

ANALYSIS OF ACCESSIBILITY OF RAILWAY TRANSPORT FOR RESIDENTS OF LARGE URBAN AGGLOMERATIONS

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ABSTRACT

The study is focused on improvement of passenger transportation by rail transport, its availability, quality of related services for residents of large agglomerations. Correlation of growth in speed of movement of passengers, distance of travel, range and quality of services provided by the carrier, as well as planning of passenger traffic and spatial urban development models are considered. Particular attention is paid to the analysis of the improvement of passenger transportation by rail transport by assigning stops for long-distance passenger trains (including fast, speed and high-speed trains) in suburban areas of large

agglomerations, since that aspect has not been yet sufficiently studied.

It is concluded that it is necessary to continue research on transportation needs of the population of the agglomerations, to identify the features and patterns of changes in passenger traffic, emerging and redeeming in the suburban areas of the largest cities. This will allow transportation companies to better understand the transport services market, to develop and offer new transportation products to the population. That approach can increase the attractiveness of rail transport and its availability for the population of many cities thanks to a significant reduction in weighted average costs and travel time expenditures for passengers.

Keywords: railways, passenger transportation, urban agglomerations, customer focus, quality of services.

Background. The need for transportation is one of the priority social and cultural needs of citizens. Transport products that railway carriers offer on the transport market should reflect the interests of passengers in terms of rolling stock comfort, infrastructure, transportation process organization system (passenger train departure frequency, route speed, convenience of timetables, number of stops along the route and a number of other criteria), as well as meet the consumer demand of potential passengers. Only in this case the healthy and effective competition of the railway with other modes of transport for the passenger is possible.

Over the past 20 years, the configuration and structure of agglomerations¹ have changed in a fundamental way, developing and maintaining the tendency to compaction of the core, complication of their structure and perimeter expansion. Not only the city-core expands its borders to the suburbs, but the agglomeration itself grows in all directions, which greatly aggravates its transport problems. The pace of development of a growing agglomeration transport network often does not correspond to the pace and peculiarities of changes in the territory of the agglomeration itself [1].

Objective. The objective of the authors is to provide analysis of enhanced availability of railway transport for population of large agglomerations.

Methods. The authors use general scientific methods, comparative, statistics, transportation analysis, evaluation approach, scientific description.

Results. In terms of the trend of the reduction of the share of rail transport in the total passenger transportation in Russia, carrier companies are increasingly making efforts to improve the quality of related and additional services (channels and methods for ticketing, various marketing campaigns and offers, staff training in the field of customer-focused passenger service, etc.). At the same time, the main service – transportation, which has significant

capacity not only for retaining the existing, but also for attracting additional passengers, remains without proper attention today.

Improving the technology of passenger transportation by rail transport by determining the feasibility of appointing passenger long-distance train stops (including fast, speed and high-speed trains) in suburban areas of large agglomerations is one of the most important possible tools for improving the quality of passenger service and competitiveness of railway transport in the transport market. Implementation of that approach allows a passenger living in the suburban metropolitan area to seriously reduce weighted average costs and travel time expenditures associated with a door-to-door journey over 200 km, which is extremely important for a customer today when high speeds combined with comfortable travel conditions are often decisive for a passenger when choosing a mode of transport.

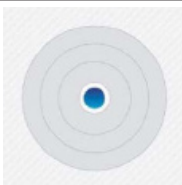
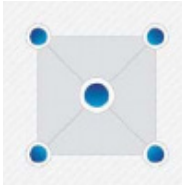
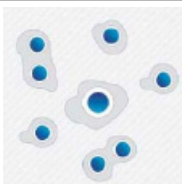
Analysis of the performance of the railway passenger transportation in Russia over the past five years has shown a stable average annual growth rate of the market for high-speed traffic of 3–5 % per year, due to which passenger turnover in long-distance traffic as a whole has had an insignificant increase of 2–3 % over the past two years. At the same time, despite an increase in the total volume of passenger transportation, there is a tendency to a gradual reduction in the average distance of passenger travel. If in 2010 the average distance of a passenger travel by rail was 1020 km, then in 2018 it was only 943 km and, according to experts of the Center to the Economics of Infrastructure, by 2025 it will not exceed 800 km [2]. This trend is due to a number of factors, the main of which is the change in the rhythm of life of residents of large cities.

Of course, the infrastructure and rolling stock capabilities do not always allow railway carriers to attract passengers due to the constant increase in route speeds [3]. However, today there are other opportunities for improving quality of the transport product by improving organization of the transportation process, which carrier companies do not always take into account on routes with a range of more than 200 km.

¹ The largest cities together with the suburbs (urban-type settlements, lower-class cities in terms of population, etc.) with passenger traffic aspiring to the center of a large city.

Table 1

Types and characteristics of spatial agglomeration models

Name of agglomeration model	Brief description of agglomeration model	Structural view
Monocentric	Development is concentrated in the existing center, from which zones of expansion and development diverge in circles.	
Polycentric	Development of a compact city with maximum redevelopment of urban land and development, closely connected with each other and with the main city, satellite cities	
Dispersed	City development is accompanied by development of a number of unrelated objects.	
Radial	City development takes place along transport corridors and is associated with development in each of them of development «rays», which are closely connected with the main city, but not necessarily between each other.	

Besides, fundamental scientific research in the field of passenger transportation by railway transport is insufficient in terms of the impact of the rapidly changing structure and geography of large cities and growing agglomerations, as well as of the increasing degree of integration of routes of various categories of passenger trains within major transportation hubs, on the long-distance passenger transportation.

Planning of passenger transportation by rail is not an easy task by itself, and in urban agglomerations, where the nature of residents' traveling, the size and structure of passenger flows depend on many factors, that task is much more complicated [4]. At the same time, it is important to take into account population's traveling needs not only in cities, but in suburban areas of agglomerations, the number of inhabitants of which, according to various estimates, ranges from 30 % to 60 %. It is important to correctly understand the patterns of transport behavior and distribution of the population of suburban areas between different modes of transport [5]. For example, if population needs to travel between peripheral areas and the center of agglomerations, the nature of changes in passenger traffic at a distance of up to 200 km is understandable, it is a gradual increase or decrease in passenger traffic, depending on the direction of movement from or to the main station, and this allows to plan the suburban train services in a traditional manner. However, if we are talking about the needs of suburban agglomeration residents in moving over

distances of more than 200 km and in directions other than the agglomeration core, then identifying the nature, structure and characteristics of such passenger traffic seems to be a very difficult task, which today is not being solved in practice.

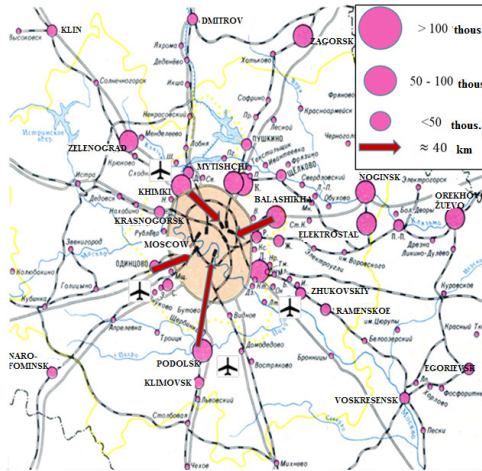
The countries closest to Russia in terms of organization of passenger transportation and the conditions of activity of passenger companies are the countries of Europe and the US. In the US, customer demand for railway transportation is low, due to high competition with road transport (including personal), offering low fares, shorter delivery times, greater traffic frequency and minimum departure intervals. The exception is the Northeast Corridor – Boston–New York–Washington–Richmond railway line, since it is the longest electrified railway line in the United States with a predominantly high-speed traffic. Currently, Amtrak, which operates about 130–150 train pairs per day and has a length of 1 175 km of its own routes, is engaged in passenger railway transportation. For some passenger trains within New York–Washington section (Newark, Wilmington stations), stops are made only if there are passengers that are known in advance, and this information is also delivered to the driver.

In Poland, Germany and Spain, medium-distance passenger transportation and transportation over short distances are popular due to daily labour migrations.

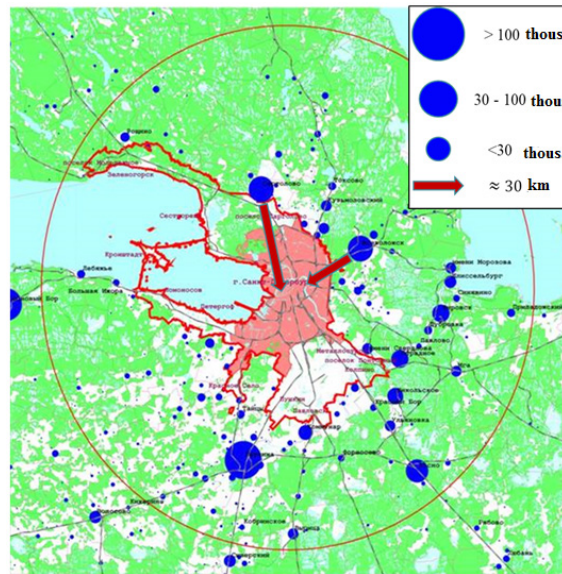
Basing on the analysis performed, the assigning of stops for passenger trains in foreign practice is as follows:



Pic. 1. Agglomerative centers of Moscow transport hub.



Pic. 2. Agglomerative centers of St. Petersburg transport hub.



- passenger trains have stops both in the city and in suburban areas;
- there are «regional trains» with a range of a route from 100 to 1000 km;
- railway junctions mainly have a radial-circular or radial-semicircular scheme;
- stopping points are at large TIH with stations or station complexes;
- for the USA («Northeast Corridor») the number of stops within a single transport hub is from 4 to 6;
- for Europe (Poland, Germany, Spain) the number of stops within a transport hub will be from 2 to 5.

In addition to the features and characteristics of passenger traffic, it is important to correctly evaluate the territorial characteristics of the agglomerations themselves, their development trends and the complexity of the structure [6]. Considering the town-planning limitations and special conditions for the use of the territory, several types (models) of the spatial development of agglomerations are distinguished (table 1).

In Russia, monocentric agglomerations with one city-core dominate, and this core city subordinates all settlements of its suburban area to its influence.

The center of agglomeration in this case exceeds its suburban area in size and economic development. All modes of transport serving the population of both the core and the suburban agglomeration zone are an integral part of a complex unified transport system forming the so-called transport hub [7, 8].

The largest agglomerations with developed transport hubs are: Moscow and Moscow region, St. Petersburg and Leningrad region, Novosibirsk, Yekaterinburg, and Nizhny Novgorod, with their suburbs.

Pic. 1, 2 show the schemes of Moscow and St. Petersburg transport hubs with the nearest suburbs and cities of agglomeration.

The example of Moscow agglomeration is indicative. The total volume of passengers traveling by long-distance trains from eight railway station complexes of Moscow railway junction is about 50 million passengers a year. The analysis of the schedule of passenger trains and organization of passenger service in Moscow transport hub allowed us to identify the following features [9]:

- out of 125 long-distance passenger trains, none have a stop within a radius of 200 km from central stations of the city of Moscow;

- the population of the suburban area comprises 40 % of the total population of Moscow agglomeration;
- the average remoteness of the place of residence of the population of the suburban area from Moscow central stations is of complexes is about 40–50 km;
- 2–3 modes of transport are used by the average commuter to get from the Moscow central station to the place of residence (and vice versa), spending at least 1.5 hours of extra time (one way).

It is obvious that passengers of long-distance trains living in the suburban area of Moscow agglomeration, suffer obvious inconvenience, getting to central stations and back. And railway transport companies do not use such a tool as assigning of stops for individual long-distance trains in the suburban area of large agglomerations in order to increase the level of transport accessibility for the residents of those areas.

A similar situation can be traced at St. Petersburg transport hub.

Assigning additional stops for passenger long-distance trains in the suburban area of the largest transport hubs, following appropriate analysis and comprehensive assessment of feasibility, can result in a number of positive effects:

- reduction of «returnable» passenger traffic within 200 km zone;
- redistribution of passenger traffic between long-distance passenger trains and commuter trains;
- reduction of load on large railway stations;
- on the whole, an increase in transport accessibility and quality of service to the population of large agglomerations, resulting in attraction of additional passenger traffic by rail.

Obviously, the problem is connected to the lack of a clear, understandable and reasonable method of determining feasibility of assigning additional stops for passenger long-distance trains in the suburban areas of large railway junctions. The method should use logical patterns of development of passenger traffic in selected areas, take into account the technical and technological features of the railway rolling stock, passenger infrastructure and passenger facilities of a large railway junction as a whole and of its individual sections, features of the system of multimode passenger transportation and the principles of development of transport interchange hubs [10, pp. 12–16].

Conclusion. The influence of the rapidly changing structure of large cities and of growing agglomerations on the system of organizing the provision of the population with rail transport is not given due attention today. Careful study of the transportation needs of the population of the agglomerations, identifying features and patterns of changes in passenger traffic, emerging and redeeming in the suburban areas of the largest cities, will allow transportation companies to better understand the transport services market, identify additional reserves for optimizing their resources, develop and offer new highly demanded transport products to passengers. In particular, the rational and reasonable assigning stops for passenger long-distance trains in suburban areas of large agglomerations is one of the tools that makes it possible to increase

attractiveness of rail transport and its availability to the population of many cities due to a tangible reduction in weighted average costs and travel time expenditures.

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