HSR-2 AND MODERNIZATION OF TRANSPORT AND LOGISTICS SYSTEMS OF MEGACITIES

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ABSTRACT

The topic of the article is the influence of HSR-2 Moscow–Kazan–Yekaterinburg on transport and logistics systems in megacities and large urban agglomerations along the route, on town-planning development concepts. The complex modernization of the transport frame of urban agglomerations in the construction of a high-speed highway can solve the transport problems that have accumulated over the centuries, positively affect the spatial and territorial development of cities, increase the efficiency of investments, and give a reasonably expected synergistic effect. Moreover, they may require even less money than planned at the construction stage (although this is not an end in itself), and the economic effect in the operation of high-speed railways, urban and suburban transport, promises to be higher than planned, and this opens up new prospects for the spatial and territorial development of towns and agglomerations located near HSR.

Keywords: HSR-2, megacities, agglomerations, international transport corridors, transport and logistics systems, mutual influence, tracing, long-term effect

Background. *Integration into the world transport space and realization of the country's transit potential are declared among the main goals of the Transport Strategy of the Russian Federation for the period until 2030 [1].*

The geographical position of the country between Europe and Asia predisposes to the development of the Eurasian corridors, which is promoted by China's rapid economic growth. The existing transport corridor «West–East» (including the Trans-Siberian Railway) is a skeleton transport structure of Russia, but in the age of high speeds and high traffic volumes the potential of the Siberian railway is limited. Therefore, this corridor needs to be modernized and supplemented by other transit lines.

Within the transport corridor «West–East» two major projects are being realized today: the highway Europe–Western China and the high-speed railway line Moscow–Kazan–Yekaterinburg (HSR-2) with the extension to Beijing. However, while two projects are developing at a slow pace, the leaders have not decided definitively even with the trajectory of the highway, each new circumstance provokes a change in the route, there are controversies about the route between the regions.

The slow pace of project implementation is due, on the one hand, to the difficult financial and economic situation in the country, on the other hand, Russia, which has not been engaged in large-scale transport projects for many years, forgot how to design and finance them, and we lack the legislative framework. Analysis of design decisions for HSR-2 shows that stereotypes of the second half of 20th century dominate, insufficient attention to mutual influence of transport corridors both on each other, and transport-logistical systems of megacities and urban agglomerations.

Objective. *The objective of the author is to consider modernization and development of transport and logistics systems of cities located near the projected HSR-2 Moscow–Kazan–Yekaterinburg.*

Methods. *The author uses general scientific methods, comparative analysis, statistical data, scientific description.*

Results.

Interrelation and interdependence of transport corridors

For the Russian economy, the priority in the transport sector is now the development of international transport corridors.

Only in 2010, in connection with the completion of the construction of the federal highway «Amur» Chita–Khabarovsk, the European part of the country was connected through a paved asphalt road with the Far East. The projected road Europe–Western China will be the first high-level Russian highway on our eastern borders. The Russian part of the road St. Petersburg–Vologda–Kazan–Orenburg–Kazakhstan border, crossing Tatarstan, will have a strong influence on the entire transport and logistics system of the republic.

As for the railways, the network built 50–100 years ago is obsolete (not the railways themselves, they are being updated), straight highways, high speeds, modern control system are needed.

The project to build a high-speed rail Moscow–Kazan–Yekaterinburg can bring qualitatively new standards in passenger and freight traffic between Europe and Asia.

In 2015, there was a third project: the state concern Avtodor announced its intention to begin in 2018 the construction of a toll highway Moscow–Kazan, and in the same corridor as HSR-2. Holding Russian Railways and SC Avtodor work out a single project for the preparation of territories and the removal of communications, which significantly reduces construction costs. Obviously, the design of large transport programs should take into account the interconnection and mutual influence of the highways on each other, and their routes can be coordinately changed if they are optimized in advance for the places of their intersection, the dislocation of related objects and communications [2, 3].

For example, the project of building a highway Moscow–Kazan will significantly affect the route of the road Europe–Western China in Kazan zone. Earlier calculations of freight and passenger flows, and consequently, the location of transport and logistics centers, terminals and stations have a reason to change significantly with the advent of any new project, which will require additional costs and efforts, including research.

Transport-logistics systems in the area of the highway

HSR-2 will have the greatest impact on development of large cities and agglomerations along the route and a thorough revision of their master plans is necessary. Changes in the general plans of cities and their transport infrastructure will, in turn, predetermine the transformation (correction) of the routes and conditions of both the existing ITC and the projected ones [3].

Transport and logistics systems of large cities have been formed for centuries, with problems overlapping each other, and at first glance it may seem

that the implementation of new projects can exacerbate existing difficulties. The laying of highways along the historically established urban transport corridors may reduce their throughput (however, as well as existing ones), significantly worsen the quality of the urban environment. Demolition of buildings and structures, transfer of communications, additional transport interchanges at the intersection with the streets will require colossal funds. Solution? It is necessary to adhere to the requirements for the organization of ITC on the tangential bypass of megacities.

Following the beginning of the design of HSR-2 in January 2015, the project of HSR Moscow–Beijing was announced. And in the summer of 2017 JSC Russian Railways announced that a project of cargo-passenger HSR Eurasia is being developed, which will unite the largest high-speed transport systems in Europe and China. The total length of the route will be 9,5 thousand kilometers (distance Beijing–Moscow–Berlin), and its route will include the section Moscow–Kazan, passing in the middle part through the Urals and Siberia, as well as Kazakhstan and Mongolia. HSR is designed to handle both passenger and freight container trains, which will radically change the transport and logistics system along the route.

According to the latest version of the routing (not yet approved), HSR-2 is located at a distance from the cities of Vladimir and Cheboksary, through Nizhny Novgorod and a large urban agglomeration – Kamskaya, including the whole city of Kazan. Moscow and Yekaterinburg are considered to be the final points, where the HSR stations are planned to be located in the center of the cities.

The route of the transit branch of HSR in Nizhny Novgorod passes along its outskirts, 15 km from the center, and thus a tangential bypass of the city is realized de facto. Trains formed in Nizhny Novgorod arrive at Moscow railway station, while it is not possible to cancel the passage through the city, the branch line to Kirov crosses the whole city, and the northern bypass is not yet discussed.

Passage of HSR-2 through Kamskaya agglomeration inevitably affects the prospects of the transport system of the cities of Naberezhnye Chelny, Nizhnekamsk and Yelabuga, radically changing the development strategies of these large settlements. While their leadership is not aware of this factor, urban planning without taking into account the tracing of HSR-2 entails significant non-rational costs today, and even greater in the future.

By the way, Moscow and Yekaterinburg, now considered to be the final points of the HSR-2 route, are not such in the future: with the development of the HSR network in the country, the extension of the highway to the west, south and north will follow. Economist, expert of the IEF V. A. Kashin in general advocates extreme measures: proposes to remove all the stations from the city center – with all their infrastructure, and to close the «ends» of the railways going to Moscow to existing airports [4].

It seems more expedient to make another decision: HSR should approach one of the stations of Moscow Central Circle (MCC), as well as one or two of Moscow airports [3]. In Yekaterinburg, the route and station location also require unconventional solutions: in addition to the eastward movement, a branch to Chelyabinsk is supposed.

The unreasoned, scientifically unsupported tracing of HSR-2 can adversely affect the optimal organization of freight and passenger transportation, preservation of nature and spatial development of cities and agglomerations, which can be demonstrated most clearly by the example of design of HSR in Kazan zone, because here the situation is particularly complex.

Transport framework of Kazan agglomeration

In the current strategy of social and economic development of the city of Kazan until 2030, the issues of transport infrastructure occupy an important place. However, the urban environment and transport infrastructure are still considered by the strategy developers in the narrow framework of urban amenities and transport services, isolated from the system of national and international transport corridors, three of which have the Eurasian status: North–South, West–East, Europe–Western China [5].

Despite the fact that in the Strategy of social and economic development of the Republic of Tatarstan-2030 the ITC is paid a lot of attention to, the same cannot be said about the network of transport and logistics centers. With this in mind, it is necessary to make adjustments to the plans for transformations of Kazan agglomeration, as well as the entire configuration of the regional transport framework.

With all the advantages of the bypass M-7, the highway and the railway became disconnected. At the same time, the bypass road and the city are also largely isolated from each other: the radial departures from the city proposed by the developers of the previous master plans have not been realized to this day – Kazan got in some kind of «cauldron».

The plans for construction of HSR-2 Moscow–Kazan–Yekaterinburg introduce additional problems that are not solved within the existing transport framework. The routing of the highway discussed by specialists with the arrival at the station Kazan-2 through the urban forest «Lebyazhye» worsens for the population the transport accessibility, the quality of the urban environment, and also leads to a rise in the cost of construction, and a decrease in the speed of the passage of the city by the trains.

Routing of HSR-2 from Nizhny Novgorod to Naberezhnye Chelny was carried out by JSC Tomgiprotrans, the designer of bridges and roads in Siberia. Analysis of approaches to design shows that a strictly sectoral approach was implemented, the station Kazan-2 was adopted as an axiom, the interconnection and mutual influence of existing and under construction highways in the Kazan zone, the prospects for development of the city's transport infrastructure and the city itself were not taken into account. The designers did not study the development of Kazan specialists, which would greatly simplify their work. Mathematical modeling of transport flows in Kazan agglomeration in three or four variants of tracing taking into account economic, ecological, town-planning aspects would make clear the choice of the optimal route.

On March 21, 2016 routing of the HSR in Kazan zone was the subject of discussion in the Human Rights Council under the President of the Russian Federation. The Council drew attention to violations of environmental legislation and recommended the Ministry of Transport of the Russian Federation, the Cabinet of Ministers of Tatarstan and Russian Railways to exclude from the project the option of passage of the HSR along the city forest «Lebyazhye» in the territory of Kazan as contradictory to Art. 105 of the Forest Code of the Russian Federation [6].

Alternative projects of zonal tracing

In addition to the route through the city, southern and northern bypasses are discussed. The statements

Pic. 1. Bypass railway in Kazan (author's development).

of individual experts on the southern bypass are not supported by any calculations and reasonable arguments, so this route is at the level of the idea. The project proposal «The Bypass Railway of Kazan» [7], which provides for construction of a railway bypassing Kazan, north of the M-7 highway from the village of Krasny Yar of Zelenodolsky district to Biryuli crossing point of Vysokogorsky district (Kalinino village), about 50 km long is of interest, as well as the new railway station of Kazan beyond the village of Sukhaya Reka and the subway line 6,5 km and the highway 6 km to it. On the existing railway lines in the length of more than 100 km will be organized ground metro, integrated with urban and suburban transport, the delivery of goods by rail to enterprises is expected at night.

The cost of the bypass railway project and the HSR-2 section in one corridor in Kazan zone is 150 billion rubles (in 2016 prices), including the construction of the following facilities:

– railway station village Krasny Yar – Biryuli crossing point (52 km • 0,5 billion rubles / km = 26 billion rubles);

– station complex on the M-7 behind Sukhaya Reka – 10 billion rubles;

– metro line with a length of 6,5 km with four stations – 50 billion roubles;

– highway with a length of 6 km with interchanges – 6 billion roubles;

– high-speed highway from the border with Mari El to the New station on M-7 (42 km • 1,26 billion roubles/km = 53 billion roubles);

– other costs – 5 billion roubles.

If the incomparably higher results are achieved, the final investment costs of the option are substantially lower than the estimated costs for the construction of the HSR-2 through the city: the 47 km long route from Mari El border to Kazan-2 was estimated by the HSR-2 initiators at 166 billion rubles in the prices of 2014, and the cost of the exit from Kazan-2 in the east direction was not taken into account.

The implementation of the project allows to straighten the route of railways and HSR, to combine three ITC – automobile, railway and HSR in close proximity to Kazan, provides a tangential bypass of the city to HSR, removes unnecessary burdens on the city's infrastructure.

The construction of the station complex at M-7, where in addition to the railway station there will be a metro station, depot of the HSR, depot of the metro, bus station, intercepting car parks, hotels, etc., is also the emergence of a new microdistrict of the city with the likely creation of a central Volga management site, declared in the system of projects of the organization of the Eurasian transport corridors.

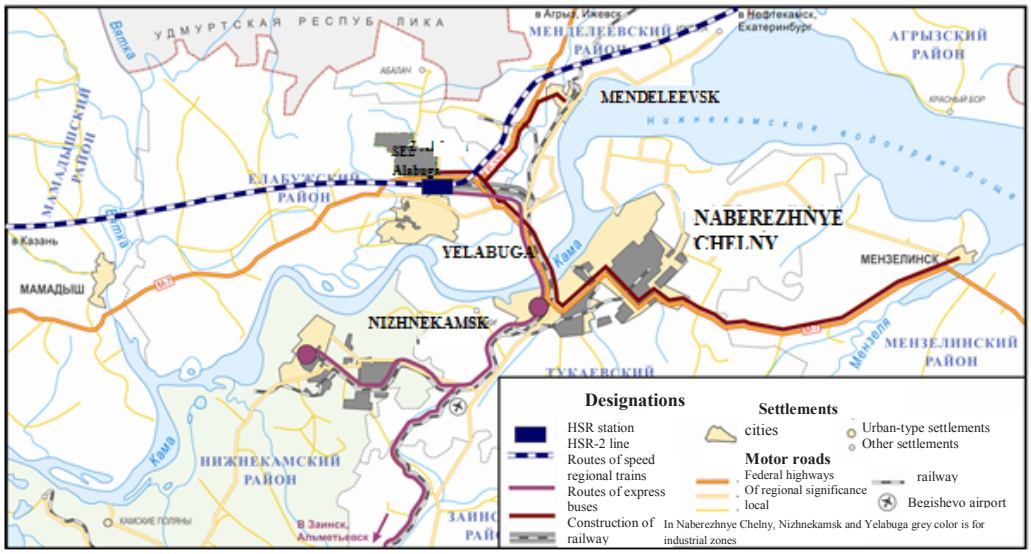
In the immediate vicinity of the city, two large logistic centers are formed: «Biryuli» and Sviyazhsky interregional multimodal logistics center (SIMLC), which will assume inter alia functions of Yudino marshalling yard. The significance of the crossing point «Biryuli» as a potential site for a large logistics center is further enhanced by the planned passage of the highway Europe–Western China.

Continuation of the highway from the station on M-7 to the intersection with the road Europe–Western China and further to the north contributes to the development of the districts of Zakazanie.

The bypass route is almost 7 km shorter than the existing one, this means a daily reduction in freight transportation by 5 million t•km, if we transform to money this is about 4 million rubles per day, 1,5 billion rubles per year. Taking into account passenger transportation, the savings will amount to 2 billion rubles per year.

And the highway is flat and straight, which gives economy in time.

The construction of a bypass railway and HSR over the city limits will make it possible to build about



Pic. 2. Scheme of passage of HSR-2, proposed by the Center for Strategic Research.

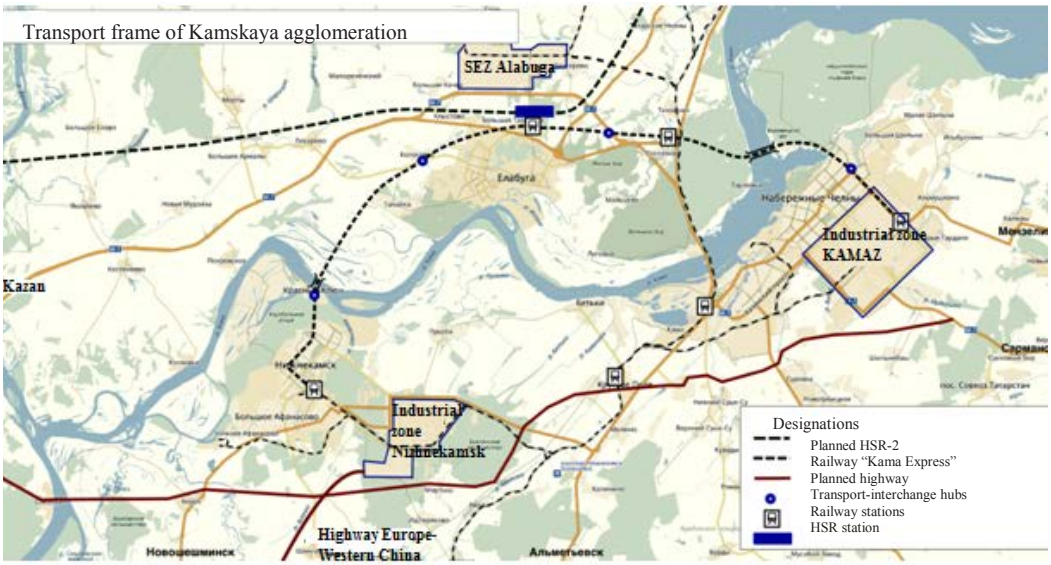
3 thousand hectares of land within a radius of 5–7 km from the Kremlin, and these sites with developed infrastructure and prestigious. For reference, 1 hectare of land in Kazan costs about 100 million rubles. The ground metro on the free railway tracks will solve the problems of urban transport for decades with minimal capital costs.

HSR-2 and transport frame of Kamskaya agglomeration

Unlike the route in Kazan zone, proposed by the Center for Strategic Research (CSR) and supported by the Ministry of Transport, the HSR route of Kamskaya agglomeration is correct: a tangential bypass of the agglomeration has been implemented. The station is supposed to be located on the M-7 highway between the city of Yelabuga and the SEZ «Alabuga».

The passage of HSR-2 through Kamskaya agglomeration will have a strong impact on the development of the transport and logistics system in the cities of Yelabuga, Naberezhnye Chelny, Nizhnekamsk, will require a rethinking of the entire transport and logistics agglomeration system, and will fundamentally change the strategy of territorial development of these cities.

The implementation of the «Innokam» project will contribute to the development of the transport and logistics system of the agglomeration. The innovation and production center is created within Nizhnekamsk agglomeration, which includes the territories of Yelabuzhsky, Zainsky, Mendeleevsky, Nizhnekamsky and Tukaevsky municipal districts and the city district of Naberezhnye Chelny.



Pic. 3. Scheme of transport of Kamskaya agglomeration (development of the author).

An important part of the project is the creation of a developed infrastructure in «Innokam». The reconstruction of the railway infrastructure and the modernization of the Begishevo International Airport are planned. And the cities that are territorially included in the Innocam are planned to be connected by a single system of public transport in order to give freedom of movement to the labor force.

However, despite the compact location of the cities and industrial enterprises of the cluster, the Kama River divides this region – for example, with a distance of 20 km between the cities of Yelabuga and Nizhnekamsk, transport distances are 65 km or more, and the only bridge connects these cities in Naberezhnye Chelny – dam of Nizhnekamsk hydroelectric power station.

The project proposal of the author «Kama Express» [8] provides for construction of a railway between the cities Yelabuga–Nizhnekamsk–Naberezhnye Chelny (the northern half-ring) with a length of 60 km, connecting the cities of Yelabuga, Nizhnekamsk and Naberezhnye Chelny.

In the future, it is supposed to close the railway ring, using existing roads (southern half-ring), located within the city limits of Naberezhnye Chelny and Nizhnekamsk, and railway tracks between them with a length of more than 50 km.

In this way, the ground metro of the agglomeration will be organized, integrated with the transport frame of the cities entering the metropolitan area, as well as by road and railways passing through the Kamskaya agglomeration.

The cost of the project «Kama Express» is 50 billion roubles (in prices of 2016), including the construction of the following objects:

– railway Nizhnekams–Yelabuga–Naberezhnye Chelny with a length of 60 km • 0,5 billion/km = 30,0 billion roubles;

– railway complex on M-7 (SEZ Alabuga), combined with HSR station – 2,5 billion roubles;

– station complex at the inresection with the ordinary railway and intercity train in the area Tikhonovo-Pospelovo – 2,5 billion roubles;

– 2 bridges across the Kama ((between Nizhnekamsk and Yelabuga and in the area Tikhonovo-Pospelovo) – 10 billion roubles;

– other costs – 5 billion roubles.

The high-speed transport frame of Kamskaya agglomeration will strengthen the coherence of cities, increase the flow of labor, business and cultural correspondence, facilitate the direct interaction of the cities of the agglomeration, in the future – create new centers for business activity and housing construction between Nizhnekamsk, Yelabuga and Naberezhnye Chelny,

The agglomeration transport frame is complemented by the construction of a highway from Mamadysh to M-7, bypassing Naberezhnye Chelny and Nizhnekamsk with a bridge crossing in the area of Sokolka village with a length of 85 km. This project will unload the M-7 highway within Nizhnekamsk agglomeration, will become an alternate route across the dam of Nizhnekamsk hydroelectric power station, thereby ensuring the transport security of the region.

Conclusions. *The construction of HSR-2 has a huge impact on the development of cities and agglomerations along the route, especially the modernization of their transport and logistics systems. At the same time, in designing it is necessary to take into account the features of the transport framework of cities and agglomerations, and consider them in development, in conjunction with city development. Optimal solutions for the design of the HSR-2 route in the suburbs of megacities and large urban agglomerations are achieved through a comprehensive analysis and modeling of traffic flows taking into account economic, environmental, urban aspects.*

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