of traffic light regulation at street crossings;
- introduction of separate restrictions for other vehicles on the streets through which city passenger transport routes pass;

– separation of a special (priority) lane for the movement of buses, which prohibits the movement of the rest of the traffic flow;

– using the method of spaced stop lines, cycle correction or the introduction of a special adjustment phase at intersections of street.

Road signs, traffic lights, as well as traffic detectors and controllers that change the mode of operation of traffic light regulation at the intersection are technical means for the implementation of the mentioned measures.

In order to make a decision about the need to create a local priority or allocate a lane on the main road for a specific traffic situation, appropriate surveys of the traffic on the site must be conducted, after which, based on the survey, a technical and economic justification of the effectiveness of the decision must be performed.

The first experience of implementing special dedicated lanes for city passenger transport of general use in the city of Kharkiv was carried out in 2012 during the European Football Championship. In the part of the city near the airport, there were several reversing lanes for the movement of trolleybuses and buses [1]. But at that time, this decision was irrelevant, because the level of the intensity of the traffic flow on these sections of the VDM was low and did not affect the traffic of the MPT. The organization of dedicated lanes for ground urban passenger transport is primarily aimed at improving the quality of passenger movement, reducing delays and travel time, and increasing the average speed of public transport. When designing dedicated lanes, it is not enough to complete the design of marking and placement of symbols. The following measures should be considered in the project:

– measures that ensure priority passage of city public transport at the intersection for changes in the direction of traffic, reduction of the number of lanes, etc.;

– changes to the traffic pattern to minimize the number of permitted maneuvers from the designated right lane, left turns and U-turns when organizing the central designated lane;

– calculation of the length of queues for turning flows crossing the allocated lane and development of solutions for their passage without the possibility of creating obstacles to urban passenger transport;

– determination of the mode of service of enterprises, shops, delivery of goods which can be carried out only from the carriageway of the road, which is occupied by a dedicated lane;

– calculation of the maximum carrying capacity of the lane based on the carrying capacity of the stopping points taking into account regulated crossings and selection of rolling stock of optimal capacity both taking into account the achievement of the maximum carrying capacity of the lane and taking into account the amount of the predicted passenger flow.

One of the methods of describing the management system is the development of its mathematical model of the research object. It is customary to call the mathematical model of the research object a set of relationships and formulas that unambiguously determine the parameters of the implementation of processes in the system, that is, the transformation of input parameters into output parameters. At the same time, depending on the problems to be solved and the approaches used to solve them, different types of models are distinguished, among which the most popular are the white box, gray and black models. Analytical models are built using letter symbols, while graphoanalytic models allow the use of graphic symbols. Depending on the type of signals, continuous and discrete system models differ. Depending on the operators used, there are linear and non-linear, as well as time and frequency models. Within this section, temporal analytical and graphoanalytical models are considered. The approach based on the use of the apparatus of mathematical functions was the most widespread in the descriptions of dynamic control systems. In this case, the behavior of the system is described either by an equation or by a system of analytical dependencies. At the first stage, a general type of input-output model is developed, as it connects input and output parameters. At the second stage, a model is formed, which is called a model of structural connections, since the connection of input and output signals is carried out through a system of variables that determine the state of the system. At the third stage, existing analytical dependencies

are developed or adapted to determine indicators and parameters of the functioning of the research object. Variable states of an autonomous dynamic system with an output *y(t)* are called independent variables *x(t),* such that the value of the output variable *y(t).* The state of the system in time is characterized by a complete set of state variables. By definition, knowing the initial state of the system, it is possible to find the value of the output variable *y(t)* in the future in the only way. In the work, the input-output model, which describes the general parameters of improving the efficiency of the urban passenger transport, can be presented in the form of a "white chest" model (Figure 1).

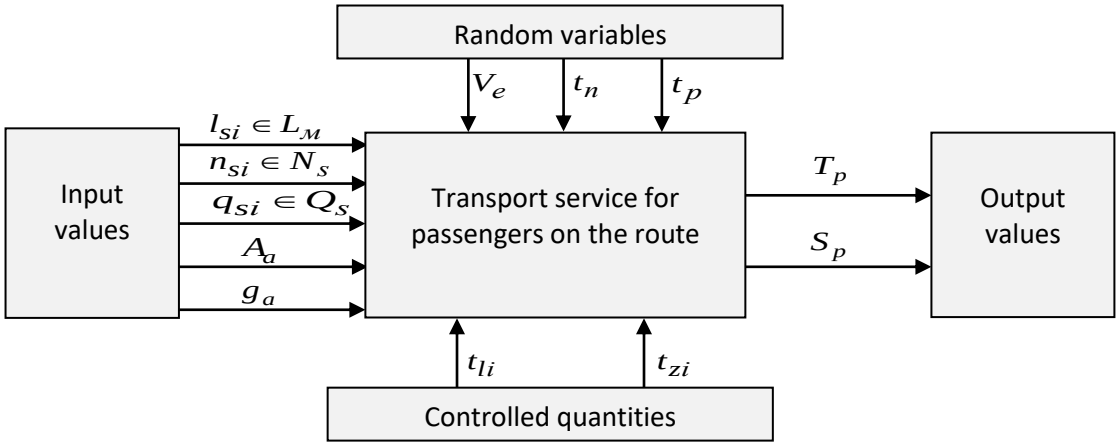

Figure 1 – The “white box” model, which describes the parameters of route operation under the conditions of creating the priority of urban passenger transport

The input values of the model include: $l_{si} \in L_м$ – the length of the route ($L_м$) and the distance between the stopping points of the route (l_{si}), km.; $n_{si} \in N_s$ – stopping points (SP) from the total number on the route (N_s); $q_{si} \in Q_s$ - the volume of transportation during the time period (Q_s) and the number of passengers boarding vehicles (vehicles) at the stopping points (SP) of the route during the flight (q_{si}), pas.; g_a - vehicle capacity, pas.; A_a - the number of vehicles on the route, unit. Random variables include: V_e – operational speed of movement on the route, which depends on the speed of movement along the sections of the route (v_{si}), km/h.; t_n – idle time at intermediate stops of the route, hours; t_p – flight time, which depends on the travel time of the route sections and idle time at intermediate stops, h. Controlled values: t_{li} – travel time of route sections, hours; t_{zi} – time of passing street crossings on route sections, hours Initial characteristics: T_p – passenger travel time along the route, hours; S_p – cost of passenger transportation, hryvnias/pass.

References:

1. Воліков В. В., Вдовиченко В. О. Транспортна інфраструктура Харкова (аналіз та основні тенденції). *Бізнес Інформ.* 2017. №12(479). С. 292-299.

2. Вдовиченко В.О. Методологічні основи формування системної ефективності громадського пасажирського транспорту в умовах сталого розвитку: монографія. Харків: ХНАДУ, 2017. 212 с.

3. Betancourt R.M., Galvis B., Rincón-Riveros J.M., Rincón-Caro M.A., Rodriguez-Valencia A., Sarmiento O.L. Personal exposure to air pollutants in a Bus Rapid Transit System: Impact of fleet age and emission standard. *Atmospheric Environment*, 2019. №202, P. 117-127.