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Assessment of impact of priority movement for urban public passenger transport on the quality of passenger service

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Abstract. Problem. *The article presents a view on solving the problem of the management formation measures to improve the quality of public transport services through the feasibility justification of implementing priority movement of urban public passenger transport in relation to the assessment of passengers' perception of the actual travel time along the route.* ***Goal****. The purpose of the work is to establish a characteristic relationship between the traffic parameters of route vehicles in the conditions of the priority of urban public passenger transport and time indicators of the quality assessment of passenger transport services.* ***Method****. The methodological basis for establishing a connection between traffic parameters in terms of the priority of urban public passenger transport and time indicators for evaluating the quality of transport service is a set of developed analytical models that describe the process of formation of passenger exchange at stopping points and time parameters of vehicle movement.* ***Results****. On the basis of the functional connection for the selected structure of the research object, it was established that the implementation of the urban public passenger transport priority with the organization of traffic on special lanes and unhindered passage of regulated intersections plays a significant role in improving the quality of passenger transport services.* ***Originality****. The assessment of the quality of transport service is based on establishing the level of compliance of each passenger's actual travel time with the previously planned. The use of travel time as a primary evaluation indicator is due to its leading role in the formation of quality criteria and the presence of influence on the parameters that determine the level of transport supply on the route.* ***Practical meaning****. The distribution of passengers at stops on route No. 24 «micro-district 602 – Akademika Pavlova subway st.» (Kharkiv, Ukraine) was obtained during modeling between the levels of perception of the quality of transport service showed that for everyday conditions, 8.9% and 27.8% of passengers (36.7% in total) receive a high-quality and suitable assessment, for traffic priority by sections – 32.3% and 64% (96.3% in total), when organizing priority passage at the intersection – 57.5% and 40.4% (97.9% in total). The obtained results indicate the expediency of implementing priority traffic from the standpoint of assessing the level of improvement in the quality of passenger service.*

Key words*: urban public passenger transport, quality of transport service, priority traffic.*

Introduction

The creation of effective passenger transport systems, in addition to the development of infrastructure, requires the implementation of technological management measures aimed primarily at increasing the speed of urban public passenger transport (UPPT) [1]. This is due to the importance of passengers' perception of travel time as a fundamental factor in the formation of the quality of transport service [2]. The solution to this problem lies in the development of high-speed urban transport mobility, the purpose of which is to create conditions for timely and high-quality satisfaction of the population's transport needs. Important tasks for the development of high-speed transport in modern cities are [3, 4]:

- creation of reliable, faster, and accessible systems and types of transport;
- introduction of new technologies for the interaction of route flows;
- improvement of traffic management systems and traffic of route vehicles;
- distribution of flows due to the provision in the territory for pedestrians and cyclists, with the

simultaneous separation of high-speed transport highways.

It should be noted that there are no single solutions of the same type for the formation of administrative measures to increase the speed of communication, which would be entirely suitable for all cities without exception. At the same time, it is possible to highlight a number of key directions in which new urban planning and technological solutions to reduce passenger travel time are currently being sought. Among such approaches, the implementation of the priority movement of the UPPT has gained popularity in practice. However, such decisions are very often made without proper analysis of their impact on indicators of the quality of passenger service, including taking into account the peculiarities of demand formation at stops.

Analysis of publications

The existing world experience in the countries of Western Europe, South America, and Japan showed the practical perspective of implementing the strategy of developing the UPPT based on the creation of high-speed passenger ground transportation systems based on specialized high-speed highways [5-7]. Among the main advantages of the implementation of such systems are their economic attractiveness and flexibility. At the same time, the greatest attention today is paid not so much to the construction of new ones but to the effective use of already existing elements of the transport infrastructure. The search for solutions in this area follows two key scientific and practical directions: improvement of infrastructure and implementation of modern technologies for managing city transport flows (creation of intelligent transport systems).

Theoretical issues of development and implementation of high-speed connection are considered in many scientific works [8-16]. Among the basic areas of application of high-speed communication in practice, the following has become widespread: the organization of express communication [14-16], the opening of specialized high-speed bus routes [8-10], and the allocation of priority lanes of the UPPT [11-13].

Research related to the organization of the express mode of the traffic of the UPPT can be conventionally divided into two periods: the end of the last century and the beginning of the present [14-16]. The basis of such works is the assumption of the possibility of reducing travel time due to a reduction in the number of stops. Among the modern works, we can single out the publication [16] in which it is proposed to use the express mode as a component of the combined mode of route maintenance. As an assessment of such a decision, a structure of criteria and a system of restrictions were chosen based on the technical and economic interests of the carrier and passengers. Evaluation from the position of the carrier is implemented by minimizing the difference between the potential and actual transport performance of buses on routes [16]. However, regardless of the apparent logic of the cause-and-effect relationship, the effectiveness of such measures is almost completely nullified by the loss of time for movement along the SRN sections.

The creation of specialized high-speed BRT bus routes (Bus Rapid Transport) allowed the implementation of the concept of the introduction of separate transport corridors of the UPPT in a number of cities. This approach involves the implementation of priority traffic of the UPPT, in which the central role is played by trunk bus routes connecting the main objects of formation and attraction of the urban population. The creation of BRT lines makes it possible to implement the service of routes by one type of vehicle in different types of communications: a separate BRT traffic zone and an ordinary SRN. This approach involves the transfer of main bus lines to separate transport corridors and, at the same time, provides the possibility of their movement on public streets, which ensures non-stop passenger movement. A vivid example of the opening of BRT lines is the city of Buenos Aires (Argentina) [8]. This ensured a reduction in the level of usage by private cars and significantly increased the quality of passenger service by reducing time spent. In total, today, there are more than 30 cities in the world in which such a system is implemented. The implementation of such a measure, although in comparison with the subway, requires much lower construction costs, it is unrealistic for communities with small budgets and in cities with limited urban space.

The introduction of separate bands of SRN for UPPT has become widespread in the countries of the EU, the USA, and Asia [11-13]. This is primarily due to the territorial limitations of cities regarding the construction of new and expansion of existing streets. The specified conditions for the organization of separate lanes of the UPPT, proposed by specialists from different countries, have specific differences and are still in the stage of clarification. Experts from South Korea [12] suggest using the minimum values of traffic intensity and passenger flow as a criterion. Values of the intensity of traffic of vehicles (TC), which ensure the efficiency of the arrangement of separated lanes for the traffic of UPPT, were considered in work [13], where a number of requirements supplement the intensity of traffic. Since the evaluation of the effectiveness of the priority lanes of the UPPT is of great interest to practitioners, research continues by improving the methods in which both new components of the criterion and new procedures for making management decisions are introduced.

The main requirement for evaluating the effectiveness of the implementation of the priority traffic of the UPPT is its complexity in relation to the accounting of the target needs of passengers, carriers, and the traffic flow of cars. Among the presented methods of implementing high-speed connections, the approach based on the allocation of special lanes for UPPT deserves special attention. However, the use of normative methods does not allow for taking into account the peculiarities of the formation of demand at stopping points for each route. This indicates the need for the development of scientific and practical approaches to the justification of the introduction of the priority movement of the UPPT as a method of increasing the speed of communication on the routes. Micromodeling is an effective tool that allows for establishing the expediency of allocating unique strips of the UPPT. It allows you to cover a wide range of conditions and take into account the influence of a number of factors: the ratio of flow intensity, the capacity of streets, the formation of passenger traffic at bus stops, etc.

Purpose and formulation of the task

The purpose of this work is to establish a characteristic relationship between the traffic parameters of route vehicles under the conditions of priority of the UPPT and time indicators of the quality assessment of passenger transport services. To achieve the set goal, you need to solve the following problems:

- highlight the structure of functional connections of the research object;
- to develop a model for determining the time indicators for assessing the quality of passenger service for individual SP routes;
- to conduct experimental studies of changes in the time indicators of passenger transport services and to provide an analysis of the obtained results.

Main material presentation

The methodological basis for establishing the connection between traffic parameters under the conditions of the priority of the UPPT and time indicators for evaluating the quality of transport service is a set of analytical models describing the process of formation of passenger traffic and movement of vehicles. The following designations are used to describe the models: $V=\{v_1,v_2,...,v_n\}$ – a set of route races characterized by lengths $L=\{l_1,l_2,...,l_n\}$, $S=\{s_1,s_2,...,s_{n+1}\}$ – plural SP, where $\{s_1,s_{n+1}\}$ – the initial and final SP, $\{s_2,...,s_n\}$ – intermediate SP; $X=\{x_1,x_2,...,x_k\}$ – multiple places of traffic delays on the route; T_p – duration of the settlement period, minutes; t_v – estimated time of movement along the race v, min.; t_s – estimated duration of idle time in SP s, min.; Δt_v – deviation of the duration of movement along the race v, min.; $\tau_x^{\min},\tau_x^{\max}$ – the minimum and maximum stay of the vehicle at the place of traffic delay X, min; Δt_s – additional idle time in SP s, min.; τ_s^y,τ_s^x - permissible and critical travel time of passengers departing from SP s, min.

The following are the main provisions of the formation of the models: the passenger exchange of the SP is constant in value in the period T_p, and its value was recorded during field surveys; the number of trips (N_p) in the period T_p depends on the turnaround time and the number of vehicles; the departure from the initial SP ($t_{s_1}^d$) is set at equal intervals of movement, which depend on the time of rotation and the number of trips.

The assessment of the quality of transport service can be performed on the basis of establishing the level of compliance of the actual travel time of each passenger with pre-planned or established regulatory requirements. The use of travel time as a primary evaluation indicator is due to its leading role in the formation of quality criteria and the presence of a direct influence on the parameters that determine the level of the transport offer of UPPT on the route. The approach to establishing quality based on the comparison of the value of the actual travel time for each passenger corresponds to the principles of the SERVQUAL methodology, which is designed to assess consumer expectations and perception of service quality [17]. According to these rules, each passenger who arrives at the SP $s \in S$ can receive three values of the perception of the quality of the service: high-quality (g_y), suitable (g_x), and not suitable (g_b)

$$q_i = \begin{cases} g_y \in G_y : (t_s^p + t_s^v) \le \tau_s^y \\ g_x \in G_x : \tau_s^y \le (t_s^p + t_s^v) \le \tau_s^x \\ g_b \in G_b : \tau_s^x \le (t_s^p + t_s^v) \end{cases}, \quad (1)$$

where t_s^p – waiting time in the SP, min; t_s^v – passenger movement time between departure and arrival points of departure, minutes; G_y, G_x, G_b – the total number of passengers who received high-quality, suitable, and unsuitable service within the limits of SP pass.

The waiting time of the passenger in the SP is set as the difference between the moment of approach (τ_{as}^p) and the departure of the vehicle on the trip (τ_{ds}^b) on which the trip is carried out, provided that $\tau_{as}^p \le \tau_{ds}^b$

$$t_s^p = \tau_{ds}^b - \tau_{as}^p. \quad (2)$$

On-site observations of the formation of the passenger interchange of the SP determine the moment of the approach. Information on the volume of passenger shipments is presented in the form of an array, in which the number of elements is equal to the period T_p with a step of 1 minute.

$$Q_s = \left[q_1^s, q_2^s, ..., q_{\tau_p}^s \right], \quad (3)$$

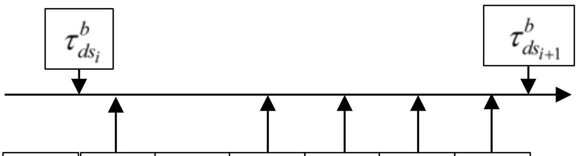
where $q_{T_p}^s$ – number of passengers who approached the SP at the moment of time $\tau_p \in T_p$, pas.

In Fig. 1 presents a fragment of establishing the time passengers stay in the SP while they are waiting for departure (for conditions without a shortage of the route's carrying capacity).

For each point in time τ_i the waiting time for the departure of the passenger is set

$$t_s^p(\tau_i) = \tau_{ds_{i+1}}^b - \tau_i, \quad (4)$$

where $\tau_{ds_{i+1}}^b$ – moment of departure of the vehicle from the SP on which the passenger departs, min.



q_1^s	2	0	4	1	1	4
t_s^p	6	5	4	3	2	1
τ_i	7:01	7:02	7:03	7:04	7:05	7:06

Fig. 1. Fragment of the timing scheme Expectation

The review τ_i is carried out for each value from the range $\tau_{ds_i}^b - \tau_{ds_{i+1}}^b$, where $\tau_{ds_i}^b$ – time of departure of the vehicle of the previous trip. The total number of passengers waiting for the duration of $t_s^p(\tau_i)$ departure from the SP is determined by the volume of passengers $q_{\tau_i}^s$ who arrive at the moment τ_i.

The departure of each vehicle from the initial SP is established on the basis of the movement interval in the calculation period

$$I_s(t_i) = \tau_0 + \frac{t_o \cdot (N_i - 1)}{A_s}, \quad (5)$$

where t_o – duration of rotation, min.; N_i – sequence number of the trip i in the calculation period T_p; A_s – the number of rolling stock on the route, units; τ_0 – the beginning of the period $\tau_0 \in T_p$, min.

The turnaround time depends on the duration of operations performed on the route

$$t_o = \sum_{i=1}^{v_n} (t_{vi} + \Delta t_{vi}) + \sum_{j=1}^{s_{n+1}} (t_{sj} + \Delta t_{sj}), \quad (6)$$

where v_n – number of sections on the route; s_{n+1} – the number of SP on the route.

Adhering to the entered notations, let's represent $t_s^a = t_s^a(t_{s-1}^d, t_v, \Delta t_v)$ the moment of arrival of the vehicle of the trip $n_{pi} \in N_p$ at the point of arrival s

$$t_s^a = t_1^d + \sum_{i=1}^{v_s} (t_{vi} + \Delta t_{vi}) + \sum_{j=1}^{n_s} (t_{sj} + \Delta t_{sj}), \quad (7)$$

where v_s – the number of sections of the route from the initial SP to the point s; n_s – the serial number of the SP on the route.

When setting t_o, t_s^a in addition to t_{s-1}^d and t_v, the total accumulated deviation Δt_v on each section of the route is decisive. This value depends on the conditions determined by the level of traffic service. Within the limits of the selected research object, situations in which traffic delays Δt_v are formed in places are considered

$$\Delta t_v = \sum_{i=1}^{x_v} (\tau_x), (\tau_x^{\min} \le \tau_x \le \tau_x^{\max}), \qquad (8)$$

where v_s – the number of traffic delays on the section v of the route $x_v \in X$.

The value τ_x is set as a random value, and the conditions of the traffic priority organization of the UPPT determine the range $\tau_x^{\min} - \tau_x^{\max}$. This is due to the fact that in conditions approaching the critical level of traffic loading of the sections v of the implementation by vehicle drivers, measures to correct traffic delays Δt_v are not possible, and the laws of distribution of magnitude cannot be established. The value $\tau_x^{\min}$ is determined by the general conditions of the traffic complication, and the value $\tau_x^{\max}$ is determined by the random component $\Delta\tau_x$, which can be defined as the maximum delay in the passage of the vehicle section of the route.

The volume $\tau_x^{\min}$ of accumulated passengers in the period between two consecutive vehicle departures from SP ($\tau_{ds_i}^b, \tau_{ds_{i+1}}^b$) is determined by the formula

$$Q_s^{\Sigma}(\tau_{ds_{i+1}}^b) = \sum_{i=\tau_{ds_i}^b}^{\tau_{ds_{i+1}}^b} q_i^s . \qquad (9)$$

When the vehicle arrives at the SP, a situation may arise in which the number of accumulated passengers exceeds the availability of accessible seats. In this case, only those passengers who arrived at the terminal first can take advantage of boarding. The rest of the passengers have to wait. At the same time, the accounting of the accumulated passengers for the next interval starts from the moment $\tau_{ds_i}^b = \tau_{ds_p}^b$, where $\tau_{ds_p}^b$ – the moment of boarding of the last passenger who can enter the vehicle cabin.

To determine the actual waiting time, simulation modeling of the movement of vehicles along the route and the stay of passengers in the waiting area is used. The simulation is based on two basic blocks: the simulation of the movement of vehicles along the route for various conditions of the organization of the UPPT priority and the waiting of passengers in the SP at the moment of departure. Fig. 2 presents a diagram of the connection of the elements of the simulation model for determining the perception of travel time by passengers who have approached the station.

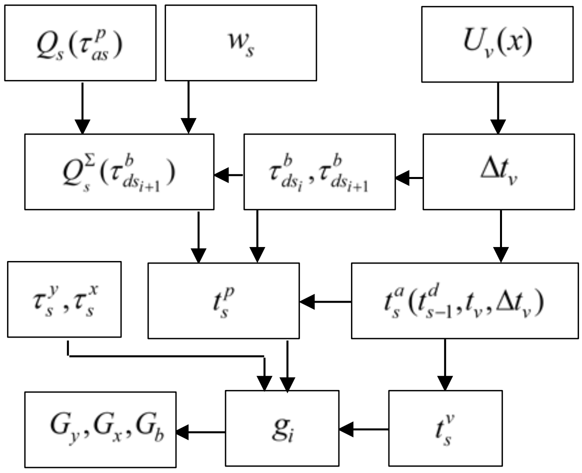


Fig. 2. Diagram of the connection of elements of the simulation model

During the modeling process, the value of the number of passengers perceiving the quality of service at level g_y, g_x and g_b is set for each SP. For this purpose, the waiting time in the SP and the specific weight of passengers who spent it is determined. When modeling, three options for organizing the priority movement of UPPT on the route sections are considered for each SP $U_v(x)$: without priority, when there is a delay x_v in the movement of vehicles on each element ($U_v(x_a)$); with traffic priority only within network sections ($U_v(x_b)$) and with traffic priority on network sections and passing regulated intersections ($U_v(x_c)$). Depending on the choice of the controlling influence, the value of the range $U_v(x)$ changes and, accordingly, the value $\tau_x^{\min} - \tau_x^{\max}$ is generated as a random variable Δt_v, which is decisive when establishing the moment of arrival of the vehicle to the SP. The distribution of the volume of passenger accumulation

$Q_s^{\Sigma}(\tau_{ds_{i+1}}^b)$ at each moment of the period $\tau_{ds_i}^b - \tau_{ds_{i+1}}^b$, together with the number of accessible seats in the vehicle (w_s) determines the number of passengers with waiting time $t_s^p \in t_s^u : \tau_{ds_i}^b - \tau_{ds_{i+1}}^b$. In addition to the arrival time of the vehicle, the organization of the UPPT priority affects the duration of the passengers' movement along the route sections t_s^v, which, together with t_s^p, is decisive when establishing the level of perception of the quality of service g_i. The software implementation of the model is carried out using VBA integrated in the MS Office Excel environment, which fully satisfies the task and allows presenting the results in tabular and graphical form.

Trolleybus route No. 24 «602 micro district – sub st. Akademika Pavlova» (Kharkiv, Ukraine)» was chosen for experimental research. The choice of this route is due to two factors. Firstly, there are difficult traffic conditions on many sections of the route and there is a possibility of introducing priority traffic. The second factor is the nature of the demand on the route. Almost all movements in the morning period are made in the direction of the sub st. Akademika Pavlova, which greatly simplifies the procedure for determining passenger correspondence points. For the simulation, two public means of transport with a significant passenger exchange and a different nature of the formation of passenger exchange were chosen: «Traktorobudivnekiv Avenue» (s_5) and «Gvardiytsiv Shironyntsiv street» (s_6). The formation of a mixed shipment volume in the form of a combination of an even distribution of the approach of passengers living within the adjacent territory and a deterministic component in the form of passengers arriving from tram routes and making a transfer is characteristic of the «Traktorobudivnekiv Avenue» in SP «Gvardiytsiv Shironyntsiv street» (49.99746, 36.32968) there are no transfers and the entire shipment volume is uniform over time. Also, the choice of these SP is due to their mutual location in relation to other SP of the route. The selected SP are located in the part of the route where there is a high level of vehicle filling. This makes it possible, along with the impact of the UPPT priority traffic on the travel time, to also assess its impact on the expectations of vehicle due to a possible shortage of transport capacity. The scheme of the route is presented in Fig. 3.

The volume of dispatches from the SP and its distribution τ_i was established during on-site observations, which were carried out in October 2021 between 7 and 8 a.m. The total volume of shipment is $Q_{s5} = 306$ pas., $Q_{s6} = 155$ pas. On the basis of the survey, the values of the permissible and critical travel time of passengers departing from SP s_5 and s_6. This information is presented in Table 1.

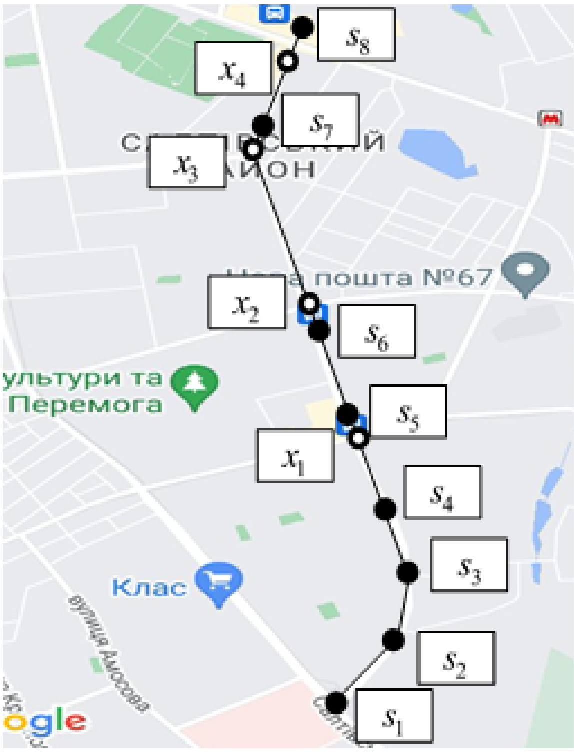


Fig. 3. Scheme of route No. 24 «602 micro district – sub st. Akademika Pavlova»

Table 1. Values of permissible and critical travel time, min.

Stopping point	τ_s^y	τ_s^x
s_5	15	20
s_6	12	15

Three options are offered as measures to implement the priority traffic of the UPPT: Option 1 $U_v(x_a)$ – without priority traffic; Option 2 $U_v(x_b)$ – allocation of special lanes on the sections from Saltivskyi highway to Akademika Pavlova street; Option 3 $U_v(x_c)$ – in addition to option 2, the priority of crossing the intersection is organized. Information on the time parameters of traffic for option one is established on the basis of field observations and for options 2 and 3 by an analytical method, taking into account the elimination of traffic delays on the route. Table 2 presents the movement parameters for various options of the organization.

The component parameters of idle time at stops are determined based on the methodology presented in [17]. During the simulation, 20 series of experiments were conducted for each variant of driving conditions. Each series is a simulation of 10 trips in the time period from 7 to 8 hours. In each series, for each trip, the generated values of the time of movement between the SP were used.

Table 2. Traffic parameters on sections of the route

Section of the route	The range of time spent moving vehicles with different variants of traffic organization, min.		
	$U_v(x_a)$	$U_v(x_b)$	$U_v(x_c)$
$s_1 - s_2$	1,2-1,4	1,2-1,4	1,2-1,4
$s_2 - s_3$	1-1,2	1-1,2	1-1,2
$s_3 - s_4$	0,9-1,1	0,9-1,1	0,9-1,1
$s_4 - s_5$	2,8-3,5	2,2-2,6	1,8-2
$s_5 - s_6$	1,6-2	1,6-2	1,6-2
$s_6 - s_7$	4,1-5,5	2,5-2,9	2,1-2,3
$s_7 - s_8$	3,9-4,8	2,1-2,5	1,9-2,1

The values of the passenger exchange of SP were fixed. The duration of the vehicle's stay in the service center was calculated based on the number of passengers entering and leaving and the standard time for passenger boarding and disembarking without additional service downtime. The values of the time parameters of passenger service obtained in the course of a simulation, corresponding to the SP s_5, s_6 are presented in Fig. 4 and 5.

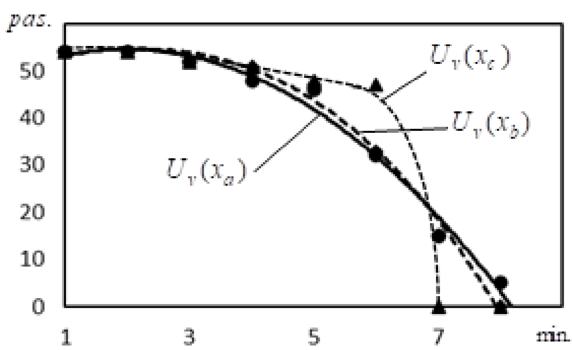


Fig. 4. Allocation of waiting time in SP «Traktorobudivnekiv Avenue»

The Table 3 presents data on the distribution of passengers departing from selected terminals by levels of perception of service quality.

Analyzing the results of the modeling, it is possible to establish the main trends regarding the change in the quality of passenger transport services upon the introduction of the priority movement of the UPPT. Passengers' waiting time for departure depends on the conditions of the organization of priority traffic of the UPPT. For the SP «Traktorobudivnekiv Avenue», it was determined that under normal conditions, the maximum waiting time is 8 minutes, while 83% of departing passengers have to wait up to 5 minutes. The implementation of the priority of traffic of UPPT on network sections makes it possible to reduce the maximum waiting time to 7 minutes. and 6 min. when organizing priority passages at the intersection. At the same time, 85% of departure passengers have to wait up to 5 minutes. The proximity of the values of the distribution of passengers waiting for departure within 5 min. due to the fact that there is an even combination of arrival moments in the period and the inter-trip interval at the same time does not increase significantly. Reduction of the maximum range of waiting time in the SP «Traktorobudivnekiv Avenue» when priority traffic is implemented by 1-2 minutes.

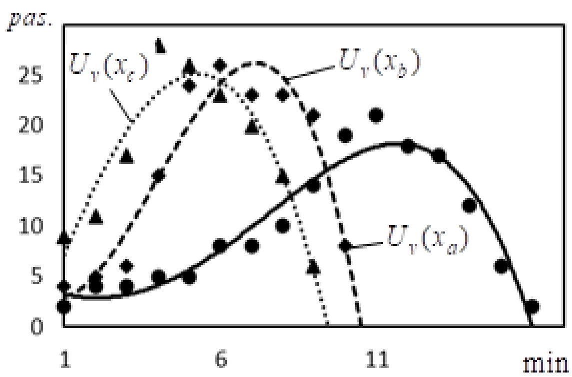


Fig. 5. Allocation of waiting time in SP «Gvardiytsiv Shironyntsiv street»

Table 3. The specific weight of passengers by levels of quality perception

Quality level	Variant of movement organization		
	$U_v(x_a)$	$U_v(x_b)$	$U_v(x_c)$
G_y	0,089	0,323	0,575
G_x	0,278	0,64	0,404
G_b	0,633	0,037	0,021

Primarily due to the reduction of the rotation time, which makes it possible to reduce the movement interval, which is decisive in this case. For SP «Gvardiytsiv Shironyntsiv street», the implementation of the priority movement of the UPPT allows for reducing the maximum waiting time from 16 minutes. to 11 min. (by 31.1%) when implementing priority in network sections and up to

10 min. (by 37.5%) when organizing priority passages at the intersection. Waiting for the shipment for up to 5 minutes. for normal conditions, have 12.9% of passengers, 34.8% for priority traffic on sections, and 58.7% when organizing priority crossings. A significant reduction in the maximum waiting time and an increase in the specific weight of passengers with a wait of up to 5 minutes is due to the fact that under normal traffic conditions, the SP «Gvardiytsiv Shironyntsiv street» in many cases is characterized by a shortage of transportation opportunities. The reason for this is a decrease in the productivity of the rolling stock due to an increase in the rotation time.

The distribution of passengers of the considered public transportation between the levels of perception of the quality of transport service obtained during the simulation showed that for normal conditions, 8.9% receive a high-quality and suitable assessment and 27.8% of passengers (36.7% in total), 32.3%, and 64% (total 96.3%), when organizing priority passage at the intersection – 57.5% and 40.4% (together 97.9%). The obtained results indicate the expediency of implementing the priority movement of the UPPT from the point of view of assessing the level of improvement in the quality of passenger service.

Conclusions

The main requirement for the management of the city passenger transport system is the need to ensure high quality of public service, which is realized through full compliance of the provided transport offer with the stated needs. Among the priority tasks of ensuring the quality of transport services, the implementation of measures to reduce the waiting time and the movement of passengers is highlighted.

On the basis of the selected structure of the functional connection of the research object, it was established that the implementation of the UPPT priority with the organization of traffic on separate lanes and the priority passage of controlled intersections plays a significant role in reducing the time of passengers' movement. In such a case, the reduction of passenger travel time is achieved by eliminating the points of difficulty in the movement of the UPPT, which not only reduces the overall costs of carrying out motor vehicle operations but also significantly stabilizes the compliance of time parameters in relation to the formation of passenger exchange in the SP.

The developed model for determining the characteristic influence of the conditions of the organization of the priority movement of the UPPT on the time indicators of the public service is the basis for accounting for the moments of the actual arrival of vehicles in the SP and their comparison with the moments of the arrival of passengers. In the future, such a model can be used to establish a number of additional indicators for evaluating the quality of transport services.

On the basis of experimental studies, it was established that there is a characteristic relationship between the traffic parameters of route vehicles under the conditions of the UPPT priority and time indicators for assessing the quality of passenger transport services. It was established that the implementation of priority traffic on sections of route No. 24 «602 micro district – sub st. Akademika Pavlova» (Kharkiv, Ukraine)» makes it possible to ensure an increase in the specific weight of the perception of travel time at the level of a qualitative and suitable assessment by 59.6% for the priority of traffic on sections and by 61.2% – when organizing priority crossing intersections.

Conflict of interest

The authors declare no conflict of interest regarding the publication of this article.

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Оцінка впливу пріоритетного руху міського громадського пасажирського транспорту на якість обслуговування пасажирів

Анотація. Проблема. *В статті представлений погляд на розв'язання проблеми формування управлінських заходів з підвищення якості транспортного обслуговування населення через обґрунтування доцільності впровадження пріоритетного руху міського громадського пасажирського транспорту по відношенню до оцінки сприйняття пасажирами фактичного часу пересування по маршруту.* ***Мета.*** *Метою роботи є встановлення характеристичного зв'язку між параметрами руху маршрутних транспортних засобів в умовах пріоритету міського громадського пасажирського транспорту та часовими показниками оцінки якості транспортного обслуговування пасажирів.* ***Методика.*** *Методологічною основою для встановлення зв'язку між параметрами руху в умовах пріоритету міського громадського пасажирського транспорту та часовими показниками оцінки якості транспортного обслуговування є сукупність розроблених аналітичних моделей, що описують процес формування пасажирообміну зупинних пунктів та часові параметри руху транспортних засобів.* ***Результати.*** *На основі виділеної структури функціонального зв'язку об'єкта дослідження було встановлено, що суттєву роль на підвищення якості транспортного обслуговування пасажирів відіграє впровадження пріоритету міського громадського пасажирського транспорту з організацією руху по спеціальних смугах та безперешкодного проїзду регульованих перехресть.* ***Оригінальність.*** *Оцінка якості транспортного обслуговування виконана на основі встановлення рівня відповідності фактичних витрат часу кожного пасажира на пересування з заздалегідь запланованим. Використання часу пересування, як базового показника оцінки обумовлено його провідною роллю у формуванні критеріїв якості та наявністю впливу на параметри, що визначають рівень транспортної пропозиції на маршруті.* ***Практичне значення.*** *Одержаний в ході моделювання розподіл пасажирів зупинних пунктів маршруту №24 «602 мкр. – ст. м. Академіка Павлова» (м. Харків, Україна) між рівнями сприйняття якості транспортного обслуговування показав, що для звичайних умов якісну та придатну оцінку отримують 8,9 % та 27,8 % пасажирів (разом 36,7 %), для пріоритету руху по ділянках – 32,3 % та 64 % (разом 96,3 %), при організації пріоритетного проїзду перехресть – 57,5 % та 40,4 % (разом 97,9 %). Одержані результати свідчать про доцільність провадження пріоритетного руху з позиції оцінки рівня підвищення якості обслуговування пасажирів.*

Ключові слова: *міський громадський пасажирський транспорт, якість транспортного обслуговування, пріоритетний рух.*

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