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Europe-Asia transport corridor development as Russian competitive advantage (example of Sverdlovsk region)

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Abstract. The implementation of Russian national project “Fast and High-speed Transportation” is analyzed in the article. Sverdlovsk railway is taken as an example. The use of an innovative rolling-stock “Lastochka” is considered in suburban passenger transportation of the Sverdlovsk Suburban Company (SPK).

1. Introduction

The value of competitive advantages grows in conditions of globalization.

Due to the necessity of a deep technological passenger railway transport reform and providing its competitiveness by means of transport there is a developed program of fast and high-speed railway lines in Russian Federation [1] which is being implemented step by step. The program implementation will help change the tendency of reducing in distant and suburban passenger links. Also it will provide a high multiplicative effect for the country social and economic development and budget sphere of Russia.

Fast and high-speed trains stations will be created in more than 100 cities of Russia with total population of more than 45 million people.

The transport mobility of Russian population will grow by 700 passengers-km for 1 person a year due to induced demands for passenger transportations appeared as a result of a great travel time cutting between cities. It will let fulfill the objective of the Russian transport strategy by 15%. At present there are three high-speed lines in RF: Moscow – St. Petersburg, Moscow – Nizhniy Novgorod, St. Petersburg – Buslavskaya (further to Helsinki).

The program suggests the implementation of 20 projects of fast and high-speed lines creation. It will let create more than 50 high-speed routes, the capacity of which will not be less than 84 million travels a year. The total length of fast and high-speed mainlines will be more than 7000 km.

Every project of the program is rentable and has a positive NPV for transporters, infrastructure owners and the State.

The system principal projects of fast and high-speed transportation are high-speed mainlines Moscow – Kazan, Kazan – Ekaterinburg, Moscow – Adler, Moscow – St. Petersburg. The task of the high-speed mainlines creation is the modernization of the supporting frame of Russian Railways net and harmonize it to the present and future demands for passenger and freight transportation. To reduce the expenses of the project implementation and to increase the number of potential investors the system principal projects will be implemented step by step. The project will be started from the regions which will give



the highest positive effect to the economical development of the country and maximum budget replenishment.

Except for the system engineering projects short-distance fast and high-speed mainlines are being created which can provide a great positive economical and social effect due to widening the range of the present agglomerations and the optimization of settlement system.

The program suggests three stages. The first stage (2015-2020 – pilot projects of fast and high-speed transportation implementation mostly effective for the transporters, infrastructure owners and the State, such as:

- high-speed mainline “Moscow – Kazan”;
- high-speed mainline “Moscow – Tula” as the first stage of “Moscow – Adler” fast and high-speed mainline;
- fast mainline “Tula – Orel – Belgorod” (modernization of the present infrastructure);
- high-speed mainline “Ekaterinburg – Chelyabinsk”;
- fast mainline “Ekaterinburg – Nizhniy Tagil” (modernization of the present infrastructure) [2].

Stage 2. (2020-2025) suggests regional expansion of fast and high-speed transportation due to the growth of the fast and high-speed mainlines length. Stage 3 (2025-2030) will let create complete corridors of fast and high-speed transportation.

At present the implementation of the program is started at Sverdlovsk region suburban links. Since the middle of 2000-s there is a shortened route which lead to the reduce of passengers transported in the suburban links. Figure 1 shows the tendency of reducing of the number of passenger transportation by railways in the suburban links. The number of passengers transported by Sverdlovsk Suburban Company in 2006 was 30 million passengers, and in 2017 – 20.8 million passengers [3].



Figure 1. The number of transported passengers (Calculated by the authors basing on the data of Sverdlovsk Railways – branch of JSC “RZhD” [5]).

However, according to the analysts’ data of Sverdlovsk Railways there is a great necessity of passengers’ transportation in the suburban links. To keep the consumers of railway service and providing them with modern, qualified service SPK decided to use an innovative motor-car rolling-stock of electric train ES2G “Lastochka” in several lines. Such trains exploitation was introduced in 3 stages. At present electric trains “Lastochka” are more often used to satisfy the consumers’ demands to distant points of destination with a great passenger flow on Fridays, Saturdays, Sundays and Mondays and in “Ekaterinburg – Serov” line only on Holidays. The destination points of electric trains “Lastochka” are

in the following lines: “Ekaterinburg-passazhirskiy – Nizhniy Tagil”, “Ekaterinburg-passazhirskiy – Kushva”, “Ekaterinburg-passazhirskiy – Kamensk-Uralskiy”, “Ekaterinburg-passazhirskiy – Kuzino”, “Ekaterinburg-passazhirskiy – Shalya”, “Ekaterinburg-passazhirskiy – Serov”, “Ekaterinburg-passazhirskiy – Talitsa”. The scheme of fast trains lines is presented in Figure 2.

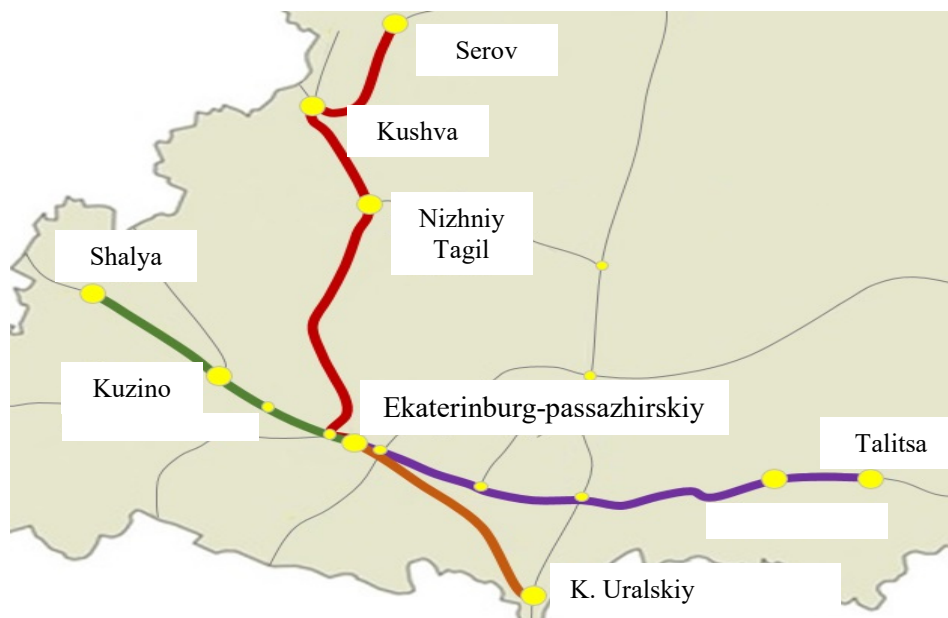


Figure 2. The scheme of fast trains lines in Sverdlovsk region.

Only a part of transportational service market was touched upon by the modernization supported by the Ministry of transport of Sverdlovsk region and JSC “RZhD”. From November 2015 electric trains “Lastochka” were introduced in the lines “Ekaterinburg-passazhirskiy – Nizhniy Tagil”, “Ekaterinburg-passazhirskiy – Kamensk-Uralskiy”, “Ekaterinburg-passazhirskiy – Kuzino”. During the last three years exploitation of such trains was implemented in the lines of Shalya, Kushva, Talitsa and Serov. Since the moment of the project of electric trains “Lastochka” exploitation the company has transported almost 4 million passengers. The main passenger line is “Ekaterinburg-passazhirskiy – Nizhniy Tagil”. Table 1 shows the number of electric trains “Lastochka” and the distance of the lines.

Table 1. The number of electric trains “Lastochka” and the rout distance.

№ p/p	Line	Number of trains	Distance, km.
1	Nizhniy Tagil	8	149
2	Kushva	2	200
3	K. Uralskiy	4	100
4	Kuzino	2	88
5	Shalya	2	146
6	Talitsa	2	215
7	Serov	2	500

The SPK survey, made in the year 2015 shows that passengers prefer the reduce of the rolling-stock running time, comfort and car ergonomics, the comfort of boarding, the inner-climate conditions, modern toilet rooms, prices.

The principal factors, as the survey shows are: the transportation price and running time. The comparative characteristics of price and running time comparing to bus transport is presented in Figure3 and 5.

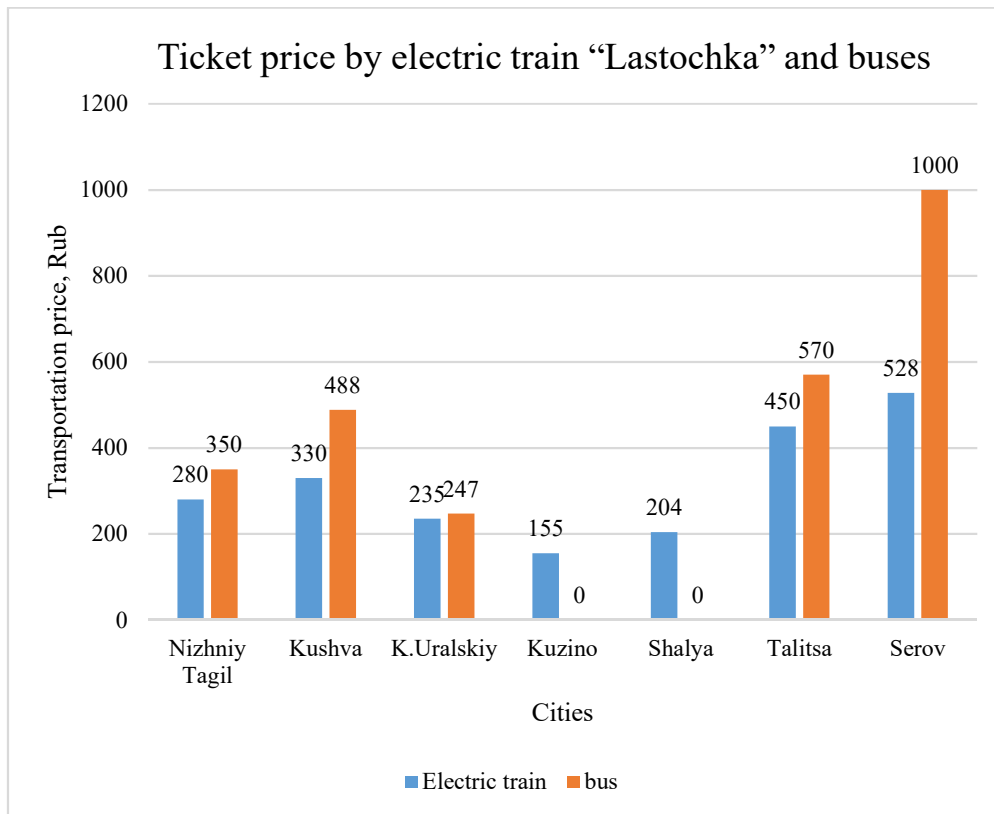


Figure 3. Transportation price

The data in the table shows that the passengers save in transportation price using railways. Basing on Figure 3 data we can construct a diagram of persantage savings of the rout price, which is shown in Figure 4.

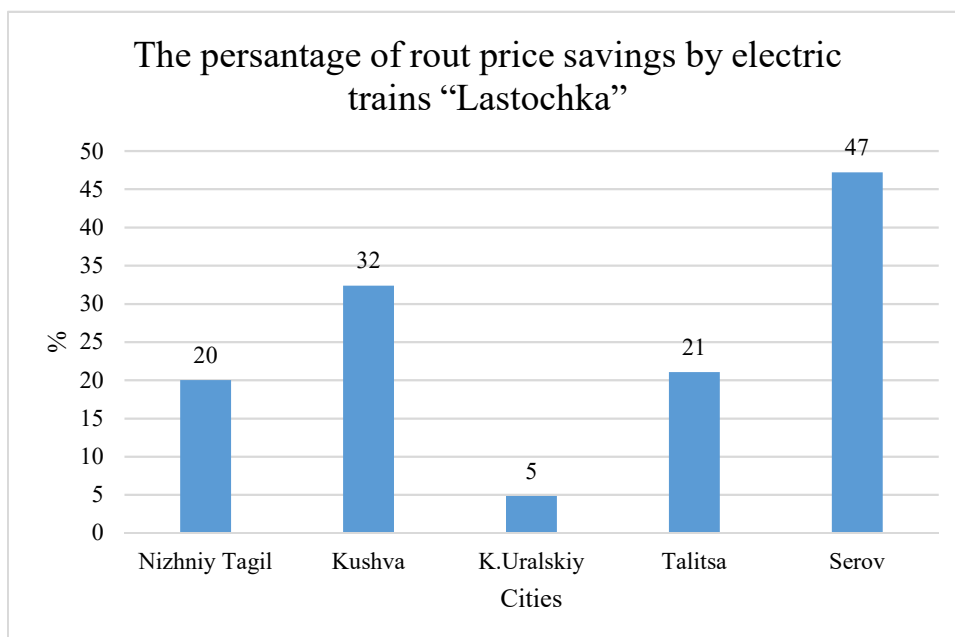


Figure 4. The persantage of rout price savings by electric trains "Lastochka".

On average the rout price by electric trains "Lastochka" is 25% less than that on by bus.

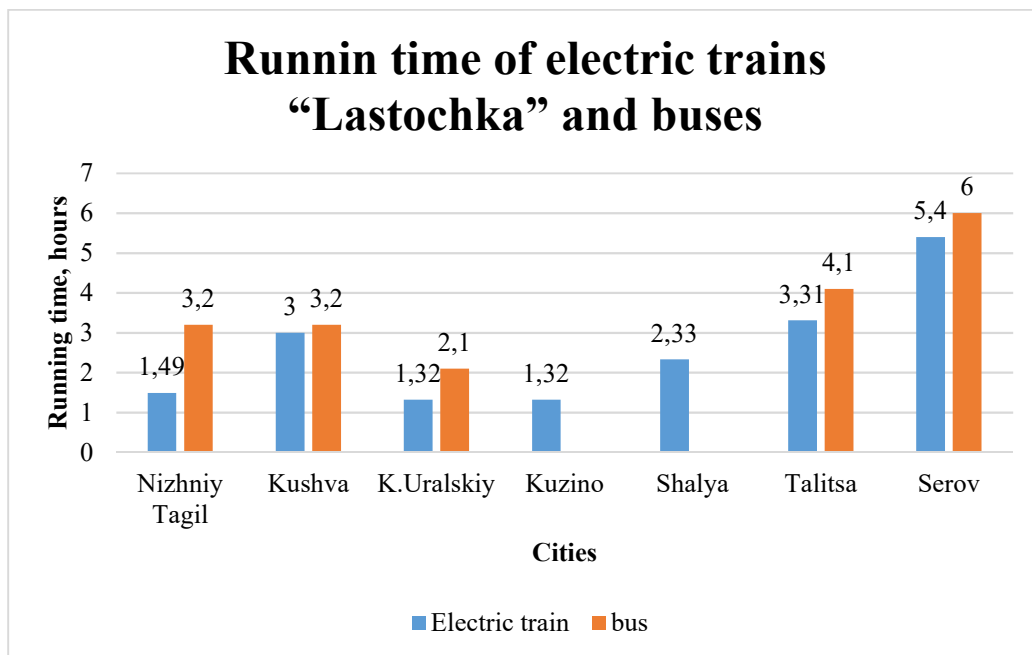


Figure 5. Running time of electric trains “Lastochka” and buses.

Figure 5 shows that the use of electric trains “Lastochka” saves running time. Basing on figure 5 data we can construct a percentage diagram of the running time savings (Figure 6)

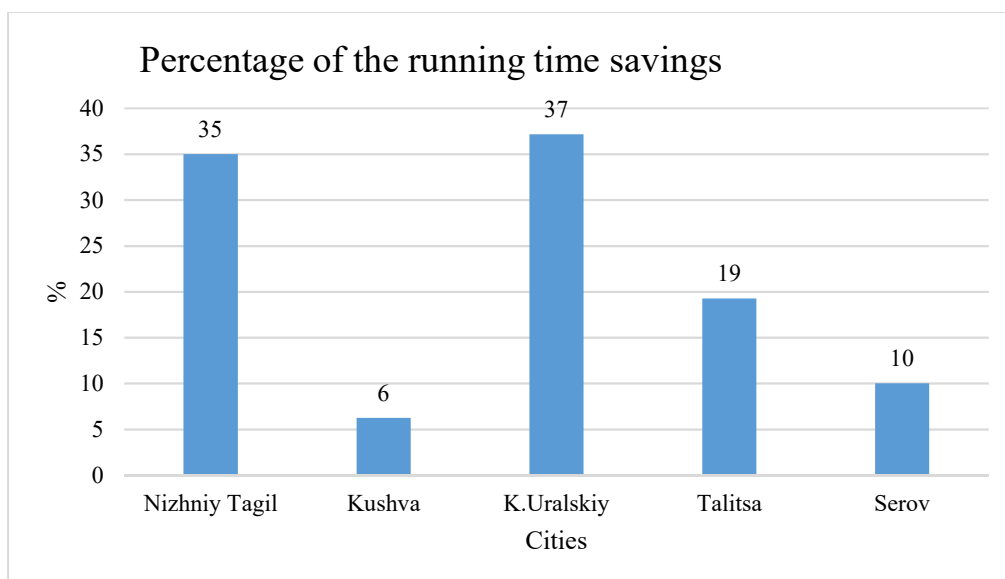


Figure 6. Percentage of the running time savings by electric trains “Lastochka”.

On average the running time of electric trains “Lastochka” is 22% less than that of a bus.

Such destination points as Kuzino and Shalya can be reached only by railways. Thus, the total savings of time and money is the competitive advantage of electric trains “Lastochka”.

The electric trains “Lastochka” saves resouces to the Sverdlovsk Suburban Company too, as “Lastochka” equipped by an asynchrone propulsion engine is considered to transfer passengers by railways of 1520 mm track width and it is the sollution for urban, suburban and interigional transportations. It lets use already existing railways.

The main technical characteristics of electric trains “Lastochka” are presented in table 2. The use of electric trains “Lastochka” will let any transporter choose a suitable transport according to real exploitative conditions in a service ground even in the areas with different type of the current.

Table 2. Technical characteristics of electric trains “Lastochka”.

Electric train type	ES2G standard	ES2G Premium	ES1P
Structural speed, km/h	160	160	160
Track width, mm	1520	1520	1520
Power, kV	3	3	3/25 (50)
Current type	DC	DC	AC/DC
Basic train composition, N of cars	5	5	5
Wheel drive capacity of the basic train composition, kW	2932	2932	2550
Traction effort of the basic train composition, kN	280	280	255
Maximum angle of the long-edged cross-section, %	30	30	30
Maximum traction on the shaft, tons	19	19	19
Length of the basic train composition, m	130	130	130
Car width, mm	3480	3480	3480
The number of seats of the basic train composition	368 fixed seats; 4 wheelchair rooms; 18 fold-back seats; 999 standing rooms	349 fixed seats; 2 wheelchair rooms	351 fixed seats; 2 wheelchair rooms
Climatic conditions, the range of the environmental air temperature, °C	-40 to +40	-40 to +40	-40 to +40
Exploitation period, years	40	40	40

The table shows that the equipment and materials set in the electric train provide a safe exploitation in climatic regions with the environmental temperature from -40 to +40 degrees on Centigrade.

The use of electric trains of an innovative motor-car rolling-stock - electric trains ES2G “Lastochka” in Sverdlovsk region has both advantages and disadvantages which are presented in table 3.

Table 3. Advantages and disadvantages of electric trains “Lastochka”.

Advantages	Disadvantages
Electric train is instrumented with microprocessor system of the train control, auto drive system, video surveillance system. Light weight construction of the body of the car made of extruded aluminum cross-sections and the crew with a pneumatic suspension provide energy efficiency and high comfort at any speed All passenger compartments have panoramic windows with heat insulating properties.	Limited lines range

Due to the use of modern technical solutions the maintenance operations are simplified and the overhaul life is increased.	Lack of professional staff
The Electric train is designed and constructed according to the nowadays demands on ergonomics and safety.	
Powerful and safe climate controller creates a comfortable indoor climate	
Specially designed seats for non-mobile passengers.	
The electric train is equipped with modern toilet rooms with a special equipment for passengers with physically reduced abilities	Duration of the project implementation
Audio and video information systems	
Active and passive safety systems to protect passengers	
Internet access system at any part of the rout	

The advantages of electric trains “Lastochka” are in the combination of innovative solutions, comfort and safety.

To widen the links of the rolling-stock “Lastochka” and to raise the competitiveness of railway transport there was a great evaluation of the competitors in Sverdlovsk region passenger transportation which is presented in table 4. Five grade scale was used to make this analyses.

Table 4. Grade evaluation of the competitors in Sverdlovsk region passenger transportation.

	Geographical location	Service quality	Number of changings	Price policy	Rout time	Safety	Staff potential	Total grade
Personal automobiles	3	5	3	5	2	1	1	20
Share taxi (IE)	3	2	2	4	2	1	1	15
Buses (IE, LLC)	5	5	4	4	2	4	5	29
SPK	5	3	4	2	5	5	4	28

The grade evaluation showed that the leader is haulers – great number of individual entrepreneurs and LLC. Their competitive advantage is the service quality and staff potential. Further is Sverdlovsk Suburban Company (SPK).

Basing on the grade evaluation of the competitors the SPK SWOT-analyses was made in table 5. The objective of the analyses is the determination of problems and opportunities for the company development.

Table 5. SWO-analyses.

Advantages - brand popularity - geographical position - rout time - safety	Opportunities - differential price policy - staff potential - rolling-stock modernization - use of innovations - economical and political stability - the growth of the electric train “Lastochka” links
Disadvantages - long-time project development - not all directions are covered on the territory of Sverdlovsk region	Risks - New competitors - energy cost growth - population incomes fall

- service quality	- inflation
- staff potential	- ruble depreciation
- price policy	

Thus, SWOT-analyses showed that the company has the opportunities to strengthen weak points.

Taking into account the position of the electric train as an innovative motor-car rolling-stock – electric trains “Lastochka” in Russia and some parts of Sverdlovsk region links there are activities to develop competitive advantages of this type of railway transport, which is presented in table 6.

Table 6. Activity system.

	Activity	Objective	Result
Service quality	Monitoring of the service quality every 6 months	Quality raise	Competitiveness raise
Staff potential	Qualification raise once a year Organization of the competition “The best worker” with further promotion	To provide qualified staff hiring and service quality	Competitiveness raise
Price policy	Consumers’ differentiation Bonuses for regular customers	Raise of passenger flow and car occupancy	Sales raise
Raise of the number of links with “Lastochka” trains in Sverdlovsk region	Growth of investments into railway sphere and its infrastructure	Population life quality raise	Population life quality raise Creation of technical maintenance grounds in Ekaterinburg
New Markets entrance (Tyumen region)	Government complex program formation	Competitiveness raise	Ural Federal District development

The suggested activity implementation will let increase passenger flow due to the qualified service and reasonable price policy, that will provide the development of the SPK competitiveness.

References

- [1] 2015 *The program of the organization of high-speed railway transport in Russian Federation* <http://www.rzd.ru>
- [2] Samuilov V, Kargapoltseva T and others 2019 *Organization of transport innovative activity (Russia-China as an example) Monograph* (Ekaterinburg: URFU) p 136
- [3] Samuilov V, Bronnikov S, Kargapoltseva T 2018 *Innovative transport* N3 29 pp 18-23
- [4] Tsigler V, Mangler R Desiro 2016 *RUS – Perspective suburban electric train. Innovative Digest, innovative development JSC “RZhD”* (Simens)
- [5] *On the report of Sverdlovsk branch JSC “RZhD”* <http://www.rzd.ru>
- [6] <https://www.kommersant.ru/doc/2602146>