Assessment of the Quality of Transport Service for Vladivostok City Population

P Volodkin¹, A Ryzhova², O Shirokorad³, S Arkhipov⁴

¹Pacific National University (PNU), Transport and Energy faculty, Tikhookeanskaya st., 136, Khabarovsk 680035, Russia
²Pacific National University (PNU), Transport and Energy faculty, Tikhookeanskaya st., 136, Khabarovsk 680035, Russia
³Far Eastern Federal University (FEFU), Engineering school, v. Ayaks, 10, Russian island, Vladivostok 690922, Russia
⁴Far Eastern Federal University (FEFU), Engineering school, v. Ayaks, 10, Russian island, Vladivostok 690922, Russia

E-mail: zyba250@mail.ru

Abstract. Transportation of passengers by city transport plays an important role in the transportation of urban residents in Russia. The preference for personal transport over public transport leads to congestion of highways, increases the time of movement around the city, both by personal and public transport, and causes environmental pollution. For the population to choose public transport, it is necessary to improve the quality of transport services, and first of all, the transport accessibility of urban passenger transport. The main types of urban transport and their scope have been identified. The data of a questionnaire sociological survey of more than 16 thousand city residents were analyzed, 11 bus routes (12% of all routes) were studied. The standards of transport services were established and the analysis of deviations of the actual values from the declared ones was carried out. Individual indicators of comfort, timeliness, regularity, information content, as well as satisfaction with the quality of transport services in general in the city districts were assessed. Recommendations for reforming the city's passenger transport are presented.

1. Introduction

At present, in Russia, passengers within cities, suburbs and long-distance routes move in their overwhelming majority by public transport. Of all types of passenger transport, bus transport in many regions of Russia plays a significant role in meeting the demand for passenger transportation. Public bus transport serves 1596 cities and urban-type settlements, as well as 85.9 thousand rural settlements at the end of 2019. Passenger transportation by bus on public routes is carried out by 1834 large and medium-sized road transport enterprises, of which 487 are cargo-and-passerger and 1347 passenger enterprises. The total length of bus routes is 1849 thousand km, which are served daily by more than 72 thousand buses. The provision of public buses is 114 units per 100 000 people [1].

The age structure of the bus fleet remains one of the main problems of the passenger transportation industry in Russia at the moment. In the total volume of traffic by all types of land urban transport in the Russian Federation, the share of road transport accounts for more than 68% of passenger traffic.
According to Avtostat, as of 01.01.2021, there are 411.1 thousand buses on the territory of the Russian Federation. In 2019, 10,637 million people were transported by urban land passenger transport, for the last 19 years there has been a tendency for a decrease in passenger traffic, so since 2000, passenger traffic has decreased by 2.16 times [1].

The decrease in the volume of traffic is due to the fact that an increasing number of the population prefers personal transport to public transport. The increase in the personal income of the population and the high availability of bank loans made it possible to purchase personal vehicles.

According to the data of the analytical agency "AUTOSTAT" over the past 10 years, the fleet of vehicles in our country has grown by almost a third. If at the beginning of 2011 its volume was 45.2 million units, then as of January 1, 2021 it reached 59.2 million units, of which 45 million are cars [2].

As of November 2020, there were 309 passenger cars for every thousand Russians [3].

Negative factors associated with this situation:
– in large cities, the congestion of public roads increases every year, in this regard, the timetable for passenger transport is not observed;
– the increasing number of cars complicates the organization of traffic, requiring more and more investments;
  – the accident rate in road transport is increasing;
  – the emission of harmful emissions into the atmosphere increases;
  – control of traffic flows is complicated.

Recently, the urban population has been giving preference to private transport over public transport. At the same time, as a result of a survey in 2020 [4], almost 25% of owners of personal vehicles began to use them less often. The main reason for the decrease in the intensity of use among the respondents is the introduction of a self-isolation regime – 45.5% of respondents, 26.7% reduced the frequency of use due to lack of need, because everything is within walking distance, also 21.6% noted an increase in the cost of maintaining a personal car and their refusal was dictated by economic considerations, 23.2% of Russians reduced the use of personal vehicles due to the more convenient use of public transport, 17.7% became more travel on foot and 1.9% think about protecting the environment.

Government regulation aims to reduce the use of private cars. The main motive for encouraging people to return to public transport is to improve the quality of service and ease of use of urban public passenger transport, as well as to offer a real alternative to private cars.

Abroad, such an alternative is the joint use of cars (car sharing) and bicycle rental [5,6].

Today, for the city of Vladivostok, the main alternative to personal cars is bus and taxi transport. The problems that can be singled out in the sphere of servicing passengers of urban transport are typical for many cities of Russia [1]:
– outdated rolling stock, both physically worn out and morally (a rather low percentage of the use of electric buses and buses running on liquefied natural gas);
– irrational routing schemes of cities;
– lack of a centralized system for managing city passenger transport;
– lack of a convenient non-cash fare payment system;
– lack of a unified fare collection system that is valid for all types of public transport in the city;
– low speed of the message;
– low level of comfort and safety of transportation;
– unsatisfactory condition of roads, including cleaning of roads and snow in winter and the condition of the road surface;
– lack of purposeful long-term development and investment.

These problems require a systematic approach, which includes the simultaneous solution of several tasks, the main of which is to improve the convenience of service through research and management of the quality of passenger transportation.

The works of foreign authors are aimed at increasing the attractiveness of public urban bus transport by understanding the expectations of users, regularly assessing the quality of service and...
improving the usability [7]. The need for a single, community-friendly transportation system has fueled the emergence of Mobility as a Service (MaaS) – an intelligent system aimed at managing the movement of people without the need for personal transportation, in which an integrator combines the offers of several transport service providers and provides end users with them through a digital interface, allowing them to plan and pay for mobility seamlessly.

After analyzing the work of domestic authors, the main indicators of quality include: comfort; availability; transportation safety; information for passengers. But at the same time, the indicators, characterizing the efficiency of the functioning of passenger enterprises, do not fully reflect the degree of satisfaction of the needs of passengers in travel.

The analysis of the considered indicators of the quality of transport services for passengers allows us to draw the following conclusions:

– criteria for the efficiency of the public transport functioning proposed by the authors are different in their substantive essence;
– most of the indicators do not determine the actual level of transport services, since they characterize the result of the work of individual links of the GTP system and do not reflect the requirements of passengers for the quality of the transportation process;
– many indicators require information that is difficult to determine and a significant amount of computational work, which complicates the process of planning the quality of transportation.

Development of recommendations for ensuring transport accessibility is carried out under the auspices of the European Union (programs: Towards a barrier free Europe for people with disabilities – "Towards a barrier-free Europe", A Europe Accessible for All – "Europe accessible for all"). In particular, in recent years, the MAPLE project has been carried out in Europe, which analyzes the current state of transport services for people with reduced mobility in a number of countries. The special research report, Accessibility planning methods, is one of the most comprehensive contemporary publications addressing various aspects of transport accessibility. The EU’s consideration of transport accessibility has provided a comprehensive social and economic renewal [8,9,10,11].

Recently, the issue of the availability of transport services for all categories of the population, including those with disabilities, has also been raised in the Russian Federation. But people with no special needs also highly appreciate the convenience of the accessible transport infrastructure.

The purpose of our further research is to identify the level of transport services for passenger bus transportation using the example of Vladivostok. To achieve this goal, it is necessary to solve the following tasks:

– Analysis of transport services by public bus transportations in Vladivostok.
– Determination of the quality of passenger transportation in Vladivostok.
– Determining the availability of transport services.
– Identification of the main directions of influence.

2. Materials and methods

The presented results were obtained by conducting a questionnaire sociological survey of the population of the city of Vladivostok. For completeness, the questionnaire was developed on the basis of GOST standard [12], which contained 20 questions. The studies were carried out on the routes of urban public transport, which have a different route shape and are used by enterprises of various forms of ownership. When choosing routes and carriers, the contribution to the total volume of traffic was also taken into account. The studies were carried out along 11 routes of the city (12% of the total number of all routes in the city), of the bottom 7 radial, 2 chord and 2 diametrical, served by both municipal and commercial carriers.

The standards of transport services were investigated and established: according to the availability of public transport stopping points, it should not exceed 5 minutes, and the time spent by the
population on moving from their place of residence to work in Vladivostok should not exceed 38-39 minutes.

To determine the indicator of transport accessibility, it is necessary to find out the temporary accessibility, which is different for residents living in different areas of the city. To study this indicator, the city was divided into 17 transport districts and 59 micro-districts, covering an approximately equal volume of territory, and routes through the transport micro-districts were identified.

To determine the time availability, a survey of residents was also carried out with their distribution in the city's microdistricts.

The main indicators that were obtained during the survey:
- the time spent by the population on moving from home to a stop, in order to find out the availability of stopping points for residents of transport microdistricts;
- waiting time for transport, in order to find out the intervals and frequency of movement of passenger public transport;
- movement time of a passenger on public transport in order to find out the average travel distance of passengers;
- the number of transfers made by the population on public transport in order to find out whether the city's transport network is rationally organized;
- the influence of the number of city transport routes passing through the transport districts of the city on the temporary transport accessibility of the population.

The survey involved the population over the age of 18, provided that the respondent is a student of FEFU. At the same time, the main condition was to interview approximately the same number of respondents living in different transport areas of the city. To conduct the survey, a questionnaire was developed, consisting of twelve questions related to transport accessibility. In this survey, a regionalized production sample was made – the population of Vladivostok was determined in the amount of 16378 people who have reached the age of majority, all university students (due to the availability of this information). Thus, with the population of the city for 2019 in the amount of 605 thousand people, the sample is complete and representative, the confidence level is 99% with a sampling error of 0.1%.

To identify the quality of transport services, a questionnaire was developed, consisting of 20 questions, and another questionnaire of 12 questions to determine transport accessibility. Based on the analysis of the survey, it was found that the majority of the city's residents study (work) in a district of Vladivostok that is different from their residence. Most of the respondents assess the quality of transportation as satisfactory. The main indicator of the quality of transportation, passengers identified the ability to travel while sitting. Timeliness of transportation remains the priority indicator, followed by speed and comfort.

3. Summary
The survey was attended by 45% of men and 55% of women. 41% of the surveyed population have personal transport. When traveling by public transport, the majority of respondents (64%) prefer the bus.

In the course of the study, it was revealed that 31% of the respondents use buses of the M3 category in their movements by public road transport, 29% of the M2 category and 40% of the respondents use both types of transport. However, in the course of the survey, respondents noted the inconvenience of low-capacity buses when traveling. The comments were directed to the following points: the comfort of the trip (inconvenience of entering / exiting the bus due to the low ceiling height), the inability of M2 category vehicles to carry standing passengers.

The indicators of "Comfort, ethics and aesthetics", "Timeliness", "Informativeness" were proposed to be assessed on a ten-point scale, where 0 – it does not satisfy at all, and 10 completely satisfies.

The respondents rated the cleanliness in the cabin the highest, and the least points were given to the appearance and politeness of the driver, the cleanliness of stopping points, as well as the temperature in the cabin. At the same time, the respondents noted that it is cleaner in the cabins of small buses, and
the temperature is more comfortable in large buses. The main indicator of the quality of transportation, passengers identified the ability to travel while sitting.

The respondents rated the speed of transportation the lowest (4 points). Difficult road conditions, especially during rush hour, do not allow passengers to travel at the right time.

The regularity of the movement was estimated at 6 points out of 10, this is due to the fact that in the evening the bus schedule is not observed due to low passenger traffic, many buses stop working.

In general, the respondents gave a high enough assessment of the information content.

The one-way traffic scheme in the city center, approved in 2011, also requires adjustments in terms of content.

In the process of data processing, it turned out that 69% of the survey participants do not make transfers, which is the bulk of the respondents, 31% of the respondents change when making trips related to work. After conducting the research, we can conclude that the availability of stopping points according to the standard 42.13330.2011 corresponds to ten districts of the city. For residents of other areas, the availability of stopping points exceeds the norms according to the standard.

After conducting a study, it was found that the indicators of temporary accessibility in some transport areas of the city are significantly higher than those prescribed by urban planning standards.

Analyzing the transport accessibility of Vladivostok, it was concluded that the main type of passenger transport is the bus. The city of Vladivostok combines many unfavorable natural and geographical conditions that complicate transport services in the city.

The overcrowding of routes with buses does not allow for scheduled transportation, as required by the “Regulations on ensuring the safety of passenger transportation by buses” [13]. At the terminal stops, buses line up and do not leave the starting stops until all the seats are occupied on their buses. In the future, bus drivers arrange "races" to "intercept" passengers from duplicate routes.

The identified trends are due to a number of reasons. The first is the growth of motorization of the population. The second is a fundamentally new route scheme, introduced since 2012. Under this scheme, the number of bus routes increased from 33 to 94, in connection with this, the number of passenger transfers has decreased, and hence the number of their trips per day [14].

Based on the results obtained, one of the promising directions of reforming the city's passenger transport is to increase the regularity of bus traffic, due to: the introduction of dedicated lanes for public transport; reforming the route network, in order to avoid its saturation with rolling stock, pay special attention to optimizing the length of routes and the development of intra-district and intra-quarter short routes; reducing the time spent at stopping points by introducing transport cards; transition to a unified management system for all types of buses on routes; further renewal of the rolling stock, introduction of a larger number of low-floor buses suitable for transportation of low-mobility groups of the population.

The study shows that the relationship between the weighted averages of time spent on travel for labor purposes and the number of city transport routes passing through the transport areas of Vladivostok has an inverse correlation: with an increase in route saturation of areas, the average travel time decreases.

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