UDC 338.3+629.3 DOI: 10.30977/AT.2019-8342.2022.50.0.06

Research on the influence of design characteristics on the performance of large class city buses

Shevchenko I.[1], Dmytriiev I.[1], Dmytriieva O.[1]

[1]Kharkiv National Automobile and Highway University, Ukraine

Abstract. Problem. *The relevance of the problem under consideration is due, firstly, to the traditionally highest share of road transport in the structure of passenger transportation, and, secondly, the predominance (more than 75 %) of transportation by large class city buses in the structure of road passenger transportation. Under such conditions, improving the performance of large class city buses is of particular relevance.* ***Goal.*** *The goal of the article is to study the influence of design characteristics on the performance of large class city buses.* ***Methodology.*** *The research on the influence of design characteristics on the performance of city buses employs the following methods: the method of analysis and synthesis, systems approach, the observation method, comparative analysis, factor analysis, simulation modeling, and the experimental method.* ***Results.*** *The results of the conducted analysis have allowed the authors to develop and test a methodology for assessing the effect of carrying capacity on the performance of large-class city buses; to develop and test a methodology for assessing the impact of speed characteristics on the performance of large-class city buses; to conduct a factor analysis of the influence of design characteristics on the performance of large-class city buses.* ***Originality.*** *The research has made it possible to get an insight of the influence of design characteristics (in particular, carrying capacity and speed) on the performance of large class city buses.* ***Practical value.*** *The results obtained can be recommended to enterprises engaged in passenger urban transportation for determining the carrying capacity of buses, which is the major characteristic set when designing a new model of a city bus.*

Key words: *performance, urban transport, bus carrying capacity, speed, design characteristics.*

Introduction

Road transport is an integral part of the transportation industry of Ukraine. Given the unconditional manoeuvring advantages of road transport in comparison with other modes of transport, it has won a leading position in carrying goods and passengers over short distances. Ukraine's road transport has significant potential: in the post-crisis period, the volume of freight and passenger transportation by road decreased but at a slower pace than the volume of freight and passenger transportation by other modes of transport. Thus, it can be concluded that Ukrainian road transport is more resistant to the negative impact of external conditions than other modes of transport, which determines its leading position in the transportation industry of the country.

Road transport plays an important role in providing passenger transportation services in Ukraine. According to the statistical publication "Transport of Ukraine 2020", in 2020, 42 % of all passenger transportation in Ukraine was carried out by road transport enterprises.

At the same time, of great interest is the peculiarity of the distribution of passenger transportation by road in the country for the mentioned period in the context of transportation type: intercity, suburban and intracity transportation. As it was revealed based on the analysis of the data of the statistical compilation "Transport of Ukraine – 2020", 76 % of passenger transportation was accounted for by intracity transportation, 18 % – suburban transportation, 6 % – intercity transportation.

Accordingly, when studying passenger road transportation, it is advisable to focus specifically on intracity services, where passenger transportation is carried out by large class city buses.

Among the large number of characteristics of city buses, of particular importance is their performance – the passenger carrying capacity, which is the first characteristic that is set when designing a new model of a city bus. Up until now, there has been no methodology for qualitative and quantitative assessment of city bus performance that implies presetting specific characteristics for the desired performance at the design stage.

Therefore, the study of the influence of design characteristics on the performance of large class city buses is relevant.

Analysis of publications

Theoretical, methodological and applied aspects of ensuring efficiency and effectiveness of urban transport are considered in publications of such Ukrainian scientists as I. Shevchenko, I. Dmytriiev [1, 2], S. Niemyi [4], D. Omarov, H. Prokudin, Yu. Bilokobyla, [5-7], V. Shynkarenko, K. Vakulenko [8], O. Kunytsia, V. Prodan [9], I. Bashynska, V. Fillipov [10].

These scientists comprehensively study various aspects of city transport ensuring efficiency.

Thus, in the articles [1, 2], the authors analyze methodological aspects of the formation of industry associations of enterprises engaged in intercity passenger road transportation. The study reveals that the formation of an industry association of enterprises engaged in intercity passenger road transportation is economically feasible only if there is an annual need for transportation of more than 3.3 million passengers.

The author of the publication [3] describes the main indicators of the development of road transport in comparison with the development of other modes of transport and the whole transportation industry of Ukraine in the last decade.

The research by S. Niemyi [4], presents an analysis of the impact of passenger carrying capacity of buses on the efficiency of urban passenger transportation. In his study, the author argues that in case of busy passenger flows, when using buses with large and extra-large passenger carrying capacity, the cost of transportation is significantly reduced compared to buses of small passenger capacity. It is worth mentioning the studies [5, 6, 7], where the authors associate the improvement of performance of passenger transportation with service quality. In their work, the researchers determine the significance of the quality parameters of public transport services, which were determined based on field survey data, for passengers.

But despite extensive research efforts in this field, the issue of influence of design characteristics (in particular, such as passenger capacity and speed) on performance of large class city buses has been paid not enough attention.

Purpose and Tasks

The purpose of the study is to investigate the influence of design characteristics on performance of large class city buses.

To achieve the set goal, it is necessary to develop a methodology for assessing the effect of passenger carrying capacity on the performance of large class city buses; to develop a methodology for assessing the impact of speed characteristics on the performance of large class city buses; to conduct a factor analysis of the influence of design characteristics on the performance of large class city buses.

The solution of these tasks requires a step-by-step implementation of the following subtasks:

– assessing the effect of the overall length on the passenger capacity of large class city buses as a factor of their performance (according to the options when the overall length of large class city buses is 10.5 m, 11.0 m, 11.5 m, 12.0 m);

– assessing the impact of the engine layout on the passenger capacity of large class city buses and provide recommendations on the most rational engine layout from the standpoint of optimizing the utilization of the usable area of the passenger compartment and, thereby, improving the performance of large class city buses;

– studying the influence of key parameters of movement speed (in particular, acceleration characteristics, average speed between stops on the route, passenger exchange time, braking characteristics) on the performance of large class city buses;

– determining the weight of the factors that affect the performance of large class city buses based on the analysis of changes in their performance depending on the overall length, dynamic properties, passenger capacity, floor height, width of passenger doors.

City bus performance is usually understood as the number of passengers transported on a certain city route at a certain speed per hour.

To calculate city bus performance, it is customary to apply the formula:

$$\text{CBP} = (Q\ V_o\ \beta\ \gamma) \div l, \quad (1)$$

where CBP is the performance of a city bus, passengers per hour; Q is the maximum passenger capacity of the city bus, passengers; V_o is the operating speed of the bus, km/h; β is the distance utilization rate; γ is the capacity utilization rate; l is the average length of the passenger trip, km [2].

It is necessary to note that the article examines not the actual performance of large class city buses under specific operating conditions, but the potential or maximum design performance, determined only by design characteristics.

Therefore, in the formula (1): $\beta = 1$; $\gamma = 1$; $l = 500$ m (the average distance between stops on the city route).

V_o is the speed developed by a large class city bus on the segment between two stops of the route (500 m) under the following conditions: accelerating from a rest to a speed of 60 km/h; moving at a given constant speed; slowing down 50-60 m before coming to a stop; rest.

Considering the constants β, γ, l and changing the value of *Vo*, it is possible to measure the degree of influence of speed characteristics and passenger capacity on the performance of a city bus. Indicators that have the most significant impact on the indicator under study are determined based on the relative value (%) of the influence of each indicator on the performance of a city bus. This approach allows to assess the significance or weight of individual indicators (in particular, overall length, passenger compartment layout, engine layout) and, respectively, their priority in the design of city buses and the impact on the resulting indicator – passenger capacity.

In almost all countries of the world, it is customary to produce large class buses with an overall length of 10.5 m, 11.0 m, 11.5 m, 12.0 m. In the practice of bus manufacturing, the overall length intervals are 0.5 m, since at the same dimensions of the front and rear parts of the bus, they differ in length due to the number of body sections.

The study of the effect of passenger capacity on the performance of a city bus was carried out by the authors using the initial data on the impact of the engine layout and overall length of a city bus on its capacity for models of city buses with an overall length of ≈ 10.5 m (Mudan MD 6100, Higer KLQ6118GS, Daewoo BS-406); an overall length of ≈ 11.0 m (Jelcz M11, Jelcz M11, Zonda YCK 6117HC, Hyundai Super Aero City, Irisbus B951E, Zonda YCK 6105HC, BAZ A148); an overall length of ≈ 11.5 m (JAC HK 6118G, Golden Dragon XML 6112UE, Ankai GK15, Higer KLQ 6118G, Zonda YCK 6116 HC, Mercedes-Benz O405, Ikarus IK-112, Ikarus IK-103, Yutong ZK 6118 HGA); an overall length of ≈ 12.0 m (Zhong Tong Sunny, Irisbus Citelis 12M CNG, Higer KLQ 6118 GL, Irisbus Agora 12M, Mercedes-Benz Conecto, Mudan MD6120, Golden Dragon XML 6123UE).

In order to exclude the influence of other design factors on the passenger capacity of a city bus, a number of limitations were set, in particular, the number of seats was conventionally assumed to be 22, based on the averaging of the options (X_{aver} = (25 + 21 + 19 + 21 + 23 + 22 + + 23 + 25 + 15 + 17 + 24 + 21 + 23 + 25 + 27 + + 19 + 28 + 21 + 26 + 20 + 22 + 24 + 20 + 16 + + 20 + 31) ÷ 26 = 22.23 ≈ 22 seats).

The placement of the seats was taken the same for all options: two double seats on each of the four wheel arches (16 seats) and three seats at each side (6 seats). The interval between the seats (650 mm) and their dimensions were also taken the same.

The area occupied by one seated passenger was taken as 0.36 m^2, the area occupied by one standing passenger – 0.125 m^2.

For all options, a single layout of the engine providing the maximum utilization of the useful area of the city bus interior – outside the passenger compartment – was taken.

The number of doors (three) and their width (1200 mm) were assumed to be the same for all options. The minimum area of the platforms in front of the doors was 2.5-3.5 m^2. The total area of the footboards and steps was taken to be 1.75 m^2.

The area of the driver's cab was also the same for all options and amounted to 2.3 m^2.

It should be noted that the area of bumpers (0.2 m^2), driver's cab, footboards and steps is not included in the usable area of the city bus. Thus, the floor area for standing passengers is equal to the internal area of the city bus, excluding the area of the driver's cab, footboards and steps, the seating area, and the free floor area that cannot be used to accommodate standing passengers.

In accordance with the above methodology, the actual usable floor area and, thus, the capacity of the city bus for the reference case, with the entire usable area of the interior utilized to accommodate passengers, were determined.

The analysis of the results has made it possible to clearly identify the influence of the overall length on the capacity of a city bus. So, in the range of the overall length from 10.5 m to 12.0 m, an increase in the length of a city bus for every 0.5 m allows increasing the passenger carrying capacity by 9-10 passengers, or 6-7 %. The passenger capacity of a city bus with an overall length of 12.0 m exceeds that of a city bus with an overall length of 10.5 m by an average of 28 passengers, or 23.5 %.

Another indicator that affects the passenger capacity of city buses (with equal overall lengths) is the layout (or location) of the engine.

In the practice of the world bus manufacturing, the commonly used layouts of engines in city buses are as follows:

– within the passenger compartment: next to the driver's workplace; in the rear; under the floor within the wheel base, under passenger seats, closer to the left side;

– outside the passenger compartment: under the floor within the wheel base; under the driver's seat [2].

In the first case of engine layout, there are losses of up to 2.5 m^2 of the usable area that could be utilized to accommodate standing passengers, which reduces the capacity of a city bus by 12-15 passengers. In the second case of engine layout, there are no losses of the usable area of the passenger compartment.

The formula (1) employs the indicator of operating speed, which includes all parameters of the actual movement of a bus along the city route (traffic flow intensity, intersection operation regulations, downtime at route stops and terminals, technical factors affecting the bus speed, etc.). It is the indicator of operating speed that is advisable to use when assessing the city bus performance under operating conditions.

In calculations of the potential or design performance, it is customary to use the design speed on the route V_d, which is influenced by such technical characteristics of a city bus as weight, powertrain capacity, power output, torque, etc.

The route of city buses is organized in such a way that the distance between stops is no less than 300 m, and the actual distance is 300-750 m, depending on real needs for improvement of the stop, proximity of facilities to it, considering the convenience of passengers' approaching it. Therefore, the calculation had the constraint: the average distance between stops is l = 500 m.

As a standard for assessing the dynamic parameters of a city bus, the time to accelerate to a speed of 60 km/h (16 m/s) was taken. This was the second methodological limitation of the study.

Accordingly, the purpose of the research is to determine the optimal values of time to accelerate to a given speed to ensure high performance of a city bus. Too low acceleration values will lead to a decrease in the speed and a decrease in the performance of a city bus; too high acceleration is limited by the value of the maximum permissible acceleration.

To comply with safety rules, it is advisable to take the acceleration of a city bus when starting from rest as 0.2q for seated passengers and 0.15q for standing ones. This was assumed as the third methodological limitation of the applied research. Moreover, it should be borne in mind that high dynamic parameters set in the design of a bus often cannot be realized under real urban conditions with heavy traffic flows.

The movement of a city bus along the route is clearly cyclical. With relatively equal average distances between stops in the city, the average bus speed on one segment of the route between two stops can be adequately extrapolated to any other segment, as well as to the whole route. Acceleration has the greatest influence on the average speed of a city bus, and braking has the least influence, since the braking distance differs inconsiderably for different models of city buses.

By setting constant values for the indicators that determine the braking intensity, it is possible to estimate the degree of influence of the acceleration intensity on the average speed on a certain segment of the route.

To simplify the calculations and obtain comparable results, the same braking deceleration value j_b = 2.3 m/s was set for all models of city buses.

Further, for the braking to rest from the maximum speed of V = 60 km/h, allowable in the city, we determined the braking time t_b using the formula (2) and the braking distance S_b using the formula (3):

$$T_b = V \div (3.6\, j_b) = 60 \div (3.6 \cdot 2.3) = 7.2 \text{ s} \quad (2)$$

$$S_b = A\ V + V^2 \div (26\, j_b) = \\ = 0.19\ 60 + 60^2 \div (26\ 2.3) = 71.6 \text{ m} \quad (3)$$

The time to accelerate modern large class city buses from rest to a speed of 60 km/h is usually from 25 to 42 s.

The formula (4) is used to determine the acceleration distance in the case when the acceleration time of the motor vehicle is known [2]:

$$S_a = 2/3 \cdot V_a \cdot t_a, \quad (4)$$

where S_a is the acceleration distance, m; V_a is the acceleration, m/s; t_a is the acceleration time, s.

In the study, the calculated values of the distances to accelerate large class city buses to a speed of 60 km/h at a given acceleration time were obtained using the formula (4).

It was determined that buses that accelerate to a speed of 60 km/h for 40 and 45 s, cannot not reach the maximum allowable speed on limited segments of the urban route between two stops.

Knowing the distance and time of acceleration and braking, it is possible to determine the time the bus takes to cover a given segment of the route moving at a given speed using the following formulas:

$$t_r = (L - S_a - S_b) \div V_r, \quad (5)$$

or

$$t_r = S_r \div V_r, \quad (6)$$

where S_r is the route distance the bus covers at a given speed $V_r = V_a$:

$$S_r = L - S_a - S_b. \quad (7)$$

The average speed of the bus on the segment of the urban route between two stops is determined by the formula (8):

$$V_{aver} = 3.6 \cdot (L \div t_q) = = 3.6 \cdot ((S_a + S_r + S_b) \div (t_a + t_r + t_b)), \quad (8)$$

where t_q is the time taken by the bus to cover the distance between two stops on the urban route, s.

By setting the value of acceleration time and the corresponding value of acceleration distance, using the values of braking time and distance calculated by formulas (2), (3), we determined the route length by the formula (7), and the time of the bus movement on the route by formula (8) for different values of acceleration of a city bus.

In the study, the average speed of a city bus on the segment of the route between stops with a length of 500 m was determined for different acceleration values.

The analysis of the results obtained has allowed to conclude that a decrease in the acceleration time of a city bus by 5 s contributes to an increase in its average speed between stops and a decrease in the bus movement time by an average of 4 %. Accordingly, a decrease in the acceleration time of a city bus by 10 s contributes to an increase in its average speed between stops and a decrease in the movement time by 8 %.

Passenger exchange time depends on: bus occupancy rate; number and width of passenger doors; number of boarding and alighting passengers; boarding and alighting time and in general can be determined by the formula (9) [2]:

$$t_{pe} = (t_{bo} \cdot \Delta q_{bo} + t_{al} \cdot \Delta q_{al}) \div N, \quad (9)$$

where t_{pe} is the passenger exchange time, s; t_{bo} is the boarding time per passenger, s; t_{al} is the alighting time per passenger, s; Δq_{bo} is the number of boarding passengers; Δq_{al} is the number of alighting passengers; N is the number of passenger doors. For large city buses, $N = 5$.

The results of observing 24 runs of large class city buses BAZ A148 and Zhong Tong Sunny on a city route with 28 stops show that the average passenger exchange time was 16.8 s. At the same time, the occupancy of these buses varied from 6-14 passengers to 113-139 passengers, i.e., it almost completely included the range of the calculated values of the capacity of large class city buses for different engine layouts. According to the experiment results, the average boarding / alighting time per passenger was 2.9 s. Using the formula (9), the average number of boarding and alighting passengers was calculated. It amounted to 29 passengers (when changing the indicator value from 6 to 49 passengers).

The estimated (design) performance of a city bus was determined by the formula (1), which, in view of the indicated methodological limitations of the study, has the following form:

$$CBP = 3.6 \cdot q \div 0.5 \cdot V_d, \quad (10)$$

where V_d is the average speed of a bus on a city route, which is conditioned by the preset design technical characteristics, m/s:

$$V_d = L \div (t_q + t_{pe}). \quad (11)$$

To assess the degree of influence of passenger capacity, which depends on the engine layout, floor height and door width, on the performance of a large class city bus, comparative calculations were made using the formula (10).

To make it possible to compare the results, in the first case, for all options, the same design speed, obtained for large class city buses with the engine located within the wheel base, was set; in the second case, for the specified intervals of overall lengths, the capacity of large class city buses with the engine located within the wheel base was set using the same values as for large class city buses with the location of the engine in the rear.

The results of assessing the significance of indicators that affect the performance of large class city buses have allowed to draw the following conclusions.

The most significant indicator that affects the performance of large class city buses is passenger carrying capacity, which is mainly determined by the layout of the interior. The maximum utilization of the usable area of the interior and the largest passenger capacity, i.e., the highest performance of large class city buses, can be achieved by optimizing the passenger compartment layout due to locating the engine outside the interior under the floor within the wheel base. The use for urban passenger transportation of large class buses of an overall length of 12.0 m with an engine located outside the passenger compartment under the floor within the wheel base instead of large class buses of an overall length of 10.5 m with an engine located in the rear within the passenger compartment allows to increase the performance by 16 %.

Increasing the floor height from 740 mm (when the engine is located in the rear within the passenger compartment) to 920 mm (when the engine is located outside the passenger compartment under the floor within the wheel base), with three levels (footboard → step → floor) at the entrance door, practically does not cause any decrease in the time of passenger exchange.

For a large class city bus with mid-engine installment the same passenger capacity as for a large class city bus with rear-engine installment can be achieved by reducing the overall length of the bus by 0.5 m.

Conclusion

Thus, on the basis of the study, the authors have obtained the following results:

– the influence of the overall length on the passenger capacity of large class city buses as a factor of their performance was assessed (for large class city buses with the overall length of 10.5 m, 11.0 m, 11.5 m, 12.0 m). In the range of the overall length from 10.5 m to 12.0 m, an increase in the length of a city bus for every 0.5 m allows increasing the passenger carrying capacity by 9-10 passengers, or 6-7 %. The passenger capacity of a city bus with an overall length of 12.0 m exceeds the passenger capacity of a city bus with an overall length of 10.5 m by an average of 28 passengers, or 23.5 %;

– the influence of the engine layout on the capacity of large class city buses was assessed, and recommendations for the most rational engine layout from the standpoint of optimizing the utilization of the usable interior area for accommodating more passengers and, thereby, increasing the performance of large class city buses were given. It was found that the engine location outside the passenger compartment under the floor within the wheel base allows to increase the capacity of a large class city bus by 12-15 passengers compared to the layout option when the engine is located within the passenger compartment in the rear of a large class city bus;

– the influence of key parameters of the movement speed (in particular, acceleration characteristics, average speed between two stops, passenger exchange time, braking characteristics) on the performance of large class city buses was studied. It was determined that a decrease in the acceleration time of a city bus by 5 s contributes to an increase in its average speed between stops and a decrease in the bus movement time by an average of 4 %; a decrease by 10 s contributes to an increase in its average speed between stops and a decrease in the movement time by 8 %. Furthermore, reducing the passenger exchange time from 21 s to 16.8 s contributes to an increase in speed by 7 %;

– the weight of the factors that affect the performance of large class city buses was established based on the analysis of changes in their performance depending on the overall length, dynamic properties, passenger capacity, floor height, width of passenger doors. It was found that the most significant indicator that affects the performance of large class city buses is passenger carrying capacity, which is mainly conditioned by the layout of the interior. The maximum utilization of the usable area of the interior and the largest passenger capacity, i.e., the highest performance of large class city buses, can be achieved by optimizing the passenger compartment layout due to locating the engine outside the interior under the floor within the wheel base. The use for urban passenger transportation of large class buses of an overall length of 12.0 m with an engine located outside the passenger compartment under the floor within the wheel base instead of large class buses of an overall length of 10.5 m with an engine located in the rear within the passenger compartment allows to increase the performance by 16 %. Increasing the floor height from 740 mm (when the engine is located in the rear within the passenger compartment) to 920 mm (when the engine is located outside the passenger compartment under the floor within the wheel base), with three levels (footboard → step → floor) at the entrance door, practically does not cause any decrease in the time of passenger exchange.

For a large class city bus with mid-engine installment the same passenger capacity as for a large class city bus with rear-engine installment can be achieved by reducing the overall length of the bus by 0.5 m.

Conflict of interests

The authors declare that there is no conflict of interest concerning the article publication.

References

1. Дмитрієв І.А., Шевченко І.Ю. (2015). Методичні аспекти формування виробничих об’єднань підприємств міжміського

пасажирського автомобільного транспорту. Проблеми і перспективи розвитку підприємництва: Збірник наукових праць Харківського національного автомобільно-дорожнього університету, 1(8), 94-100. Dmytriiev I.A., Shevchenko I.Iu. (2015). Metodychni aspekty formuvannia vyrobnychykh obiednan pidpryiemstv mizhmiskoho pasazhyrskoho avtomobilnoho transportu [Methodological aspects of formation of production associations of long-distance passenger road transport enterprises]. Problems and prospects of entrepreneurship development: Collection of scientific works of Kharkiv National Automobile and Road University, 1 (8), 94-100. [in Ukrainian].
2. Іванілов О.С., Дмитрієв І.А., Шевченко І.Ю. (2017). Економіка підприємств автомобільного транспорту: підручник для студентів вищих навчальних закладів. Х.: ФОП Бровін О.В. Ivanilov O.S., Dmytriiev I.A., Shevchenko I.Iu. (2017). Ekonomika pidpryiemstv avtomobilnoho transport. [Economics of road transport enterprises]. Textbook. Kh.: FOP Brovin O.V. [in Ukrainian].
3. Шевченко І.Ю. (2015). Місце автомобільного транспорту в транспортному комплексі України. Проблеми і перспективи розвитку підприємництва: Збірник матеріалів IX Міжнародної науково-практичної конференції, присвяченої 85-річчю ХНАДУ. Х.: ФОП Крамаренко Ю.М., С. 105-106. Shevchenko I.Iu. (2015). Mistse avtomobilnoho transportu v transportnomu kompleksi Ukrainy [The place of road transport in the transport complex of Ukraine]. Problems and prospects of business development: Proceedings of the IX International Scientific and Practical Conference dedicated to the 85th anniversary of KhNADU. H.: FOP Kramarenko Yu.M., 105-106. [in Ukrainian].
4. Нємий С.В. (2019). Ефективність міських пасажирських перевезень в залежності від пасажиромісткості автобусів. Автомобільний транспорт, 45, С. 62 – 69. Niemyi S.V. (2019). Efektyvnist miskykh pasazhyrskykh perevezen v zalezhnosti vid pasazhyromistkosti avtobusiv [The efficiency of urban passenger transport depending on the passenger capacity of buses]. Road transport, 45, 62 - 69. [in Ukrainian].
5. Омаров Д.М., Прокудін Г.С. (2016). Підвищення продуктивності та якості автобусних пасажирських перевезень в місцях конгломераціях. LXXII наукова конференція професорсько-викладацького складу, аспірантів, студентів та працівників відокремлених структурних підрозділів університету: тези доповідей. Київ: НТУ, 233. Omarov D.M., Prokudin H.S. (2016). Pidvyshchennia produktyvnosti ta yakosti avtobusnykh pasazhyrskykh perevezen v mistsiakh konhlomeratsiiakh [Improving the productivity and quality of bus passenger traffic in conglomerates]. LXXII scientific conference of faculty, graduate students, students and employees of separate structural units of the university: abstracts. Kyiv: NTU, 233. [in Ukrainian].
6. Омаров Д.М. (2018). Підвищення продуктивності та якості міських автобусних перевезень: дис…канд. тех. наук: 05.22.01 / Національний транпортний університет. Київ, 221 с. Omarov D.M. (2018). Pidvyshchennia produktyvnosti ta yakosti miskykh avtobusnykh perevezen [Improving the productivity and quality of urban bus transport]. Candidate’s thesis. Kyiv. [in Ukrainian].
7. Omarov D. (2016). Improvement of the Methods for Determining Optimal Characteristics of Transportation Networks. Eastern-European Journal of Enterprise Technologies, 6/3 (84), 54–61.
8. Вакуленко К.Є. (2009). Вибір автотранспортного засобу на маршрутах міського пасажирського транспорту: автореф. дис. канд. техн. Наук. Харків, 2009. 23 с. Vakulenko K.Ie. (2009). Vybir avtotransportnoho zasobu na marshrutakh miskoho pasazhyrskoho transport [Choice of motor vehicle on urban passenger transport routes]. Extended abstract of candidate’s thesis. Kharkiv. [in Ukrainian].
9. Куниця О.А. Продан В.В. (2013). Застосування різномарочного рухомого складу на маршрутах міського пасажирського транспорту. Вісті Автомобільно-дорожнього інституту, 2 (17), С. 5-9. Kunytsia O.A. Prodan V.V. (2013). Zastosuvannia riznomarochnoho rukhomoho skdadu na marshrutakh miskoho pasazhyrskoho transport [Application of multi-brand rolling stock on the routes of urban passenger transport]. News of the Automobile and Road Institute, 2 (17), S. 5-9. [in Ukrainian].
10. Башинська І.О., Філліпов В.Ю. (2017). Проблеми та шляхи удосконалення функціонування міського пасажирського транспорту. Економіка, фінанси, право, 7/1, 35 – 37. Bashynska I.O., Fillipov V.Iu. (2017). Problemy ta shliakhy udoskonalennia funktsionuvannia miskoho pasazhyrskoho transport [Problems and ways to improve the functioning of urban passenger transport]. Economics, Finance, Law, 7/1, 35 – 37. [in Ukrainian].

Inna Shevchenko[1], DSci (Economics), Assoc. Prof.,
Dean of Faculty of Management and Business,
e-mail: shevchenko.khnadu@gmail.com,
Phone.: +38-066-187-28-30,
ORCID: https://orcid.org/0000-0003-0758-9244
Illia Dmytriiev [1], DSci (Economics), Prof.
Vice-rector for scientific work,
e-mail: dmitriev.khnadu@gmail.com,
Phone.: +38-050-587-97-66,
ORCID: https://orcid.org/0000-0001-8693-3706

Oksana Dmytriieva [1]**,** DSci (Economics), Prof.,
Head of the Department of Economics and Business,
e-mail: oksanahnadu@gmail.com,
Phone.: +38-063-353-79-98,
ORCID: https://orcid.org/0000-0001-9314-350X
[1]Kharkiv National Automobile and Highway University Yaroslava Mudrogo str., 25, Kharkiv, Ukraine, 61002

Дослідження впливу конструкційних характеристик на продуктивність міських автобусів великого класу

Анотація. Проблема. *Актуальність даної проблеми обумовлено, по-перше, традиційним лідерством автомобільного транспорту в структурі пасажирських перевезень, по-друге, переважанням (більше 75%) перевезень у внутрішньоміському сполученні в структурі пасажирських перевезень автомобільним транспортом, яке забезпечується міськими автобусами великого класу. У таких умовах підвищення продуктивності міських автобусів великого класу отримує особливу актуальність.* ***Мета.*** *Метою є дослідження впливу конструкційних характеристик на продуктивність міських автобусів великого класу.* ***Методологія****. В роботі для дослідження впливу конструкційних характеристик на продуктивність міських автобусів використано метод аналізу та синтезу, системний підхід, метод спостереження, порівняльний аналіз, метод факторного аналізу, метод імітаційного моделювання, експериментальний метод.* ***Результати*** *Отримані результати аналізу дозволили авторам розробити й апробувати методику оцінювання впливу місткості на продуктивність міських автобусів великого класу; розробити й апробувати методику оцінювання впливу швидкості руху на продуктивність міських автобусів великого класу; здійснити факторний аналіз впливу конструкційних характеристик на продуктивність міських автобусів великого класу.* ***Оригінальність.*** *Проведене дослідження надало можливість отримати уявлення про вплив конструкційних характеристик (зокрема, таких як місткість і швидкість руху) на продуктивність міських автобусів великого класу.* ***Практичне значення****. Отримані результати можуть бути рекомендовані для підприємств пасажирського міського транспорту для визначення перевізної здатності, яка є першою характеристикою, яка задається при проєктуванні нової моделі міського автобуса.*

Ключові слова: *продуктивність, міський транспорт, місткість автобусів, швидкість руху, конструкційні характеристики.*

Шевченко Інна Юріївна[1], д.е.н., доцент, декан факультету управління та бізнесу,
e-mail: shevchenko.khnadu@gmail.com,
тел.: +38-066-187-28-30,
ORCID: https://orcid.org/0000-0003-0758-9244
Дмитрієв Ілля Андрійович[1], д.е.н., професор, проректор з наукової роботи, заслужений діяч науки і техніки України,
e-mail: dmitriev.khnadu@gmail.com,
тел.: +38-050-587-97-66,
ORCID: https://orcid.org/0000-0001-8693-3706
Дмитрієва Оксана Іллівна[1]**,** д.е.н., професор, завідувач кафедри економіки і підприємництва,
e-mail: oksanahnadu@gmail.com,
тел. +38-063-353-79-98,
ORCID: https://orcid.org/0000-0001-9314-350X
[1]Харківський національний автомобільно-дорожній університет, вул. Ярослава Мудрого, 25, м. Харків, Україна, 61002.