TO BUILD SLOWLY, TO GO FAST…

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ABSTRACT

Nowadays, in countries with developed high-speed passenger transport, the most noticeable growth rates in tourism are observed, namely, high speeds attract many travel enthusiasts, increase passenger and tourist traffic, ensuring the lowest total travel time with the most decent safety, comfort and economy. The era of fast trains, however, is not so long as to acquire a full-fledged history. But nonetheless the HSR already has the past. And it makes to show itself. Railway tour routes, varied in geographical location, form and content, help to do that.

Keywords: railway, high-speed rail, history, international lines, passenger flow, tourism development.

Background. *In the 1920s and 1930s, development of high-speed rail transport using internal combustion engines began in different countries. It was just a start of a long journey, timid experiments were, by and large, prerequisites for the birth of the first stage, not even of development, but of attempts to master high-speed traffic on railway transport.*

Objective. *The objective of the author is to consider the history of development of high-speed rail transport and relationship between transportation and tourism.*

Methods. *The author uses general scientific methods, historical-retrospective method, comparative method.*

Results.

Rail zeppelin

The speed and power of the first diesel locomotives were lower than that of the best steam locomotives of the time. In the high-speed traffic, at first there were attempts to use light aerowagons and aero railcars.

One such air car with a propeller located at the rear was designed by German aircraft engineer Franz Kruckenberg in 1929. The 28,5 meter long railcar was supported on a wheelbase with two axles. It accelerated at the expense of a four-bladed (later – two-bladed) wooden propeller. It had aviation gasoline engine of 600 hp.

On June 21, 1931, the Dr. Krukenberg air train set a new world speed record on the railway of 230,2 km/h on Hamburg–Berlin route. This record had not been surpassed by any other train until 1954.

The design of the car was light and durable: aluminum frames were covered with canvas, like in airships (zeppelins) – hence the name «rail zeppelin» (German: Schienenzeppelin). The train could carry up to 40 passengers.

In general, the idea of cars with a propeller engine has not justified itself [1]. And in commercial operation, the aero cars were not used because of the strong noise and difficulties at the beginning of movement [2, p. 12].

A no less unique diesel passenger train was ordered by Deutsche Reichsbahn-Gesellschaft to the WUMAG plant in early 1932. One of the main requirements of the customer to the new project was that the train was no less than the fastest in the world. By the end of the year, the prototype had been ready and made its first journey from Berlin (Lehrter station) to Hamburg (Altona station) at a speed of 165 km/h [3]. None of the steam locomotive driven trains that existed at that time could have developed such a speed, the customer's requirements were met.

The train consisted of two cars, each of which was equipped with a separate power plant. The power plant was a combined, 12-cylinder Maybach G05 diesel engine with a power of 302 hp set in motion a generator, which in turn produced electricity for electric motors. The total length of the train was 41,9 meters, weight – 85 tons. The train was so advanced for its time that it attracted the attention of both railway specialists and aircraft manufacturers, and ordinary people went to the station just to gaze at the «flying hamburger» passing at great speed along the rails [3]. These trains even entered into regular operation.

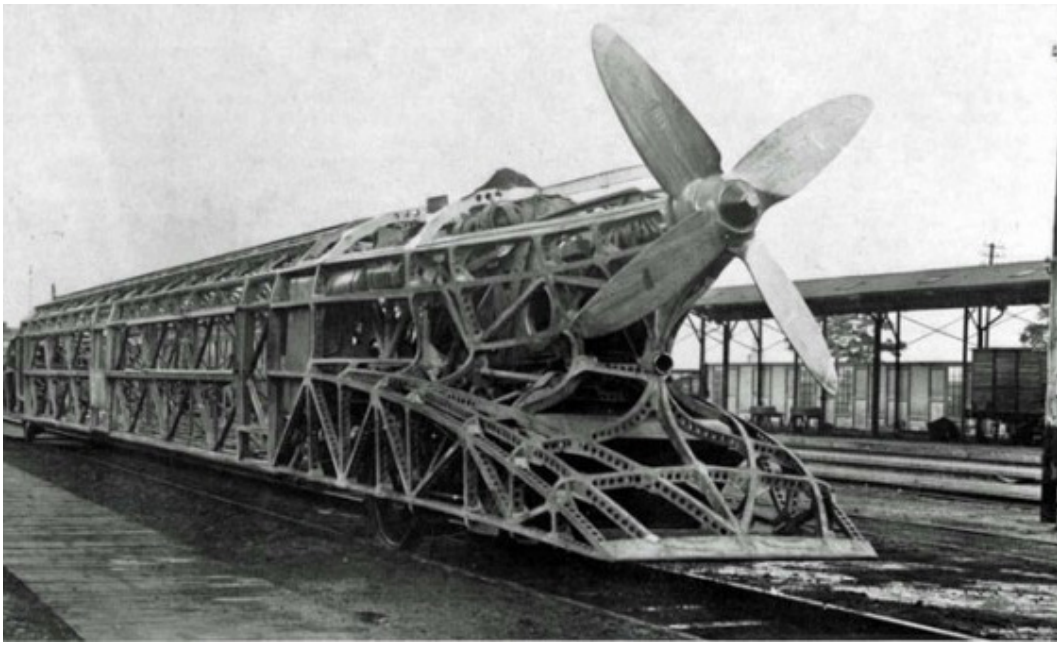
In the USA, the first train with ICE was the Pioneer Zephyr. The simplification of the structure compared to traditional trains was achieved through the use of an «articulated» carriage joint using common mobile four-wheel bogies. Thus, the train consisted of three parts, which gave an additional reduction in weight, because in addition to reducing the total number of wheeled carts, there was no need for car couplings. Construction of the first sample of the train «Zephyr» was finished by the company Budd Manufacturing on April 9, 1934. The diesel-electric propulsion unit on it consisted of an 8-cylinder diesel engine Winton 201-A with a capacity of 600 hp and a generator manufactured by General Electric. Traction motors, also made by GE, were installed only on the front carriage of a motor car.

The ceremony of launching the new train was solemn. The train left Denver at 7 hours 04 minutes in the morning and arrived in Chicago at 8 hours 9 minutes in the evening of the same day, 13 hours 5 minutes after departure. The average speed of its movement during this journey was 77 miles per hour (124 km/h). In some areas it accelerated to 112,5 miles per hour (181 km/h). A non-stop «throw» with a length of 1015 miles (1633 km) surpassed in speed the most daring calculations of Chicago, Burlington and Quincy Railroad (CB&Q) company. The train covered this distance by 1 hour and 55 minutes faster than planned on schedule. Ordinary CB & Q trains spent about 25 hours to cover the distance from Denver to Chicago. For a long time these diesel trains provided large volumes of high-speed rail transportation in the USA [4].

Conceptual speed criteria

In the 1930s, high-speed Bugatti motor cars with unique four-axle bogies with wheels, which were fitted with rubber liners between the centers and bandages, were used on Paris–Lyon to the Mediterranean Sea route in France. Bugatti designed the railcar to adapt engines unclaimed to the vehicle. And this option was one of the first high-speed trains in the world.

The prototype, built in Alsace by spring 1933, was impressive: 172 kilometers per hour. The first model was commissioned in May by the state network; it provided an average of 116 km/h. In February 1934, the second carriage was delivered. Four gasoline 8-cylinder engines were set for each motorcar. In 1937, this model set a world speed record on railways: 196 km/h [5]. These trains had first class lounges for 48 seats; reached a speed of 170 km/h, but the operation was too expensive [2, p. 13].



Rail Zeppelin of F. Krukenberg.

In the second half of the 1950s, France achieved even greater success in the field of high-speed rail transport. The tests were carried out on a specially prepared 66 km long section of Paris–Orleans line. Locomotives for high-speed trips have been upgraded. Traction motors, gearboxes, axle boxes and wheel sets were tested on a test bench for a rotational speed equivalent to the linear speed of the locomotive at 450 km/h [6]. But these were bench tests; in reality, in 1955, electric locomotives of the SS7100 and BB9000 series, each with a train of three cars, accelerated to speeds of 331 and 326 km/h, respectively. In the 60s of the last century in France, the development of passenger train projects for high-speed traffic began. Strictly speaking, the discussion of this problem was held in many countries of the world in the prewar years. At that time, it was believed that high-speed trains are trains that reach speeds of over 150 km/h with steam propulsion and over 160 km/h with other types of traction. Naturally, in the postwar years, the criteria have changed. Developing passenger traffic, France competed with Japan. As part of this competition on regular lines, some trains reached a speed of about 200 km/h [2, P. 16].

In 1964, Tokyo–Osaka railway, 515 km long, was commissioned in Japan. This is the world's first main line, which is designed for regular movement of trains at speeds of over 200 km/h. At the first HSR Tokyo–Osaka, the classical structure of the railway track was used – ballast on the road bed. Operating experience in the first years showed that it requires huge costs for its maintenance. After an intensive pass of trains with speeds of 190–210 km/h in the period from 6 to 24 hours, the track came to a state that required a continuous alignment of it both in the plan and in the profile.

These circumstances contributed to the fact that in the future the choice was made in favor of rigid bases instead of the ballast section and wider use of viaducts and racks instead of the road bed. The roadbed on the slab base provides a low level of vibration and noise, reliably fixes the optimal dimensions of the track, drastically reduces the current costs of its maintenance.

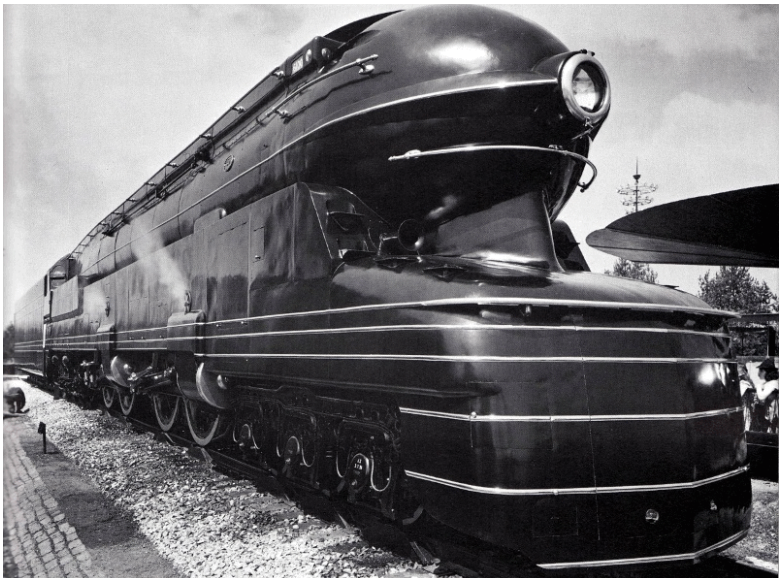
Looking at development of HSR, one can distinguish a fundamental difference between the Western European and Japanese models. In the Japanese version, all stations are built in a transverse pattern with the minimum necessary track development. At passing stations there are no separately located passenger buildings: ticket offices, the office of the station head and other premises are located under the tracks and platforms. At the stations, passenger platforms are located on the outer side of each receiving track, or between two receiving-departure tracks [9].

The concept of high-speed rail (HSR), which differs from conventional railways in that it is associated with specialized passenger lines for mass transportation in strictly designated transport corridors, has been approved. Today it is a separate area of development of international railway transport.

No bumpkin

In the USSR, in the postwar period, an unprecedented General Plan for the technical re-equipment of the railway industry on the basis of electrification was carried out. In the 1950s, a more powerful eight-axle DC electric locomotive VL8 was created, followed by VL10 and VL11. At the same time, in the USSR, as well as in France, work began on creating a new, more economical system for electric traction of alternating current at an industrial frequency of 50 Hz with a voltage in the traction network of 25000 V.

In this system, traction substations, as in the DC system, were powered by common industrial high-voltage three-phase networks. But there are no rectifiers on them. The three-phase AC voltage of the transmission lines is transformed by transformers into a single-phase voltage of the contact network of 25000 V, and the current is rectified directly on the electric rolling stock [7]. Lightweight, compact and safe for staff semiconductor rectifiers, which replaced the mercury ones, ensured the priority of this system. All



Schienenzeppelin.

over the world, the electrification of railways began to evolve according to the industrial frequency AC system.

The country's government paid great attention to development of rail transport not only because of the task to overcome the post-war devastation, but also because of understanding of the enormous size of the country, progress of which is simply impossible without reliable long-haul transport. Officially, the beginning of development of high-speed traffic on the railways of our country dates back to 1957, when an order of the Ministry of Railways dated May 29, 1957 «On preparing Moscow–Leningrad line for passenger trains with increased speeds» developed an action program and defined organizational and technical actions providing the solution of an objective.

In 1957, the diesel locomotive TE7–001 on the Klin–Reshetnikovo–Zavidovo section with a train weighing 1010 tons developed a maximum speed of 129 km/h, on the Pokrovka–Klin section, having a slope of 5 ‰, the highest speed was 134 km/h. With trains weighing 800–900 tons diesel locomotive developed a speed of 140 km/h. The TE7 diesel locomotives served passenger trains on Moscow–Leningrad line until 1963, and since 1960 they drove the Day Express trains, going from Moscow to Leningrad in 6 h 20 min.

At the first stage, stations were the bottleneck that slowed down the growth of speeds. Speed of movement on the turnout's stations was limited to 100 km/h. To overcome these restrictions, 18 low-density stations were closed and more than 100 switches were removed from the main routes of other separate points. In 1960, the track was completely laid on a gravel base with rails of type R50, curves were lengthened and straight inserts were laid between the curves, artificial structures were strengthened, and a number of crossings were closed.

During the period of development of increased speeds up to 120 km/h, the switch facilities of the line underwent a significant reconstruction. After testing, the speed of movement on such switches in the direct direction increased to planned maximum of 120 km/h [8].

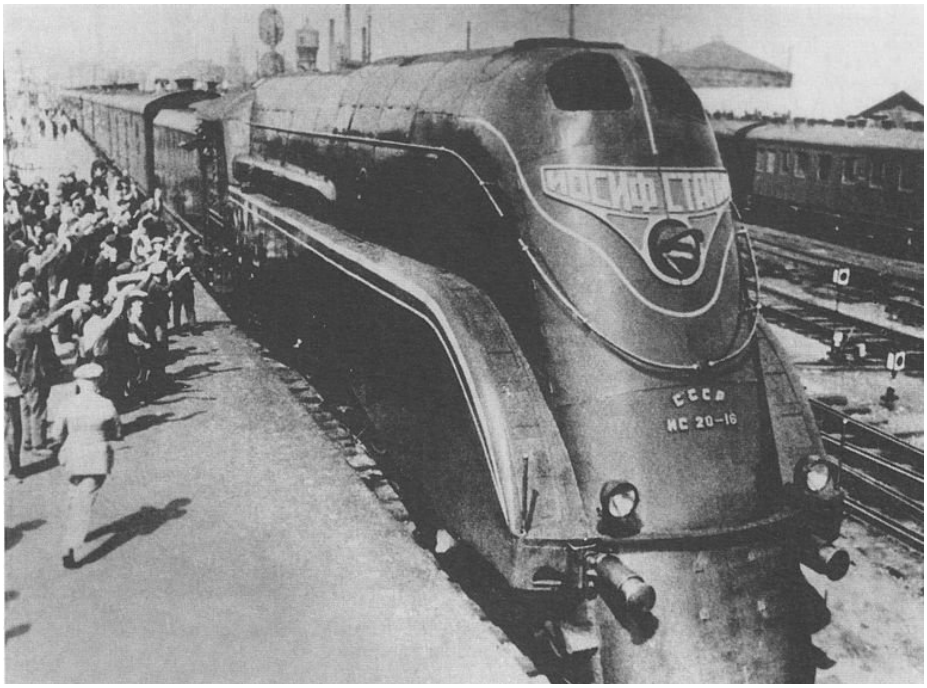
In the 1960s, results comparable with the high-speed express trains of the railways of Japan, Italy, the USA and France were achieved. Moscow–Leningrad line in terms of passenger train speed was no worse than the best foreign main lines. In 1966, a train with an electric locomotive on Leningrad–Moscow route accelerated to a speed of 200 km/h for the first time in the history of the country [2, P. 16].

In the Soviet Union, development of high-speed rail transport had some features. For all experiments in this regard, Leningrad–Moscow line was chosen. In 1967, a technical assignment was approved for a 14-car direct-current train with a voltage of 3000 V with a maximum speed of 200 km/h, which obtained ER200 index. The electric train was manufactured at the Riga Carriage Building Plant (RVZ), a set of electrical equipment was manufactured at the Riga Electrotechnical Plant (REZ).

A pilot electric train ER200 was manufactured in December 1973. For the first time in the domestic electric car building, the idea of manufacturing brand new bogies with pneumatic central suspension, disc and magnetic rail brakes was embodied. Lightweight body of aluminum alloys with a streamlined head was also new. The multi-valued automatic locomotive alarm system, automatic train driving, air conditioning, information system in passenger compartments, bar-buffet and much more were provided, which at the time was at the level of not only the best, but also of the most advanced foreign models [10].

The regular operation of this train, the first high-speed train in the history of Soviet railways started on March 1, 1984 on the route Leningrad-Moscow. It passed the entire route in 4 hours and 59 minutes. In 1993, a record speed for diesel locomotives was reached at St. Petersburg–Moscow section of Oktyabrskaya Railway by the diesel locomotive TEP80–271 km/h [8].

There was an attempt to develop another high-speed electric train of a new generation. As the leading project organization, PJSC VSM attracted the TsBB MT Rubin. In total, more than 60 organizations participated in creation of Sokol [Falcon]. Delivery of individual components and materials for Sokol was carried out by more than 100 Russian enterprises. The production of the prototype of Sokol train began



IS 20-16 «Joseph Stalin» (1937) achieved speed of 155 km/h during tests.

in February 1998. The total cost of the project amounted to 450 million dollars. The record speed that Sokol developed on June 29, 2001 was 236 km/h.

Sokol-250 has not been in regular operation for a single day. It was written off in 2002 [11]. It is difficult to say what prevented the promising Russian projects and why priority was given to cooperation with foreign firms. After all, all the possibilities existed. And it would be possible to pull the Russian economy onto innovative rails by modernizing railways and highways, as it had been done in the USA. The German train was given the name Sapsan [Peregrine falcon].

Slowly but reliably?

Today, it is the accelerated construction of HSR that can and should be the impetus for development of the entire industry. The problem is that the allocated tracks in Russia are being built extremely slowly. But the uniqueness of the Russian project also lies in the fact that, unlike countries with a relatively favorable climate, there is a huge number of issues to be resolved related to the particular features of the harsh climate of our country, with long, cold and snowy winters. Accordingly, our country has yet to answer in the near future the numerous questions related to organization of high-speed movement at low temperatures.

The emergence of HSR stimulates not only economic, but also social development of the territory thanks to the progress in industry and the provision of a new level of service. Construction of HSR will make a significant contribution to elimination of bottlenecks in the transport system of Russia, since part of the passenger traffic will switch from the existing railway lines to high-speed lines. In addition to increasing competition, and possible reduction in fares for passengers, the transport infrastructure that exists today, which slows down traffic, will be freed up for freight traffic.

In addition, it will turn out to increase passenger traffic in suburban traffic thanks to increased mobility of the population. Finally, high-speed rail is the safest for the environment. Mass use of HSR will help to unload the roads; a decrease in car traffic will lead to a serious improvement in the ecological situation. In addition, in the presence of high-speed communication, many people will not need to change their place of residence to work in a megacity and you can always catch up for business negotiations in another city. This is very important for people living quite far from the metropolis, but working in it.

For example, residents of the city of Alexandrov, located 100 kilometers from Moscow, spend 2 hours each day traveling to work in one direction only, and 1,5 hours on trains with a minimum number of stops [12]. The commissioning of HSR in the suburban traffic can turn such cities into practically distant suburbs of the Moscow metropolis. Finally, HSR is able to influence the development of tourism, especially inbound, which, with the immense expanses of our country, could not become a significant sector of the economy compared to foreign railway tourism and is still in its infancy.

It is important to note that today in countries with developed high-speed passenger transport, higher growth rates of tourism are noted, since it is high-speed rail passenger transport that gives an increase in the total traffic volume of both passengers and tourists. According to the rules of the WTO [13], any person who goes on a trip not for the purpose of earning money or making a profit is a tourist. For example, a large number of Moscow residents visit the city of Sergiev Posad regularly with religious purposes, using suburban trains, and according to WTO standards, this is pilgrim tourism.

There is a quantitative growth of individual components of the material base of high-speed passenger transport, aimed primarily at meeting the needs of passengers (tourists): double-deck cars are being introduced on many roads, catering for passengers is improving (for example, Hitachi offers four possible levels of catering passengers en route).

Experimental M-497 turbojet train («Black Beetle», 1966), USA.

The first level assumes the presence of a full-fledged kitchen, the second – a combination of a shopping area and a pantry, the third – the use of a shopping area with an expanded range, the fourth – the sale of food and beverages in the car using a special trolley [14]; new tourist stations are being commissioned and existing railway stations are being reconstructed.

There is a qualitative improvement of rolling stock for organization of high-speed passenger rail service: reducing travel time by increasing the operational speed of rolling stock on high-speed rail; improving the interior of cars and the quality of service along the line; improving the design of cars according to the requirements of tourists (expanding the possibilities of visual observation (panoramic windows), limiting noise from engine operation, vibration; increasing the convenience of accommodation in a train car); providing enhanced traffic safety measures [15].

Cohesion of meaning

With emergence and development of new types of tourism, new organizational methods are introduced, as well as forms and means of passenger service according to the «door-to-door» principle. For example, in many countries, railway organizations successfully operate, the main or sole activity of which is serving tourists along the way or organizing railway tours (in Russia, such an organization is RZD-Tour).

Rapid train Sokol-250 (Falcon).

In the structures of travel agencies special transport divisions are created, in order to achieve coordination of efforts in the field of tourist services, communications are established between railway and tourist organizations.

Under the influence of the conjuncture of the tourist market, reorganization and reprofiling of the activity of railway enterprises is carried out. It is also important to note that the development of tourist destinations leads to implementation of organizational changes in the territorial redistribution of high-speed passenger rail transport routes (high-speed railways Moscow–Sochi, Moscow–Kazan, etc. will be promising and popular). With the growth of tourist flow, new forms of service have appeared, as part of the provision of combined transport services using the formula «train + car», «train + bus + vessel», etc. Important in the improvement of tourist service is the increased attention of railway companies to holding various actions to attract tourists to travel on special tourist trains.

An important and interesting example for development of railway tourism is the start of operation by JR West (Japan) on the line running along the western coast of Honshu of two tourist diesel trains, which were created on the basis of converted serial rolling stock [16]. The cars were equipped with a new air conditioning system, the lighting system has undergone significant changes. In this regard, it was necessary to install a more powerful generator that provides power to the electrical equipment of the train. In the outer and inner colors of the cars, mostly red, black and golden tones are used. The front part of the train is decorated with the familiar French motto – Belle montagnes et mer («Beautiful mountains and the sea»). Through panoramic windows 2520 mm wide, passengers can admire the picturesque scenery of the coast. Also important is the commissioning in March 2016 of a new 149 km long Hokkaido–Sinkansen line [17]. High-speed trains for the first time tied three major islands of Japan – Kyushu, Honshu and Hokkaido.

The presence of a dense network of railways in Russia allows to organize a variety of routes for railway tours different in geographic location, form and content. In domestic tourism, these are short-term tours lasting from 3 to 10 hours, performed on electric trains, one-day, two-and three-day (short) and multi-day tours of 5 and more days.

Conclusion. *The organization of high-speed traffic in Russia is becoming a nationwide project today, leading not only to modernizing the economy and creating the multiplier effect in related sectors of the economy, but also has a positive effect on tourism development, turning it into an independent sector of the economy.*

Thus, we can conclude that development of high-speed passenger transport directly affects development of tourism. Transport and tourism are two interrelated concepts. Accordingly, the faster, more comfortable and cheaper transport is, the more people will use it.

The main competitor of high-speed rail transport is air transport. But an air ticket is often more expensive than a train ticket, and the travel time for some distances is approximately the same. As the modern European experience shows, at distances up to 1000 kilometers, high-speed rail transport is an effective competitor to air transport and constantly attracts ever-increasing masses of tourists, bringing substantial profits, both to transport and the tourist industry.

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