совпадать с набором требований стандарта ГОСТ Р 51004-96, хотелось бы подчеркнуть растущую востребованность тех из них, которые связаны с отзывом пассажиров. Именно оценка потребителей услуг, критерий обратной связи призваны стать приоритетными для управляющих качеством структур.

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ANALYSIS OF BUS PASSENGER SERVICES IN RUSSIA AND ABROAD

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ABSTRACT

Quality evaluation standards of transport service play an important role in search for means to improve service, facilities and procedures for bus passengers. In many countries these standards consist of a set of indicators or groups of indicators, reflecting the specificity of road transportation and at the same time giving certain regulatory guidelines for the accompanying process. This article presents a comparative analysis of Russian and international practice in this area for a number of parameters and with use of dynamic coefficients to help compare objectively the measure of quality of services and management in real towns and metropolitan cities.

ENGLISH SUMMARY

Background.

Mobility has become one of the main criteria of efficiency of modern society. There is no city that could function properly without public transport system, including buses, the most accessible form of passenger transport for all segments of population.

Designed for mass consumption, the bus needs a certain level of comfort and convenience. In many countries, however, there are standards, built on a set of indicators, to assess the quality of passenger service.

Objective.

The authors try to show different aspects of quality assessment, which are applied to services on bus transport, give certain mathematical tools for calculation of important indicators, and, eventually, provide information of foreign countries experience on the analyzed topic.

Methods.

The authors apply, mostly, the method of comparative analysis and, additionally, mathematical method.

Results.

I.

In Russia, the quality of passenger transportation by all modes of public transport is estimated according to State standard 51004–96 «Transport. Passenger transportation. Nomenclature of quality indicators», which was put into effect on 1 January 1997. State Standard specifies the following range of major groups of quality indicators characterized by consumptive features of passenger traffic [1]:

- ✓ *information services indicators;*
- ✓ *comfort indicators;*
- ✓ *speed indicators;*
- ✓ *promptness indicators;*
- ✓ *baggage safety indicators;*
- ✓ *safety indicators.*

These positions cover various aspects and attributes of bus transportation.

The first group of indicators contains information of:

- ✓ *departure and arrival of vehicles;*
- ✓ *offered services to passengers and their cost;*
- ✓ *location of necessary facilities, communication facilities, catering facilities, etc.*

Comfort indicators include:

- ✓ *area (volume) of space per one passenger*
- ✓ *frequency of cleaning vehicles;*
- ✓ *temperature in the vehicle cabin;*
- ✓ *illumination in the vehicle and at bus stops;*
- ✓ *permissible values of noise, vibration and humidity;*
- ✓ *average (permissible) number of passengers in the vehicle cabin.*

Passenger comfort during the trip is primarily determined by the degree of occupancy of the vehicle cabin. It affects physical and mental (so-called «transport") fatigue of passengers, affecting not only their performance, but also health.

Occupancy of buses by passengers on urban communication is characterized by γ coefficient. Static coefficient of filling is:

$$\gamma_c = \frac{Q_\phi}{q},$$

where Q_Φ, q – respectively, the actual and nominal seating capacity of the bus, people.

Nominal seating capacity of urban bus transport is set basing on the number of seats and standard of free floor space per one standee.

Established norms of usable space per one passenger are for seated-0,315 m², for standee – 0,125 m² (preferably 0.2 m²). In big cities abroad (London, Helsinki, Singapore, etc.) standard – 8 pass. /m² is used in calculations. [2]

For a more complete characterization of passengers comfort, it is necessary to know not only the daily average value of capacity, but also the value at «rush hours» on the busiest route direction.

In characterizing the capacity of buses subject to travel distances dynamic capacity utilization coefficient is applied

$$\gamma_д = \frac{l_{еп} * Q_ф}{q * L} = \frac{P_ф}{P_{воз}},$$

where $l_{еп}$, L – respectively, the average trip distance and the total mileage of the rolling stock, km; $P_ф$, $P_{воз}$ – actually performed and possible transportation work, pass./km.

Physiological comfort index is determined by the aesthetics of interior design, the lighting level, the level of vibration and noise, temperature regime.

Interior of the passenger cabin shall be made in accordance with the «Regulations on the design and equipment of and stopping points of passenger vehicles, as well as the appearance and interior decoration of buses and taxis».

The noise level in the cabin should not exceed 78 dBA in a tram, 88 dBA in a bus. Width of doorways for single-wing doors is expected to be not less than 785 mm, for double-wing doors-1370 mm.

The doors of passenger transport must meet the following requirements:

- ✓ *remote control from the instrument panel of the driver;*
- ✓ *time of opening and closing of doors – 2 sec;*
- ✓ *blocking, eliminating the movement, if not all doors are closed;*
- ✓ *blocking, providing return of doors to their original position, if there is resistance to opening or closing of 150 N.*

There are also established standards for temperature regime in the cabin, for lighting system and vibrations.

These regulations are designed to control the quality of equipment repair of the vehicle cabin. As for trip comfort of passengers, it is determined by the coefficient of compliance with the requirements of rolling stock. This coefficient must be 1.

Availability of stopping points is determined by the approach to it, which should not exceed 7 minutes. Average distance between them should not exceed 600 m [2].

Speed indicators characterize features of transportation, which contribute to the length of stay of the passenger in the trip. In accordance with State standard 51004–96, they include:

- ✓ *duration of the trip;*
- ✓ *average speed;*
- ✓ *frequency of stops.*

Average speed of passenger movement is determined by the formula:

$$v_{ср} = \frac{l_{ср}}{t_{ср}},$$

where $l_{ср}$ – average trip distance, km; $t_{ср}$ – average time of movement of passengers, hours.

Speed communication is the average speed of delivery of passengers. It is determined by the ratio of the length of the route to duration of the trip:

$$v_{ср} = \frac{l_м}{t_д + t_{ос}},$$

where $t_д$, $t_{ос}$ – travel time and stops time in the total time of passengers delivery, hours.

II.

In determining the level of development of route systems, route network density is used, which is numerically equal to the ratio of the total length of the network to the area of the serviced space:

$$\rho = \frac{L_c}{F},$$

where F – area of residential territory of the locality, km²; L_c – total length of the route network, km.

Route network density values in cities with different level of population are shown in Table 1. [3]

Time spent on pedestrian movement of passengers can be reduced ensuring regulatory density of route network with planning of urban development, the rational allocation of stopping points on the routes.

Standards of time expenditures for movement are shown in Table 2 [3].

Quality assessment of transport services by time expenditures is presented in Table 3.

Coefficient increases with the population of the city due to the rapid growth in the number of possible transport links and for average conditions can be approximately determined by the formula:

$$K_{пер} = \frac{l_п * N_{нас}}{4,77 + 0,000154 * N_{нас}}.$$

For cities with different types of public transport interchange coefficient is determined based on all modes of transport. In the absence of data, it is designated approximately with the use of table 4 [3].

Higher (10% or more) values of $K_{пер}$ indicate a poor level of organization of the routing system. Interchange coefficient decreases due to the optimization of the route network, thereby reducing the travel time of passengers from point of departure to point of destination.

Timeliness indicators include:

- *o portion of vehicles departing on schedule;*
- *o proportion of vehicles arriving on schedule;*
- *o average traffic interval;*
- *o maximum traffic interval.*

Regularity of passenger transport is fixed as the number of completed scheduled runs to the total number of planned scheduled runs per day, decade, month, year:

$$R = \frac{z_p}{z_{пл}} \times 100,$$

where $Z_р$ – the number of performed scheduled runs; $Z_{пл}$ – total number of scheduled runs.

Coefficient of runs – a figure adopted in practice to assess the transport traffic regularity.

$$K_р = \frac{z_ф}{z_{пл}},$$

where $Z_ф$ – the number of actual runs.

Safety indicators include:

- ✓ *reliability of the vehicles;*
- ✓ *competency of transport services providers;*
- ✓ *availability of the vehicle to perform vehicle transportation (equipped by life saving appliances, regulatory documents, route maps, tools, fixtures, etc.).*

Baggage safety indicators contain:

- ✓ *percentage of baggage shipments arriving with defects;*
- ✓ *average cost of damage to baggage;*
- ✓ *replacement cost of lost baggage.*

In assessing the quality level of passenger traffic economic indicators of services should be taken into account that characterize the general expenses in the course of the transfer of passengers from point of departure to the place of destination, or the cost of the individual elements of the transportation process.

III.

Depending on the structure of the city, political institutions, economic development and infrastructure, each of them has different indicators to assess the quality of passenger service on buses.

In Singapore, the quality of passenger service on buses is evaluated by several factors [2]:

- *reliability;*
- *information service;*
- *availability;*
- *comfort;*
- *duration of transportation;*
- *attitude of staff to passengers;*
- *fares and ticket prices for the trip;*
- *security.*

In addition, following parameters are taken into account:

- ✓ *availability of hotline and information on the website for the convenience of planning a trip;*
- ✓ *display information on all bus stops with display objects;*
- ✓ *availability of timetable at bus stops.*

Helsinki is one of the founders of the best Benchmarking Network, which also includes Barcelona, Berlin, Copenhagen, Geneva, Manchester, Oslo, Prague, Stockholm and Vienna. [4] Ten indicators used here to assess the quality of bus passengers:

- *self-esteem of bus users;*
- *reliability;*
- *information service;*
- *comfort;*
- *attitude of staff to passengers;*
- *luggage security and safety;*
- *ratio between the ticket price and quality of bus service.*

Notably, Helsinki implemented priority actions to improve the speed and reliability of rolling stock, as well as reducing operating costs and inefficiency of operating companies.

And in the most developed cities (London, Athens, Rome) quality of bus service is estimated by about the same basic parameters [5]:

- *o safety – comfort – cleanliness;*
- *o information and communication links with the passengers;*
- *o accessibility;*
- *o reliability;*
- *o average speed of the vehicle;*
- *o time of passengers movement;*
- *o estimation of bus users.*

In European cities (Helsinki, London, Stockholm, Barcelona, Vienna, Berlin) one of important indicators is quality assessment of bus users. Consumers of transport services themselves are involved in the transport process and know exactly how to help passengers. Their opinions are collected, including through written surveys.

Conclusion. *The requirements from behalf of the passengers have become the most important criterion of assessment of bus passenger transport. The feedback from their part should dominate the managerial structures' decisions.*

Keywords: urban public transport, quality evaluation standards, bus passengers service, quality indicators, dynamic coefficients, passenger traffic, evaluation of buses users.

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